NUREG-1828

Safety Evaluation Report
Related to the License Renewal of the Arkansas Nuclear One, Unit 2

Docket No. 50-368

Entergy Operations, Inc.

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

AVAILABILITY OF REFERENCE MATERIALS IN NRC PUBLICATIONS

NRC Reference Material

As of November 1999, you may electronically access NUREG-series publications and other NRC records at NRC's Public Electronic Reading Room at http://www.nrc.gov/reading-rm.html.
Publicly released records include, to name a few, NUREG-series publications; *Federal Register* notices; applicant, licensee, and vendor documents and correspondence; NRC correspondence and internal memoranda; bulletins and information notices; inspection and investigative reports; licensee event reports; and Commission papers and their attachments.

NRC publications in the NUREG series, NRC regulations, and *Title 10, Energy*, in the Code of *Federal Regulations* may also be purchased from one of these two sources.

1. The Superintendent of Documents
   U.S. Government Printing Office
   Mail Stop SSOP
   Washington, DC 20402–0001
   Internet: bookstore.gpo.gov
   Telephone: 202-512-1800
   Fax: 202-512-2250
2. The National Technical Information Service
   Springfield, VA 22161–0002
   www.ntis.gov
   1–800–553–6847 or, locally, 703–605–6000

A single copy of each NRC draft report for comment is available free, to the extent of supply, upon written request as follows:
Address: Office of the Chief Information Officer,
Reproduction and Distribution
Services Section
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001
E-mail: DISTRIBUTION@nrc.gov
Facsimile: 301–415–2289

Some publications in the NUREG series that are posted at NRC's Web site address http://www.nrc.gov/reading-rm/doc-collections/nuregs are updated periodically and may differ from the last printed version. Although references to material found on a Web site bear the date the material was accessed, the material available on the date cited may subsequently be removed from the site.

Non-NRC Reference Material

Documents available from public and special technical libraries include all open literature items, such as books, journal articles, and transactions, *Federal Register* notices, Federal and State legislation, and congressional reports. Such documents as theses, dissertations, foreign reports and translations, and non-NRC conference proceedings may be purchased from their sponsoring organization.

Copies of industry codes and standards used in a substantive manner in the NRC regulatory process are maintained at—
The NRC Technical Library
Two White Flint North
11545 Rockville Pike
Rockville, MD 20852–2738

These standards are available in the library for reference use by the public. Codes and standards are usually copyrighted and may be purchased from the originating organization or, if they are American National Standards, from—
American National Standards Institute
11 West 42nd Street
New York, NY 10036–8002
www.ansi.org
212–642–4900

Legally binding regulatory requirements are stated only in laws; NRC regulations; licenses, including technical specifications; or orders, not in NUREG-series publications. The views expressed in contractor-prepared publications in this series are not necessarily those of the NRC.

The NUREG series comprises (1) technical and administrative reports and books prepared by the staff (NUREG–XXXX) or agency contractors (NUREG/CR–XXXX), (2) proceedings of conferences (NUREG/CP–XXXX), (3) reports resulting from international agreements (NUREG/IA–XXXX), (4) brochures (NUREG/BR–XXXX), and (5) compilations of legal decisions and orders of the Commission and Atomic and Safety Licensing Boards and of Directors' decisions under Section 2.206 of NRC's regulations (NUREG–0750).

NUREG-1828

Safety Evaluation Report
Related to the License Renewal of the Arkansas Nuclear One, Unit 2

Docket No. 50-368

Entergy Operations, Inc.

Manuscript Completed: May 2005
Date Published: June 2005

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

ABSTRACT

This safety evaluation report (SER) documents the technical review of the Arkansas Nuclear One, Unit 2 (ANO-2), license renewal application (LRA) by the U.S. Nuclear Regulatory Commission staff (staff). By letter dated October 14, 2003, Entergy Operations, Inc. (Entergy or the applicant), submitted the LRA for ANO-2 in accordance with Title 10 of the *Code of Federal Regulations* Part 54 (10 CFR Part 54 or the Rule). Entergy is requesting renewal of the operating licenses for ANO-2, (Facility Operating License No. NPF-6) for a period of 20 years beyond the current expiration dates (midnight, July 17, 2018).

The ANO site is located in southwestern Pope County, Arkansas, on a peninsula formed by Lake Dardanelle. The NRC issued ANO-2 construction permit on December 6, 1972. The operating license were issued by the NRC on September 1, 1978. ANO-2 consists of a Combustion Engineering pressurized water reactor unit licensed to generate 3026 megawatts-thermal (MWt), or approximately 1023 megawatts-electric (MWe).

This SER presents the staff's review of information submitted to the NRC in the application. The staff's conclusion of its review of the ANO-2 LRA can be found in Section 6 of this SER.

The NRC ANO-2 license renewal project manager is Mr. Gregory F. Suber. Mr. Suber may be reached at 301-415-1124. Written correspondence should be addressed to the License Renewal and Environmental Impacts Program, U.S. Nuclear Regulatory Commission, Washington, DC 20555-001.

TABLE OF CONTENTS

ABBREVIATIONS

AAC	alternate alternating current
ACI	American Concrete Institute
ACRS	Advisory Committee on Reactor Safeguards
AERM	aging effect requiring management
AFW	auxiliary feedwater
AMP	aging management program
AMR	aging management review
ANO	Arkansas Nuclear One
ANO-1	Arkansas Nuclear One, Unit 1
ANO-2	Arkansas Nuclear One, Unit 2
ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ATWS	anticipated transient without scram
AWWA	American Water Workers Association
B&PV	Boiler and Pressure Vessel
BAC	boric acid corrosion
BL	Bulletin
BTP	Branch Technical Position
BWR	boiling-water reactor
CASS	cast austenitic stainless steel
CCW	component cooling water
CE	Combustion Engineering
CEA	control element assembly
CEDM	control element drive mecanism
CEOG	Combustion Engineering Owners Group
CFR	Code of Federal Regulations
CI	confirmatory item
CLB	current licensing basis
CMAA	Crane Manufacturers Association of America
CR	condition report
CRD	control rod drive
CS	containment spray
CSB	core support barrel
CUF	cumulative usage factor
C_VUSE	charpy upper-shelf energy
CVCS	chemical and volume control system
DBA	Design-Basis Accident
DBD	design basis document
DC	direct current

ECCS	emergency core cooling system
ECP	emergency cooling pond
EDG	emergency diesel generator
EFPY	effective full-power year
EFW	emergency feedwater
EOL	end of life
EPRI	Electric Power Research Institute
EQ	environmental qualification
ESF	engineering safety feature
FAC	Flow-accelerated corrosion
FAP	fuel assembly plate
FIV	flow-induced vibration
FMP	fatigue monitoring program
FP	Fire Protection
FSAR	Final Safety Analysis Report
FW	Feedwater
GALL	Generic Aging Lessons Learned
GDC	general design criterion
GEIS	Generic Environmental Impact Statement
GL	generic letter
GSI	generic safety issue
HAZ	heat-affected zone
HELB	high-energy line break
HPSI	high pressure safety injection
HVAC	heating, ventilation, and air conditioning
HX	heat exchanger
I&C	instrumentation and controls
IASCC	irradiation-assisted stress corrosion cracking
ICI	in-core instrumentation
IGA	intergranular attack
ISG	interim staff guidance
IGSCC	inter-granular stress corrosion cracking
IN	information notice
IPA	integrated plant assessment
ISG	interim staff guidance
ISI	inservice inspection
kV	kilo-volt
KW	kilo-watt
LBB	leak before break
LOCA	loss of coolant accident
LOSP	loss of offsite power
LPSI	low pressure safety injection
LR	license renewal

LRA	license renewal application
LTOP	low-temperature overpressure protection
LWR	light water reactor
MCL	main coolant line
MeV	mega-electron volt
MIC	microbiologically influenced corrosion
MNSA	mechanical nozzle seal assemblies
MRP	Material Reliability Program
MRV	minimum required values
MSIS	main steam isolation signal
MWe	megawatts-electric
MWt	megawatts-thermal
NDE	non-destructive testing
NEI	Nuclear Energy Institute
NESC	National Electric Safety Code
NFPA	National Fire Protection Association
NPS	nominal pipe size
NRC	U. S. Nuclear Regulatory Commission
NRR	Office of Nuclear Reactor Regulation
NSSS	nuclear steam supply system
NUREG	NRC technical report designation (Nuclear Regulatory Commission)
ODSCC	outside-diameter stress corrosion cracking
P&ID	piping and instrumentation diagram
pH	potential hydrogen
ppm	parts-per-million
PSPM	periodic surveillance and preventive maintenance
P-T	pressure-temperature
PTS	pressurized thermal shock
PVC	polyvinyl chloride
PWR	pressurized-water reactor
PWSCC	primary water stress corrosion cracking
RAI	request for additional information
RBHV	reactor building heating and ventilation
RCP	reactor coolant pump
RCPB	reactor coolant pressure boundary
RCS	reactor coolant system
RFO	refueling outage
RG	regulatory guide
RHR	residual heat removal system
RI-ISI	risk-informed inservice inspection
RTD	resistance temperature detector
RTPTS	reference temperature (pressurized thermal shock)
RV	reactor vessel
RVH	reactor vessel head

RVI	reactor vessel internals
RVID	reactor vessel integrity database
RWT	refueling water tank
RPV	reactor pressure vessel
RT_{NDT}	nil-ductility reference temeprature
SAR	safety analysis report
SBO	station blackout
SCC	stress corrosion cracking
SER	safety evaluation report
SFP	spent fuel pool
SG	steam generator
SIAS	safety injection actuation signal
SRP	standard review plan
SS	stainless steel
SSC	system, structure, and component
SW	service water
TLAA	time-limited aging analysis
TS	technical specifications
TSP	trisodium phosphate
UFSAR	updated final safety analysis report
UGS	upper guide structure
USE	upper-shelf energy
VCT	volume control tank
VHP	vessel head penetration

1. INTRODUCTION AND GENERAL DISCUSSION

1.1 Introduction

This document is a safety evaluation report (SER) on the application for license renewal for Arkansas Nuclear One, Unit 2 (ANO-2), as filed by Entergy Operations, Inc. (Entergy, or the applicant). By letter dated October 14, 2003, Entergy submitted its application to the U.S. Nuclear Regulatory Commission (NRC, or the Commission) for renewal of the ANO-2 operating license for up to an additional 20 years. The NRC staff prepared this report, which summarizes the results of the staff's safety review of the renewal application for compliance with the requirements of Title 10, Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants," of the *Code of Federal Regulations* (10 CFR Part 54), also known as the License Renewal Rule or Rule. The NRC project manager for the ANO-2 license renewal review is Gregory Suber. Mr. Suber may be contacted by calling 301-415-1124, e-mailing GXS@nrc.gov, or writing to the License Renewal and Environmental Impacts Program, Office of Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001.

In its October 14, 2003, submittal letter, the applicant requested renewal of the operating license issued under Section 103 of the Atomic Energy Act of 1954, as amended (Facility Operating License Number NPF-6) for a period of 20 years beyond the current license expiration date of midnight, July 17, 2018. The ANO site is located in southwestern Pope County, Arkansas, on a peninsula formed by Lake Dardanelle. The NRC issued the ANO-2 construction permit on December 6, 1972, and the operating license on September 1, 1978. The ANO-2 plant consists of a Combustion Engineering (CE) pressurized-water reactor (PWR) unit licensed to generate 3026 megawatts-thermal (MWt), or approximately 1023 megawatts-electric (MWe). The updated final safety analysis report (UFSAR) contains details concerning the plant and the site.

The license renewal process consists of two concurrent reviews, including a technical review of safety issues and an environmental review. The NRC regulations in 10 CFR Parts 54 and 51, respectively, provide the requirements for these reviews. The NRC bases the safety review for the ANO-2 license renewal on the applicant's license renewal application (LRA) and on the responses to requests for additional information (RAIs) from the staff. The applicant supplemented its responses to the LRA and RAIs during audits, meetings, and in docketed correspondence. Unless otherwise noted, the staff reviewed and considered information the applicant submitted through February 28, 2005, which includes all the information submitted in support of the LRA. The LRA and all pertinent information and materials, including the UFSAR mentioned above, are available to the public for review at the NRC Public Document Room, 11555 Rockville Pike, Room O1-F21, Rockville, Maryland (301-415-4737/800-397-4209), or at Ross Pendergraft Library and Technology Center at Arkansas Tech University in Russellville, Arkansas. Materials related to the LRA are also available through the NRC's Web site, at http://www.nrc.gov.

This SER summarizes the results of the staff's safety review of the ANO-2 LRA and delineates the scope of the technical details the staff considered in evaluating the safety aspects of its proposed operation for up to an additional 20 years beyond the term of the current operating license. The staff reviewed the LRA in accordance with NRC regulations and the guidance provided in NUREG-1800, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants," (SRP-LR) issued July 2001.

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

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

In accordance with 10 CFR Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions," the staff will prepare a draft for comment and a final, plant-specific supplement to the generic environmental impact statement (GEIS) that discusses the environmental considerations related to renewing the license for ANO-2. The NRC issued NUREG-1437, Supplement 19, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants: Regarding Arkansas Nuclear One, Unit 2, Draft Report," in September 2004.

1.2 License Renewal Background

Pursuant to the Atomic Energy Act of 1954, as amended, and NRC regulations, the NRC issues licenses to operate commercial power reactors for 40 years. It is possible to renew these licenses for up to 20 additional years. The original 40-year license term was selected on the basis of economic and antitrust considerations, not because of 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 interest in license renewal. That workshop led the NRC to establish a comprehensive program plan for nuclear plant aging research. 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 NRC participated in an industry-sponsored demonstration program to apply the Rule to a pilot plant and to develop experience for establishing 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 the 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, the NRC amended the License Renewal Rule in 1995. 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, the NRC amended 10 CFR Part 54 to focus on managing the adverse effects of aging rather than on identifying age-related degradation unique to license renewal. The NRC intended that the Rule changes would ensure that important structures, systems, and components (SSCs) will continue to perform their intended functions during the period of extended operation. In addition, the NRC clarified and simplified the integrated plant assessment (IPA) process 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 and developed 10 CFR Part 51 to focus the scope of the review of environmental impacts of license renewal, in order to fulfill the NRC's responsibilities under the National Environmental Policy Act of 1969 (NEPA).

1.2.1 Safety Review

The NRC bases license renewal requirements for power reactors on the following 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, and possibly a few other 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 (1) that are safety related, (2) whose failure could affect safety-related functions, and (3) that are necessary to demonstrate compliance with the NRC's regulations for fire protection (FP), environmental qualification, pressurized thermal shock, anticipated transients without scram, 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 License Renewal Rule to identify SCs subject to an aging management review (AMR). The 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. The NRC considers active equipment, however, 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 revealed through performance indicators, or the applicant will identify and correct them through routine surveillance 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. According to 10 CFR 54.21(d), a supplement to the UFSAR must contain a summary description of the programs and activities for managing the effects of aging and the evaluations of time-limited aging analyses for the period of extended operation.

The Rule also requires an applicant to identify and update time-limited aging analyses (TLAAs). During the design phase for a plant, certain assumptions are made about the length of time the plant will operate. These assumptions are incorporated into design calculations for several of the plant's SSCs. In accordance with 10 CFR 54.21(c))(1), the applicant must either show that these calculations will remain valid for the period of extended operation, project the analyses to the end of the period of extended operation, or demonstrate that it will adequately manage the effects of aging on these SSCs 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 RG endorses an implementation guideline prepared by the Nuclear Energy Institute (NEI) as an acceptable method for implementing the License Renewal Rule. This guideline is NEI 95-10, "Industry Guideline for Implementing the Requirements of 10 CFR Part 54—The License Renewal Rule," issued in March 2001. The NRC also prepared the SRP-LR, which it used to review this application.

The applicant used the process defined in NUREG-1801, "Generic Aging Lessons Learned (GALL) Report," issued July 2001. The GALL Report provides the staff with a summary of staff-approved aging management programs (AMPs) for the aging of many 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 with managing aging for most of the SCs used throughout the industry. It serves as a reference for both applicants and staff reviewers to quickly identify those AMPs and activities that the staff has determined will adequately manage aging during the period of extended operation.

1.2.2 Environmental Review

Title 10, Part 51, of the *Code of Federal Regulations* (10 CFR Part 51) governs environmental protection regulations. The NRC revised these regulations in December 1996 to facilitate the environmental review for license renewal. The staff prepared a GEIS, in which the staff 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. Appendix B to Subpart A of 10 CFR Part 51 identifies these generic findings as Category 1 issues. Pursuant to 10 CFR 51.53(c)(3)(I), an applicant for license renewal may incorporate these generic findings in its environmental report. The applicant must include analyses of those environmental impacts that it must evaluate on a plant-specific basis (Category 2 issues) 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 there was new and significant information not considered in the GEIS. A public meeting took place on

February 3, 2004, in Russellville, Arkansas, as part of the NRC's scoping process to identify environmental issues specific to the plant. On August 30, 2004, the NRC documented the results of the environmental review (and a preliminary recommendation with respect to the license renewal action) in its draft plant-specific supplement to the GEIS, which was discussed at a separate public meeting held on October 19, 2004, in Russellville, Arkansas. After considering comments on the draft, the NRC will prepare and publish a final plant-specific supplement to the GEIS. These documents are published separate from this SER.

1.3 Principal Review Matters

Title 10, Part 54, of the *Code of Federal Regulations* (10 CFR Part 54) describes the requirements for renewing operating licenses for nuclear power plants. The staff performed its technical review of the ANO-2 LRA in accordance with Commission guidance and the requirements of 10 CFR Part 54. Furthermore, 10 CFR 54.29 describes the standards for renewing a license. 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 ANO-2, submitted by letter dated October 15, 2003. The staff finds that the applicant has submitted the information required by 10 CFR 54.19(a) in Section 1 of the LRA.

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

> The current indemnity agreement for ANO-2 states in Article VII that the agreement shall terminate at the time of expiration of the license specified in Item 3 of the Attachment to the agreement, which is the last to expire. Item 3 of the Attachment to the indemnity agreement as revised by Amendment No. 6, lists ANO-2 operating license number NPF-6. Entergy Operations requests that conforming changes be made to Article VII of the indemnity agreement, and Item 3 of the Attachment to that agreement, specifying the extension of agreement until the expiration date of the renewed ANO-2 facility operating license sought in this application. In addition, should the license number be changed upon issuance of the renewal license, Entergy Operations requests that conforming changes be made to Item 3 of the Attachment, and other sections of the indemnity agreement as appropriate.

The staff intends to maintain the license numbers on issuance of the renewed licenses. Therefore, conforming changes to the indemnity agreement are not necessary, 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 (1) an IPA, (2) a description of CLB changes during the staff's review of the application, (3) an evaluation of TLAAs, and (4) an UFSAR supplement. Chapters 3 and 4, and Appendices 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, the applicant must submit an amendment to the renewal application. In the amendment, the applicant must identify any change to the CLB of the facility that materially affects the contents of the LRA, including the UFSAR supplement.

In accordance with 10 CFR 54.22, an applicant must include in the LRA any technical specification changes or additions necessary to manage the effects of aging during the period of extended operation. In Appendix D to the LRA, the applicant stated that no changes to the ANO-2 technical specifications are necessary. This satisfies the requirement specified in 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. Sections 2, 3, and 4 of this SER document the staff's evaluation of the technical information.

The staff will document its evaluation of the environmental information required by 10 CFR 54.23 in the final plant-specific supplement to the GEIS that specifies the considerations related to renewing the license for ANO-2. The staff will prepare this supplement separate from this SER. As required by 10 CFR 54.25, the ACRS will issue a report to document its evaluation of the staff's LRA review and the associated SER. Section 5 of this SER will incorporate this ACRS report. Section 6 of this SER will document the findings required by 10 CFR 54.29.

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 are intended to conform to the NRC's performance goals of maintaining safety, improving effectiveness and efficiency, reducing regulatory burden, and increasing public confidence. The NRC documents the lessons learned in interim staff guidance (ISG) documents that it issues to the public for comment, modifies as necessary to resolve comments, reissues in final, and makes available for use by the staff and interested stakeholders until the improved license renewal guidance documents are revised.

The following provides the current set of relevant ISGs that the staff has issued, and the SER sections in which the staff addresses the issues:

ISG Issue (Approved ISG No.)	Purpose	SER Section
How to credit plant programs and activities for license renewal **(ISG-01)**	To clarify that GALL report contains one, though not the only, acceptable way to determine adequacy of plant programs and activities for license renewal	N/A
Station Blackout Scoping **(ISG-2)**	The License Renewal Rule, at 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 emergency diesel generators. The offsite power system should be included within the scope of license renewal.	2.5.2 3.6.2.3.1
Concrete Aging Management Program **(ISG-3)**	Lessons learned from the GALL demonstration project indicate that the GALL Report is not clear whether concrete needs any AMPs.	3.5.2.2 3.5.2.3.1

ISG Issue (Approved ISG No.)	**Purpose**	**SER Section**
Fire Protection System Piping **(ISG-4)**	The ISG clarifies the staff position for wall thinning of FP piping system in GALL AMPs XI.M26 and XI.M27. The new position states that there is no need to disassemble FP piping, as oxygen can be introduced in the FP piping which can accelerate corrosion. Instead, licensees should use a nonintrusive method, such as volumetric inspection. Licensees should test the sprinkler heads every 50 years and 10 years after initial service. The ISG eliminates Halon/carbon dioxide system inspections for charging pressure, valve lineups, and automatic mode of operation test from the GALL Report, as the staff considers these test verifications to be operational activities.	3.0.3.2.4

ISG Issue (Approved ISG No.)	Purpose	SER Section
Identification and Treatment of Electrical Fuse Holders **(ISG-5)**	The ISG includes the 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
The ISG Process **(ISG-8)**	To update and establish the interim staff guidance process.	N/A
License Renewal Application Format **(ISG-10)**	To standardize license renewal application format for 2003 applicants	N/A
Environmental Fatigue for Carbon/Low-Alloy Steel **(ISG-11)**	To review the aging management of environmental fatigue in the ISG process, as agreed at September 18, 2002, meeting	N/A

1.5 Summary of Open Items

Open items are items for which the applicant has not presented a sufficient basis for resolution. The draft SER was issued on November 5, 2004 with no open items. No subsequent open items were identified in the preparation of the final SER.

1.6 Summary of Confirmatory Items

Confirmatory items are items for which the staff and the applicant have reached a satisfactory resolution, but the applicant has not yet formally submitted the resolution to the staff. The draft SER was issued on November 5, 2004 with no confirmatory items. No subsequent confirmatory items were identified in the preparation of the final SER.

1.7 Summary of Proposed License Conditions

As a result of the staff's review of the ANO-2 LRA, including the additional information and clarifications submitted subsequently, the staff identified three proposed license conditions.

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

The second license condition requires that the future activities identified in the FSAR Supplement be completed prior to entering the period of extended operation.

The third license condition is as follows:

> All capsules in the reactor vessel that are removed and tested must meet the test procedures and reporting requirements of ASTM E 185-82 to the extent practicable for the configuration of the specimens in the capsule. Any changes to the capsule withdrawal schedule, including spare capsules, must be approved by the NRC prior to implementation. All capsules placed in storage must be maintained for future insertion.

2. STRUCTURES AND COMPONENTS SUBJECT TO AGING MANAGEMENT REVIEW

2.1 Scoping and Screening Methodology

2.1.1 Introduction

In Title 10, Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants," of the *Code of Federal Regulations*, (10 CFR Part 54), also referred to as the Rule, 10 CFR 54.21, "Contents of Application—Technical Information," requires that each application for license renewal contain an integrated plant assessment (IPA). Furthermore, the IPA must list and identify those structures and components (SCs) that are subject to an aging management review (AMR) from the structures, systems, and components (SSCs) that are within the scope of license renewal, in accordance with 10 CFR 54.4.

In Section 2.1, "Scoping and Screening Methodology," of the license renewal application (LRA), the applicant described the scoping and screening methodology used to identify SSCs at Arkansas Nuclear One, Unit 2 (ANO-2), 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 ANO-2 LRA, the applicant considered the requirements of the Rule, the Statements of Consideration (SOC) for the Rule, and the guidance presented by the Nuclear Energy Institute (NEI), in NEI 95-10, Revision 3, "Industry Guideline for Implementing the Requirements of 10 CFR Part 54—The License Renewal Rule," issued March 2001. In addition, the applicant also considered the U.S. Nuclear Regulatory Commission (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

Sections 2.0 and 3.0 of the LRA provide the technical information required by 10 CFR 54.21(a). In Section 2.1 of the LRA, the applicant described 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"; Section 2.4, "Scoping and Screening Results: Structures"; and Section 2.5, "Scoping and Screening Results: Electrical and Instrumentation and Control Systems," of the LRA amplify the process that the applicant used to identify the SCs that are subject to an AMR. Chapter 3 of the LRA, "Aging Management Review Results," contains Section 3.1, "Reactor Vessel, Internals and Reactor Coolant System"; Section 3.2, "Engineered Safety Features Systems"; Section 3.3, "Auxiliary Systems"; Section 3.4, "Steam and Power Conversion Systems"; Section 3.5, "Structures and Component Supports"; and Section 3.6, "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 Scoping Methodology

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

In Sections 2.1.1, "Scoping Methodology," and 2.1.1.1, "Application of Safety-Related Scoping Criteria," of the LRA, the applicant discussed the scoping methodology with regard to safety-related criteria in accordance with 10 CFR 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 it identified by a review of plant-specific information to determine if they meet the criteria of 10 CFR 54.4(a)(1).

The applicant maintained a component-level database which identified the component safety classification. The safety-related classification uses the same definition as that stated in 10 CFR 54.4. The ANO-2 definition of safety related used to develop and maintain the component-level Q-list includes the SSCs that are relied on to remain functional during or after design-basis events to ensure the following:

- the integrity of the reactor coolant pressure boundary
- the capability to shut down the reactor and maintain it in a safe-shutdown condition
- the capability to prevent or mitigate the consequences of accidents which could result in potential offsite exposures comparable to the guideline exposures of 10 CFR Part 100, "Reactor Site Criteria"

In addition to the guidelines of 10 CFR 100.11, the safety-related criteria of 10 CFR 54.4(a)(1)(iii) includes reference to the dose guidelines of 10 CFR 50.34(a)(1) and 10 CFR 50.67(b)(2).

The LRA indicates that the applicant determined the SSCs which perform safety functions by reviewing the ANO-2 component-level Q-list and the system and structure functions. If one or more of the three criteria were met, the applicant determined the function to be a safety intended function and included the corresponding system or structure within the scope of license renewal as safety related. The applicant used the plant design-basis documents, including the safety analysis report (SAR) and the upper level design documents, to identify the system functions and verify the Q-list identification of safety-related components. The applicant elected to designate some components that do not perform any of the functions of 10 CFR 54.4(a)(1) as safety-related because of plant-specific considerations or preferences. Therefore, certain components may not meet the criteria of 10 CFR 54.4(a)(1), although the component was designated as safety related for plant-specific reasons. The LRA states that very few components meet this exception and notes that the applicant still evaluated the systems and structures containing these components for inclusion in the scope of license renewal using the criteria of 10 CFR 54.4(a)(2) and 10 CFR 54.4(a)(3).

In Sections 2.1.1 and 2.1.1.2, "Application of Criterion for Nonsafety-Related SSCs Whose Failure Could Prevent the Accomplishment of Safety Functions," of the LRA, the applicant discussed the scoping methodology with regard to the nonsafety-related criteria, in accordance with 10 CFR 54.4(a)(2). With respect to the nonsafety-related criteria, the applicant stated, in part, that it performed a review to identify the nonsafety-related SSCs whose failure could prevent satisfactory accomplishment of the safety-related intended functions identified in 10 CFR 54.4(a)(1).

The LRA states that the applicant identified nonsafety-related SSCs whose failure could prevent satisfactory accomplishment of a safety function. The applicant considered the impacts of nonsafety-related SSC failures as either functional or spatial. In a functional failure, the failure of an SSC to perform its normal function impacts a safety function. In a spatial failure, a safety function is impacted by the loss of structural or mechanical integrity of an SSC in physical proximity to a safety-related component.

Functional Failures of Nonsafety-Related SSCs. The LRA states that, with few exceptions, the applicant classified SSCs as safety related if they are required to perform a function in support of other safety-related components and included them in the scope of license renewal, per 10 CFR 54.4(a)(1). For the few exceptions where nonsafety-related equipment is required to remain functional in support of a safety function, the applicant included the supporting systems within the scope as nonsafety-related SSCs affecting safety-related SSCs. The applicable sections of the SAR, technical specifications, Maintenance Rule scoping documents, and design-basis documents provided the system information to determine the appropriate systems and structures in this category.

The applicant determined that, for piping systems, the nonsafety-related piping and supports, up to and including the first equivalent anchor beyond the safety/nonsafety-related interface, are subject to an AMR. In addition, nonsafety-related portions of safety-related systems downstream of the first anchor are subject to an AMR if they have the potential for spatial interaction with safety-related SSCs.

Spatial Failures of Nonsafety-Related SSCs. The applicant determined that components meeting the scoping criteria of 10 CFR 54.4(a)(2) are either nonsafety-related SSCs directly connected to safety-related SSCs (typically piping systems), or nonsafety-related SSCs with the potential for spatial interaction with safety-related SSCs. The LRA states that protective features (e.g., whip restraints, spray shields, supports, and barriers) were installed to protect safety-related SSCs against spatial interaction with nonsafety-related SSCs. Such protective features credited in the plant design are included within the scope of license renewal and are subject to an AMR. Where those protective features provide adequate protection, the applicant excluded the nonsafety-related system itself from the scope of license renewal. Protective features are typically associated with a structure and are addressed in the structural AMR. The applicant determined that the different modes of spatial interaction include the following:

- The first mode is physical impact. Nonsafety-related supports for nonseismic or seismic Category II/I piping systems with a potential for spatial interaction with safety-related SSCs are subject to an AMR based on the criteria of 10 CFR 54.4(a)(2). These supports are addressed in a commodity fashion within the civil/structural section of the LRA. The LRA states that, based on earthquake experience data that include aged pipe, the following conclusions can be drawn:
    - — No experience data exist of welded steel pipe segments falling because of a strong-motion earthquake.

- Falling of piping segments is extremely rare and only occurs when the supports fail. As long as the effects of aging on the supports for piping systems are managed, the applicant did not consider the falling of piping sections to be credible, and the piping section itself is not within scope for 10 CFR 54.4(a)(2) because of the physical impact hazard. Internal or external events, such as failure of rotating equipment, can generate missiles. Inherent nonsafety-related features that protect safety-related equipment from missiles require an AMR based on the criteria in 10 CFR 54.4(a)(2). The overhead-handling systems (i.e., cranes), whose structural failure could result in damage to any system that could prevent the accomplishment of a safety function, meet the criteria of 10 CFR 54.4(a)(2) and are within the scope of license renewal.

- The second mode includes pipe whip, jet impingement, or harsh environments. The LRA states that the site-specific analyses of high-energy line breaks (HELB) and medium-energy line breaks address pipe whip, jet impingement, and harsh environment effects on safety-related equipment. The LRA states that if a HELB analysis assumes that a nonsafety-related piping system does not fail or assumes failure only at specific locations, then that piping system is within the scope of license renewal per 10 CFR 54.4(a)(2) and subject to an AMR. This provides reasonable assurance that those assumptions remain valid through the period of extended operation.

- The third mode includes leakage, spray, or flooding. The LRA states that moderate- and low-energy systems have the potential for spatial interactions of spray and leakage. Nonsafety-related systems and nonsafety-related portions of safety-related systems with the potential for spray or leakage that could prevent safety-related SSCs from performing their required safety function are within the scope of license renewal and subject to an AMR. The LRA states that no credible aging effects of air and gas (nonliquid) systems exist, and they cannot adversely affect safety-related SSCs by leakage or spray. Operating experience indicates that nonsafety-related systems containing only air or gas have experienced no failures from aging that could impact the ability of safety-related equipment to perform required safety functions. These systems are not within the scope of license renewal according to the scoping criteria of 10 CFR 54.4(a)(2).

The LRA states that the applicant considered nonsafety-related systems and nonsafety-related portions of safety-related systems containing steam or liquid that are near safety-related equipment to be within scope and subject to an AMR for 10 CFR 54.4(a)(2). Pressure boundary failures of these systems could result in the nonsafety-related piping spraying or leaking on safety-related equipment. The LRA states that consideration of hypothetical failures that could result from system interdependencies that are not part of the current licensing basis (CLB) and that have not been previously experienced is not required. Long-term exposure to conditions resulting from a failed nonsafety-related SSC (e.g., leakage or spray) is not considered credible. The applicant indicated that operators would detect leakage or spray from liquid-filled low-energy systems during their routine rounds or system walkdowns long before it could impact the performance of safety-related equipment. The LRA states that walls, curbs, dikes, doors, and other structures that provide flood barriers to safety-related SSCs require an AMR based on the criteria of 10 CFR 54.4(a)(2). The applicant included these as part of the building structure and evaluated them in the civil/structural AMR.

In Sections 2.1.1 and 2.1.1.3, "Application of Criterion for Regulated Events," of the LRA, the applicant discussed the scoping methodology as it relates to the regulated event criteria in accordance with 10 CFR 54.4(a)(3). The LRA states that the scope of license renewal includes those SSCs relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48), environmental qualification (EQ) (10 CFR 50.49), pressurized thermal shock (PTS) (10 CFR 50.61), anticipated transients without scram (ATWSs) (10 CFR 50.62), and station blackout (SBO) (10 CFR 50.63).

Fire Protection. The LRA states that systems and structures within the scope of license renewal for fire protection include equipment based on functional requirements defined in 10 CFR 50.48 and Appendix R. The SSCs credited with fire prevention, detection, and mitigation in areas containing equipment important to the safe operation of the plant are within scope for license renewal. To establish this scope of equipment, the applicant performed a detailed review of the ANO-2 CLB for fire protection. Based on this review, the applicant determined the intended functions performed in support of 10 CFR 50.48 requirements. The applicant included the SSCs relied on in safety analyses or plant evaluations to perform an intended function and demonstrate compliance with NRC regulations for fire protection within the scope of license renewal, in accordance with the criteria of 10 CFR 54.4(a)(3).

Environmental Qualification. The LRA states that 10 CFR 50.49 defines electric equipment important to safety that is required to be environmentally qualified to mitigate certain accidents that result in harsh environmental conditions in the plant. The LRA states that 10 CFR 50.49 codifies requirements for the EQ of electrical equipment that has been presented in other regulatory documents, such as NRC Office of Inspection and Enforcement (IE) Bulletin 79-01B, and the ANO-2 EQ program satisfies these requirements. The applicant used a bounding scoping approach for electrical equipment. Electrical systems and electrical equipment in mechanical systems, subject to the regulation, are included as within the scope of license renewal. The applicant included the SSCs relied on in safety analyses or plant evaluations to perform an intended function and demonstrate compliance with NRC regulations for EQ within the scope of license renewal, in accordance with the criteria of 10 CFR 54.4(a)(3).

Pressurized Thermal Shock. The LRA states that the rule concerning PTS, 10 CFR 50.61, requires that licensees evaluate the reactor vessel beltline materials against specific criteria to ensure protection from brittle fracture. For ANO-2, the limiting reference temperatures are well below the screening criteria. As a result, no flux reduction programs or modifications to equipment, systems, or operation are necessary to prevent potential failure of the reactor vessels. The only system relied upon to meet the PTS regulation is the reactor coolant system (RCS), which contains the reactor vessel. No structures are relied upon to meet the PTS regulation. The applicant included the SSCs relied on in safety analyses or plant evaluations to perform an intended function and demonstrate compliance with NRC regulations for PTS within the scope of license renewal, in accordance with the criteria of 10 CFR 54.4(a)(3).

Anticipated Transients Without Scram. The LRA states that an ATWS is an anticipated operational occurrence that is accompanied by a failure of the reactor trip system to shut down the reactor. The ATWS rule, 10 CFR 50.62, requires specific improvements in the design and operation of commercial nuclear power facilities to reduce the probability of failure to shut down the reactor following anticipated transients and to mitigate the consequences of an ATWS event. Based on the ANO-2 CLB for ATWS, the applicant determined the intended functions supporting 10 CFR 50.62 requirements. Since the scope of equipment required by 10 CFR 50.62 extends from sensor output to the final actuation device, the plant systems that support compliance with the ATWS rule are electrical and instrumentation and control (I&C) systems. The applicant used a bounding scoping approach for electrical equipment. Electrical systems are included within the scope of license renewal, and the applicant evaluated the electrical equipment in mechanical systems with the electrical systems. The applicant included the SSCs relied on in safety analyses or plant evaluations to perform an intended function and demonstrate compliance with NRC regulations for ATWS within the scope of license renewal, in accordance with the criteria of 10 CFR 54.4(a)(3).

Station Blackout. According to the LRA, to comply with 10 CFR 50.63, ANO-2 relies upon equipment to ensure the cooling of the reactor core and maintenance of the containment integrity using the station batteries and the alternate alternating current (ac) diesel before offsite or onsite ac power is restored. Based on the review of the ANO-2 current licensing bases for SBO, the applicant identified the equipment performing intended functions required for compliance with 10 CFR 50.63. The applicant included the systems and structures relied upon to restore the offsite ac power (including the onsite portion of the offsite power sources) and onsite ac power within the scope of license renewal for SBO. In addition to the plant electrical systems, certain switchyard components required to restore offsite power are included. The SSCs relied on in safety analyses or plant evaluations to perform an intended function and demonstrate compliance with NRC regulations for SBO are included within the scope of license renewal, in accordance with the criteria of 10 CFR 54.4(a)(3).

2.1.2.1.2 Documentation Sources Used for Scoping and Screening

In Section 2.1.1 of the LRA, the applicant stated that it reviewed information derived from the applicable sections of the SAR, technical specifications, Maintenance Rule scoping documents, upper level documents, and ANO topical reports for the NRC regulations identified in 10 CFR 54.4(a)(3) during the license renewal scoping and screening process. The applicant used this information to identify the functions performed by plant systems and structures. The applicant then compared these functions with the scoping criteria in 10 CFR 54(a)(1–3) to determine if the associated plant system or structure performs a license renewal intended function. The applicant also used these sources develop the list of SSCs subject to an AMR.

2.1.2.2 Screening Methodology

Following the determination of SSCs within the scope of license renewal, the applicant implemented a process for determining which SCs are subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1). In Section 2.1.2, "Screening Methodology," of the LRA, the applicant discussed these screening activities as they relate to the SCs that are within the scope of license renewal.

2.1.2.2.1 Mechanical Component Screening Methodology

Following component-level scoping for mechanical systems, the applicant performed screening to identify those mechanical components that are subject to an AMR. The applicant stated in LRA Section 2.1.2.1, "Screening of Mechanical Systems," that within the system, long-lived passive components that perform or support an intended function without moving parts or a change in configuration or properties are subject to an AMR. In the case of valves, pumps, and housings for fans and dampers, the applicant determined the valve bodies, pump casings, and housings that perform an intended function by maintaining the pressure boundary and are therefore subject to an AMR.

If the component is not subject to replacement based on qualified life or specified time period, the applicant considered it to be long-lived. Replacement programs are based on vendor recommendations, plant experience, or other means that establish a specific service life, qualified life, or replacement frequency under a controlled program. The applicant did not include components that are not long-lived in the AMR.

2.1.2.2.2 Structural Component Screening Methodology

Following component-level scoping for structures, the applicant performed screening to identify those civil/structural components that are subject to an AMR. In LRA Section 2.1.2.2, "Screening of Structures," the applicant described the methodology used to screen civil/structural components.

The LRA states that for each structure within the scope of license renewal, the applicant evaluated the structural components and commodities to determine those subject to an AMR. The screening process for structural components and commodities involved a review of design-basis documents to identify specific structural components and commodities that constitute the structure. Structural components or commodities subject to an AMR are those that perform an intended function without moving parts or a change in configuration or properties (i.e., passive), and are not subject to replacement based on qualified life or specified time period (i.e., long-lived). Since structures are inherently passive, and with few exceptions are long-lived, the screening of structural components and commodities was based primarily on whether they perform an intended function.

Structural Component and Commodity Groups. The LRA states that structural components and commodities often have no unique identifiers, such as those given to mechanical components. Therefore, grouping structural components and commodities based on materials of construction provides a practical means of categorizing them for AMRs. The applicant categorized structural components and commodities according to the following groups, based on materials of construction:

- steel
- threaded fasteners
- concrete
- fire barriers
- elastomers
- earthen structures
- Teflon

Evaluation Boundaries. The applicant generally categorized structural components and commodities that are attached to a structure or reside within a structure as either component supports or other structural members:

- The applicant established the evaluation boundaries for mechanical component supports in accordance with rules governing inspection of component supports (i.e., American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section XI, Subsection IWF). Article IWF-3100, Figure IWF-1300-1, defines component support examination boundaries for integral and nonintegral (i.e., mechanically attached) supports. In general, the support boundary extends to the surface of the building structure but does not include the building structure. Furthermore, the support boundary extends to include nonintegral attachments to piping and equipment but excludes integral attachments to the same.

- Supports for electrical components include cable trays and conduit supports, electrical panels, racks, cabinets, and other enclosures. The evaluation boundary for these items includes supporting elements, such as mechanical or integral attachments to the building structure.

- Evaluation boundaries for other structural members which carry dynamic loads caused by postulated design-basis events are consistent with the method for establishing boundaries for supports specified above. That is, the boundary includes the structural component and the associated attachment to the building structure. The applicant considered the portion of the attachment embedded in the building structure as part of the structure.

Intended Function. The applicant evaluated structural components and commodities to determine intended functions as they relate to license renewal. Unlike mechanical equipment for which both system-level and component-level intended functions are defined, the intended functions for structures are typically based on a simple set of functions that apply both to the structure and to its components and commodities. NEI 95-10 provides guidelines for determining the intended functions of structures, structural components, and commodities for purposes of license renewal.

2.1.2.2.3 Electrical/Instrumentation and Control Component Screening Methodology

Following system-level scoping, the applicant performed screening to identify those electrical/I&C components that are subject to an AMR. In LRA Section 2.1.2.3, "Electrical and Instrumentation and Control Systems," the applicant described the methodology used to screen civil/structural components.

Passive Screening. The LRA states that Appendix B, "Typical Structure, Component and Commodity Groupings and Active/Passive Determinations for the Integrated Plant Assessment," to NEI 95-10 identifies electrical commodities considered to be passive. The applicant identified and cross-referenced the ANO-2 electrical commodity groups to the appropriate NEI 95-10 commodity, which identified the passive commodity groups.

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

(1) cables and connections, bus, and electrical portions of electrical and I&C penetration assemblies

(2) high-voltage insulators

The applicant considered the pressure boundary function that may be associated with some electrical and I&C components identified in Appendix B to NEI 95-10 (e.g., flow elements, vibration probes) in the mechanical AMRs, as applicable. In addition, electrical components which are supported by structural commodities (e.g., cable trays, conduit and cable trenches) are included in the structural AMRs.

Long-Lived Screening. The LRA states that electrical components included in the Environmental Qualification Program per 10 CFR 50.49 are replaced based on qualified life and, therefore, do not meet the long-lived criterion of 10 CFR 54.21(a)(1)(ii) and are not subject to an AMR. Some insulated cables and connections and most electrical penetration assemblies are included in the Environmental Qualification Program and are not subject to an AMR. The applicant did not screen out any other passive, non-EQ electrical components per the long-lived criterion; therefore, they are subject to an AMR.

2.1.3 Staff Evaluation

As part of its review of the applicant's LRA, the NRC staff evaluated the scoping and screening activities described in Section 2.1 to ensure that the applicant described a process for identifying SSCs that are within the scope of license renewal, in accordance with the requirements of 10 CFR 54.4(a)(1–3). The staff evaluated Sections 2.2, 2.3, 2.4, and 2.5 to assure that the applicant described a process for determining structural, mechanical, and electrical components at ANO-2 that are subject to an AMR for license renewal, in accordance with the requirements of 10 CFR 54.21(a)(1–2).

In addition, the staff conducted a scoping and screening methodology audit at ANO-2 from January 20–23, 2004. The results of the audit were documented in the ANO-2 Trip Report issued on October 7, 2004 (ML0428104440). The audit focused on ensuring that the applicant 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. It 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 main feedwater, emergency feedwater, and emergency diesel generator (EDG) to ensure that the applicant appropriately implemented the methodology outlined in the administrative controls. The team found the results reports 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 that describe the scoping and screening methodology implemented by the applicant. These procedures include LRPG-03, "System and Structure Scoping Guidelines"; LRPG-04, "Mechanical System Screening and Aging Management Reviews"; LRPG-05, "Electrical Systems Scoping, Screening and Aging Management Reviews"; LRPG-06, "Structural Screening and Aging

Management Reviews"; A2-ME-2003-001-1, "Aging Management Review of Nonsafety-related Systems and Components Affecting Safety-related Systems"; ULD-0-TOP-01, "Environmental Qualification"; ULD-0-TOP-02, "Fire Protection Topical"; ULD-0-TOP-19, "Station Blackout"; ULD-2-SYS-34, "DSS DEFAS Reactor Trip System (ATWS)"; SAR Section 5.2.4.3.2, "Pressurized Thermal Shock"; ULD-0-TOP-22, "ANO Component Classification Topical"; LRPG-01, "Project Plan"; A2-ME-2003-001-1, "Aging Management Review of Nonsafety-Related"; and LI-110, "Commitment Management Program." The team found that the scoping and screening methodology instructions are consistent with Section 2.1 of the LRA and are 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 design-basis documents, 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 is consistent with the CLB of ANO-2.

The applicant compiled lists of systems and structures from sources, such as the component and maintenance databases; design-basis documents; the Updated Final Safety Analysis Report (UFSAR); site architectural, civil, and piping and instrumentation diagrams (P&IDs); Maintenance Rule documents; regulatory compliance reports; Environmental Qualification Program documents; fire hazard analysis reports; safety evaluation reports (SERs); and the probabilistic risk assessment summary report. The applicant used these sources to identify the intended safety functions of the systems and structures in accordance with the criteria of 10 CFR 54.4(a)(1–3). The applicant used the component database system, "Passport," which identifies safety-related, Q-list components. This information was transferred to the License Renewal Information System and used to identify those systems containing safety-related and regulated event supporting components to be considered within scope for license renewal. The applicant documented the scoping results in accordance with LRPG-03.

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

10 CFR 54.4(a)(1). Pursuant to 10 CFR 54(a)(1), the applicant must consider as within the scope of license renewal all safety-related SSCs which are relied upon to remain functional during and following design-basis events to ensure (1) the integrity of the reactor coolant pressure boundary, (2) the ability to shut down the reactor and maintain it in a safe-shutdown condition, or (3) the capability to prevent or mitigate the consequences of accidents which could result in potential offsite exposures comparable to those referenced in 10 CFR 50.34(a)(1), 10 CFR 50.67(b)(2), or 10 CFR 100.11.

As part of its review of the applicant's scoping methodology, the audit team evaluated a sample of the license renewal database 10 CFR 54(a)(1) scoping results, examined a sample of the analyses and documentation to support these reviews, and discussed the methodology and results with the applicant's personnel responsible for these evaluations. The team verified that the applicant identified and used pertinent engineering and licensing information in order to determine the SSCs required to be within scope, in accordance with the 10 CFR 54.4(a)(1) criteria. On the basis of this sample review and discussions with the applicant, the audit team determined that the applicant's methodology for identifying systems and structures meeting the scoping criteria of 10 CFR 54(a)(1) is adequate.

The audit team noted that 10 CFR 54.4(a)(1)(iii) requires that the applicant consider within the scope of license renewal those SSCs that ensure the capability to prevent or mitigate the consequences of accidents which could result in potential offsite exposures comparable to those referred to in 10 CFR 50.34(a)(1), 10 CFR 50.67(b)(2), or 10 CFR 100.11. In Section 2.1.1.1 of the LRA, the applicant stated that, because of plant-unique considerations or preferences, it designated some components that do not perform any of the functions meeting the requirements of 10 CFR 54.4(a)(1) as safety related, such that certain items classified as safety related in the facility database do not perform any of the safety-related intended functions of 10 CFR 54.4(a)(1). The staff requested a description of the process used during license renewal scoping activities to disposition components classified as safety related that do not perform a safety-related intended function. In particular, the staff requested (a) a description of any components or structures classified as safety related in the facility safety classification database that are not included within the scope of license renewal under the 10 CFR 54.4(a)(1) criteria and (b) the process used to reconcile the facility database safety classification information with scoping intended function determinations. The staff documented this as Request for Additional Information (RAI) 2-1.3.

The applicant responded in a letter to the NRC dated May 19, 2004:

a. For the majority of mechanical components, the safety classification in the ANO-2 component database was consistent with the determination that the components required aging management review for license renewal. The following individual mechanical components were listed in the component database as safety-related but did not support the safety functions identified under the 10 CFR 54.4(a)(1) criteria or meet the 10 CFR 54.4(a)(2) or (a)(3) criteria and, therefore, did not require aging management review.

   Safety-related instrument air solenoid valves do not require aging management review since the passive pressure boundary function is not required for the system intended functions to be met. The components supplied by the instrument air solenoid valves fail to the safe position on loss of air pressure, so pressure boundary integrity of the solenoid valves that supply instrument air is not required to accomplish system intended functions.

   The emergency diesel generator air compressors and their relief valves are classified as safety-related in the database, but the compressors are not required to operate during the starting of the diesel. There is adequate air stored in tanks to ensure the diesel starts without the compressors. The compressors and relief valves are not part of the tank pressure boundary. These components are conservatively classified in the database, but are not required to accomplish system intended functions.

   Flexible stainless steel piping to reactor coolant pump seal pressure transmitters are shown as safety-related in the database, but are connected to nonsafety-related piping and transmitters and do not have a safety function. These components are conservatively classified in the database, but are not required to accomplish system intended functions.

The review identified a few components identified as safety-related in the database where safety classification changes are pending that will change the classification to nonsafety-related.

There were no structures identified as safety-related in the component database that were not included in the structural aging management reviews.

b. As described in LRA Section 2.1.1, the process used to determine the systems and structures in the scope of license renewal for ANO-2 followed the recommendations of Nuclear Energy Institute (NEI) 95-10. Functions for the structures and mechanical systems were identified based on reviews of applicable plant licensing and design documentation. The applicable sections of the safety analysis report, technical specifications, maintenance rule scoping documents, upper level documents, and ANO topical reports for the NRC regulations identified in 10 CFR 54.4(a)(3) were used to determine system and structure functions. During system aging management reviews, detailed component level evaluations were completed to identify components that are required to support system level functions.

After completion of the system aging management reviews, a database review was performed that identified safety-related components in the component database that had not been identified as subject to aging management review. These components or groups of components were evaluated to confirm that a suitable basis was used for their exclusion. See the response to part (a) for discussion of the basis for exclusion of components classified as safety-related.

The staff concluded that the applicant's response describes the process used during license renewal scoping activities to disposition components classified as safety related that do not perform a safety-related intended function and, therefore, adequately addresses the questions documented in RAI 2.1-3.

<u>10 CFR 54.4(a)(2)</u>. Pursuant to 10 CFR 54(a)(2), the applicant must consider to be within the scope of license renewal all nonsafety-related SSCs whose failure could prevent satisfactory accomplishment of any of the functions identified in 10 CFR 54(a)(1)(i)-(iii).

The applicant documented the review of scoping activities in support of 10 CFR 54.4(a)(2) in an engineering report titled, "Aging Management Review of Nonsafety-Related Systems and Components Affecting Safety-Related Systems." The applicant discussed the scoping methodology as it relates to the nonsafety-related criteria in accordance with 10 CFR 54.4(a)(2). With respect to the nonsafety-related criteria, the applicant stated that it performed a review to identify the nonsafety-related SSCs whose failure could prevent satisfactory accomplishment of the safety-related intended functions identified in 10 CFR 54.4(a)(1).

As stated in the LRA, the applicant identified nonsafety-related SSCs whose failure could prevent satisfactory accomplishment of a safety function. It considered the impacts of nonsafety-related SSC failures as either functional or spatial. In a functional failure, the failure of an SSC to perform its normal function impacts another safety function. In a spatial failure, the loss of structural or mechanical integrity of an SSC in physical proximity to a safety-related component impacts a safety function.

The applicant used three steps to evaluate the potential for spatial interaction of fluid-filled, nonsafety-related piping with safety-related systems or components—(1) determination of whether the pipe contains liquid, (2) determination of whether the piping system has components in safety-related structures or a location containing a safety-related system, and (3) determination of whether the potential exists for spatially related interaction between the nonsafety-related, fluid-filled system and a safety-related system or component. After identifying fluid-filled systems through a component database review, the applicant used a spaces approach to identify nonsafety, fluid-filled systems which are located in the proximity of safety-related systems.

The applicant installed protective features (e.g., whip restraints, spray shields, supports, and barriers) to protect safety-related SSCs against spatial interaction with nonsafety-related SSCs. The applicant included such protective features credited in the plant design within the scope of license renewal and as subject to an AMR. Where those protective features provide adequate protection, the applicant excluded the nonsafety-related system itself from the scope of license renewal. Protective features are typically associated with a structure and are addressed in the structural AMR.

The audit team determined that the applicant classified SSCs required to perform a function in support of other safety-related components as safety-related and included them within the scope of license renewal. For the few exceptions where nonsafety-related equipment must remain functional in support of a safety function, the applicant included the supporting systems within the scope as nonsafety-related SSCs affecting safety-related SSCs. The applicable sections of the SAR, technical specifications, Maintenance Rule scoping documents, and design-basis documents provide the system information to determine the appropriate systems and structures in this category.

For nonsafety-related piping systems directly connected to safety-related SSCs, the nonsafety-related piping and supports, up to and including the first equivalent anchor beyond the safety/nonsafety-related interface, are subject to an AMR. In addition, nonsafety-related portions of safety-related systems downstream of the first anchor are subject to an AMR if they have the potential for spatial interaction with safety-related SSCs.

By letters dated December 3, 2001, and March 15, 2002, the NRC issued a staff position to the NEI which describes areas to be considered and options it expects licensees to use to determine what SSCs meet 10 CFR 54.4(a)(2) (i.e., all nonsafety-related SSCs whose failure could prevent satisfactory accomplishment of any safety-related functions identified in 10 CFR 54.4(a)(1)(i–iii)). The December 3 letter provides specific examples of operating experience which identify 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 within scope based on

10 CFR 54.4(a)(2). The March 15 letter further describes the staff's expectations for the evaluation of nonpiping SSCs to determine which additional nonsafety-related SSCs are within the scope. The position states that applicants should not consider hypothetical failures, but rather should base their evaluations on the plant CLB, engineering judgment 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 (e.g., significant operating event reports), and engineering evaluations.

The audit team determined that Section 2.1.1.2.2, "Spatial Failures of Nonsafety-Related SSCs," of the LRA states that the nonsafety-related piping and supports, up to and including the first equivalent anchor beyond the safety/nonsafety interface, are within the scope of license renewal and subject to an AMR. The staff requested additional information regarding the process used by the applicant to ensure that it adequately considered all nonsafety-components and structures between the safety/nonsafety interface and the first equivalent anchor point during scoping. Specifically, staff asked the applicant to describe the method used to ensure that it considered all material-environment combinations between the safety/nonsafety interface and the first equivalent anchor during an AMR. The staff documented this as RAI 2.1-4, part (a).

The applicant responded to RAI 2.1-4, part (a), in a letter to the NRC dated May 19, 2004. For ANO-2, the nonsafety-related piping connected to safety-related piping up to the first equivalent anchor beyond the safety/nonsafety interface is within the scope of license renewal and subject to an AMR. The safety/nonsafety interface is normally shown on the LRA drawings through the use of license renewal boundary flags. In most cases, flags indicate seismic Class 1 evaluation boundaries on the LRA drawings. However, the exact location of the equivalent anchor may not be indicated on these drawings. To assure that the LRA AMR summary tables include all material and environment combinations, the applicant reviewed the systems within the scope of license renewal that contain safety-related components. The applicant reviewed piping classifications beyond the license renewal boundary indicated on the drawings for these systems to ensure that no new material-environment combinations exist. To do this, the applicant either (1) traced piping from the license renewal boundary back to an obvious anchor point (i.e., a larger line or a larger component such as a pump or heat exchanger), or (2) when a seismic Class 1 boundary flag was available, traced the piping back to at least two major components beyond the flag to identify piping class changes.

This approach assured that the piping reviewed would include the equivalent anchor. If the applicant identified a piping material or environment change, it compared the change with the AMR results for that system or a connected system to validate that the material-environment combination was addressed. The review of these systems confirmed that LRA Section 3.0 includes all applicable material-environment combinations, up to and including the first equivalent anchor.

The staff concluded that the applicant's response provides information regarding the process it used to ensure that it adequately considered all nonsafety-components and structures between the safety/nonsafety interface and the first equivalent anchor point during scoping and adequately addressed the questions documented in RAI 2.1-4, part (a).

The audit team determined that Section 2.1.1.2.2 of the LRA states that nonsafety-related systems and nonsafety-related portions of safety-related systems containing steam or liquid that are in the proximity of safety-related equipment are considered within the scope of license renewal, per 10 CFR 54.4(a)(2). However, this section of the LRA also states that long-term exposure to conditions resulting from a failed nonsafety-related SSC (such as leakage or spray) is not considered credible. The staff requested that the applicant clarify its position and methodology relative to the consideration of spray and wetting of safety-related SSCs from the failure of nonsafety-related equipment. The staff documented this as RAI 2.1-4, part (b). Specifically, the staff asked the applicant to address the following:

(1) Clarify how it reached the determination that long-term exposure to conditions resulting from a failed nonsafety-related SSC are not considered credible. Address if the applicant excluded nonsafety-related SSCs from the scope of license renewal based on this determination.

(2) Describe how it considered the effects of short-term wetting and spray on passive and active safety-related SSCs during 10 CFR 54.4(a)(2) scoping. During the methodology audit, the applicant indicated that the methodology for evaluating spatial interactions assumes that safety-related SSCs can withstand short-term duration spray and wetting without a loss of intended function. Therefore, the staff asked the applicant to clarify its consideration of the effects of short-term spray and wetting during scoping. Furthermore, if the applicant assumed that safety-related SSCs could withstand short-term spray or wetting without a loss of intended function, it should describe the basis for this assumption.

(3) Identify if it used the System Walkdown Program described in Section B.1.28, "System Walkdown," of the LRA as the sole aging management program (AMP) for any nonsafety-related structures or components that could potentially spatially interact with safety-related SSCs. If only the System Walkdown Program manages the effects of aging for any nonsafety-related SSC, describe the applicant's consideration of the effects of short-term spray and wetting during scoping and AMR evaluations.

The applicant responded to RAI 2.1-4, part (b), in a letter to the NRC dated May 19, 2004, as follows:

> 1. LRA Section 2.1.1.2.2, under the heading of Leakage, Spray, or Flooding, states that "Long-term exposure to conditions resulting from a failed nonsafety-related SSC (such as leakage or spray) is not considered credible." This conclusion was not applied during scoping evaluations. If a steam or liquid-filled nonsafety-related system (or nonsafety-related portion of a safety-related system) was in a safety-related building, then that system was considered in scope for 10 CFR 54.4(a)(2) regardless of potential exposure duration. No nonsafety-related SSCs were excluded from the scope of license renewal based on the consideration that long-term exposure to conditions resulting from a failed nonsafety-related SSC was not credible.
>
> 2. The potential for wetting or spray on passive and active safety-related components was considered in scoping evaluations. Nonsafety-related

systems containing steam or liquid that are near safety-related equipment are considered in scope for 10 CFR 54.4(a)(2) regardless of potential exposure duration. An assumption that safety-related SSCs could withstand short-term spray or wetting without loss of intended function was not applied during scoping or screening.

3. As indicated in Table 3.3.2-11 of the LRA, the System Walkdown Program is credited as the sole aging management program for some nonsafety-related components that could spatially interact with safety-related SSCs. As stated above, the duration of potential spray or wetting was not a consideration during scoping. The System Walkdown Program as described in Appendix B.1.28 of the LRA is considered adequate since it requires periodic walkdowns that will detect and correct failures caused by long-term exposure to spray or wetting. Short-term exposure is not a concern for passive components such as valve bodies and piping. Active safety-related component failures due to short-term exposure would be detected in the course of normal operation, or through monitoring required by the maintenance rule, and appropriate corrective actions would be taken. This is consistent with the Statements of Considerations for the license renewal rule which states, "On the basis of consideration of the effectiveness of existing programs which monitor the performance and condition of systems, structures, and components that perform active functions, the Commission concludes that structures and components associated only with active functions can be generically excluded from a license renewal aging management review. Functional degradation resulting from the effects of aging on active functions is more readily determinable, and existing programs and requirements are expected to directly detect the effects of aging."

The staff concluded that the applicant's response to RAI 2.1-4, part (b), sections 1 and 2, clarifies its position and methodology relative to the consideration of spray and wetting of safety-related SSCs from the failure of nonsafety-related equipment and adequately addresses the questions documented in RAI 2.1-4, part (b), sections 1 and 2. The staff's concern with respect to using the System Walkdown Program as the sole aging management program for some nonsafety-related components was resolved by RAI 3.3.3.4.11-1, which is addressed in Section 3.3 of this SER. Therefore, RAI 2.1-4, part (b), section 3 is resolved.

On the basis of the additional information supplied by the applicant, including the determination of the credible failures which could impact the ability of safety-related SSCs to perform their intended functions, evaluation of relevant operating experience, and incorporation of identified nonsafety-related SSCs into the applicant's AMPs, and the results of NRC inspection and audit activities, the staff concludes that the applicant has, with the exceptions noted above regarding the response to RAI 2.1-4, part (b), section 3, supplied sufficient information to demonstrate that the applicant has identified as within the scope of license renewal all SSCs that meet the 10 CFR 54.4(a)(2) scoping requirements.

<u>10 CFR 54.4(a)(3)</u>. Pursuant to 10 CFR 54(a)(3), the applicant must consider all SSCs relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48), EQ (10 CFR 50.49), PTS

(10 CFR 50.61), ATWSs (10 CFR 50.62), and SBO (10 CFR 50.63) to be within the scope of the license renewal. ANO-2 procedure 02-R-02008-01, "License Renewal Project System and Structure Scoping Method and Results," details the approach used to identify the scoping of the SSCs relied upon for these regulated events. The applicant identified SSCs within the scope of 10 CFR 54(a)(3) by reviewing associated plant documents. The NRC audit team reviewed a sample of the specific documentation referenced in 02-R-02008-01, including the following:

- ANO-2 SAR Section 9.5, "Fire Protection Program"
- ANO Engineering Standard EES-13, "Evaluation of Safe Shutdown Capability"
- ANO-2 Calculation 85-E-0087-01, "Fire Hazard Analysis Report Safe Shutdown Capability Assessment"
- ULD-0-TOP-01, "Environmental Qualification Topical"
- technical specification evaluation A2-EP-2002-004, "TLAA and Exemption Evaluation"
- ULD-2-SYS-34, Revision 0, "Diverse Scram and Diverse Emergency Feedwater Actuation Systems"
- ULD-0-TOP-19, Revision 0, "Station Blackout"

As part of its review of the applicant's scoping methodology, the audit team evaluated a sample of the license renewal database 10 CFR 54(a)(3) scoping results, examined a sample of the analyses and documentation to support these reviews, and discussed the methodology and results with the applicant's personnel responsible for these evaluations. The team verified that the applicant had identified and used pertinent engineering and licensing information to determine the SSCs required to be within scope in accordance with the 10 CFR 54.4(a)(3) criteria. Based on this sampling review and discussions with the applicant, the audit team determined that the applicant's methodology for identifying systems and structures meeting the scoping criteria of 10 CFR 54(a)(3) is adequate.

Mechanical Scoping Methodology. The applicant described the methodology used for mechanical scoping in LRA Section 2.1.1 LRPG-03, and LRPG-04. For each mechanical system within scope of license renewal, the applicant evaluated the components to determine those subject to an AMR. The applicant reviewed design-basis documents to identify the specific components that support the intended function of the mechanical system and to establish evaluation boundaries.

The applicant determined the evaluation boundary to be that portion of the system that is necessary to ensure that the intended function of the system will be performed. The applicant based the evaluation boundary on a review of numerous documents, including the UFSAR, component database, accident analyses, design-basis documents, and P&IDs. The applicant marked the evaluation boundary on the system P&ID.

The team determined that the applicant's proceduralized methodology is consistent with the description provided in Section 2.1.1 of the LRA and the guidance contained in Section 2.1 of NUREG-1800, "Standard Review Plan for Review of License Renewal Applications for Nuclear

Power Plants," (SRP-LR). Based on review of information contained in the LRA, the applicant's detailed scoping implementation procedures, and a sampling review of mechanical scoping results, the team concluded that the applicant's methodology for identification of structural components within the scope of license renewal meets the requirements of 10 CFR 54.4(a).

Structure Scoping Methodology. The applicant described the methodology used for structural scoping in LRA Section 2.1.1, LRPG-03, and in Section 2.4 of the system scoping method and results (SAR) procedure 02-R-2008-01, Revision 1. The applicant developed a list of plant structures from a review of civil/structural and plant layout drawings as the starting point for scoping and included all structures that could potentially support license renewal. It identified functions for the structures and structural components and commodities (e.g., pipe supports, structural steel, foundations, floors, walls, ceilings, penetrations, stairways, and curbs) based on reviews of plant licensing and design documentation, including the SARs. The applicant relied upon the SARs to identify safety classification of structures and structural components. The applicant considered Class I structures and structural components safety related.

The applicant determined structure evaluation boundaries, including examination of structure interfaces. It evaluated all structure functions against the criteria of 10 CFR 54.4(a)(1–3) and documented the results of this evaluation in the LRA. In those instances where the structure intended functions require support from other structures or systems, the applicant identified the supporting systems or structures and evaluated them against the criteria in 10 CFR 54.4(a)(2). The applicant used a single boundary diagram based on site plot and equipment layout drawings, which displays all of the structures in relation to one another. For in-scope structures, the applicant identified all structural components that are required to support the intended functions of the structure as within the scope of the Rule.

The audit team reviewed plant drawings and the list of in-scope plant structures that the applicant developed from a review of civil/structural and plant layout drawings and also interviewed engineering personnel to further assess the methodology used for scoping. The audit team compared the applicant's generic structural component listing to the typical structural commodity groups identified in Table 2.1-5 of the SRP-LR and concluded that the applicant's general structural component list is reasonable. Following identification of all system components, the applicant evaluated each component against the scoping criteria of 10 CFR 54.4(a). The applicant classified structural components meeting the criteria of 10 CFR 54.4(a) are within the scope of license renewal.

The audit team determined that the applicant's proceduralized methodology is consistent with the description provided in Section 2.1.1 of the LRA and the guidance contained in Section 2.1 of the SRP-LR. Based on review of information contained in the LRA, the applicant's detailed scoping implementation procedures, and a sampling review of structural component and commodity scoping results, the team concluded that the applicant's methodology for identification of structural components within the scope of license renewal meets the requirements of 10 CFR 54.4(a).

Electrical and Instrumentation and Control Scoping Methodology. The applicant described the methodology used for electrical and I&C scoping in LRA Section 2.1.1, LRPG-03, and LRPG-05. The applicant used a plant systems list from the ANO-2 component database which identifies the component safety, safety-related, or Q-classification using the same definition as that stated in 10 CFR 54.4. Specifically, the ANO-2 definition of safety related, which was used to develop and maintain the component-level Q-list, includes the SSCs that are relied on to remain functional during or following design-basis events. The applicant also used NEI 95-10 to determine the electrical and I&C components to be included within the scope of the license renewal process for ANO-2. If any of the electrical components met the criteria of 10 CFR 54.4, the applicant considered them to be within the scope of license renewal and documented the results in Engineering Report 02-R-2008-01, the Scoping Methods and Results Report. The report also describes the method used to identify those electrical systems and structures which will meet the 10 CFR 54.4 criteria. In addition to the plant electrical systems, the applicant conservatively included certain nonplant equipment components of the switchyard within the scope of license renewal because of SBO considerations.

2.1.3.2 Screening Methodology

2.1.3.2.1 Mechanical Component Screening

The applicant described the methodology used for mechanical component screening in LRA Section 2.1.2.1 and LRPG-04.

The applicant determined that components subject to an AMR are those that perform an intended function without moving parts or a change in configuration or properties (i.e., passive) and are not subject to replacement based on qualified life or specified time period (i.e., long-lived). In accordance with LRPG-04, the applicant then determined whether the components within the evaluation boundary are passive and long-lived and documented the results.

The NRC audit team reviewed the methodology for identifying 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 mechanical screening methodology by reviewing the components identified as within the scope of license renewal, the corresponding component intended functions, and the resulting list of components subject to an AMR.

The audit team noted that 10 CFR 54.21(a)(1) requires that SCs subject to an AMR encompass those SCs that (1) perform an intended function without moving parts or a change configuration or properties and (2) that are not subject to replacement based on a qualified life or specified time period. Table 2.1-3, "Specific Staff Guidance on Screening," of the SRP-LR provides guidance for determining if consumable items should be subject to an AMR. For consumables that are periodically replaced, Table 2.1-3 states that the applicant should identify the standards that are relied on for replacement as part of the methodology description. For consumables such as packing, gaskets, component seals, and O-rings, Table 2.1-3 states that these components may be excluded from an AMR using a clear basis. Section 2.1.2 of the LRA states that the process for evaluating consumables is consistent with the NRC staff guidance on consumables provided in a letter from C.I. Grimes, NRC, to D.J. Walters, NEI, dated March 10, 2000. The staff requested that the applicant provide a more detailed description of the actual method used to demonstrate that it adequately evaluated the criteria and the basis for that determination. The staff documented this RAI 2-1.5.

The applicant responded to RAI 2-1.5 in a letter to the NRC dated May 19, 2004. For ANO-2, the applicant reviewed consumable subcomponents based on criteria in the letter from C.I. Grimes, NRC, to D.J. Walters, NEI, dated March 10, 2000, which is consistent with the SRP-

LR, Table 2.1-3, issued April 2001. The applicant provided the following additional detail on the implementation for ANO-2:

- The applicant excluded packing, gaskets, components seals, and O-rings because these components are not relied on for the pressure boundary function, as stated in CE NPSD-1215 and ASME Code, Section III.

- The applicant evaluated structural sealants (elastomers) and identified aging effects and AMPs as applicable.

- Oil, grease, and component filters are tested or inspected periodically and replaced under ANO-2 maintenance activities. They are excluded because they are considered short-lived.

- System filters are inspected periodically and replaced as required under ANO-2 maintenance activities. Fire extinguishers and hoses are inspected per ANO-2 SAR Section 9.5.1 and Appendix 9D. Air packs are maintained under the Self-Contained Breathing Apparatus Program based on 42 CFR 84, 29 CFR 19.10, 29 CFR 19.26, NUREG-0041, and ANSI-Z88.2. These items are excluded because they are short-lived (i.e., periodically inspected and replaced based on their condition).

The staff concluded that the applicant's response provides a more detailed description of the actual method used to demonstrate that it adequately evaluated the criteria and the basis for that determination. Therefore, the applicant adequately addressed the questions documented in RAI 2.1-5.

The team determined that the applicant's mechanical component screening methodology described in LRA Section 2.1.2.1 is consistent with the guidance contained in the SRP-LR. It is capable of identifying those passive, long-lived components within the scope of license renewal that are subject to an AMR. Therefore, the screening methodology for structural components and commodities is adequate.

2.1.3.2.2 Structural Component Screening

The applicant described the methodology used for structural scoping in LRA Section 2.1.2.2 and LRPG-06. For each structure within the scope of license renewal, the applicant evaluated the structural components and commodities to determine those subject to an AMR. The screening process involved a review of design-basis documents to identify specific structural components and commodities that constitute the structure. The applicant determined that structural components or commodities subject to an AMR are those that perform an intended function without moving parts or a change in configuration or properties (i.e., passive) and are not subject to replacement based on qualified life or specified time period (i.e., long-lived). Consequently, the applicant determined that since structures are inherently passive, and with few exceptions long-lived, it based the screening of structural components and commodities primarily on whether they perform an intended function.

The applicant evaluated structural elements and components in commodity groups based on materials such as steel, threaded fasteners, and concrete. The scoping and screening evaluation did not identify and evaluate these multiple structural components on an individual basis. Rather, the evaluation grouped similar structural components as generic components for scoping and screening. The applicant generally categorized structural components and commodities that are attached to a structure or reside within a structure as either component supports or as other structural members.

The applicant established evaluation boundaries for mechanical component supports in accordance with ASME Code, Section XI, Subsection IWF, which governs inspection of component supports. For support of electrical components, the evaluation boundary includes mechanical or integral attachments to the building structure. The evaluation boundary for other structural members includes the structural component and the associated attachment to the building structure. The applicant used the guidelines provided in NEI 95-10 to determine the intended functions of SSCs and commodities for the LRA.

The team reviewed the methodology for identifying structures and structural components and commodities 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 structural screening methodology by reviewing the structural components and commodities identified as within the scope of license renewal, the corresponding structural component intended functions, and the resulting list of structural components subject to an AMR.

Revision 1 to LRPG-06 provides guidance on conducting structural component and commodity screening. The team reviewed structural component and commodity groups developed under the screening methodology, which also established evaluation boundaries and intended functions. The team also reviewed LRA Table 3.5.1, which summarized the AMPs for SC supports evaluated in NUREG-1801, "Generic Aging Lessons Learned (GALL) Report."

The team determined that the applicant's structural component screening methodology described in LRA Section 2.1.2.2 is consistent with the guidance contained in the SRP-LR. It is capable of identifying those passive, long-lived components within the scope of license renewal that are subject to an AMR. Therefore, the screening methodology for structural components and commodities is adequate.

2.1.3.2.3 Electrical and Instrumentation and Control Component Screening

The applicant described the methodology used for mechanical component screening in LRA Section 2.1.2.3 and LRPG-04. The applicant separated the active components from the passive ones using the guidance in NEI 95-10. The screening criteria initially identified passive electrical systems and components (i.e., those which perform their intended function without moving parts and without a change in configuration or properties the component are considered passive). Within the passive components, if the component is not subject to replacement based on a qualified life or specified time period, it is considered long-lived and subject to an AMR. As a result, the applicant identified the electrical and I&C system commodities that are within the scope and subject to AMR in a table in the LRA.

Supports for electrical components include cable trays and conduit supports, electrical panels, racks, cabinets, and other enclosures. The evaluation boundary for these items includes supporting elements, such as mechanical or integral attachments to the building structure.

The team reviewed the methodology for identifying electrical components subject to an AMR, as well as the applicant's technical justification for this methodology. The team also examined the applicant's results of the application of the screening methodology by reviewing components identified as within the scope of license renewal. Procedure LRPG-05 provides guidance for conducting the electrical screening. The team reviewed the electrical commodity groups developed under the screening methodology.

The team determined that the applicant's electrical scoping and screening methodology described in LRA Section 2.1.2.3 is consistent with the guidance contained in the SRP-LR. It is capable of identifying those passive, long-lived components within the scope of license renewal that are subject to an AMR. Therefore, the screening methodology for electrical components is adequate.

The NRC staff's scoping and screening methodology audit identified a number of items requiring action by the applicant. These are identified in the ANO-2 Audit Trip Report. Most of the items were resolved thorough request for additional information as noted above. RAI 2.1-4, part b, section 3 was subsequently resolved and discussed in the resolution of RAI 3.3.3.4.11-1 in Section 3.3 of this SER.

2.1.4 Conclusion

The staff formed the basis of its safety determination based on its review of the information presented in LRA Section 2.1, the supporting information in LRPG-03, LRPG-04, LRPG-05, LRPG-06, A2-ME-2003-001-1, ULD-0-TOP-01, ULD-0-TOP-02, ULD-0-TOP-19, ULD-2-SYS-34, SAR Section 5.2.4.3.2, ULD-0-TOP-22, LRPG-01, ULD-0-TOP-22, A2-ME-2003-001-1, and LI-110, the information presented during the scoping and screening audit, the NRC scoping and AMR inspections, and the applicant's responses to the staff's RAIs. The staff found that the applicant's scoping and screening methodology, including its supplemental 10 CFR 54.4(a)(2) review which brought additional nonsafety-related piping segments and associated components into the scope of license renewal, is consistent with the requirements of the Rule and the staff's position on the treatment of nonsafety-related SSCs. On the basis of this review, the staff concludes that the applicant's methodology for identifying the SSCs within the scope of license renewal and the SCs requiring an AMR is consistent with the requirements of 10 CFR 54.4 and 10 CFR 54.21(a)(1).

2.2 Plant-Level Scoping Results

In LRA Section 2.2, the applicant provided the results of plant-level scoping review. The staff reviewed this section of the LRA to determine whether the applicant has properly identified all plant-level systems and structures that are within the scope of license renewal, as required by 10 CFR 54.4.

2.2.1 Summary of Technical Information in the Application

In LRA Tables 2.2-1a, 2.2-1b, 2.2-2, 2.2-3, and 2.2-4, the applicant listed plant systems and structures that are within the scope of license renewal and those that are not within the scope of license renewal. Based on the design-basis events considered in the plant's CLB, other CLB information relating to nonsafety-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.

2.2.2 Staff Evaluation

In LRA Section 2.1, the applicant described its methodology for identifying the SCs that are within the scope of license renewal and subject to an AMR. The staff reviewed the scoping and screening methodology and provides its evaluation in Section 2.1 of this SER. To determine that the applicant has properly implemented its methodology, the staff focused its review on the implementation results shown in LRA Tables 2.2-2 and 2.2-4 to confirm that the applicant did not omit plant-level systems and structures within the scope of license renewal.

The staff considered whether the applicant properly identified the structures and systems within the scope of license renewal, in accordance with 10 CFR 54.4. The staff reviewed selected structures and systems identified by the applicant as not falling within the scope of license renewal to determine that they have no intended functions that do in fact fall within the scope of license renewal. The staff conducted its review of the applicant's implementation in accordance with Section 2.2 of the SRP-LR.

The staff reviewed LRA Section 2.2 and sampled the contents of the UFSAR, based on the listing of systems and structures in LRA Tables 2.2-2 and 2.2-4, to determine whether the applicant omitted any systems or structures that may have intended functions, as identified by 10 CFR 54.4, from the scope of license renewal.

During its review of LRA Section 2.2 and LRA Tables 2.2-2 and 2.2-4, the staff determined that it needed additional information and/or clarification. The following describes the staff's RAI, provided to the applicant by letter dated May 11, 2004, and the applicant's response.

RAI 2.2-1

The UFSAR does not describe some of the mechanical systems that the applicant determined not to be within the scope of license renewal, as listed in LRA Table 2.2-2. The staff could not determine whether these systems have the intended functions that would meet any of the criteria in 10 CFR 54.4(a)(1–3). For those systems that are not described in the UFSAR, the staff requested that the applicant briefly describe the system, including its intended function.

Applicant's Response and Staff's Evaluation

In its response dated June 10, 2004, the applicant stated that Table 2.2-2 identifies six mechanical systems that do not have a UFSAR reference. These systems include the administration building heating and ventilation, diesel fuel services, emergency operations facility, low-level radwaste, miscellaneous system, and startup boiler.

The administration building heating and ventilation system is a nonsafety-related heating and air conditioning system that provides ventilation to the administration building. The building houses offices for site personnel.

The diesel fuel services system includes only two mechanical components, which are nonsafety-related drain valves for the enclosures around the EDG fuel oil day tanks.

The mechanical components in the emergency operations facility (EOF) include a backup diesel generator and heating, ventilation, and air conditioning (HVAC) components such as heat exchangers, blowers, and filters. The EOF serves as an alternate location for the technical support center and the operational support center, if required by the site emergency plan. The building is located 1.05 km (0.65 mi) from the reactor buildings and serves as a training center during normal plant operations.

The mechanical components in the low-level radwaste system include tanks, filters, valves, compressors, and piping that support various activities in handling low-level radioactive waste in the low-level radwaste building, which is located outside the plant power block away from safety-related structures. The low-level radwaste storage building temporarily stores low-level radioactive waste before its shipment off site. This system is only required to support the collection and handling of low-level solid radioactive waste.

The miscellaneous system includes miscellaneous site equipment that is entered into the site component database for work tracking and other purposes but is not a part of an existing system. The mechanical components include a portable hoist and backup power diesel generators for site office buildings.

The startup boiler provides auxiliary steam for plant heating and testing as required during periods when the plant is shut down. The system consists of the boiler, pumps, filters, valves, piping, and other miscellaneous mechanical components.

Based on its review, the staff finds the applicant's response to RAI 2.2-1 acceptable, because none of the systems described has an intended function that meets any of the criteria in 10 CFR 54.4(a)(1–3). The staff confirmed that these systems are not within the scope of license renewal. Therefore, the staff considers its concern described in RAI 2.2-1 resolved.

The staff has completed its review of plant-level scoping results. The staff did not identify any omissions of structures and systems that meet the scoping criteria of 10 CFR 54.4.

2.2.3 Conclusion

The staff reviewed LRA Section 2.2, supporting information in the ANO-2 UFSAR, and the information provided in the applicant's response to the staff's RAIs to determine whether the applicant omitted any structures and systems that should be within the scope of license renewal. On the basis of its review, the staff concludes that the applicant has appropriately identified the structures and systems that are within the scope of license renewal in accordance with 10 CFR 54.4. Sections 2.3 through 2.5 of this SER provide the staff's detailed review of the SSCs that are subject to an AMR.

2.3 System Scoping and Screening Results—Mechanical Systems

The sections of this SER noted in parentheses address the following mechanical system scoping and screening results for license renewal:

- reactor coolant system (2.3.1)
    - reactor vessel and control element drive mechanism pressure boundary
    - reactor vessel internals
    - Class 1 piping, valves, and reactor coolant pumps
    - pressurizer
    - steam generators
- engineered safety features (2.3.2)
    - emergency core cooling
    - containment spray system
    - containment cooling
    - containment penetrations
    - hydrogen control
- auxiliary systems (2.3.3)
    - spent fuel pool
    - water suppression fire protection
    - emergency diesel generator
    - alternate ac diesel generator
    - chemical and volume control
    - Halon fire protection and reactor coolant pump motor oil leakage collection
    - fuel oil
    - service water
    - auxiliary building ventilation
    - control room ventilation
    - miscellaneous systems within scope for 10 CFR 54.4(a)(2)
    - other miscellaneous systems
- steam and power conversion systems (2.3.4)
    - main steam
    - main feedwater
    - emergency feedwater

Pursuant to 10 CFR 54.21(a)(1), applicants must identify and list SCs that are subject to an AMR. These are passive, long-lived SCs that are within the scope of license renewal. To determine whether the applicant has properly implemented its methodology, the staff focused its review on the implementation results. This approach allows the staff to confirm that the applicant has not omitted any system components that are subject to an AMR.

Staff Evaluation Methodology

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

Scoping. To perform its evaluation, the staff reviewed the applicable LRA section and associated component drawings, focusing its review on components that had not been identified as within the scope of renewal. The staff reviewed relevant licensing basis documents, including the UFSAR, for each mechanical system to determine if the applicant had omitted system components with intended functions delineated under 10 CFR 54.4(a) from the scope of license renewal. The staff also reviewed the licensing basis documents to determine if all intended function(s) delineated under 10 CFR 54.4(a) were specified in the LRA. If omissions were identified, the staff requested additional information to resolve the discrepancy.

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

In the LRA, the applicant described a methodology for mechanical system scoping and screening that interprets 10 CFR 54.21(a) differently from previous LRAs and the SRP-LR. Specifically, the applicant did not define the component-level scoping boundary. For an in-scope system, the applicant included all components within the scope of license renewal regardless of their intended functions. The license renewal drawings submitted by the applicant depict a boundary for the components of a system that are subject to an AMR. They do not depict components within the scope of license renewal. On the license renewal drawings, the applicant highlighted those components that are passive and long-lived and have intended functions as subject to an AMR. Therefore, the LRA Section 2.3 tables do not identify and list some components that have intended functions, nor do the license renewal drawings highlight them, because the component scoping boundary is not defined. The applicant combined passive, long-lived, and intended function criteria into one screening process to meet the requirements of 10 CFR 54.21(a)(1).

The methodology used by previous LRA applicants, consistent with the SRP-LR review guidance, describes two steps to perform scoping and screening. The first step, scoping, identifies those SSCs within the scope of license renewal in accordance with 10 CFR 54.4(a). The applicant then identified the components of the in-scope system that have intended functions to be included in the license renewal scope, in accordance with the criteria of 10 CFR 54.4(a). The component scoping boundary within a system is then highlighted on license renewal drawings. The second step, screening, identifies those components in the scoping boundary that are passive and long-lived in accordance with 10 CFR 54.21(a)(1). The resulting components from these scoping and screening steps are subject to an AMR.

As a result of using a different scoping and screening process, and with insufficient information provided in the LRA associated with this methodology, the NRC staff could not determine whether the applicant omitted any components within the scope of license renewal and subject to an AMR. The applicant did not provide scoping information at the component-level equivalent to that provided by previous LRA applicants for the review of systems in LRA Section 2.3.

To better understand the applicant's scoping methodology, the staff visited the ANO-2 plant site between January 20–22, 2004, to review site documentation including, the applicant's license renewal project guidelines and procedures. The results of the audit were documented in a trip report for the site visit issued on May 17, 2004 (ML040610626). The purpose of this plant audit was to determine, by review of plant information, that system components within the scope of license renewal were identified and that the components of the in-scope systems subject to an AMR were properly screened. The staff reviewed the applicant's site documentation in the following areas:

- license renewal process plan
- license renewal project guidelines—system and structure scoping
- license renewal project guidelines—system screening and AMRs
- engineering report for system and structure scoping method and results
- engineering report for screening results for AMRs
- engineering reports, AMR results for selected systems
- Engineering Report A2-ME-2003-001-1

To ensure that the applicant screened all components of an in-scope system or identified them as passive and long-lived, in accordance with 10 CFR 54.21(a)(1), the staff audited engineering reports on the main feedwater system, the emergency feedwater system, and the EDG system. Additionally, the LRA did not provide sufficient scoping information for the miscellaneous systems within scope that meet the 10 CFR 54.4(a)(2) criteria. Therefore, the staff reviewed Engineering Report A2-ME-2003-001-1 to confirm mechanical component scoping and screening results. As a result of its review of this report, the staff issued RAI 2.3.3.11-3, described in Section 2.3.3.11 of this SER. The staff also reviewed engineering reports for other individual systems to confirm the applicant's responses to the staff's draft RAIs. A trip report issued on May 17, 2004 documents the results of the plant audit. In its trip report, the staff noted which engineering reports it reviewed at the plant site and the additional information that it requested based on the review of the site documentation.

As a result of the staff's review of LRA Section 2.3 and the plant audit, the staff found that it needed additional clarification to determine whether the applicant's component-level scoping for the systems within scope is adequate. Therefore, by letter dated May 11, 2004, the staff issued RAI 2.3-1, discussed below, to the applicant to determine whether it properly applied the scoping criteria of 10 CFR 54.4(a).

RAI 2.3-1

Section 2.1.1 of the LRA states that the applicant prepared license renewal drawings to indicate components subject to an AMR. However, the license renewal drawing legends indicate that the highlighted portions of the systems with flags represent the systems and components that are within the scope of license renewal. The staff noted that this appears to be an inconsistency between the drawing legend and the LRA statement. The staff requested that the applicant clarify this discrepancy.

Additionally, 10 CFR 54.21(a)(2) requires applicants to describe and justify the methods used in complying with 10 CFR 54.21(a)(1). In LRA Section 2.1.2, the applicant briefly described the screening methodology, stating, "for each mechanical system within the scope of license renewal, the screening process identified those components that are subject to an aging management review." This description of the screening methodology, specifically for mechanical systems, is not clear to the staff. It does not adequately describe the method used to determine how the applicant screened a component from further evaluation. The staff requested that the applicant clarify the methodology used to perform the screening of mechanical components and discuss how it established the system evaluation boundaries and determined the component intended functions.

Applicant's Response and Staff's Evaluation

In its response to the first part of RAI 2.3-1, dated June 10, 2004, the applicant stated that the LRA Section 2.1.1 statement is correct, and that the drawings are intended to be an aid used in conjunction with the tables in LRA Section 2.3 to identify and list those SCs subject to an AMR, as required by 10 CFR 54.21(a)(1).

In its response to the second part of RAI 2.3-1, dated June 10, 2004, the applicant stated that if a system is within scope, then all of the components in that system are conservatively considered to be within the scope of license renewal for the purpose of identifying SCs that are subject to an AMR.

The applicant further defined the screening process in accordance with 10 CFR 54.21(a)(1) for SCs subject to an AMR that perform an intended function without moving parts or a change in configuration or properties (i.e., passive) and that are not subject to replacement based on a qualified life or specified time period (i.e., long-lived). The applicant stated that its screening process identifies functions for the systems based on reviews of applicable plant licensing and design documentation. The applicant used sections of the UFSAR, technical specifications, Maintenance Rule scoping documents, design-basis documents, and ANO topical reports for the NRC regulations identified in 10 CFR 54.4(a)(1–3) to determine system functions and identify the components that perform intended functions required to accomplish those system functions. The applicant stated that the license renewal boundary on the drawings may be defined as the evaluation boundary between the portion of the system that performs an intended function (requires an AMR) and the portion of the system that does not perform an intended function (does not require an AMR).

Based on its review of the applicant's response and discussions with the applicant in a subsequent teleconference, the staff requested further information on the process of screening of mechanical components and the identification of the evaluation boundary.

In its clarification letter dated July 22, 2004, the applicant stated that the identification of components subject to an AMR began with determining the system evaluation boundary. The evaluation boundary includes those portions of the system necessary to ensure that the intended functions of the system will be performed. The applicant included components needed to support system-level intended functions identified in the scoping process within the evaluation boundary. System components that do not support an intended function are outside the evaluation boundary and were not considered further.

The applicant also stated that, within the evaluation boundary, screening was performed to determine components that are subject to an AMR. Each component subject to an AMR was assigned a component intended function, such as pressure boundary or heat transfer, that supports the system intended function. It grouped individual components where possible to allow disposition of the entire group with a single AMR. The applicant grouped components based on common materials of construction and common environments, then identified the aging effects requiring management for each component group. These component groups are the component types identified in the LRA Section 3.x.2-y tables, where 3 indicates the application section number; x indicates the table number from Volume 1 of the GALL Report; 2 indicates that this is the second table in the section; and y indicates the system table number.

Based on its review of the applicant's clarification discussed above, the staff finds the applicant's response to RAI 2.3-1 acceptable because it adequately describes the scoping and screening methodology for mechanical components and the definition of the evaluation boundary, and because it provides confirmation that the applicant did not omit any mechanical components from the scope of license renewal. Therefore, the staff considers its concern described in RAI 2.3-1 resolved.

On the basis of its review of the results of the plant audit, the LRA, and the applicant's responses to RAIs, the staff finds that the applicant's methodology for scoping and screening is well documented in an auditable and retrievable form at the plant site. The staff finds that the results of the audit on the three selected systems confirm that the applicant did not omit any components subject to an AMR for these systems. In the LRA Section 2.3 tables, the staff finds that the results are consistent with the methodology and are acceptable. With the additional information obtained from the site, the staff concludes that the applicant, while using a different methodology from that described in the review guidance of the SRP-LR, provided scoping and screening results and components subject to an AMR with no omissions.

For other in-scope systems that the staff did not audit at the plant site, The staff issued RAIs related to components that could be subject to an AMR based on its review of the LRA, UFSAR, and site documentation. The following describes the staff's detailed review of the balance of plant systems in LRA Section 2.3.

2.3.1 Reactor Coolant System

In Section 2.3.1 of the LRA, the applicant identified the SCs of the RCS that are subject to an AMR for license renewal. The applicant described the RCS in the following sections of the LRA:

- reactor vessel and control element drive mechanism pressure boundary (2.3.1.1)

- reactor vessel internals (2.3.1.2)
- Class 1 piping, valves, and reactor coolant pumps (2.3.1.3)
- pressurizer (2.3.1.4)
- steam generators (2.3.1.5)

The applicant identified the following criteria for the RCS to determine the SSCs that are within the scope of license renewal:

• safety-related	10 CFR 54.4(a)(1)
• nonsafety-related that can prevent a safety-related function	10 CFR 54.4(a)(2)
• pressurized thermal shock	10 CFR 54.4(a)(3)
• station blackout	10 CFR 54.4(a)(3)
• anticipated transient without scram	10 CFR 54.4(a)(3)
• environmental qualification	10 CFR 54.4(a)(3)
• fire protection	10 CFR 54.4(a)(3)

2.3.1.1 Reactor Vessel and Control Element Drive Mechanism Pressure Boundary

2.3.1.1.1 Summary of Technical Information in the Application

In Section 2.3.1.1 of the LRA, the applicant described the reactor vessel and control element drive mechanism (CEDM) pressure boundary. The ANO-2 reactor vessel and CEDM pressure boundary items subject to an AMR include the closure head; closure head flange; closure stud assemblies; vessel flange; upper, intermediate, and lower shells; core stabilizing and stop lugs; core barrel support ledge; vessel supports; bottom head; primary coolant nozzles and safe ends; pressure boundary subcomponents of the CEDMs; CEDM nozzles; instrumentation nozzles; surveillance capsule holders; flow skirt; and vent line. The vessel contains the nuclear fuel core, core support structures, control rods, and other parts directly associated with the core.

Two hollow metallic O-rings seal the reactor vessel closure. Two leak-off connections, one between the inner and outer ring and one outside the outer O-ring, detect seal leakage. The O-rings do not support an intended function of the reactor vessel and are therefore not subject to an AMR.

In Table 2.3.1-1 of the LRA, the applicant identified the reactor vessel and CEDM pressure boundary component types that are within the scope of license renewal and subject to an AMR, including closure head lifting lugs, closure studs, closure nuts and washers, core stabilizing lugs, core stop lugs, flow skirt, grayloc clamp, grayloc clamp studs, grayloc clamp nuts, in-core instrumentation (ICI) drive nuts, ICI spacer sleeves, reactor vessel support pads, shear lugs, surveillance capsule holders, CEDM motor housing, CEDM upper pressure housing, CEDM ball seal housing, CEDM upper pressure housing upper fitting, CEDM motor housing upper and lower end fittings, CEDM upper pressure housing lower fitting, CEDM nozzle, ICI nozzle tubes, CEDM steel ball, ICI flange adapter/seal plate, reactor vessel vent pipe, reactor vessel vent pipe flange, bottom head (torus and dome), upper shell, closure head dome (torus and dome), closure head flange, intermediate shell, lower shell, primary inlet nozzles, primary outlet nozzles, primary inlet nozzle safe ends, primary outlet nozzle safe ends, and vessel flange.

2.3.1.1.2 Staff Evaluation

The staff reviewed LRA Section 2.3.1.1, Table 2.3.1-1, and SAR Sections 4.2.3 and 5.4.6 to determine whether the applicant identified the reactor vessel and CEDM pressure boundary as within the scope of license renewal and subject to AMR, in accordance with the requirements of 10 CFR 54.4 and 10 CFR 54.21(a). The staff used the evaluation methodology described in Section 2.3 of this SER. The staff conducted its review in accordance with the guidance described in Section 2.3, "Scoping and Screening Results—Mechanical Systems," of the SRP-LR.

In conducting its review, the staff evaluated the system functions described in the LRA and UFSAR, in accordance with the requirements of 10 CFR 54.4(a), to determine that the applicant did not inadvertently omit from the scope of license renewal any reactor vessel components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed the reactor vessel components that the applicant identified as within the scope of license renewal to determine that the applicant did not omit any passive and long-lived components that should be subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

In reviewing LRA Section 2.3.1.1, the staff identified an area in which it needed additional information to complete the evaluation of the applicant's scoping and screening results. Therefore, by letter to the applicant dated April 23, 2004, the staff issued an RAI concerning the exclusion of the reactor vessel O-rings leak monitor tube to determine whether the applicant properly applied the scoping criteria of 10 CFR 54.4(a) and the screening criteria of 10 CFR 54.21(a)(1).

The staff asked the applicant to confirm whether the O-ring leak monitor tube serves as a pressure boundary and whether the piping should be within the scope of license renewal. In its response, dated May 24, 2004, the applicant stated that the reactor vessel flange leak detection piping contains an integral orifice with the flange itself which limits flow (in the event of O-ring failure) to within the makeup capability of the plant. In the event of leakage past the O-rings and through the restricting orifice, the downstream vessel leak detection piping and associated valves do not perform an RCS pressure boundary function and would only serve to direct RCS fluid to the drain tank. The staff finds the response acceptable.

On the basis of its review, the staff found that the applicant has identified those portions of the RCS that meet the scoping requirements of 10 CFR 54.4(a) and has included those portions of the system within the scope of license renewal in LRA Section 2.3.1.1. The applicant has also included RCS components that are subject to an AMR in accordance with the requirements of 10 CFR 54.4(a) and 10 CFR 54.21(a)(1). The staff did not identify any omissions.

2.3.1.1.3 Conclusion

During its review of the information provided in the LRA, license renewal drawings, and licensing basis information, the staff did not identify any omissions or discrepancies in the applicant's scoping and screening results for the reactor vessel and RCS CEDM pressure boundary. Therefore, the staff concludes that the applicant has adequately identified the RCS SCs that are within the scope of license renewal, as required by 10 CFR 54.4(a), and the reactor vessel system SCs that are subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.1.2 Reactor Vessel Internals

2.3.1.2.1 Summary of Technical Information in the Application

In Section 2.3.1.2 of the LRA, the applicant described the reactor vessel internals. The reactor vessel internals are designed to support and orient the reactor core and control element assemblies, direct the reactor coolant flow from the core, and guide the ICI. The reactor vessel internals subject to an AMR include the upper internals assembly, control element assembly (CEA) shroud assemblies, core support barrel (CSB) assembly, core shroud assembly, lower internals assembly, and ICI.

In Table 2.3.1-2 of the LRA, the applicant listed the reactor vessel internals component types that are within the scope of license renewal and subject to an AMR, including CEA instrument tube, CEA shroud adapter, CEA shroud support, positioning plate, CEA shroud extension shaft guides, shaft cylinders, shaft bases, CEA shroud base, CEA shroud flow channel, CEA shroud flow channel cap, CEA shroud shaft retention pin, CEA shroud retention block, external spanner nut, internal spanner nut, CEA shroud fasteners, CEA shroud flow channel extension, CEA shroud tube, core shroud plates, plates, ribs, intermediate plates, core shroud guide lugs, CSB alignment keys, CSB assembly dowel pin, CSB lifting bolt insert, CSB lower flange, CSB lug, CSB nozzle, CSB cylinder, CSB upper flange, guide tubes, ICI thimble support plate assembly, ICI support plate, grid, lifting support, lifting plate, column, plates, funnel, pad, ring, nipple, hex bolt, spacer, threaded rod, hex jam nut, thimble support nut, cap screws, bottom plate, bottom plate manhole cover, and cylinder.

2.3.1.2.2 Staff Evaluation

The staff reviewed LRA Section 2.3.1.2, Table 2.3.1-2, and SAR Section 4.2.2 to determine whether the applicant identified the reactor vessel internals within the scope of license renewal and subject to AMR, in accordance with the requirements of 10 CFR 54.4 and 10 CFR 54.21(a). The staff used the evaluation methodology described in Section 2.3 of this SER. The staff conducted its review in accordance with the guidance described in Section 2.3 of the SRP-LR.

In conducting its review, the staff evaluated the system functions described in the LRA and UFSAR, in accordance with the requirements of 10 CFR 54.4(a), to determine that the applicant did not inadvertently omit from the scope of license renewal any reactor vessel components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed the reactor vessel components that the applicant identified as within the scope of license renewal to determine that the applicant did not omit any passive and long-lived components that should be subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

In reviewing LRA Section 2.3.1.2, Table 2.3.1.2-2, the staff identified an area in which it needed additional information to complete the evaluation of the applicant's scoping and screening results. Therefore, by letter to the applicant dated April 23, 2004, the staff issued an RAI concerning the exclusion of the CSB snubber bolts to determine whether the applicant has properly applied the scoping criteria of 10 CFR 54.4 (a) and the screening criteria of 10 CFR 54.21(a)(1).

Based on its position that the CSB snubber bolts serve as a pressure boundary and the bolts should be within the scope of license renewal, the staff requested justification for the exclusion of the component. In its response dated May 24, 2004, the applicant stated that it inadvertently omitted the CSB snubber bolts from the LRA but will include them in the LRA. The staff finds this acceptable.

On the basis of its review, the staff found that the applicant has identified those portions of the RCS that meet the scoping requirements of 10 CFR 54.4(a) and has included those portions of the system within the scope of license renewal in LRA Section 2.3.1.1. The applicant has also included RCS components that are subject to an AMR, in accordance with the requirements of 10 CFR 54.4(a) and 10 CFR 54.21(a)(1). The staff identified one omission.

2.3.1.2.3 Conclusion

During its review of the information provided in the LRA, license renewal drawings, and licensing basis information, the staff identified the omission of CSB snubber bolts. Subsequently, the applicant included the CSB snubber bolts in the scoping and screening results for reactor vessel components. The staff determined that this error was not indicative of a flawed scoping and screening methodology. Therefore, the staff concludes that the applicant has adequately identified the reactor coolant components that are within the scope of license renewal, as required by 10 CFR 54.4(a), and the RCS SCs that are subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.1.3 Class 1 Piping, Valves, and Reactor Coolant Pumps

2.3.1.3.1 Summary of Technical Information in the Application

In Section 2.3.1.3 of the LRA, the applicant described Class 1 piping, valves, and reactor coolant pumps (RCPs). The following RCS Class 1 piping and associated pressure boundary components are subject to an AMR:

- hot- and cold-leg straight sections and elbows
- surge line straight sections and elbows
- spray line, safety injection, pressurizer safety/relief, and letdown piping straight sections and elbows
- vent, drain, and sampling piping straight sections and elbows
- reactor vessel leak detection lines
- charging, letdown, and drain nozzles
- safety injection nozzles
- resistance temperature detector (RTD), replacement pressure nozzles, and pressure measurement and sampling nozzles
- nozzle thermal sleeves

- nozzle safe ends and inserts
- safety injection and charging nozzle thermal sleeves
- welds
- flow orifices
- reactor coolant pumps
- valves

Certain Class 1 valve subcomponents are not subject to an AMR because they are not passive components (i.e., performance of their intended functions requires moving parts or a change in configuration). These include the valve disks, stems, yokes, and operators. Pressure-retaining portions of Class 1 valves consist of the valve body bonnet and closure bolting.

The principle pressure boundary subcomponents of the RCPs include the casing, cover/thermal barrier, driver mount assembly, heat exchanger, seal cartridge, and studs/nuts. Although the pump seal cartridges are part of the pressure boundary and are within the scope of license renewal, an AMR is not required since the seal cartridges are periodically monitored, inspected, and replaced. The remaining RCP subcomponents are not subject to an AMR since they do not perform their intended functions without moving parts. These items include the impeller, shaft and journal, radial bearing, and coupling.

This section includes small portions of RCS instrumentation and sampling tubing, such as reactor coolant pressure boundary items (valves and tubing) downstream of instrument root valves.

In Table 2.3.1-3 of the LRA, the applicant listed the Class 1 piping, valve, and RCP component types that are within the scope of license renewal and subject to an AMR, including charging inlet nozzle, safety injection nozzle, surge line nozzle, charging inlet nozzle safe end, drain nozzle safe ends, letdown nozzle safe ends, pressure measurement nozzle safe end, sampling nozzle safe end, charging inlet nozzle thermal sleeve, safety injection nozzle thermal sleeve, surge line thermal sleeve, Class 1 boundary orifices, Class 1 pipe and fittings (nominal pipe size (NPS) less than 4"), Class 1 pipe (NPS less than 4"), Class 1 fittings, cold-leg piping and elbows, hot-leg piping and elbows, drain nozzles, letdown nozzles, shutdown cooling outlet nozzle, spray nozzle, pressure measurement nozzle, replacement pressure nozzle, sampling nozzle, RCP safe ends, RTD nozzles, safety injection nozzle safe end, shutdown cooling outlet nozzle safe end, surge nozzle safe end, stainless steel bolting, surge line pipe and elbows, surge line piping RTD nozzles and sampling nozzles, carbon/alloy steel bolting, valve bodies and bonnets, Class 2 and 3 closure bolting, Class 2 and 3 fittings, Class 2 and 3 pipe, Class 2 and 3 valve bodies and bonnets, tubing, RCP, RCP casing, RCP cover, RCP cover studs, RCP cover nuts, RCP driver mount assembly, RCP thermal barrier heat exchanger inner coil, RCP thermal barrier heat exchanger, outer coil, and RCP thermal barrier bored hole heat exchanger.

2.3.1.3.2 Staff Evaluation

The staff reviewed LRA Section 2.3.1.3, Table 2.3.1-3, and SAR Sections 5.5.3, 5.5.12, and 5.5.13 to determine whether the applicant identified the Class 1 piping, valves, and RCPs within the scope of license renewal and subject to AMR, in accordance with the requirements of 10 CFR 54.4 and 10 CFR 54.21(a). The staff used the evaluation methodology described in Section 2.3 of this SER. The staff conducted its review in accordance with the guidance described in Section 2.3 of the SRP-LR.

In conducting its review, the staff evaluated the system functions described in the LRA and UFSAR, in accordance with the requirements of 10 CFR 54.4(a), to determine that the applicant did not inadvertently omit from the scope of license renewal any Class 1 piping, valves, and RCP components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed the RCS components that the applicant identified as within the scope of license renewal to determine that the applicant did not omit any passive and long-lived components that should be subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1). The staff did not identify any omissions.

2.3.1.3.3 Conclusion

During its review of the information provided in the LRA, license renewal drawings, and licensing basis information, the staff did not identify any omissions or discrepancies in the applicant's scoping and screening results for Class 1 piping, valves, and RCPs. Therefore, the staff concludes that the applicant has adequately identified the reactor vessel components that are within the scope of license renewal, as required by 10 CFR 54.4(a), and the reactor vessel system SCs that are subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.1.4 Pressurizer

2.3.1.4.1 Summary of Technical Information in the Application

In Section 2.3.1.4 of the LRA, the applicant described the pressurizer. The pressurizer pressure boundary items include the vessel, attached nozzles, and safe ends out to the connection with RCS piping. Section 2.3.1.3 discusses valves (i.e., safety and relief), instrument lines, and other piping connected to the pressurizer. The following pressurizer subcomponents support the RCS pressure boundary and are subject to an AMR:

- upper and lower shell, upper head
- lower head (including internal integral attachment for heater support plates)
- manway assembly (including cover plate, gasket retainer plate, studs, and nuts)
- pressurizer surge, spray, and safety/relief nozzles and safe ends
- temperature, pressure, level nozzles, and safe ends
- nozzle inserts, flanges, and thermal sleeves
- heater sheath, sleeve, and end plug
- heater support plates and bolting
- heater penetration plugs
- pressurizer support skirt

The following pressurizer subcomponents are not subject to an AMR since they do not support an intended function of the pressurizer, do not perform intended functions without moving parts or a change in configuration, or are considered consumable items:

- spray head reducer assembly, bolting, nozzle, and hex nut
- gaskets (spray nozzle, mechanical nozzle seal assemblies)
- surge nozzle screen assemblies
- heater elements

In 2002, the applicant repaired six pressurizer heater sleeves using mechanical nozzle seal assemblies (MNSAs). These assemblies replace the function of the partial penetration J-groove welds that attach the heater sleeves to the pressurizer, moving the reactor coolant pressure boundary to the pressurizer exterior surface. The MNSAs consist of two split-seal/flange assemblies placed in a counter-bore around the leaking heater sleeve. The seal is held under compression by a compression collar, which is held in place by threaded rods placed into holes drilled and tapped into the bottom head of the pressurizer. The MNSA items subject to an AMR include the compression collar, the upper flanges, and the bolting (threaded rods, nuts, and washers).

The intended function of the pressurizer components is to maintain the pressure boundary so that the RCS may perform its system functions for the period of extended operation. However, the pressurizer components also have a second intended function of RCS pressure control. The pressurizer components provide RCS pressure control for mitigation of a feedwater line break with ac available, as described in SAR Section 15.1.14.2.2.2. However, the most limiting feedwater line break is without ac power available, and the pressurizer sprays are not credited to mitigate that event. Therefore, RCS pressure control using the pressurizer sprays is not an intended function of the pressurizer. Pressurizer heaters are required to maintain subcooling following the loss of offsite power, as described in SAR Section 5.5.10.2. However, the electrical heater elements are active and not subject to an AMR.

In Table 2.3.1-4 of the LRA, the applicant listed the pressurizer component types that are within the scope of license renewal and subject to an AMR, including heater end plug, heater sheaths, heater sleeves, heater support channel, heater support plates, heater support plate brackets, heater support plate bracket bolts, lower head, lower shell, upper shell, upper head, lower level nozzle, manway cover bolts/studs, manway cover plate, manway forging, manway gasket retainer plate, MNSA bolting (studs, nuts, and washers), MNSA compression collar, MNSA upper flanges, pressure measurement nozzle, upper level nozzle, vent nozzle, temperature nozzle, pressure measurement nozzle safe end, upper/lower level nozzle safe end, temperature nozzle safe end, vent nozzle safe end, safety valve nozzle, spray nozzle, surge nozzle, safety valve nozzle flange, spray nozzle safe end, spray nozzle thermal sleeve, surge nozzle thermal sleeve, support skirt, and surge nozzle safe end.

2.3.1.4.2 Staff Evaluation

The staff reviewed LRA Section 2.3.1.4, Table 2.3.1-4, and SAR Section 5.5.10 to determine whether the applicant identified the pressurizer, associated components, and supporting structures within the scope of license renewal and subject to AMR, in accordance with the requirements of 10 CFR 54.4 and 10 CFR 54.21(a). The staff used the evaluation methodology described in Section 2.3 of this SER. The staff conducted its review in accordance with the guidance described in Section 2.3 of the SRP-LR.

In conducting its review, the staff evaluated the system functions described in the LRA and UFSAR, in accordance with the requirements of 10 CFR 54.4(a), to determine that the applicant did not inadvertently omit from the scope of license renewal any pressurizer components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed the pressurizer components that the applicant identified as within the scope of license renewal to determine that the applicant did not omit any passive and long-lived components that should be subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1). In reviewing LRA Section 2.3.1.1, the staff identified an area in which it needed additional information to complete the evaluation of the applicant's scoping and screening results. Therefore, by letter to the applicant dated April 23, 2004, the staff issued an RAI concerning the use of pressurizer sprays to determine whether the applicant has properly applied the scoping criteria of 10 CFR 54.4 (a) and the screening criteria of 10 CFR 54.21(a)(1).

The staff asked the applicant to clarify whether it took credit for the sprays in the accident analysis. In its response, dated May 24, 2004, the applicant stated that it assumed pressurizer spray to function in order to establish the worst conditions for the analysis, but it did not credit the spray in the feedwater line break analysis or include it within the scope of LRA. The staff finds this acceptable.

The applicant confirmed in a letter dated May 27, 2004, that the pressurizer relief valve discharge piping and quench tank are within the scope and are identified in LRA Table 2.3.3-11 as "piping" and "tank," as required by 10 CFR 54.4(a)(2). The staff finds this acceptable.

On the basis of its review, the staff found that the applicant has identified those portions of the pressurizer that meet the scoping requirements of 10 CFR 54.4(a) and has included those portions of the system within the scope of license renewal in LRA Section 2.3.1.1. The applicant has also included pressurizer system components that are subject to an AMR, in accordance with the requirements of 10 CFR 54.4(a) and 10 CFR 54.21(a)(1). The staff did not identify any omissions.

2.3.1.4.3 Conclusion

During its review of the information provided in the LRA, license renewal drawings, and licensing basis information, the staff did not identify any omission or discrepancies in the applicant's scoping and screening results for the pressurizer. Therefore, the staff concludes that the applicant has adequately identified the pressurizer system SCs that are within the scope of license renewal, as required by 10 CFR 54.4(a), and the pressurizer system SCs that are subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.1.5 Steam Generators

2.3.1.5.1 Summary of Technical Information in the Application

In Section 2.3.1.5 of the LRA, the applicant described the steam generators. The following ANO-2 steam generator components are subject to an AMR:

- tube plate
- U-tubes
- channel head
- channel head divider plate
- primary manway cover and insert plate
- primary nozzles, safe ends, and closure rings
- bolting
- tube support plates
- wrapper
- antivibration bars, bar end caps, and end cap welds
- U-bend peripheral retaining rings, retainer bars, retainer bar welds
- feedwater and steam outlet nozzle
- upper and lower shell barrels, elliptical heads, and transition cones
- feedwater thermal sleeves
- secondary manway covers
- hand hole covers
- inspection port covers and diaphragms
- blowdown and sampling nozzles
- instrument taps
- stay rods, spacer pipes, and hex nuts
- integral flow restrictors (venturis)
- snubber lugs and key brackets
- tube plugs

The following steam generator components are not subject to an AMR since they do not support an intended function of the steam generator or are considered consumable items:

- gaskets

- primary and secondary moisture separation equipment and associated supports and decking

- sludge collector assembly

- feedwater distribution ring pipe and fittings

The steam generator intended functions which form the basis for inclusion into the scope of license renewal include maintenance of the primary pressure boundary, maintenance of the secondary pressure boundary, heat transfer from the primary fluid to the secondary fluid, and flow control.

In Table 2.3.1-5 of the LRA, the applicant listed the steam generator component types that are within the scope of license renewal and subject to an AMR, including channel head, primary inlet nozzle, primary nozzle safe ends, primary outlet nozzle, channel head divider plate, primary bolting (studs, closure nuts and washers, and screws), primary manway cover, primary manway insert plate, primary nozzle closure rings, tube plate, tube plugs, U-tubes, 3" inspection port cover, 3" inspection port diaphragms, 6" inspection port cover, 8" hand hole cover, antivibration bars, tube support plates, antivibration bar end caps, peripheral retaining rings, U-bend, U-shaped retainer bars, blowdown and sampling nozzles, narrow- and wide-range water-level taps, elliptical head, transition cone, upper and lower shell barrels, feedwater inlet nozzles, feedwater thermal sleeve, flow limiting insert (integral flow restrictors (venturis)), key bracket, snubber lug, secondary bolting (studs, closure washers, and nuts), secondary manway cover, steam outlet nozzle, tube bundle support system (stay rods, stay rod hex nuts, spacer pipes, and peripheral backup bars), wrapper, and wrapper jacking screws.

2.3.1.5.2 Staff Evaluation

The staff reviewed LRA Section 2.3.1.5, Table 2.3.1-5, and SAR Section 5.5.10 to determine whether the applicant identified the steam generator, associated components, and supporting structures within the scope of license renewal and subject to AMR, in accordance with the requirements of 10 CFR 54.4 and 10 CFR 54.21(a). The staff used the evaluation methodology described in Section 2.3 of this SER. The staff conducted its review in accordance with the guidance described in Section 2.3 of the SRP-LR.

In conducting its review, the staff evaluated the system functions described in the LRA and UFSAR, in accordance with the requirements of 10 CFR 54.4(a), to determine that the applicant did not inadvertently omit from the scope of license renewal any steam generator components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed the steam generator components that the applicant identified as within the scope of license renewal to determine that the applicant did not omit any passive and long-lived components that should be subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1). In reviewing LRA Section 2.3.1.1, the staff identified an area in which it needed additional information to complete the evaluation of the applicant's scoping and screening results. Therefore, by letter to the applicant dated April 23, 2004, the staff issued an RAI concerning the internal feedwater *distribution ring and the thermal sleeve connecting the header and the nozzle to determine* whether the applicant has properly applied the scooping criteria of 10 CFR 54.4 (a) and the screening criteria of 10 CFR 54.21(a)(1).

The staff requested the licensee to provide the bases for the exclusion of feedwater distribution ring and the thermal sleeve from the scope of license renewal. In its response dated May 25, 2004, the applicant stated that the internal feedwater distribution ring and the thermal sleeve connecting the header and the nozzle do not perform the pressure boundary function of the steam generators. The staff finds this acceptable.

On the basis of its review, the staff found that the applicant has identified those portions of the steam generator that meet the scooping requirements of 10 CFR 54.4(a) and has included those portions of the system within the scope of license renewal in LRA Section 2.3.1.1. The applicant has also included steam generator components that are subject to an AMR, in accordance with the requirements of 10 CFR 54.4(a) and 10 CFR 54.21(a)(1). The staff did not identify any omissions.

2.3.1.5.3 Conclusion

During its review of the information provided in the LRA, license renewal drawings, and licensing basis information, the staff did not identify any omissions or discrepancies in the applicant's scooping and screening results for the steam generator. Therefore, the staff concludes that the applicant has adequately identified the steam generator components that are within the scope of license renewal, as required by 10 CFR 54.4(a), and the reactor vessel system SCs that are subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.2 Engineered Safety Features Systems

In Section 2.3.2 of the LRA, the applicant identified the SCs of the engineered safety features that are subject to an AMR for license renewal. Chapter 6 of the SAR describes the engineered safety features. This section includes the following systems:

- emergency core cooling
- containment spray system
- containment cooling
- containment penetrations
- hydrogen control

2.3.2.1 Emergency Core Cooling

2.3.2.1.1 Summary of Technical Information in the Application

In Section 2.3.2.1 of the LRA, the applicant described the emergency core cooling system (ECCS). The ECCS provides core cooling and core reactivity control under accident conditions, including a loss-of-coolant accident (LOCA) or a main steamline break. Following a LOCA, the cooling must prevent fuel melting or significant alteration of core geometry, limit the cladding metal-water reaction, and remove the energy generated in the core for an extended period of time. In the unlikely event of a main steamline break, the ECCS injects borated water into the RCS to prevent fuel damage and to increase the shutdown margin of the core.

The major ECCS subsystems are the high-pressure safety injection (HPSI), low-pressure safety injection (LPSI), and safety injection tanks. The LPSI system consists of two pumps that discharge into a combined low-pressure header that has a return connection from the shutdown cooling heat exchangers. The HPSI system has three electric motor-driven pumps installed in parallel. Two high-pressure injection headers and eight motor-operated injection valves connect the pumps to the four injection points on the RCS loop cold legs. The LPSI and HPSI pumps are designed to take suction initially from the refueling water tank (RWT) and inject water into the RCS to provide core cooling. Injection piping and valves connect the safety injection tanks, containing borated water pressurized with nitrogen, to the RCS.

Section 2.3.1 of this SER evaluates the Class 1 components of the ECCS with the RCS. Section 2.3.3.5 of this SER evaluates certain components classified with the HPSI system, which are part of the chemical and volume control system (CVCS) charging lines at the interface with the injection headers. The LPSI system contains nonsafety-related components whose failure could impact safety-related components. Therefore, the ECCS is within the scope of license renewal based on the criteria of 10 CFR 54.4(a)(2). Section 2.3.3.11 of this SER evaluates these components.

The ECCS evaluation includes the CVCS valve in the supply from the RWT and primary sampling system components associated with ECCS.

The LPSI pumps, shutdown cooling heat exchangers, and associated equipment in the flow path are credited with RCS decay heat removal for safe shutdown after a fire. The "B" HPSI pump and injection valves in the HPSI system are credited with reactor coolant inventory maintenance for safe shutdown after a fire. These components perform functions that demonstrate compliance with the Commission's regulations for fire protection (10 CFR 50.48).

The ECCS is within the scope of license renewal based on the criteria of 10 CFR 54.4(a)(1–3).

In Table 2.3.2-1 of the LRA, the applicant listed the ECCS component types that are within the scope of license renewal and subject to an AMR, including bearing housing, bolting, heat exchanger (shell), heat exchanger (tubes), nozzle, orifice, piping, pump casing, tank, thermowell, tubing, and valves.

2.3.2.1.2 Staff Evaluation

The staff reviewed LRA Section 2.3.2.1, Table 2.3.2-1, and SAR Section 6.3 to determine whether the applicant identified the ECCS subsystems (e.g., piping, tanks, and pump casing) and supporting structures that are within the scope of license renewal and subject to AMR, in accordance with the requirements of 10 CFR 54.4 and 10 CFR 54.21(a). The staff used the evaluation methodology described in Section 2.3 of this SER. The staff conducted its review in accordance with the guidance described in Section 2.3 of the SRP-LR.

In conducting its review, the staff evaluated the system functions described in the LRA and UFSAR, in accordance with the requirements of 10 CFR 54.4(a), to determine that the applicant did not inadvertently omit from the scope of license renewal any ECCS components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed the ECCS components that the applicant identified as within the scope of license renewal to determine that the applicant did not omit any passive and long-lived components that should be subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1). The staff did not identify any omissions.

2.3.2.1.3 Conclusion

During its review of the information provided in the LRA, license renewal drawings, and licensing basis information, the staff did not identify any omissions or discrepancies in the applicant's scooping and screening results for ECCS. Therefore, the staff concludes that the applicant has adequately identified the reactor vessel 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 reactor vessel system SCs that are subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.2.2 Containment Spray System

2.3.2.2.1 Summary of Technical Information in the Application

In Section 2.3.2.2 of the LRA, the applicant described the containment spray system. The containment spray system provides spray cooling water to the containment atmosphere following a LOCA or main steamline break inside containment. This cooling water limits the peak pressure in containment to below containment design pressure. The containment spray system also removes radioactive iodine from the containment atmosphere during a LOCA.

The containment spray system consists of two independent flow trains. Each train includes a pump, heat exchanger, and sets of spray nozzles and ring headers, with associated piping, valves, and instrumentation necessary for operation. The RWT provides the source of borated water to the containment spray system during the injection phase of an accident. Once the RWT is exhausted, the containment spray system takes suction from the water accumulated in the containment recirculation sump.

The RWT, which is included in the containment spray system boundary, provides a source of borated water for the ECCS and the containment spray system during postaccident operations. The containment sump header mechanical components are reviewed with the containment spray system. This system includes the shutdown cooling heat exchangers since they cool the spray water under accident conditions.

This system contains nonsafety-related components whose failure could impact safety-related components. Section 2.3.3.11 of this SER evaluates these components.

Portions of the containment spray system, such as the RWT and the components necessary for shutdown cooling operation, are required for compliance with the Commission's regulations for fire protection (10 CFR 50.48). The containment spray system is within the scope of license renewal based on the criteria of 10 CFR 54.4(a)(1), 10 CFR 54.4(a)(2), and 10 CFR 54.4(a)(3).

In Table 2.3.2-2 of the LRA, the applicant listed the containment spray system component types that are within the scope of license renewal and subject to an AMR, including bolting, filter housing, heat exchanger (shell), heat exchanger (tubes), heat exchanger (tubesheet), heater housing, nozzle, orifice, piping, pump casing, tank, thermowell, tubing, valves, and vortex breaker.

2.3.2.2.2 Staff Evaluation

The staff reviewed LRA Sections 2.3.2.2 and 2.3.3.11 and ANO-2 UFSAR Section 6.2.2 using the evaluation methodology described in Section 2.1 of this SER. The staff conducted its review in accordance with the guidance described in Section 2.3 of the SRP-LR.

In conducting the review, the staff reviewed the system functions described in the LRA and the UFSAR, in accordance with the requirements of 10 CFR 54.4(a), to determine that the applicant did not inadvertently omit from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those that the applicant identified as within the scope of license renewal to determine that the applicant did not omit any passive and long-lived components that should be subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff found that the applicant included those portions of the containment spray system that meet the scoping requirements of 10 CFR 54.4 within the scope of license renewal and identified them as such in LRA Section 2.3.2.2. The staff also found that LRA Table 2.3.2-2 includes the containment spray system components that are subject to an AMR, in accordance with 10 CFR 54.4(a) and 10 CFR 54.21(a)(1). The staff did not identify any omissions.

2.3.2.2.3 Conclusion

During its review of information provided in the LRA, license renewal drawings, and licensing basis information, the staff did not identify any omissions or discrepancies in the applicant's scoping and screening results for the SCs of the containment spray system. Therefore, the staff concludes that the applicant has adequately identified the containment spray system SCs that are within the scope of license renewal, as required by 10 CFR 54.4(a), and the containment spray system SCs that are subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.2.3 Containment Cooling

2.3.2.3.1 Summary of Technical Information in the Application

In Section 2.3.2.3 of the LRA, the applicant described the containment cooling system (CCS). The CCS provides cooling and air circulation inside containment. It reduces the containment pressure and temperature after a postulated LOCA or main steamline break by removing thermal energy from the containment atmosphere. This also lowers offsite radiation levels by minimizing the pressure differential between the containment atmosphere and the outside atmosphere, thereby reducing the driving force for leakage of fission products from containment.

The CCS is an AMR system (see Section 2.2 of this SER) that includes system codes reactor building heating and ventilation (RBHV) and reactor building purge air. Section 2.3.2.5 of this SER evaluates the hydrogen recombiners with the hydrogen control system.

The RBHV system provides cooling and heating to containment during power operation, plant shutdown, and accident conditions. The RBHV system consists of the containment cooling units (including fans, chilled water cooling coils, and service water cooling coils), the containment recirculation fans (which are evaluated with the hydrogen control system in Section 2.3.2.5 of this SER), nonsafety-related CEDM shroud cooling units, and nonsafety-related reactor cavity cooling fans. The RBHV system contains safety-related components and is therefore within the scope of license renewal, based on the criteria of 10 CFR 54.4(a)(1). This system contains nonsafety-related components whose failure could impact safety-related components and is therefore within the scope of license renewal, based on the criteria of 10 CFR 54.4(a)(2). Section 2.3.3.11 evaluates these components.

The reactor building purge air system provides outside air to purge the containment building during plant shutdown for personnel access. The purge air system consists of fans, filters, and associated piping and valves. The system has the safety function of containment isolation for the purge penetration and is therefore within the scope of license renewal, based on the criteria of 10 CFR 54.4(a)(1).

The CCS is within the scope of license renewal based on the criteria of 10 CFR 54.4(a)(1) and 10 CFR 54.4(a)(2).

In Table 2.3.2.3 of the LRA, the applicant listed the CCS component types that are within the scope of license renewal and subject to an AMR, including blower housing, bolting, cooling coil assembly, cooling coil housing, damper housing, ductwork, piping, and valve.

2.3.2.3.2 Staff Evaluation

The staff reviewed LRA Sections 2.1.1, 2.3.2.3, and 2.3.3.11 and ANO-2 UFSAR Sections 9.4.2 and 6.2.2 using the evaluation methodology described in Section 2.1 of this SER. The staff conducted its review in accordance with the guidance described in Section 2.3 of the SRP-LR.

In conducting the review, the staff reviewed the system functions described in the LRA and UFSAR, in accordance with the requirements of 10 CFR 54.4(a), to determine that the applicant did not inadvertently omit from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4 (a). The staff then reviewed those that the applicant identified as within the scope of license renewal to determine that the applicant did not omit any passive and long-lived components that should be subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

In reviewing LRA Sections 2.1.1, 2.3.2.3, and 2.3.3.11, the staff identified an area in which it needed additional information to complete the review of the applicant's scoping and screening results. Therefore, by letter dated April 8, 2004, the staff issued RAIs, described below, concerning the specific issues to determine whether the applicant has properly applied the scoping criteria of 10 CFR 54.4(a) and the screening criteria of 10 CFR 54.21(a)(1).

RAI 2.3-1a

The staff requested that the applicant determine that the LRA has not omitted any CCS (RBHV system and purge air system) SCs that should be within the scope of license renewal according to 10 CFR 54.4(a).

Applicant's Response and Staff's Evaluation

In its response, dated May 19, 2004, the applicant stated that, in accordance with 10 CFR 54.21(a)(1), CCS (RBHV system and purge air system) SCs subject to an AMR are those that perform an intended function without moving parts or a change in configuration or properties (i.e., passive) and that are not subject to replacement based on a qualified life or specified time period (i.e., long-lived). Within the systems and structures within the scope of license renewal, the applicant identified CCS (RBHV system and purge air system) SCs that are subject to an AMR, in accordance with 10 CFR 54.21, in LRA Tables 2.2-1a, 2.2-1b, and 2.2-3. The applicant conservatively considered these SCs to be within the scope of license renewal for the purpose of identifying SCs that are subject to an AMR.

Based on its review, the staff finds the applicant's response to RAI 2.3-1a acceptable, because the applicant considered all components within the CCS (RBHV system and purge air system), as identified in LRA Tables 2.2-1a and 2.2-1b, and all CCS (RBHV system and purge air system) structures identified in LRA Table 2.2-3, to be within the scope of license renewal for the purpose of identifying SCs that are subject to an AMR. Therefore, the staff's concern described in RAI 2.3-1a is resolved.

RAI 2.3-2

In Section 2.1.1 of the LRA, the applicant stated that it prepared LRA drawings (for the RBHV system) to indicate components subject to an AMR; components for the CCS (RBHV system and purge air system) that are subject to an AMR based only on the criteria of 10 CFR 54.4(a)(2) are not indicated on the LRA drawings for the CCS (RBHV system and purge air system). The staff requested that the applicant determine that the LRA has not omitted any CCS (RBHV system and purge air system) SCs that should be within the scope of license renewal, according to 10 CFR 54.4(a).

Applicant's Response and Staff's Evaluation

In its response, dated May 19, 2004, the applicant stated that, in accordance with 10 CFR 54.21(a)(1) and as stated in the response to RAI 2.1.1-2, it considered all components for the CCS (RBHV system and purge air system) within the systems identified in LRA Tables 2.2-1a and 2.2-1b and all structures for the CCS (RBHV system and purge air system) identified in LRA Table 2.2-3 to be within the scope of license renewal for the purpose of identifying SCs for the CCS (RBHV system and purge air system) that are subject to AMR, including components in the system considered only for 10 CFR 54.4(a)(2).

Based on its review, the staff finds the applicant's response to RAI 2.3-2 acceptable, because the applicant considered all components within the CCS (RBHV system and purge air system) as identified in LRA Tables 2.2-1a and 2.2-1b, and all CCS (RBHV system and purge air system) structures identified in LRA Table 2.2-3, to be within the scope of license renewal for the purpose of identifying SCs that are subject to AMR. Therefore, the staff's concern described in RAI 2.3-2 is resolved.

2.3.2.3.3 Conclusion

During its review of information provided in the LRA, license renewal drawings, and licensing basis information, the staff did not identify any omissions or discrepancies in the applicant's scoping and screening results for the SCs of the CCS (RBHV system and purge air system). Therefore, the staff concludes that the applicant has adequately identified the CCS (RBHV system and purge air system) SCs that are within the scope of license renewal, as required by 10 CFR 54.4(a), and the CCS (RBHV system and purge air system) SCs that are subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.2.4 Containment Penetrations

2.3.2.4.1 Summary of Technical Information in the Application

In Section 2.3.2.4 of the LRA, the applicant described the containment penetrations system. The containment penetrations system isolates fluid systems that pass through containment penetrations so as to confine radioactivity released following an accident to the containment. For license renewal, the containment penetrations system includes the passive mechanical penetration components that are not included in another system AMR. In general, if a system has its own system-level AMR, then the associated containment penetrations are reviewed with that system and not in this section.

This grouping of containment isolation components from various plant systems into one consolidated review is appropriate, as indicated in Section 2.1.3.1 of the SRP-LR, which states, "An applicant may take an approach in scoping and screening that combines similar components from various systems. For example, containment isolation valves from the various systems may be identified as a single system for the purpose of license renewal." Section V.C, "Containment Isolation Components," of the GALL Report recognizes the grouping and states, "The system consists of isolation barriers in lines for BWR and PWR non-safety systems such as the plant heating, waste gas, plant drain, liquid waste, and cooling water systems."

Containment penetrations are designed to provide at least a double barrier to the escape of radioactive material at each fluid penetration through the containment liner plate. Double barriers are provided to ensure that no single, credible failure or malfunction of an active or passive system component can result in loss of isolation or significant leakage.

The electrical penetration nitrogen pressurization system provides continuous pressurization of the electrical penetrations with the highest purity nitrogen. The system consists of two sets of three seismically mounted nitrogen bottles, isolation valves, pressure relief valves, tubing, and instrumentation.

Components in the steam generator sample and blowdown penetrations are required for safe shutdown following a fire (10 CFR 50.48).

The containment penetrations system is within the scope of license renewal based on the criteria of 10 CFR 54.4(a)(1) and 10 CFR 54.4(a)(3).

In Table 2.3.2-4 of the LRA, the applicant listed the containment penetration system component types that are within the scope of license renewal and subject to an AMR, including bolting, flex hose, piping, tubing, and valve.

2.3.2.4.2 Staff Evaluation

The staff reviewed LRA Section 2.3.2.4 and ANO-2 UFSAR Section 6.2.4 and Table 6.2-26 using the evaluation methodology described in Section 2.1 of this SER. The staff conducted its review in accordance with the guidance described in Section 2.3 of the SRP-LR.

In conducting the review, the staff reviewed the system functions described in the LRA and UFSAR, in accordance with the requirements of 10 CFR 54.4(a), to determine that the applicant did not inadvertently omit from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4 (a). The staff then reviewed those that the applicant identified as within the scope of license renewal to determine that the applicant did not omit any passive and long-lived components that should be subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff found that the applicant included those portions of the containment penetration system that meet the scoping requirements of 10 CFR 54.4 within the scope of license renewal and identified them as such in LRA Section 2.3.2.4. Table 2.3.2-4 of the LRA includes the containment penetration system's components that are subject to an AMR, in accordance with 10 CFR 54.4(a) and 10 CFR 54.21(a)(1). The staff did not identify any omissions.

2.3.2.4.3 Conclusion

During its review of information provided in the LRA, license renewal drawings, and licensing basis information, the staff did not identify any omissions or discrepancies in the applicant's scoping and screening results for the SCs of the containment penetration system. Therefore, the staff concludes that the applicant has adequately identified the containment penetration system SCs that are within the scope of license renewal, as required by 10 CFR 54.4(a), and the containment penetration system SCs that are subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.2.5 Hydrogen Control

2.3.2.5.1 Summary of Technical Information in the Application

In Section 2.3.2.5 of the LRA, the applicant described the hydrogen control system. The hydrogen control system limits the hydrogen gas concentration inside containment following a LOCA. To assure that containment integrity is maintained, the hydrogen control system has the following safety functions:

- removing hydrogen gas from the containment building atmosphere after a LOCA to maintain the concentration of gases below the limits of flammability
- providing a direct reading of the concentration of hydrogen gas concentration in the containment building

The hydrogen control system is an AMR system (see Section 2.2 of this SER), which includes components from system codes hydrogen purge, hydrogen recombiners, RBHV, and radiation monitoring system. As described in the SAR, these systems are the containment atmosphere monitoring system, the hydrogen recombiner system, and the containment air recirculation system.

The ANO-2 design originally included a hydrogen purge system that was intended to release the postaccident containment atmosphere and reduce the hydrogen concentration by adding air to containment. Since hydrogen recombiners are now used, a number of components are spared in place. The hydrogen purge system includes valves that were originally intended to supply service water under accident conditions to the purge components but now have only the safety function of maintaining the service water pressure boundary. Section 2.3.3.8 of this SER evaluates these valves with the service water system.

The hydrogen recombiners are evaluated as an electrical system (see LRA Table 2.2-1b).

The hydrogen control system is within the scope of license renewal, based on the criteria of 10 CFR 54.4(a)(1).

In Table 2.3.2-5 of the LRA, the applicant listed the hydrogen control system component types that are within the scope of license renewal and subject to an AMR, including bolting, filter housing, heat exchanger (shell), heat exchanger (tubes), orifice, piping, pump casing, tubing, and valve.

2.3.2.5.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.5 and ANO-2 UFSAR Section 6.2.5 using the evaluation methodology described in Section 2.1 of this SER. The staff conducted its review in accordance with the guidance described in Section 2.3 of the SRP-LR.

In conducting the review, the staff reviewed the system functions described in the LRA and UFSAR, in accordance with the requirements of 10 CFR 54.4(a), to determine that the applicant did not inadvertently omit from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those that the applicant identified as within the scope of license renewal to determine that the applicant did not omit any passive and long-lived components that should be subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

In reviewing LRA Section 2.3.2.5, the staff identified an area in which it needed additional information to complete the review of the applicant's scoping and screening results. Therefore, by letter dated April 8, 2004, the staff issued an RAI, described below, concerning the specific issues to determine whether the applicant has properly applied the scoping criteria of 10 CFR 54.4(a) and the screening criteria of 10 CFR 54.21(a)(1).

RAI 2.3-5

The staff indicated that LRA Table 2.3.2-5 for hydrogen control system components subject to an AMR does not list separators 2F-254 and 2F-256, shown on ANO-2 P&ID LRA—2261 Sheet 3, as components requiring an AMR. The staff requested that the applicant identify where the LRA addresses the AMR for these components or justify their exclusion from an AMR.

Applicant's Response and Staff's Evaluation

In its response, dated May 19, 2004, the applicant stated that separators 2F-254 and 2F-256 are subject to an AMR and are included under the component type "filter housing" in LRA Table 2.3.2-5.

Based on its review, the staff found the applicant's response to RAI 2.3-5 acceptable, because the applicant considered all components within the hydrogen control system, as identified in

LRA Section 2.3.2.5, and all hydrogen control system structures identified in LRA Table 2.3.2-5, to be within the scope of license renewal for the purpose of identifying SCs that are subject to AMR. Therefore, the staff considers its concern described in RAI 2.3-5 resolved.

2.3.2.5.3 Conclusion

During its review of information provided in the LRA, license renewal drawings, and licensing basis information, the staff did not identify any omissions or discrepancies in the applicant's scoping and screening results for the SCs of the hydrogen control system. Therefore, the staff concludes that the applicant has adequately identified the hydrogen control system SCs that are within the scope of license renewal, as required by 10 CFR 54.4(a), and the hydrogen control system SCs that are subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3 Auxiliary Systems

In Section 2.3.3 of the LRA, the applicant identified the components of the auxiliary systems that are subject to an AMR for license renewal. This section includes the following systems:

- spent fuel pool
- water suppression fire protection
- emergency diesel generator
- alternate ac diesel generator
- chemical and volume control
- Halon fire protection and reactor coolant pump motor oil leakage collection
- fuel oil
- service water
- auxiliary building ventilation
- control room ventilation
- miscellaneous systems within scope for 10 CFR 54.4(a)(2)
- other miscellaneous systems

2.3.3.1 Spent Fuel Storage

2.3.3.1.1 Summary of Technical Information in the Application

In Section 2.3.3.1 of the LRA, the applicant described the spent fuel storage. The subsystems that make up the spent fuel pool system include fuel pool cooling and purification, spent fuel pool, and fuel handling.

The fuel pool cooling and purification subsystem removes decay heat from the stored spent fuel and maintains purity and optical clarity of the water in the spent fuel pool, the fuel transfer canal, and the refueling canal. The subsystem consists mainly of nonsafety-related fuel pool pumps, heat exchanger, filters, demineralizer, and associated piping and valves. The subsystem contains nonsafety-related components whose failure could impact safety-related components, and the system is therefore within the scope of license renewal based on the criteria of 10 CFR 54.4(a)(2). Section 2.3.3.11 of this SER evaluates these components. The safety-related components evaluated with this subsystem include components associated with containment penetrations, a CVCS valve in the makeup to the spent fuel pool system, and components associated with the service water supply to the spent fuel pool. If system cooling is lost, the seismic Class 1 service water system can provide water directly to the spent fuel pool to maintain the level, which will boil off to cool the spent fuel assemblies. The spent fuel pool cooling system piping and valves that supply service water to the spent fuel pool from the #1 service water loop are safety related. The redundant feed from the #2 service water loop feeds directly to the spent fuel pool and does not route through spent fuel pool cooling components.

The spent fuel pool subsystem stores new and spent fuel in a subcritical condition. Included in this subsystem are the spent fuel racks and the new fuel racks. The new and spent fuel pool racks are safety related and are required to support the fuel assemblies. Section 2.4.2 of this SER evaluates the new fuel racks as a structural component.

The fuel handling subsystem provides the capability of (1) underwater handling and transfer of spent fuel and control components removed from the reactor to the spent fuel pool, (2) movement of fuel and control components within the reactor vessel, and (3) movement of new fuel from the spent fuel pool to the reactor. The subsystem also provides the capability to move new fuel from shipping containers to new fuel storage or spent fuel storage.

The fuel handling subsystem consists of fuel handling equipment such as the fuel transfer tube, the spent fuel pool crane, upender assemblies, refueling machine, spent fuel machine, the new fuel elevator, and manual tools. The fuel transfer tube is a containment penetration and is therefore safety related. Some of the fuel handling cranes, evaluated in Sections 2.4.1 and 2.4.2 of this SER, are seismic Class 1 in the parked position. The safety-related fuel transfer tube gasket air test isolation valve is a service air system component which is evaluated with the spent fuel pool system.

The spent fuel pool system is within the scope of license renewal, based on the criteria of 10 CFR 54.4(a)(1–2).

In Table 2.3.3-1 of the LRA, the applicant listed the spent fuel storage component types that are within the scope of license renewal and subject to an AMR, including bolting, fuel transfer tube, piping, spent fuel racks, and valve.

2.3.3.1.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.1, ANO-2 UFSAR Section 9.1, and site documentation in its scoping and screening review of the spent fuel pool system. The staff conducted its review, with the support from the plant audit and applicant's methodology described in Section 2.3 of this SER, in accordance with the guidance described in Section 2.3 of the SRP-LR.

In the performance of its review, the staff selected system functions described in the UFSAR, in accordance with the requirements of 10 CFR 54.4, and by reviewing site documentation to determine that the applicant did not inadvertently omit from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). In LRA Section 2.3.3.11, the applicant separately compiled all components with intended functions that are within the scope of license renewal, per 10 CFR 54.4(a)(2). The staff reviews those components for the spent fuel pool system in Section 2.3.3.11 of this SER. The staff then reviewed those components that the applicant identified as having an intended function to determine that the applicant did not omit any passive and long-lived components that should be subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

On March 1 to 5, 2004, the NRC staff performed a scoping and screening inspection at ANO-2. During a walkdown of the auxiliary building, the staff discovered a potential interaction between a portion of the spent fuel pool cooling system, which the applicant had determined was not in the scope of license renewal, and the emergency feedwater system (a safety-related system). In particular, the staff found that a breech of the pump casing of the spent fuel pool cooling pumps had the potential to spray two active components in the emergency feedwater system, potentially adversely affecting it's ability to perform its safety function. In accordance with 10 CFR Part 54, if the failure of a nonsafety-related component could prevent a safety-related function from being performed, that component should be in the scope of license renewal and subject to an aging management review. The applicant subsequently included these pump casings in their list of components in the spent fuel pool system requiring an aging management review.

The NRC staff inspection identified an item requiring action by the applicant. The item listed above is identified in the ANO-2 Inspection Report, dated April 19, 2004 (ML0411006481). The applicant indicated that the spent fuel pool cooling pump casings were included in an aging management program. The aging management review is discussed in Section 3.3.2.3.1. The final disposition of this item will be addressed by the Aging Management Review Inspection scheduled for November 1 - 19, 2004.

On the basis of its review, the staff found that, with the exception of the pump casings of the spent fuel pool cooling pumps, the applicant has identified those portions of the spent fuel pool system that meet the scoping requirements of 10 CFR 54.4 and included them within the scope of license renewal in LRA Section 2.3.3.1. The applicant has also included the spent fuel pool system components that are subject to an AMR, in accordance with the requirements of 10 CFR 54.4(a) and 10 CFR 54.21(a)(1), in LRA Table 2.3.3-1.

2.3.3.1.3 Conclusion

During its review of the information provided in the LRA, site documentation, license renewal drawings, and licensing basis information, the staff did not identify any omissions or discrepancies in the applicant's scoping and screening results for the components of the spent fuel pool system. During the scoping and screening inspection, the staff found that the applicant had omitted the spent fuel pool cooling pump casings from the scope of license renewal. The staff concluded that this was an isolated human error made in implementing the scoping and screening methodology, and not indicative of a flawed scoping and screening methodology. On the basis of its review, the staff concludes that the applicant has adequately identified the spent fuel pool system components that are within the scope of license renewal, as required by 10 CFR 54.4(a), and the spent fuel pool system components that are subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.2 Water Suppression Fire Protection

2.3.3.2.1 Summary of Technical Information in the Application

In Section 2.3.3.2 of the LRA, the applicant described the water suppression fire protection system. The fire protection system protects plant personnel and equipment in the event of a fire to ensure the safe shutdown of the plant and to minimize the risk of a release of radioactive material to the environment. Overall fire protection features include fire suppression, fire detection and actuation, and fire barriers. The fire detection and actuation portion of the system is screened as part of the electrical and I&C system. Fire dampers are screened as part of the assigned HVAC system. Other passive fire barriers are screened as part of the structures.

The fire protection system includes both manual (e.g., use of hoses, portable extinguishers, and fixed systems by plant personnel) and automatically actuated fire suppression features. Depending on the area protected, the suppression system employs extinguishing agents consisting of water and/or Halon. The water suppression fire protection system includes the fire pumps (including the diesel-driven fire pump fuel oil and other auxiliary systems), the fire water distribution system (including outside loop yard mains, hydrants, hose stations, standpipes, and valves), and deluge and preaction sprinkler systems.

Portable fire protection equipment, such as fire hoses, fire extinguishers, carbon dioxide bottles, and self-contained breathing apparatus air bottles, is not subject to an AMR because it is considered short-lived, replaced on condition, and exempted from AMR consistent with the treatment of consumables.

Table 2.2-1a of the LRA lists the mechanical systems within the scope of license renewal, including the water fire suppression system. The applicant identified the 10 CFR 54.4(a)(1–3) fire protection regulated event criteria as the scoping criteria that were met by the fire protection system components which are within the scope of license renewal.

In Table 2.3.3-2 of the LRA, the applicant listed the fire protection component types that are within the scope of license renewal and subject to an AMR, including air dryer housing, blower housing, bolting, ductwork, expansion joint, filter, filter housing, flex hose, gear housing, governor housing, heat exchanger (housing), heat exchanger (shell), heat exchanger (tubes), heater housing, nozzle, orifice, pipe/fittings, piping, pump casing, tubing, and valve.

2.3.3.2.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.2 and ANO-2 UFSAR Section 9.5.1. The staff conducted its review, using the evaluation methodology described in Section 2.3 of this SER, in accordance with the guidance described in Section 2.3 of the SRP-LR.

In the performance of the review, the staff, using the scoping process described in Section 2.3 of this SER, reviewed the UFSAR to determine if the applicant failed to identify in the LRA any system functions, in accordance with the requirements of 10 CFR 54.4(a), as an intended function of the fire protection system. The staff then reviewed the LRA and UFSAR, in accordance with the screening process described in Section 2.3 of this SER, to determine that the applicant did not omit any passive and long-lived components from an AMR, in accordance with 10 CFR 54.21(a)(1).

The staff found that the applicant included those portions of the water suppression fire protection system that meet the scoping requirements of 10 CFR 54.4 within the scope of license renewal and identified them as such in LRA Section 2.3.3.2. Table 2.3.3-2 of the LRA includes the water suppression fire protection system components that are subject to an AMR, in accordance with 10 CFR 54.4(a) and 10 CFR 54.21(a)(1). The staff did not identify any omissions.

2.3.3.2.3 Conclusion

The staff reviewed the LRA and the accompanying scoping boundary drawings to determine whether the applicant failed to identify any SSCs that should be within the scope of license renewal. The staff did not identify any omissions. In addition, the staff performed an independent assessment to determine if the applicant identified all components that should be subject to an AMR. The staff did not identify any omissions. On the basis of its review, the staff concludes that the applicant has adequately identified the components of the fire protection system that are within the scope of license renewal, as required by 10 CFR 54.4(a), and the components of the fire protection system that are subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.3 Emergency Diesel Generator

2.3.3.3.1 Summary of Technical Information in the Application

In Section 2.3.3.3 of the LRA, the applicant described the EDG system. The EDG system provides redundant emergency power sources capable of furnishing adequate power to safely shut down the reactor, remove reactor residual heat, and maintain the unit in a safe-shutdown condition upon the loss of preferred power with or without a coincident design-basis event. The EDGs are the redundant emergency power sources. The EDG system consists of diesel generators and the starting air, cooling water, lubrication, and combustion air intake and exhaust subsystems. Section 2.3.3.7 of this SER evaluates the fuel oil storage and transfer subsystem associated with the EDG.

The system is the safety-related source of electrical power required for engineered safety feature loads during design-basis events. The system also provides the emergency power required for safe shutdown following a fire. The EDG system is therefore within the scope of license renewal, based on the criteria of 10 CFR 54.4(a)(1) and 10 CFR 54.4(a)(3).

In Table 2.3.3-3 of the LRA, the applicant listed the EDG system component types that are within the scope of license renewal and subject to an AMR, including blower housing, bolting, booster housing, distributor housing, ejector, expansion joint, filter, filter housing, flex hose, governor housing, heat exchanger (bonnet), heat exchanger (shell), heat exchanger (tubes), heat exchanger (tubesheet), heater housing, orifice, piping, pump casing, silencer, tank, thermowell, tubing, unloader, and valve.

2.3.3.3.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.3, ANO-2 UFSAR Sections 8.3.1.1.7 and 9.5.5 through 9.5.9, and site documentation in its scoping and screening review of the EDG system. The staff conducted its review, with the support from the plant audit and applicant's methodology described in Section 2.3 of this SER, in accordance with the guidance described in Section 2.3 of the SRP-LR.

In the performance of its review, the staff selected system functions described in the UFSAR, in accordance with the requirements of 10 CFR 54.4, and evaluated site documentation to determine that the applicant did not inadvertently omit from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). In LRA Section 2.3.3.11, the applicant separately compiled all components with intended functions that are within the scope of license renewal, per 10 CFR 54.4(a)(2). The staff reviews those components for the EDG system in Section 2.3.3.11 of this SER. The staff then reviewed those components that the applicant identified as having an intended function to determine that the applicant did not omit any passive and long-lived components that should be subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

In reviewing LRA Section 2.3.3.3 and site documentation, the staff identified an area in which it needed additional information to complete the review of the applicant's scoping and screening results. Therefore, by letter dated May 11, 2004, the staff issued an RAI, described below, to the applicant to determine whether it has properly applied the scoping criteria of 10 CFR 54.4(a).

RAI 2.3.3.3-1(a)

The staff identified several active components that are highlighted on license renewal drawings as subject to an AMR. For the EDG system, these include exhaust turbo chargers and EDG engines 2K-4A and 2K-4B. Table 2.3.3-3 of the LRA does not include these as components subject to an AMR. In LRA Section 2.1.1, the applicant stated that all components highlighted on license renewal boundary drawings are subject to an AMR. The staff requested that the applicant clarify if the highlighted active components are subject to an AMR. If so, the staff requested that the applicant justify their exclusion from LRA Table 2.3.3-3, or include the components in LRA Tables 2.3.3-3 and 3.3.2-3.

Applicant's Response and Staff's Evaluation

In its response dated June 10, 2004, the applicant stated that LRA Tables 2.3.3-3 and 3.3.2-3 show the passive portion of the turbo chargers as the component type "blower housing." The applicant also stated that EDG engines 2K-4A and 2K-4B, in accordance with Appendix B to NEI 95-10 and consistent with SRP-LR Table 2.1-5, are not subject to an AMR and as such should not be highlighted on the drawing.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.3-1(a) acceptable, because the turbo charger housings which are passive and long-lived are appropriately included within the scope and are subject to an AMR. As such, LRA Tables 2.3.3-3 and 3.3.2-3 include them as blower housings. The applicant made an error in highlighting the active components in question on the license renewal drawing; therefore, they are not subject to an AMR. This determination is acceptable. Therefore, the staff considers its concern described in RAI 2.3.3.3-1(a) resolved, as it relates to the EDG system.

2.3.3.3.3 Conclusion

During its review of the information provided in the LRA, site documentation, the license renewal drawings, and licensing basis information, the staff did not identify any omissions or discrepancies in the applicant's scoping and screening results for the components of the EDG system. Therefore, the staff concludes that the applicant has adequately identified the EDG system components that are within the scope of license renewal, as required by 10 CFR 54.4(a), and the EDG system components that are subject to AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.4 Alternate ac Diesel Generator

2.3.3.4.1 Summary of Technical Information in the Application

In Section 2.3.3.4 of the LRA, the applicant described the alternate ac diesel generator system, which provides backup power at ANO. The alternate ac generator is a 4400-kilowatt (kW) diesel generator installed in response to the regulatory requirements of 10 CFR 50.63. The alternate ac system consists of a single diesel generator and the air start, engine cooling water, lubrication, combustion air intake and exhaust, fuel oil, and alternate ac building heating and ventilation subsystems. Ventilation components are part of the ventilation system code (VENT).

While it does not have a safety function, 10 CFR 50.63 requires the alternate ac generator system. The system is nonsafety related. The alternate ac generator system is credited for providing power during a loss of offsite power concurrent with a loss of the EDGs (i.e., SBO). The alternate ac diesel can furnish adequate power to safely shut down the reactor upon a loss of all ac power at ANO-2 by connecting to either of the 4160-V safety-related buses on the unit. The alternate ac diesel is also credited with providing electrical power for operation for safe shutdown after a fire. Therefore the alternate ac system is within the scope of license renewal, based on 10 CFR 54.4(a)(3), for the fire protection and SBO regulated events.

The alternate ac generator is shared with ANO, Unit 1 (ANO-1). To have a complete review of the components required for ANO-2 operation, the SER evaluates portions of the system that are required to support the supply of power to ANO-2 even if they have already been reviewed for ANO-1 license renewal.

In Table 2.3.3.4 of the LRA, the applicant listed the alternate ac diesel system component types that are within the scope of license renewal and subject to an AMR, including air motor housing, blower housing, bolting, expansion joint, filter, filter housing, flex hose, governor housing, heat exchanger (shell), heat exchanger (tubes), heater housing, indicator housing, lubricator housing, orifice, piping, pump casing, silencer, tank, thermowell, tubing, and valve.

2.3.3.4.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.4, ANO-2 UFSAR Section 8.3.3, and site documentation in its scoping and screening review of the alternate ac diesel generator system. The staff conducted its review, with the support from the plant audit and applicant's methodology described in Section 2.3 of this SER, in accordance with the guidance described in Section 2.3 of the SRP-LR.

In the performance of its review, the staff selected system functions described in the UFSAR, in accordance with the requirements of 10 CFR 54.4, and evaluated site documentation to confirm that the applicant did not inadvertently omit from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). In LRA Section 2.3.3.11, the applicant separately compiled scoping and screening results for all components with intended functions that are within the scope of license renewal, per 10 CFR 54.4(a)(2). The staff reviews those components for the alternate ac diesel generator system in Section 2.3.3.11 of this SER. The staff then reviewed those components that the applicant identified as having an intended function to determine that the applicant did not omit any passive and long-lived components that should be subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

In reviewing LRA Section 2.3.3.4 and site documentation, the staff identified areas in which it needed additional information to complete its evaluation of the applicant's scoping and screening results. Therefore, by letter dated May 11, 2004, the staff issued RAIs, described below, to the applicant concerning the specific issues to determine whether the applicant has properly applied the scoping criteria of 10 CFR 54.4(a) and the screening criteria of 10 CFR 54.21(a)(1).

RAI 2.3.3.3-1(b)

The staff identified several active components that the applicant highlighted on the license renewal drawings as subject to an AMR. For the alternate ac generator system, these include cylinder block and head, piston cooling jets (housing), engine sump, bearings (housing), and turbo chargers. Table 2.3.3-4 of the LRA does not list these as components subject to an AMR. In LRA Section 2.1.1, the applicant stated that all components highlighted on license renewal boundary drawings are subject to an AMR. The staff requested that the applicant clarify if these highlighted active components are subject to an AMR. If so, the staff requested that the applicant justify their exclusion from LRA Table 2.3.3-4, or include these components in LRA Tables 2.3.3-4 and 3.3.2-4.

Applicant's Response and Staff's Evaluation

In the response dated June 10, 2004, the applicant stated that LRA Tables 2.3.3-4 and 3.3.2-4 show the passive portion of the turbo chargers as the component type "blower housing." The applicant also stated that it inadvertently highlighted the cylinder block and head, the bearings, piston cooling jets, and sump. These components are part of the alternate ac diesel generator engine assembly which, in accordance with Appendix B to NEI 95-10 and consistent with SRP-LR Table 2.1-5, are not subject to an AMR. Therefore, LRA Tables 2.3.3-4 and 3.3.2-4 do not include these components.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.3-1(b) acceptable, because the applicant appropriately included the turbo charger housings, which are passive and long-lived, within the scope of license renewal and as subject to an AMR. As such, LRA Tables 2.3.3-4 and 3.3.2-4 include them as blower housings. The applicant made an error in highlighting the active components in question on the drawings; therefore, they are not subject to an AMR. This determination is consistent with the SRP-LR and, as such, acceptable. Therefore, the staff considers its concern described in RAI 2.3.3.3-1(b) resolved, as it relates to the alternate ac generator system.

RAI 2.3.3.4-1

Section 8.3.3, "Alternate AC Power Source," of the ANO-2 UFSAR states that the engine generator set has Class F insulation, and that license renewal drawing LRA—2241, Sheet 2, shows the insulated piping as not subject to an AMR. The staff requested that the applicant briefly state the basis for excluding this insulation from within the scope of license renewal (e.g., system efficiency, heat load calculations, or EQ purposes). The insulation is passive and long-lived and should be subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1), if it is relied upon for EQ purposes. The staff requested that the applicant verify whether the Class F insulation is subject to an AMR.

Applicant's Response and Staff's Evaluation

In its response dated June 10, 2004, the applicant stated that the insulation referred to in UFSAR Section 8.3.3 is on the generator windings and is not piping insulation. As part of the alternate ac generator system, the generator and the piping are within the scope of license renewal. However, the generator with its associated insulation is an active component that is not subject to an AMR. The insulation shown on exhaust piping on the referenced drawing, though not specifically highlighted, is subject to an AMR.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.4-1 acceptable for the generator insulation because the insulation referred to in UFSAR Section 8.3.3 is part of the generator which is an active component and, therefore, not subject to an AMR. The staff finds the applicant's response to RAI 2.3.3.4-1 acceptable for the insulation on the exhaust piping, which is in scope and subject to an AMR with the component type "insulation." Therefore, the staff considers its concern described in RAI 2.3.3.4-1 resolved.

2.3.3.4.3 Conclusion

During its review of the information provided in the LRA, site documentation, license renewal drawings, and licensing basis information, the staff identified one omission in the applicant's scoping and screening results for insulation of the alternate ac diesel generator system. The staff determined that this error was not indicative of a flawed scoping and screening methodology. Therefore, the staff concludes that the applicant has adequately identified the alternate ac diesel generator system components that are within the scope of license renewal, as required by 10 CFR 54.4(a), and the alternate ac diesel generator system components that are subject to AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.5 Chemical and Volume Control

2.3.3.5.1 Summary of Technical Information in the Application

In Section 2.3.3.5 of the LRA, the applicant described the CVCS. The CVCS maintains RCS inventory and controls RCS chemistry. The CVCS system consists of four subsections, including letdown, charging, boron addition, and reactor makeup water. The CVCS also supplies borated water to the RCS from the boric acid makeup tanks or the RWT via the charging pumps.

The components in this system are mostly nonsafety related, but safety-related components include the containment isolation valves, part of the RCS pressure boundary, or boundary valves to safety-related systems. The CVCS contains nonsafety-related components, evaluated in Section 2.3.3.11 of this SER, whose failure could impact safety-related components.

This system is credited as one method of providing RCS inventory addition for safe shutdown following a fire with the suction supplied from the RWT or the boric acid makeup tanks. These components perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48).

Section 2.3.1 of this SER evaluates the portions of the CVCS that are part of the RCS pressure boundary with the RCS. Section 2.3.2.1 of this SER evaluates the CVCS valve in the supply from the RWT with the ECCS. Finally, Section 2.3.3.1 of this SER evaluates the CVCS valves in the makeup to the spent fuel pool system with the spent fuel pool system. The CVCS evaluation includes components from the nitrogen supply system that are associated with the charging pump pulsation dampeners and suction stabilizers. The CVCS is within the scope of license renewal based on the criteria of 10 CFR 54.4(a)(1–3).

In Table 2.3.3.5 of the LRA, the applicant listed the CVCS system component types that are within the scope of license renewal and subject to an AMR, including bolting, gear housing, heat exchanger (shell), piping, pump casing, sight glass, sight glass (housing), tank, thermowell, tubing, and valve.

2.3.3.5.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.5, Table 2.3.3-5, and SAR Section 9.3.4 to determine whether the applicant identified the CVCS subsystems (e.g., piping, tanks, and pump casing) and supporting structures that are within the scope of license renewal and subject to AMR, in accordance with the requirements of 10 CFR 54.4 and 10 CFR 54.21(a). The staff used the evaluation methodology described in Section 2.3 of this SER. The staff conducted its review in accordance with the guidance described in Section 2.3 of the SRP-LR.

In conducting its review, the staff evaluated the system functions described in the LRA and UFSAR, in accordance with the requirements of 10 CFR 54.4(a), to determine that the applicant did not inadvertently omit from the scope of license renewal any CVCS components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed the CVCS components that the applicant identified as within the scope of license renewal to confirm that the applicant did not omit any passive and long-lived components that should be subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1). The staff did not identify any omissions.

2.3.3.5.3 Conclusion

During its review of the information provided in the LRA, license renewal drawings, and licensing basis information, the staff did not identify any omissions or discrepancies in the applicant's scooping and screening results for the CVCS. Therefore, 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 the CVCS system SCs that are subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.6 Halon Fire Protection and Reactor Coolant Pump Motor Oil Leakage Collection

2.3.3.6.1 Summary of Technical Information in the Application

In Section 2.3.3.6 of the LRA, the applicant described the Halon fire protection system and the RCP motor oil collection system. The Halon fire protection system provides fire suppression in the core protection calculator room, flooding the room with Halon 1301 to extinguish a fire. The Halon system consists of Halon storage tanks, discharge piping, valves, controls, alarms, and smoke detectors. The RCP motor oil collection system collects random leakage from the four RCP motors to reduce the chance of a fire. Each sump tank has the capacity to contain the lube oil inventory of a single RCP.

Table 2.2-1a of the LRA lists the mechanical systems within the scope of license renewal, including the Halon fire suppression system and the RCP motor oil collection system. The applicant identified the 10 CFR 54.4(a)(3) fire protection regulated event criteria as the scoping criteria that are met by the fire protection system components which are within the scope of license renewal.

In Table 2.3.3-6 of the LRA, the applicant listed the fire protection component types that are within the scope of license renewal and subject to an AMR, including bolting, flex hose, indicator housing, nozzle, pan, piping, tank, tubing, and valve.

2.3.3.6.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.6 and ANO-2 UFSAR Sections 9.5.1.2 and 9.5.1.3. The staff conducted its review, using the evaluation methodology described in Section 2.3 of this SER, in accordance with the guidance described in Section 2.3 of the SRP-LR.

In the performance of the review, the staff, using the scoping process described in Section 2.3 of this SER, reviewed the UFSAR to determine if the applicant failed to identify in the LRA any system functions, in accordance with the requirements of 10 CFR 54.4(a), as an intended function of the fire protection system. The staff then reviewed the LRA and UFSAR, in accordance with the screening process described in Section 2.3 of this SER, to confirm that the applicant did not omit any passive and long-lived components that are subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

The staff found that the applicant identified those portions of the Halon fire protection system and RCP motor oil collection system that meet the scoping requirements of 10 CFR 54.4 as within the scope of license renewal and included them in LRA Section 2.3.3.6. The applicant included the Halon fire protection system components and RCP motor oil collection system components that are subject to an AMR, in accordance with 10 CFR 54.4(a) and 10 CFR 54.21(a)(1), in LRA Table 2.3.3-6. The staff did not identify any omissions.

2.3.3.6.3 Conclusion

The staff reviewed the LRA and the accompanying scoping boundary drawings to determine whether the applicant failed to identify any SSCs that should be within the scope of license renewal. The staff did not identify any omissions. In addition, the staff performed an independent assessment to determine whether the applicant failed to identify any components that should be subject to an AMR. The staff did not identify any omissions. On the basis of its review, the staff concludes that the applicant has adequately identified the components of the fire protection system that are within the scope of license renewal, as required by 10 CFR 54.4(a), and the components of the fire protection system that are subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.7 Fuel Oil

2.3.3.7.1 Summary of Technical Information in the Application

In Section 2.3.3.7 of the LRA, the applicant described the fuel oil system. The fuel oil system provides fuel oil for site components, including the various diesel engines and the auxiliary boiler. The system consists of various tanks, pumps, injectors, piping, and valves to store and transfer fuel oil.

The system contains components that are the safety-related source of diesel fuel as required for emergency diesel operation during design-basis events. The system provides diesel fuel as required to the alternate ac generator for the SBO event. The fuel oil to the fire diesel, the emergency generators, and alternate ac generators is credited for the safe-shutdown fire regulated event.

The fuel oil system includes ANO-1 shared components, such as the bulk fuel oil storage tank. To have a complete review of components required for ANO-2 operation, components necessary for providing fuel oil to the systems required for ANO-2 are evaluated even if they have already been reviewed for ANO-1 license renewal. The ANO-1 fuel oil system is credited as a backup supply to the ANO-2 diesel generators in the case of a fire that renders the ANO-2 fuel oil transfer pumps unavailable.

The fuel oil system includes safety-related components and is therefore within the scope of license renewal, based on 10 CFR 54.4(a)(1). The fuel oil system is required for compliance with the Commission's regulations for fire protection (10 CFR 50.48) and SBO events. Therefore, it is within the scope of license renewal based on 10 CFR 54.4(a)(3).

In Table 2.3.3.7 of the LRA, the applicant listed the compressed air component types that are within the scope of license renewal and subject to an AMR, including bolting, filter, filter housing, flame arrestor, flex hose, heat exchanger (shell), heat exchanger (tubes), indicator housing, injector housing, orifice, piping, pump casing, tank, thermowell, tubing, and valve.

2.3.3.7.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.7, ANO-2 UFSAR Sections 8.3.3.2.3.3, 9.5.1, and 9.5.4, and site documentation in its scoping and screening review of fuel oil system. The staff conducted its review, with the support from the plant audit and applicant's methodology described in Section 2.3 of this SER, in accordance with the guidance described in Section 2.3 of the SRP-LR.

In the performance of its review, the staff selected system functions described in the UFSAR, in accordance with the requirements of 10 CFR 54.4, and evaluated site documentation to confirm that the applicant did not inadvertently omit from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). In LRA Section 2.3.3.11, the applicant separately compiled scoping and screening results for all components with intended functions that are within the scope of license renewal, per 10 CFR 54.4(a)(2). The staff reviews those components for the fuel oil system in Section 2.3.3.11 of this SER. The staff then reviewed those components that the applicant identified as having an intended function to confirm that the applicant did not omit any passive and long-lived components that should be subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

On the basis of its review, the staff found that the applicant has identified those portions of the fuel oil system that meet the scoping requirements of 10 CFR 54.4 and included them within the scope of license renewal in LRA Section 2.3.3.7. The applicant has also included the fuel oil system components that are subject to an AMR, in accordance with the requirements of 10 CFR 54.4(a) and 10 CFR 54.21(a)(1), in LRA Table 2.3.3-7. The staff did not identify any omissions.

2.3.3.7.3 Conclusion

During its review of the information provided in the LRA, site documentation, license renewal drawings, and licensing basis information, the staff did not identify any omissions or discrepancies in the applicant's scoping and screening results for the components of the fuel oil system. Therefore, the staff concludes that the applicant has adequately identified the fuel oil system components that are within the scope of license renewal, as required by 10 CFR 54.4(a), and the fuel oil system components that are subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.8 Service Water

2.3.3.8.1 Summary of Technical Information in the Application

In Section 2.3.3.8 of the LRA, the applicant described the service water system. The service water system provides cooling water from Lake Dardanelle or the emergency cooling pond to safety-related and nonsafety-related equipment, as well as an emergency supply of water to the emergency feedwater system and the fuel pool system. The service water system provides cooling water to two independent flowpaths, which furnish water to two independent, safety-related engineered safety features equipment trains and two nonsafety-related flowpaths (auxiliary cooling water and component cooling water heat exchangers/main chillers). Three service water pumps supply the various components cooled by service water.

The service water system is the safety-related source of cooling water for equipment cooling during design-basis events. The system contains nonsafety-related components, evaluated in Section 2.3.3.11 of this SER, whose failure could impact safety-related components. The service water system is required to function following a fire for safe shutdown of the unit.

The emergency feedwater suction supply valves from the service water system are evaluated with the service water system. The service water evaluation also includes hydrogen control system valves that were originally intended to supply service water under accident conditions to the purge components but now only have the safety function of maintaining the service water pressure boundary. Ventilation components that provide cooling for the service water pumps and motors are classified as part of the intake structure system but are evaluated with the service water system. The individual service water supplied heat exchangers are evaluated with the systems that they cool.

The service water system is within the scope of license renewal based on the criteria of 10 CFR 54.4(a)(1)-(3).

In Table 2.3.3-8 of the LRA, the applicant listed the service water component types that are within the scope of license renewal and subject to an AMR, including blower housing, bolting, damper housing, ductwork, expansion joint, filter, filter housing, flow straightener, orifice, piping, pump casing, thermowell, tubing, and valve.

2.3.3.8.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.8, ANO-2 UFSAR Sections 9.2.1, 9.2.5, 3.6.4.5.1.1, and 9.4.6, and site documentation in its scoping and screening review of the service water system. The staff conducted its review, with the support from the plant audit and applicant's methodology described in Section 2.3 of this SER, in accordance with the guidance described in Section 2.3 of the SRP-LR.

In the performance of its review, the staff selected system functions described in the UFSAR, in accordance with the requirements of 10 CFR 54.4, and evaluated site documents to confirm that the applicant did not inadvertently omit from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). In LRA Section 2.3.3.11, the applicant separately compiled scoping and screening results for all components with intended functions that are within the scope of license renewal, per 10 CFR 54.4(a)(2). The staff reviews those components for the service water system in Section 2.3.3.11 of this SER. The staff then reviewed those components that the applicant identified as having an intended function to confirm that the applicant did not omit any passive and long-lived components that should be subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

On the basis of its review, the staff found that the applicant has identified those portions of the service water system that meet the scoping requirements of 10 CFR 54.4(a) and included them within the scope of license renewal in LRA Section 2.3.3.8. The applicant also included the service water system components that are subject to an AMR, in accordance with 10 CFR 54.21(a)(1), in LRA Table 2.3.3-8. The staff did not identify any omissions.

2.3.3.8.3 Conclusion

During its review of the information provided in the LRA, site documentation, license renewal drawings, and licensing basis information, the staff did not identify any omissions or discrepancies in the applicant's scoping and screening results for the components of the spent fuel pool system. Therefore, the staff concludes that the applicant has adequately identified the service water system components that are within the scope of license renewal, as required by

10 CFR 54.4(a), and the service water system components that are subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.9 Auxiliary Building Ventilation

2.3.3.9.1 Summary of Technical Information in the Application

In Section 2.3.3.9 of the LRA, the applicant described the auxiliary building ventilation. The auxiliary building ventilation system provides ventilation for equipment in the auxiliary building and the auxiliary building extension. The system consists of safety-related and nonsafety-related equipment in the auxiliary building to provide both normal and emergency cooling and ventilation. The system includes the auxiliary building heating and ventilation system code.

The auxiliary building is served by separate ventilation systems for each of the following areas:

- fuel handling floor radwaste area
- auxiliary building radwaste area (includes electrical equipment room 2096)
- noncontaminated areas
- emergency diesel generator rooms
- battery rooms and direct current equipment rooms
- switchgear rooms
- cable spreading room and electrical equipment room 2108
- computer room 2098-C
- electrical MG room 2076
- ventilation equipment room
- main steamline enclosure
- elevator-machine room
- boiler room area
- heat exchanger and pipeway area
- electrical equipment room 2091

The components within these subsystems include supply and exhaust fans, cooling and heating coils, dampers, filters, ductwork, condensing units, and dehumidifiers.

Safety-related ventilation systems serve areas containing safety-related equipment, including the HPSI pumps, the charging pumps, the shutdown cooling heat exchangers, the emergency feedwater pumps, electrical equipment (rooms 2091 and 2096), the EDGs, batteries, and switchgear.

This system contains nonsafety-related components, evaluated in Section 2.3.3.11, whose failure could impact safety-related components. The cooling for some components, such as the EDG room and the safety parameters display system room, is required to support safe shutdown following a fire. The fire dampers included in this system are required for fire protection (10 CFR 50.48).

Section 2.3.3.10 of this SER evaluates components in the auxiliary building heating and ventilation system code that support control room ventilation with control room ventilation. The system is within the scope of license renewal based on 10 CFR 54.4(a)(1)-(3).

In Table 2.3.3-9 of the LRA, the applicant listed the auxiliary ventilation system component types that are within the scope of license renewal and subject to an AMR, including blower housing, bolting, cooling coil housing, damper housing, ductwork, expansion joint, heat exchanger (tubes), piping, tubing, and valve.

2.3.3.9.2 Staff Evaluation

The staff reviewed LRA Sections 2.1.1, 2.3.3.9, and 2.3.3.11 and ANO-2 UFSAR Section 9.4.2 using the evaluation methodology described in Section 2.1 of this SER. The staff conducted its review in accordance with the guidance described in Section 2.3 of the SRP-LR.

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

In reviewing LRA Sections 2.1.1, 2.3.3.9, and 2.3.3.11, the staff identified an area in which it needed additional information to complete the review of the applicant's scoping and screening results. Therefore, by letter dated April 8, 2004, the staff issued RAIs, described below, concerning the specific issues to determine whether the applicant has properly applied the scoping criteria of 10 CFR 54.4(a) and the screening criteria of 10 CFR 54.21(a)(1).

RAI 2.3-1b

The staff requested that the applicant determine that the LRA has not omitted any auxiliary building ventilation system SCs that should be within the scope of license renewal, according to 10 CFR 54.4(a).

Applicant's Response and Staff's Evaluation

In its response, dated May 19, 2004, the applicant stated that, in accordance with 10 CFR 54.21(a)(1), auxiliary building ventilation system SCs subject to AMR are those that perform an intended function without moving parts or a change in configuration or properties (i.e., passive) and that are not subject to replacement based on a qualified life or specified time period (i.e., long-lived). Among the systems and structures within the scope of license renewal, the applicant identified the auxiliary building ventilation system SCs that are subject to an AMR, in accordance with 10 CFR 54.21, in LRA Tables 2.2-1a, 2.2-1b, and 2.2-3. The applicant conservatively considered them to be within the scope of license renewal for the purpose of identifying SCs that are subject to an AMR.

Based on its review, the staff finds the applicant's response to RAI 2.3-1b acceptable, because the applicant considered all components within the auxiliary building ventilation system as identified in LRA Tables 2.2-1a and 2.2-1b, and all auxiliary building ventilation system structures identified in LRA Table 2.2-3, to be within the scope of license renewal for the purpose of identifying SCs that are subject to AMR. Therefore, the staff's concern described in RAI 2.3-1b is resolved.

RAI 2.3-2

In LRA Section 2.1.1, the applicant stated that it prepared LRA drawings (for the auxiliary building ventilation system) to indicate components subject to an AMR. The applicant did not indicate components (for the auxiliary building ventilation system) that are subject to an AMR based only on the criteria of 10 CFR 54.4(a)(2) on the LRA drawings (for the auxiliary building ventilation system). The staff requested that the applicant determine that the LRA has not omitted any auxiliary building ventilation system SCs that should be within the scope of license renewal, according to 10 CFR 54.4(a).

Applicant's Response and Staff's Evaluation

In its response, dated May 19, 2004, the applicant stated that, in accordance with 10 CFR 54.21(a)(1), as given in the response to RAI 2.1.1-2, it considered all components (for the auxiliary building ventilation system) within the systems identified in LRA Tables 2.2-1a and 2.2-1b, and all structures (for the auxiliary building ventilation system) identified in LRA Table 2.2-3, to be within the scope of license renewal for the purpose of identifying SCs (for the auxiliary building ventilation system) that are subject to AMR, including components in the system considered only in response to 10 CFR 54.4(a)(2).

Based on its review, the staff finds the applicant's response to RAI 2.3-2 acceptable, because the applicant considered all components within the auxiliary building ventilation system as identified in LRA Tables 2.2-1a and 2.2-1b, and all auxiliary building ventilation system structures identified in LRA Table 2.2-3, to be within the scope of license renewal for the purpose of identifying SCs that are subject to AMR. Therefore, the staff's concern described in RAI 2.3-2 is resolved.

RAI 2.3-3.b

The staff requested that the applicant clarify whether sealants used as a pressure boundary function for the auxiliary building ventilation system are within the scope of license renewal, in accordance with 10 CFR 54.4(a), and subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

Applicant's Response and Staff's Evaluation

In its response, dated May 19, 2004, the applicant stated that it did not credit sealants with a function of pressure boundary for the auxiliary building ventilation system. Sealants used in the auxiliary building ventilation system do not perform a license renewal intended function.

Based on its review, the staff finds the applicant's response to RAI 2.3-3.b acceptable, because the applicant did not credit sealants to perform any pressure boundary function for the auxiliary building ventilation system and, as such, sealants do not perform a license renewal intended function. Therefore, the staff's concern described in RAI 2.3-3.b is resolved.

2.3.3.9.3 Conclusion

During its review of information provided in the LRA, license renewal drawings, and licensing basis information, the staff did not identify any omissions or discrepancies in the applicant's scoping and screening results for the SCs of the auxiliary building ventilation system. Therefore, the staff concludes that the applicant has adequately identified the auxiliary building ventilation system SCs that are within the scope of license renewal, as required by 10 CFR 54.4(a), and the auxiliary building ventilation system SCs that are subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.10 Control Room Ventilation

2.3.3.10.1 Summary of Technical Information in the Application

In Section 2.3.3.10 of the LRA, the applicant described the control room ventilation system, which provides a suitable environment for equipment and personnel in the control room. The system contains normal and emergency operation trains that include ductwork, filter units, blowers, cooling units, and heat exchangers to supply the control room space with the proper heating or cooling and limit the postaccident dose rate to the operators.

The control room ventilation system is the safety-related source of ventilation required for control room cooling during design-basis events. It provides protection from emergency events, such as a toxic gas release. The system contains fire dampers that must close to isolate the control room in the event of a fire. These dampers are required for compliance with the Commission's regulations for fire protection (10 CFR 50.48).

This system is shared with ANO-1. To have a complete review of the components required for ANO-2 operation, the components necessary for providing cooling for ANO-2 are evaluated even if they have already been reviewed for ANO-1 license renewal. This evaluation includes the safety-related components of the chilled water system that support control room ventilation. The control room ventilation system is within the scope of license renewal, based on the criteria of 10 CFR 54.4(a)(1) and 10 CFR 54.4(a)(3).

In Table 2.3.3.10 of the LRA, the applicant listed the auxiliary and radwaste area ventilation system component types that are within the scope of license renewal and subject to an AMR, including blower housing, bolting, compressor casing, cooling coil housing, damper housing, ductwork, expansion joint, filter housing, heat exchanger (bonnet), heat exchanger (shell), heat exchanger (tubes), indicator housing, piping, sight glass, sight glass (housing), silencer, tank, thermowell, tubing, and valve.

2.3.3.10.2 Staff Evaluation

The staff reviewed LRA Sections 2.1.1 and 2.3.3.10 and ANO-2 UFSAR Section 9.4.2 using the evaluation methodology described in Section 2.1 of this SER. The staff conducted its review in accordance with the guidance described in Section 2.3 of the SRP-LR.

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

In reviewing LRA Sections 2.1.1 and 2.3.3.10, the staff identified an area in which it needed additional information to complete its evaluation of the applicant's scoping and screening results. Therefore, by letter dated April 8, 2004, the staff issued RAIs, described below, concerning the specific issues to determine whether the applicant has properly applied the scoping criteria of 10 CFR 54.4(a) and the screening criteria of 10 CFR 54.21(a)(1).

RAI 2.3-1c

The staff requested that the applicant determine that the LRA has not omitted any control room ventilation system SCs that should be within the scope of license renewal, according to 10 CFR 54.4(a).

Applicant's Response and Staff's Evaluation

In its response, dated May 19, 2004, the applicant stated that, in accordance with 10 CFR 54.21(a)(1), control room ventilation system SCs subject to AMR are those that perform an intended function without moving parts or a change in configuration or properties (i.e., passive) and that are not subject to replacement based on a qualified life or specified time period (i.e., long-lived). Among the systems and structures within the scope of license renewal, the applicant identified control room ventilation system SCs that are subject to an AMR, in accordance with 10 CFR 54.21, in LRA Tables 2.2-1a, 2.2-1b, and 2.2-3. The applicant conservatively considered them to be within the scope of license renewal for the purpose of identifying SCs that are subject to an AMR.

Based on its review, the staff finds the applicant's response to RAI 2.3-1c acceptable, because the applicant considered all components within the control room ventilation system as identified in LRA Tables 2.2-1a and 2.2-1b, and all control room ventilation system structures identified in LRA Table 2.2-3, to be within the scope of license renewal for the purpose of identifying SCs that are subject to an AMR. Therefore, the staff's concern described in RAI 2.3-1c is resolved.

RAI 2.3-2

In Section 2.1.1 of the LRA, the applicant stated that it prepared LRA drawings (for the control room ventilation system) to indicate components subject to an AMR. The LRA drawings (for the control room ventilation system) do not indicate the components (for the control room ventilation system) that are subject to an AMR based only on the criteria of 10 CFR 54.4(a)(2). The staff requested that the applicant determine that the LRA has not omitted any control room ventilation system SCs that should be within the scope of license renewal, according to 10 CFR 54.4(a).

Applicant's Response and Staff's Evaluation

In its response, dated May 19, 2004, the applicant stated that, in accordance with 10 CFR 54.21(a)(1), as noted in the response to RAI 2.3-2, the applicant considered all components (for the control room ventilation system) within the systems identified in LRA Tables 2.2-1a and 2.2-1b, and all structures (for the control room ventilation system) identified in LRA Table 2.2-3, to be within the scope of license renewal for the purpose of identifying SCs (for the control room ventilation system) that are subject to AMR, including components in the system considered only for 10 CFR 54.4(a)(2).

Based on its review, the staff finds the applicant's response to RAI 2.3-2 acceptable, because the applicant considered all components within the control room ventilation system as identified in LRA Tables 2.2-1a and 2.2-1b, and all control room ventilation system structures identified in LRA Table 2.2-3, to be within the scope of license renewal for the purpose of identifying SCs that are subject to AMR. Therefore, the staff's concern described in RAI 2.3-2 is resolved.

RAI 2.3-3(a)

The staff requested that the applicant clarify whether it included the sealants used on the main control room envelope to prevent unfiltered inleakages within the scope of license renewal, in accordance with 10 CFR 54.4(a), and subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

Applicant's Response and Staff's Evaluation

In its response, dated May 19, 2004, the applicant stated that it included sealants or elastomers that are used on the main control room envelope within the scope of license renewal. These sealants are structural sealants used to minimize leakage into the control room. They are addressed as part of structural bulk commodities and are subject to an AMR, as documented in Section 2.4 of the LRA. Table 2.4-4 of the LRA lists the sealants under the component type "elastomers."

Based on its review, the staff finds the applicant's response to RAI 2.3-3.a acceptable, because the applicant considered sealants and elastomers within the control room ventilation system, as identified in LRA Table 2.4-4, to be within the scope of license renewal and subject to an AMR. Therefore, the staff's concern described in RAI 2.2.3-3(a) is resolved.

2.3.3.10.3 Conclusion

During its review of information provided in the LRA, license renewal drawings, and licensing basis information, the staff did not identify any omissions or discrepancies in the applicant's scoping and screening results for the SCs of the control room ventilation system. Therefore, the staff concludes that the applicant has adequately identified the control room ventilation system SCs that are within the scope of license renewal, as required by 10 CFR 54.4(a), and the control room ventilation system SCs that are subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.11 Miscellaneous Systems in Scope for 10 CFR 54.4(a)(2)

2.3.3.11.1 Summary of Technical Information in the Application

In Section 2.3.3.11 of the LRA, the applicant described the miscellaneous systems within the scope of license renewal for 10 CFR 54.4(a)(2). The applicant identified the systems within the scope of license renewal based on the criteria of 10 CFR 54.4(a)(2) using the method described in Section 2.1.1.2 of this SER. The applicant reviewed each mechanical system to identify nonsafety-related systems or nonsafety-related portions of safety-related systems with the potential for adverse spatial interaction with safety-related systems or components. This section evaluates components subject to an AMR because of the scoping criteria of 10 CFR 54.4(a)(2). Systems within the scope of license renewal based on the criteria of 10 CFR 54.4(a)(2) may also meet the criteria of 10 CFR 54.4(a)(1). The system description discusses which scoping criteria are met.

The following systems, described in the referenced sections of this SER, are within the scope of license renewal based on the criteria of 10CFR54.4(a)(2):

- auxiliary building ventilation (Section 2.3.3.9)
- containment spray (Section 2.3.2.2)
- chemical and volume control (Section 2.3.3.5)
- containment cooling (reactor building ventilation) (Section 2.3.2.3)
- emergency feedwater and condensate storage and transfer (Section 2.3.4.3)
- spent fuel pool (fuel pool cooling and purification) (Section 2.3.3.1)
- main feedwater (Section 2.3.4.2)
- emergency core cooling (LPSI) (Section 2.3.2.1)
- main steam (Section 2.3.4.1)
- reactor coolant (RCS and RCP system) (Section 2.3.1)
- service water (Section 2.3.3.8)
- water suppression fire protection (Section 2.3.3.2)

The following systems are within the scope of license renewal based on the criteria of 10 CFR 54.4(a)(2) and have not been described elsewhere in the application:

- auxiliary building sump
- postaccident sampling system
- auxiliary cooling water
- plant heating
- auxiliary steam
- primary sampling
- boron management
- regenerative waste
- chemical addition
- resin transfer
- chilled water
- sampling system
- circulating water
- shutdown cooling
- component cooling water
- spent resin
- domestic water
- startup and blowdown demineralizers
- drain collection header
- steam generator secondary/blowdown
- liquid radwaste management

- turbine building sump

The descriptions below note those cases where additional scoping criteria apply and reference the section of this SER evaluating the affected components.

Auxiliary Building Sump. The auxiliary building sump system provides drainage for equipment to support normal plant operation. The system contains piping, valves, and pumps for equipment and floor drains in the containment, auxiliary building, and turbine building.

Section 2.3.2.4 of this SER evaluates the safety-related components at the containment penetration with the containment penetrations. Therefore, the auxiliary building sump system is also within the scope of license renewal, based on the criteria of 10 CFR 54.4(a)(1).

Auxiliary Cooling Water. The auxiliary cooling water system provides cooling water to nonsafety-related components in the auxiliary building and turbine building to support normal plant operation. The service water system pumps supply water to the auxiliary cooling water system. Service water system valves provide isolation of the service water system from auxiliary cooling water as necessary under accident conditions.

Auxiliary Steam. The auxiliary steam system provides low-pressure steam for heating and process purposes to support normal plant operation and system testing. The system contains valves, orifices, piping, and tubing.

Boron Management. The boron management system provides collection, handling, and treatment of borated water to assist in the control of the boron concentration of the primary systems. The major influent to the boron management system is reactor coolant from the CVCS letdown as a result of feed and bleed operations for shutdown, startup, and boron dilution over core life. The boron management system consists of boric acid tanks, holdup tanks, pumps, and various piping and valves. The system also contains boric acid evaporators and concentrators, but these are no longer used.

The system contains safety-related components and is therefore also within the scope of license renewal, based on the criteria of 10 CFR 54.4(a)(1). Section 2.3.2.4 of this SER evaluates these safety-related components with the containment penetration system.

Chemical Addition. The chemical addition system provides chemicals for various water systems. The majority of this system is not safety related and only supports proper water chemistry controls for normal plant operation. The system includes chemical storage tanks, pumps, valves, and miscellaneous components needed to store and inject chemicals. The system includes the safety-related trisodium phosphate dodecahydrate (TSP-C) baskets in the containment and is therefore also within the scope of license renewal, based on the criteria of 10 CFR 54.4(a)(1). Section 2.4.4 of this SER evaluates the TSP-C baskets in the containment as a structural bulk commodity.

Chilled Water. The chilled water system provides chilled water to cooling units. This system includes components of several closed-loop chilled water systems in different areas of the plant, such as the containment, auxiliary building, and turbine building. Many of the system components are nonsafety related, are not required for emergency cooling or regulated events, and only provide cooling to support normal plant operation.

The system contains safety-related components and is therefore also within the scope of license renewal, based on the criteria of 10 CFR 54.4(a)(1). Section 2.3.2.4 of this SER evaluates the containment penetration components, and Section 2.3.3.10 of this SER evaluates the components in control room ventilation.

Circulating Water. The circulating water system provides cooling water to the main condenser. One section of pipe and a valve require an AMR, based on the criteria of 10 CFR 54.4(a)(2). These components, located in the auxiliary building, drain the circulating water system to the service water discharge pipe.

Component Cooling Water. The component cooling water system provides closed-cycle cooling water to nonsafety-related components to support normal plant operation. The system consists of tanks, pumps, and associated valves and piping to the nonsafety-related equipment.

The system contains safety-related components and is therefore also within the scope of license renewal, based on the criteria of 10 CFR 54.4(a)(1). Section 2.3.2.4 of this SER evaluates these safety-related components with the containment penetrations system.

Domestic Water. The domestic water system provides makeup water to plant systems and supplies water for domestic use (e.g., drinking water and sinks). The domestic water system consists of tanks, pumps, and the associated piping and valves.

Drain Collection Header. The drain collection header system provides a drain flowpath for numerous components in the auxiliary building. The system consists of piping and valves.

Liquid Radwaste Management. The liquid radwaste management system collects and processes the liquid radioactive wastewater. The system includes pumps, piping, valves, and tanks that collect, transport, and store the liquids.

Plant Heating. The plant heating system provides hot water for plant heating. It includes a boiler, pumps, piping, valves, and area heaters.

This system includes safety-related components at the containment penetration and is therefore also within the scope of license renewal, based on the criteria of 10 CFR 54.4(a)(1). Section 2.3.2.4 of this SER evaluates these components with the containment penetrations system. The system contains a valve that is required for the fuel oil pressure boundary to the fire diesel and is therefore also within the scope of license renewal, based on the criteria of 10 CFR 54.4(a)(3). The fuel oil system evaluation in Section 2.3.3.7 of this SER includes this valve.

Postaccident Sampling System. The postaccident sampling system provides postaccident sampling of the containment. The system includes piping, valves, coolers, pumps, sample containers, and detectors to allow the samples to be drawn and analyzed.

Primary Sampling. The primary sampling system collects and analyzes samples from the RCS and associated auxiliary systems. The system contains heat exchangers, pumps, tanks, valves, piping, and other mechanical components. The sampling function is not a safety function.

The primary sampling system contains safety-related components and is therefore also within the scope of license renewal, based on the criteria of 10 CFR 54.4(a)(1). Section 2.3.1 of this SER evaluates the components in this system that are part of the RCS pressure boundary. Section 2.3.2.1 evaluates the components in this system that are part of the ECCS pressure boundary. Section 2.3.2.4 evaluates the containment penetration components.

Regenerative Waste. The regenerative waste system processes and regenerates radioactive wastewater. This system was originally designed with radioactive waste evaporators that are no longer used. The system contains pumps, tanks, filters, valves, piping, and other miscellaneous mechanical components.

Resin Transfer. The resin transfer system transfers resin for the various site demineralizers. The system includes valves and piping.

Sampling System. The sampling system collects samples from plant systems to ensure proper chemistry control. The sampling system consists of pumps, heat exchangers, filters, valves, tanks, piping, and other miscellaneous components.

The system includes safety-related piping and valves at containment penetrations that have the safety function of maintaining the steam generator secondary pressure boundary and containment integrity under accident conditions. The system is therefore also within the scope of license renewal, based on the criteria of 10 CFR 54.4(a)(1). The steam generator secondary-side pressure boundary, as maintained by these components, is required during a safe shutdown following a fire. The system is therefore also within the scope of license renewal, based on the criteria of 10 CFR 54.4(a)(3). Section 2.3.2.4 of this SER evaluates these components with the containment penetrations system.

Shutdown Cooling. The shutdown cooling system provides cooling of the RCS without reliance on the steam generators. The shutdown cooling system consists of heat exchangers, valves, tanks, piping, and other miscellaneous components.

Certain shutdown cooling components are also used for postaccident operation as part of the LPSI system. The system is therefore also within the scope of license renewal, based on the criteria of 10 CFR 54.4(a)(1). The system contains components that are required for safe shutdown following a fire and is therefore also within the scope of license renewal, based on the criteria of 10 CFR 54.4(a)(3). Section 2.3.2.1 of this SER evaluates these components with the ECCS.

Spent Resin. The spent resin system facilitates the transfer and storage of resin from the site demineralizers before its disposal. The system consists of tanks, pumps, filters, valves, piping, and other miscellaneous mechanical components.

Startup and Blowdown Demineralizers. The startup and blowdown demineralizer system removes impurities from condensate and steam generator water inventory. The blowdown demineralizer system starts at the blowdown lines at the steam generators and includes the blowdown heat exchangers tank, the blowdown demineralizers, blowdown pumps, and the associated piping and valves. The majority of the system components outside of containment are not safety related.

The components in containment are safety related to provide a closed loop inside the containment building for containment integrity. The system is therefore also within the scope of license renewal, based on the criteria of 10 CFR 54.4(a)(1). The system must isolate to control the steam generator inventory under accident conditions and during safe shutdown following a fire when the steam generators are fed by emergency feedwater. The system is therefore also within the scope of license renewal, based on the criteria of 10 CFR 54.4(a)(3). Section 2.3.2.4 of this SER evaluates these components with the containment penetrations.

Steam Generator Secondary/Blowdown. The steam generator secondary/blowdown system includes instrumentation valves, tubing, and piping on the steam generator secondary side, as well as components in the steam generator blowdown subsystem. The instrumentation piping and valves sense the steam generator secondary side conditions and provide a main steam system pressure boundary. The steam generator instrumentation maintains pressure boundary integrity and indicates steam generator secondary-side conditions during safe shutdown following a fire.

The steam generator secondary/blowdown system contains safety-related components and is therefore also within the scope of license renewal, based on the criteria of 10 CFR 54.4(a)(1). The system contains components that are required for safe shutdown following a fire and is therefore also within the scope of license renewal, based on the criteria of 10 CFR 54.4(a)(3). Sections 2.3.4.1 and 2.3.4.2 of the SER include these components in the evaluations for main steam and main feedwater, respectively.

Turbine Building Sump. *The turbine building sump system provides the floor drains for* components in the turbine building and other areas, such as the emergency feedwater and EDG rooms. The system consists of pumps, filters, valves, piping, and other miscellaneous mechanical components.

In Table 2.3.3-11 of the LRA, the applicant listed the miscellaneous system component types that are within the scope of license renewal and subject to an AMR, including bolting, filter housing, heat exchanger (shell, channel head), heat exchanger (heating or cooling coil when not enclosed in a housing), level glass gauge, orifice, piping, pump casing, tank, thermowell, tubing, valve, and ventilation unit housing.

2.3.3.11.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.11, the ANO-2 UFSAR, and Engineering Report A2-ME-2003-001-0, Revision 1. The staff conducted its review, with support from the plant audit and the applicant's methodology described in Section 2.3 of this SER, in accordance with the guidance described in Section 2.3 of the SRP-LR.

In the performance of its review, the staff selected the miscellaneous system functions described in the UFSAR, in accordance with the requirements of 10 CFR 54.4, and evaluated the cited engineering report to confirm that the applicant did not inadvertently omit from the scope of license renewal any components of the miscellaneous systems with intended functions delineated under 10 CFR 54.4(a)(2). The staff then reviewed the applicant's screening process, with the information in the LRA, the engineering report, and the screening methodology described in Section 2.3 of this SER, to confirm that the applicant did not omit any passive and long-lived components of the miscellaneous systems that should be subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

In reviewing LRA Section 2.3.3.11 and the engineering report, the staff identified areas in which it needed additional information to complete its evaluation of the applicant's scoping and screening results. Therefore, by letter dated May 11, 2004, the staff issued RAIs, described below, to the applicant concerning the specific issues to determine whether the applicant has properly applied the scoping criteria of 10 CFR 54.4(a) and the screening criteria of 10 CFR 54.21(a)(1).

RAI 2.3.3.11-1(a)

The staff reviewed Engineering Report A2-ME-2003-001-0, Revision 1, Section 3.62, "Plant Heating," and Section 3.87, "Turbine Building Sump," and noted that both sections list cast iron components (i.e., valves and piping) as requiring an AMR. However, LRA Table 3.3.2-11 does not contain an entry for cast iron valve bodies or piping for the environments cited in the engineering report. Therefore, the staff requested that the applicant explain why a separate entry in LRA Table 3.3.2-11 does not exist for cast iron components, or update LRA Table 3.3.2-11 to include them.

Applicant's Response and Staff's Evaluation

In its response dated June 10, 2004, the applicant stated that cast iron material type is included in the general material type "carbon steel" since the aging effect (loss of material) and AMPs (System Walkdown Program for all components and Water Chemistry Control Program for treated water systems) are the same for carbon steel or cast iron components in Engineering Report A2-ME-2003-001-0, Revision 0. The engineering report indicates this inclusion of cast iron in the carbon steel material type with the phrase "carbon steel (including cast iron)" or "carbon steel (cast iron)" in Sections 3.62 and 3.87. These subsections of the engineering report identify selective leaching as an aging mechanism that will result in the aging effect of loss of material for cast iron components.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.11-1(a) acceptable, because the aging effects for cast iron are similar to those of carbon steel in the same environments. An evaluation performed by an NRC staff metallurgist supports this statement. Therefore, the staff considers its concern described in RAI 2.3.3.11-1(a) resolved.

RAI 2.3.3.11-1(b)

Section 2.3.3.11 of the LRA lists the component types "tank" and "filters" for the regenerative waste system. The staff reviewed Section 3.75 of Engineering Report A2-ME-2003-001-0 and found that the list of the passive mechanical components in the regenerative waste system that require an AMR to meet the criteria of 10 CFR 54.4(a)(2) does not include tanks or filters. Therefore, the staff requested that the applicant justify why these tanks and filters are not subject to an AMR, when the piping and valves leading to them are subject to an AMR.

Applicant's Response and Staff's Evaluation

In its response dated June 10, 2004, the applicant stated that, as identified in Engineering Report A2-ME-2003-001-0, a large portion of the regenerative waste system is not used. This system was originally designed with radioactive waste evaporators and other associated components that are no longer used.

The applicant further stated that no tanks in the system are within the scope of license renewal, per 10 CFR 54.4(a)(2), since the tanks that are in the system are empty or are located in areas that cannot affect safety-related components. Two filters, as well as the piping and valves, associated with the regenerative waste system are located in the auxiliary building and are subject to an AMR. Section 3.75 of A2-ME-2003-001-0 does not specifically identify these two filters, but Attachment 2 of A2-ME-2003-001-0 includes them. Tables 2.3.3-11 and 3.3.2-11 of the LRA include them as component type "filter housing."

Based on its review, the staff finds the applicant's response to RAI 2.3.3.11-1(b) acceptable, because the filter housings are appropriately included within the scope of license renewal and are subject to an AMR. With regard to the tanks, the applicant has verified that the tanks of concern currently do not contain liquid or will not spatially interact with safety-related components. As such, these tanks do not meet the criteria in 10 CFR 54.4(a)(2) and are not within the scope of license renewal. Therefore, the staff considers its concern described in RAI 2.3.3.11-1(b) resolved.

RAI 2.3.3.11-1(c))

Pursuant to 10 CFR 54.21(a), applicants must identify and list in their LRAs those SCs that are subject to an AMR. The staff identified that the LRA does not satisfy this requirement because the applicant did not identify the mechanical components within the scope of license renewal, in accordance with 10 CFR 54.4(a)(2), as subject to an AMR on license renewal drawings or, by any designator or specific description, in Engineering Report A2-ME-2003-001-0. The engineering report provides a general description on aging management of nonsafety-related systems and components affecting safety-related systems but does not specify or identify the components that require an AMR for each system. Therefore, the staff requested that the applicant provide a means of specifically identifying mechanical components subject to an AMR.

Applicant's Response and Staff's Evaluation

In its response dated June 10, 2004, the applicant stated that it considered the impacts of the failure of nonsafety-related SSCs to be either functional or spatial. In a functional failure, the failure of an SSC to perform its normal function impacts another safety function. In a spatial failure, a safety function is impacted by the loss of structural or mechanical integrity of an SSC in physical proximity to a safety-related component. Spatial failures result in the inclusion of the most equipment. Section 2.1.1.2.2 of the LRA provides information on how and where nonsafety-related equipment can impact safety-related equipment through spatial interaction. The applicant also stated that, in Engineering Report A2-ME-2003-0001-0, it reviewed all mechanical systems at ANO-2. If a system contains components subject to an AMR in accordance with the requirements of 10 CFR 54.4(a)(2), then the applicant listed the component types subject to an AMR in the system section of the LRA. The applicant further stated that highlighted license renewal drawings identifying 10 CFR 54.4(a)(2) components would be of limited value to a reviewer since license renewal drawings do not provide equipment location information. Without location information, it cannot be determined if nonsafety-related equipment has a potential for spatial interaction, such as that from leakage or spray, with safety-related equipment.

The applicant then described the approach implemented in Engineering Report A2-ME-2003-0001-0 to identify mechanical systems that meet the requirements of 10 CFR 54.4(a)(2) and components that are subject to an AMR for leakage and spray. First, the applicant identified the structures at ANO-2 containing safety-related equipment. The applicant identified the ANO-2 containment building, auxiliary building, intake structures, and emergency diesel fuel oil storage vault as the primary seismic Class 1 structures at ANO-2 containing safety-related plant equipment. These areas contain the relevant targets (i.e., safety-related SSCs with the potential to be affected by failure of nonsafety-related components). Second, if the system contains liquid or steam and has nonsafety-related equipment in the containment building, auxiliary building, intake structures, or emergency diesel fuel oil storage vault, then the applicant reviewed individual system components. The applicant performed this review with the ANO-2 component database information that identifies component locations. The applicant reviewed liquid- or steam-filled nonsafety-related components in the safety-related structures specified above for their potential for interaction with safety-related equipment using equipment location information in the ANO-2 component database and equipment layout drawings. Initially, the applicant included all nonsafety-related components containing liquid or steam located in the containment building, auxiliary building, intake structure, and emergency diesel fuel storage vault as subject to an AMR unless no safety-related equipment is in the area of the nonsafety-related component. The applicant performed additional reviews to exclude specific nonsafety-related components where design features, such as room separation, walls, panels, or enclosures, would protect safety-related equipment from leakage or spray. The applicant stated that it identified nonsafety-related components within the scope of license renewal and subject to an AMR, in accordance with the requirements of 10 CFR 54.4(a)(2), to the extent necessary to assure effective management of the effects of aging.

However, the staff found that the applicant's response did not specifically identify which components in the nonsafety-related systems meet the 10 CFR 54.4(a)(2) scoping criteria and are subject to an AMR. In a followup question, the staff asked the applicant to identify the nonsafety-related components having either functional or spatial impacts on safety-related components and subject to an AMR using one of the following previously accepted methods or another equally effective method. The applicant should (1) list specific systems and specific identifiable plant areas where all components of the listed system are within the scope of license renewal, (2) list specific components subject to an AMR, or (3) identify components within the scope of license renewal by highlighting them on system drawings.

Specifically, the staff requested, for certain systems with the credible potential to cause broad spatial effects through flooding (i.e., large-diameter fire water and service water piping), that the applicant provide the basis for concluding that the effect of a leak from a component failure in these systems would be limited to direct spray on nearby safety-related components.

In its response dated June 10, 2004, the applicant stated that the method for nonsafety-related components having either functional or spatial impacts on safety-related components is very similar to the first method given above, in that Section 2.3.3.11 of the LRA provides all the mechanical systems with components included for 10 CFR 54.4(a)(2). The response to RAI 2.3.3.11-1(c)) provides the plant buildings/areas where these components are located. Section 3.0 of Engineering Report A2-ME-2003-0001-0 addresses the limited population of components in the buildings excluded from review.

With regard to the staff's question about certain systems with the credible potential to cause broad spatial effects through flooding, the applicant stated, in its response dated June 10, 2004, that the engineering report identifies the fire water piping and service water system piping in safety-related buildings that are not already reviewed as part of the system review in LRA Sections 2.3.3.2 and 2.3.3.8, respectively, as within the scope of license renewal per 10 CFR 54.4(a)(2) and subject to an AMR. The applicant stated that the portions of the fire water and service water systems that could cause flooding of safety-related components are within the scope of license renewal and subject to an AMR. Section 2.3.3.11 of the LRA covers these.

Based on its review of the applicant's June 10, 2004 response to RAI 2.3.3.11-1(c)), followup questions, and discussions with the applicant in a subsequent teleconference, the staff reviewed the service water, containment spray, and CVCS mechanical systems in Engineering Report A2-ME-2003-0001-0 to confirm that the applicant has appropriately included components within the scope of license renewal and subject to an AMR, in accordance with the requirements of 10 CFR 54.4(a)(2). On the basis of its review of these mechanical systems, the staff did not find any omissions. The staff concluded that the applicant has appropriately included in the LRA nonsafety-related components within the scope of license renewal and subject to an AMR for these systems.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.11-1(c)) and clarifying questions acceptable, pending the AMR review of these nonsafety-related components within the scope of license renewal and subject to an AMR, in accordance with 10 CFR 54.4(a)(2). Since the applicant has not specifically identified components by component identification number in its response, and the staff did not find any omissions of nonsafety-related components subject to an AMR in accordance with 10 CFR 54.4(a)(2), the staff concluded that the applicant defined the population of components within the scope of license renewal in accordance with 10 CFR 54.4.(a)(2). However, the staff also concluded that the lack of identified component identification numbers may create inconclusive staff AMR reviews of 10 CFR 54.4(a)(2) components. Therefore, the staff considers its concern described in RAI 2.3.3.11-1(c)) and clarifying questions resolved, pending the staff's AMRs of these components. Section 3.3.2.4.11 of this SER provides the staff's AMR reviews of these nonsafety-related components.

2.3.3.11.3 Conclusion

During its review of the information provided in the LRA, UFSAR, engineering report, other site documents, the license renewal drawings, and licensing basis information, the staff did not identify any omissions or discrepancies in the applicant's scoping and screening results for the components of the miscellaneous systems. Therefore, the staff concludes that the applicant has adequately identified the components of the miscellaneous systems that are within the scope of license renewal, as required by 10 CFR 54.4(a), and the miscellaneous systems that are subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.12 Other Miscellaneous Systems

2.3.3.12.1 Summary of Technical Information in the Application

In Section 2.3.3.12 of the LRA, the applicant described other miscellaneous systems. This section discusses various systems within the scope of license renewal with components subject to an AMR that have been included in the mechanical system reviews of other systems or the structural reviews. The system descriptions include discussions of the components subject to an AMR and references to the sections containing the component evaluations. Systems described in this section include the intake structure (ventilation), nitrogen supply, service air, traveling screen wash, and ventilation system.

Intake Structure (Ventilation). The intake structure (ventilation) system consists of ventilation components in the intake structure that support fire protection and service water system functions. The component database classifies these components as intake structure system components, but they are evaluated with the systems supported (see Sections 2.3.3.2 and 2.3.3.8 of this SER). Section 2.4.3 of this SER describes the intake structure itself.

The ventilation supporting the service water pumps is safety related, and therefore the intake structure (ventilation) is within the scope of license renewal, based on the criteria of 10 CFR 54.4(a)(1). The ventilation for the fire protection components is required for compliance with Commission's regulations for fire protection (10 CFR 50.48), and the system is therefore within the scope of license renewal based on the criteria of 10 CFR 54.4(a)(3).

Nitrogen Supply. The nitrogen supply system provides pressurized nitrogen gas for site components such as the safety injection tanks, the steam generator secondary, and the CVCS charging pump pulsation dampeners and suction stabilizers. The nitrogen supply system also provides nitrogen to safety-related electrical penetrations to prevent leakage under accident conditions. The nitrogen system includes containment penetration components that are required for containment isolation under accident conditions, as well as valves and piping for supplying the nitrogen.

Sections 2.3.2.4, 2.3.3.5, and 2.3.4.1 of this SER evaluate the nitrogen supply system components that are subject to an AMR.

The nitrogen supply system contains safety-related components and is therefore within the scope of license renewal, based on the criteria of 10 CFR 54.4(a)(1).

Service Air. The service air system provides compressed air for service air outlets located throughout the plant site which will be used for operation of pneumatic tools. The service air system consists of air compressors, air receivers, piping, and valves. The service air system contains several safety-related containment isolation valves, evaluated in Section 2.3.2.4 of this SER. Section 2.3.3.1 of this SER evaluates the safety-related fuel transfer tube gasket air test isolation valve with the spent fuel pool system. The system is within the scope of license renewal, based on the criteria of 10 CFR 54.4(a)(1).

Traveling Screen Wash. The traveling screen wash system for ANO-2 filters water from Lake Dardanelle before it is supplied to the service water bays. This system code includes two traveling water screens in the ANO-2 intake structure, along with their motors, gearboxes, and controls and the associated ANO-2 screen wash piping and valves. Water from the ANO-1 screen wash system provides spray water to wash the ANO-2 traveling water screens as they travel past the spray nozzles. The debris can be sluiced to trash collection baskets.

The system contains no safety-related components but is conservatively included in the scope of license renewal to be consistent with the evaluation of the traveling screen wash system in the ANO-1 license renewal SER. No components are subject to an AMR, as they are either active components or do not perform an intended function. Consistent with the ANO-1 license renewal SER, the traveling water screens are considered active devices. The supporting structural components are reviewed as required in structural evaluations.

Ventilation System. The ventilation system provides a suitable environment for equipment and personnel for various structures on the ANO site, including the alternate ac diesel generator building. The system consists of blowers, heating coils, filters, dampers, ductwork, and other miscellaneous mechanical components. The system does not include safety-related components or perform a safety function, but the alternate ac diesel generator building ventilation is required for the alternate ac diesel to function during SBO or for safe shutdown following a fire. Thus, the system contains components that are required for SBO and safe shutdown following a fire and is therefore within the scope of license renewal, based on the criteria of 10 CFR 54.4(a)(3). Section 2.3.3.4 of this SER evaluates the alternate ac ventilation components with the alternate ac diesel.

2.3.3.12.2 Staff Evaluation

The staff evaluated LRA Section 2.3.3.12, the UFSAR, and site documentation in its scoping and screening review of other miscellaneous systems. The staff conducted its review, with the support from the site visit and applicant's methodology described in Section 2.3 of this SER, in accordance with the guidance described in Section 2.3 of the SRP-LR.

In the performance of the review, the staff selected system functions described in the UFSAR, in accordance with the requirements of 10 CFR 54.4, and evaluated site documentation to confirm that the applicant did not inadvertently omit from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant identified as having intended functions to confirm that the applicant did not omit any passive and long-lived components that should be subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

In reviewing LRA Section 2.3.3.12 and site documentation, the staff identified areas in which it needed additional information to complete the evaluation of the applicant's scoping and screening results. Therefore, by letter dated May 11, 2004, the staff issued RAIs, described below, to the applicant concerning the specific issues to determine whether the applicant has properly applied the scoping criteria of 10 CFR 54.4(a) and the screening criteria of 10 CFR 54.21(a)(1).

RAI 2.3-1d

The staff requested that the applicant determine that the LRA has not omitted any other miscellaneous systems' SCs that should be within the scope of license renewal, according to 10 CFR 54.4(a).

Applicant's Response and Staff's Evaluation

In its response, dated May 19, 2004, the applicant stated that, in accordance with 10 CFR 54.21(a)(1), other miscellaneous systems' SCs subject to AMR are those that perform an intended function without moving parts or a change in configuration or properties (i.e., passive) and that are not subject to replacement based on a qualified life or specified time period (i.e., long-lived). Among the systems and structures within the scope of license renewal, the applicant identified the other miscellaneous systems' SCs that are subject to an AMR, in accordance with 10 CFR 54.21, in LRA Tables 2.2-1a, 2.2-1b, and 2.2-3. The applicant conservatively considered them to be within the scope of license renewal for the purpose of identifying SCs that are subject to an AMR.

Based on its review, the staff finds the applicant's response to RAI 2.3-1d acceptable, because the applicant considered all components within the other miscellaneous systems as identified in LRA Tables 2.2-1a and 2.2-1b, and all other miscellaneous systems' structures identified in LRA Table 2.2-3, to be within the scope of license renewal for the purpose of identifying SCs that are subject to AMR. Therefore, the staff's concern described in RAI 2.3-1d is resolved.

RAI 2.3-2

In LRA Section 2.1.1, the applicant stated that it prepared LRA drawings to indicate components subject to an AMR. The applicant did not indicate components for the other miscellaneous systems that are subject to an AMR based only on the criteria of 10 CFR 54.4(a)(2) on the LRA drawings. The staff requested that the applicant determine that the LRA has not omitted any other miscellaneous systems' SCs that should be within the scope of license renewal, according to 10 CFR 54.4(a).

Applicant's Response and Staff's Evaluation

In its response, dated May 19, 2004, the applicant stated that, in accordance with 10 CFR 54.21(a)(1), as given in the response to RAI 2.1.1-2, it considered all components for other miscellaneous systems within the systems identified in LRA Tables 2.2-1a and 2.2-1b, and all structures for the other miscellaneous systems' identified in LRA Table 2.2-3, to be within the scope of license renewal for the purpose of identifying other miscellaneous systems' SCs that are subject to AMR, including components in the system considered only in response to 10 CFR 54.4(a)(2).

Based on its review, the staff finds the applicant's response to RAI 2.3-2 acceptable, because the applicant considered all components within the other miscellaneous systems as identified in LRA Tables 2.2-1a and 2.2-1b, and all other miscellaneous systems' structures identified in LRA Table 2.2-3, to be within the scope of license renewal for the purpose of identifying SCs that are subject to AMR. Therefore, the staff's concern described in RAI 2.3-2 is resolved.

RAI 2.3.3.12-1

License renewal drawing LRA—2260 shows the ventilation for the intake structure, two exhaust fans, shutoff dampers, and associated ducts as subject to an AMR. In UFSAR Section 9.4.6, the applicant stated that exhausted air is replaced through an opening in the roof and two openings in louvered doors. The license renewal drawing does not highlight these openings and fans. The staff determined, from its review of the UFSAR, that the two fans supported by the openings are necessary to ventilate the rooms during a design-basis accident to maintain safe equipment operating temperatures. The staff asked the applicant to justify why the openings which replace the exhausted air are not subject to an AMR.

Applicant's Response and Staff's Evaluation

In its response dated June 10, 2004, the applicant stated that the ventilation intake openings are subject to an AMR as part of the intake structure. Table 2.4-3 of the LRA lists them as support for roof hatches and louvered doors. Based on its review, the staff finds the applicant's response acceptable, because LRA Table 2.4-3 includes the ventilation intake openings within the scope of license renewal and subject to an AMR as part of the intake structure scoping and screening results. Therefore, the staff considers its concern described in RAI 2.3.3.12-1 resolved.

RAI 2.3.3.12-2

License renewal drawing LRA—2260 shows two intake structure exhaust fans as subject to an AMR. The staff requested that the applicant clarify if it included the housings for these fans as a component type in LRA Tables 2.3.3-8 and 3.3.2-8. If not, the staff asked the applicant to update the corresponding tables to include these components.

Applicant's Response and Staff's Evaluation

In its response dated June 10, 2004, the applicant stated that LRA Tables 2.3.3-8 and 3.3.2-8 include the housings for the two exhaust fans, shown on license renewal drawing LRA—2260, as the component type "blower housing." Based on its review, the staff finds the applicant's response acceptable, because LRA Tables 2.3.3-8 and 3.3.2-8 include the two intake structure exhaust fans as the component type "blower housing." The two intake structure exhaust fans are subject to an AMR. Therefore, the staff considers its concern described in RAI 2.3.3.12-2 resolved.

RAI 2.3.3.12-3

Section 2.3.3.12 of the LRA states that the nitrogen supply system contains safety-related components and is therefore within the scope of license renewal, based on the criteria of 10 CFR 54.4(a)(1). During the December 16, 2003, teleconference between the staff and the applicant, the applicant stated that if a system is determined to be within the scope of license renewal, then it conservatively assumed that all components in that system are within the scope of license renewal. The staff identified portions of the nitrogen supply system that are highlighted on license renewal drawings LRA—2232, LRA—2231, and LRA—2206. However, license renewal drawing LRA—2239 does not highlight the supply lines to the above nitrogen supply system piping; only portions associated with the containment penetrations are highlighted. The staff asked the applicant to explain why the portions of the nitrogen supply system, in particular the supply lines discussed above as shown on drawing LRA—2239, are not subject to an AMR.

Applicant's Response and Staff's Evaluation

In its response dated June 10, 2004, the applicant stated that the nitrogen supply system is within the scope of license renewal, based on the criteria of 10 CFR 54.4(a)(1), because it contains safety-related components. However, only those passive and long-lived components that perform a license renewal intended function are subject to an AMR, as stated in 10 CFR 54.21(a). Passive and long-lived components in the containment penetration portion of the supply lines (highlighted on LRA— 2239) perform a containment isolation function and are therefore subject to an AMR. Passive and long-lived nitrogen supply system components, such as those highlighted on license renewal drawings LRA—2232, LRA—2231, and LRA—2206, perform a system-level pressure boundary function for a system with a license renewal intended function and are therefore subject to an AMR. The remainder of the nitrogen supply system (including the nonhighlighted supply lines on drawing LRA—2239) does not perform a license renewal intended function. Thus, passive and long-lived components in the nonhighlighted nitrogen supply lines are not subject to an AMR.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.12-3 acceptable, because the portions of the nitrogen system in question do not perform an intended function per 10 CFR 54.4(a), and therefore are not in scope and subject to an AMR. Therefore, the staff considers its concern described in RAI 2.3.3.12-3 resolved.

On November 1 through 5 and 15 through 19, 2004, the NRC staff performed an AMP inspection at ANO-2 during which the staff reviewed the procedures for implementing AMP's for mechanical components. During the inspection, the NRC staff noted that some component types added to the scope of license renewal as result of the applicant's response to RAI 2.1-4, part a were not included in the appropriate tables in LRA Sections 2.3 and 3.3. During a follow-up inspection on February 16 and 17, 2005, the inspectors confirmed that the applicant had identified the components that were omitted from the tables. These components were listed in a supplemental table and included in a letter from the applicant dated February 28, 2005. The aging management reviews for these components are included in Section 3 of this SER. The issue associated with this inspection item is closed.

2.3.3.12.3 Conclusion

During its review of the information provided in the LRA, UFSAR, site documentation, the license renewal drawings, and licensing basis information, the staff did not identify any omissions or discrepancies in the applicant's scoping and screening results for the components of the other miscellaneous systems addressed in the LRA. Therefore, the staff concludes that the applicant has adequately identified the components of the other miscellaneous 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 other miscellaneous systems that are subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.4 Steam and Power Conversion Systems

In Section 2.3.4 of the LRA, the applicant identified the SCs of the steam and power conversion systems that are subject to an AMR for license renewal. The applicant described the following steam and power conversion systems:

- main steam
- main feedwater
- emergency feedwater

2.3.4.1 Main Steam

2.3.4.1.1 Summary of Technical Information in the Application

In Section 2.3.4.1 of the LRA, the applicant described the main steam system. The main steam system conveys steam from the steam generators to the turbine generator and to other auxiliary equipment for power generation. The main steam system supplies steam to the high-pressure turbine and to the moisture separator reheaters during normal plant operation, to the turbine gland seals during low loads, and to the main feedwater pump steam turbine drivers during low loads or whenever low-pressure steam is not sufficient. The main steam system provides steam to the supply header for the turbine-driven emergency feedwater pump turbine that is required for accident conditions and for safe shutdown following a fire.

The main steam system forms part of the closed system inside containment for containment integrity under accident conditions. This system contains nonsafety-related components, evaluated in Section 2.3.3.11 of this SER, whose failure could impact safety-related components.

This system provides main steam pressure control following a fire to control the cooldown of the RCS. The local control of the atmospheric dump valve or its upstream isolation valve will control the steaming rate and the plant cooldown rate for safe shutdown.

Certain components in the nitrogen supply system are evaluated with the main steam system. These components are associated with the nitrogen supply to the secondary side of the steam generator. Certain emergency feedwater components in the main steam supply to the emergency feedwater turbine are also evaluated with the main steam system, as are components from the steam generator secondary/blowdown system.

The main steam system is within the scope of license renewal, based on the criteria of 10 CFR 54.4(a)(1–3).

In Table 2.3.4-1 of the LRA, the applicant identified the main steam system component types that are within the scope of license renewal and subject to an AMR, including bolting, expansion joint, orifice, piping, steam trap, thermowell, tubing, and valve.

2.3.4.1.2 Staff Evaluation

The staff reviewed LRA Section 2.3.4.1, ANO-2 UFSAR Sections 10.3, 15.1.14, and 3.6.4.1, and site documentation in its scoping and screening review of the main steam system. The staff conducted its review, with support from the plant audit and the applicant's methodology described in Section 2.3 of this SER, in accordance with the guidance described in Section 2.3 of the SRP-LR.

In the performance of its review, the staff selected system functions described in the UFSAR, in accordance with the requirements of 10 CFR 54.4, and evaluated site documents to confirm that the applicant did not inadvertently omit from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). In LRA Section 2.3.3.11, the applicant separately compiled scoping and screening results for all components with intended functions that are within the scope of license renewal, per 10 CFR 54.4(a)(2). The staff reviews those components for the main steam system in Section 2.3.3.11 of this SER. The staff then reviewed those components that the applicant identified as having an intended function to confirm that the applicant did not omit any passive and long-lived components that should be subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

In reviewing LRA Section 2.3.4.1 and site documentation, the staff identified an area in which it needed additional information to complete its evaluation of the applicant's scoping and screening results. Therefore, by letter dated May 11, 2004, the staff issued an RAI, described below, to the applicant concerning the specific issues to determine whether the applicant has properly applied the scoping criteria of 10 CFR 54.4(a) and the screening criteria of 10 CFR 54.21(a)(1).

RAI 2.3.4.1-1

Section 10.2.3.1 of the UFSAR states that a venturi flow element and a flow restrictor are installed in each main steamline and steam generator outlet nozzle, respectively, to limit the blowdown rate following a main steamline break. Table 2.3.4-1 of the LRA lists the component type "orifice," which would include the venturi flow element and the flow restrictor, as subject to an AMR. However, the table lists "pressure boundary" as the only intended function of the component type "orifice" and neglects to list "flow control" as an intended function. The staff asked the applicant to justify not listing flow control as an intended function of the component type "orifice" in the table or revise the table accordingly.

Applicant's Response and Staff's Evaluation

In its response dated June 10, 2004, the applicant stated that, as described in the third paragraph of UFSAR Section 10.3.2.1, "The venturi flow element can also function to limit the blowdown rate following a postulated pipe rupture in the main steam line; however, the main steam flow restrictors installed in the steam generator outlet nozzles are credited with performing this function." The applicant further stated that, because the UFSAR states that the venturi (orifice) is not credited with the function of flow control, LRA Table 2.3.4-1 does not list the intended function of flow control. Table 2.3.1-5 of the LRA includes the main steamflow restrictors in the steam generator in the RCS as flow-limiting inserts with the intended functions of flow control and pressure boundary.

Based on its review, the staff finds the applicant's response to RAI 2.3.4.1-1 acceptable, because the flow control function of the flow restrictors is included in the AMR for the steam generators. Since the applicant did not credit the venturi in the accident analysis, LRA Table 2.3.4-1 need not include the intended function of flow control for the venturi component. Therefore, the staff considers its concern described in RAI 2.3.4.1-1 resolved.

2.3.4.1.3 Conclusion

During its review of the information provided in the LRA, UFSAR, site documentation, the license renewal drawings, and the licensing basis information, the staff did not identify any omissions or discrepancies in the applicant's scoping and screening results for the components of the main steam system. Therefore, the staff concludes that the applicant has adequately identified the components of the main steam 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 main steam system that are subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.4.2 Main Feedwater

2.3.4.2.1 Summary of Technical Information in the Application

In Section 2.3.4.2 of the LRA, the applicant described the main feedwater system, which provides feedwater to the steam generators to support normal operations. The main feedwater system provides a flowpath for emergency feedwater to the steam generators and isolates feedwater flow to the steam generators during a main steam or feedwater line break event or containment over pressurization. The system comprises two interconnected trains, consisting of steam-driven main feedwater pumps, pump recirculation valves, feedwater flow control valves, feedwater heaters, feedwater block valves, vent and drain valves, and associated piping and tubing.

The main feedwater system is largely nonsafety related but has a safety-related portion that provides isolation to the steam generators following a main steam or feedwater line break or containment building overpressure condition. The safety-related portion of the system is the piping and related equipment, starting with the main feedwater block valve closest to containment and continuing to the steam generators. The second block valve (outboard) on each train is also safety related, but the piping and valves between the two block valves are not safety related.

This system contains nonsafety-related components, evaluated in Section 2.3.3.11 of this SER, whose failure could impact safety-related components. The main feedwater block valves, piping, and steam generators, which are credited in conjunction with main steam for RCS decay heat removal for safe shutdown after a fire, provide the pressure boundary integrity for feedwater. These components perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48).

Steam generator water-level monitoring components, which are classified as part of the steam generator secondary/blowdown system, are evaluated with the main feedwater system. These components provide monitoring of the steam generator water-level for power operations and safe plant shutdown.

The main feedwater system is within the scope of license renewal, based on the criteria of 10 CFR 54.4(a)(1–3).

In Table 2.3.4-2 of the LRA, the applicant identified the main feedwater system component types that are within the scope of license renewal and subject to an AMR, including bolting, piping, tubing, and valve.

2.3.4.2.2 Staff Evaluation

The staff reviewed LRA Section 2.3.4.2, ANO-2 UFSAR Sections 10.4.7, 15.1.14, and 3.6.4.1, and site documentation in its scoping and screening evaluation of the main feedwater system. The staff conducted its review, with support from the plant audit and the applicant's methodology described in Section 2.3 of this SER, in accordance with the guidance described in Section 2.3 of the SRP-LR.

In the performance of its review, the staff selected system functions described in the UFSAR, in accordance with the requirements of 10 CFR 54.4, and reviewed site documents to determine that the applicant did not inadvertently omit from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). In LRA Section 2.3.3.11, the applicant separately compiled scoping and screening results for all components with intended functions that are within the scope of license renewal, per 10 CFR 54.4(a)(2). The staff reviews those components for the main feedwater system in Section 2.3.3.11 of this SER. The staff then reviewed those components that the applicant identified as having an intended function to determine that the applicant did not omit any passive and long-lived components that should be subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

The main feedwater system is largely nonsafety related, except for a portion of piping between the steam generators and the outboard containment isolation valves. The license renewal drawings highlight the safety-related portion of the main feedwater piping within the scope of license renewal and subject to an AMR. As stated in the UFSAR, the portions of the nonsafety-related piping have been analyzed to withstand design-basis earthquake loads. Although the applicant has not highlighted license renewal drawings nor identified, in the LRA, the specific main feedwater components within the scope of license renewal meeting the criteria of 10 CFR 54.4(a)(2), the applicant stated in LRA Section 2.1.1.2.2 that if a HELB analysis assumes that nonsafety-related piping does not fail or assumes failure only at specific locations, then that piping system is within the scope of license renewal per 10 CFR 54.4(a)(2) and subject to an AMR, in order to provide confirmation that those assumptions remain valid through the period of extended operation. Section 2.1.1.2.2 of the LRA also states that nonsafety-related systems and nonsafety-related portions of safety-related systems containing steam or liquid that are near safety-related equipment are considered in scope and subject to an AMR, per 10 CFR 54.4(a)(2). Therefore, the staff considers that the LRA properly addresses nonsafety-related components.

In its review of LRA Section 2.3.4.2 and site documentation, the staff identified an area in which it needed additional information to complete its evaluation of the applicant's scoping and screening results. Therefore, by letter dated May 11, 2004, the staff issued an RAI, described below, to the applicant concerning the specific issues to determine whether the applicant has properly applied the scoping criteria of 10 CFR 54.4(a) and the screening criteria of 10 CFR 54.21(a)(1).

RAI 2.3.4.2-1

Section 2.3.4.2 of the LRA states that the second block valve (outboard) on each train of the main feedwater system is safety related. The staff identified that license renewal drawing LRA—2206 does not highlight the outboard block valves as subject to an AMR. In UFSAR Section 15.1.14, the applicant identified these valves (as the backup main feedwater isolation valves) as receiving an isolation signal to close during steamline breaks (either via the main steam isolation signal or the containment spray actuation signal). The UFSAR Chapter 15 analyses credit these valves. The staff asked the applicant to justify its exclusion of the outboard second feedwater block valve from the scope of license renewal, and of its valve body from an AMR.

Applicant's Response and Staff's Evaluation

In its response dated June 10, 2004, the applicant stated that the second (outboard) block valves are within the scope of license renewal (as part of the main feedwater system) but are not subject to an AMR as they perform their intended function with moving parts. The applicant further stated that the only intended function of these outboard block valves is to provide feedwater isolation, which relies on the closure of the valve disc by the motor operator. The loss of pressure boundary in this portion of the system would not prevent satisfactory isolation of feedwater flow to the steam generators.

Based on its review of the applicant's response and a teleconference with the applicant, the staff asked the applicant to clarify its response to RAI 2.3.4.2-1. The staff stated that since the valve is safety related, the valve body should be subject to an AMR by definition, according to 10 CFR 54.4(a)(1). The staff asked the applicant to specifically discuss and cite the process used to screen out the outboard block valves in accordance with 10 CFR 54.21(a)(2).

By letter dated July 22, 2004, the applicant revised its response to RAI 2.3.4.2-1 to include the statement, "These valves perform their function with moving parts, and in accordance with 10 CFR 54.21(a)(1)(i), are not subject to aging management review."

Based on its review, the staff finds the applicant's revised response to RAI 2.3.4.2-1 unacceptable, because the intended function of the outboard block valves (to provide satisfactory isolation of feedwater flow to the steam generators) does require the integrity of the valve. The 10 CFR Part 54 SOC (September 29, 1995) states the following:

> However, pressure-retaining boundaries (e.g., pump casings, valve bodies, fluid system piping) and structural supports (e.g., diesel generator structural supports) that are necessary for the structure or component to perform its intended function meet the description of passive, and will be subject to an aging management review.

Furthermore, the main feedwater block valves provide pressure boundary integrity for the feedwater system following a fire and satisfy the criteria in 10 CFR 54.4(a)(3). The applicant did not identify this function. Therefore, pressure boundary integrity of the outboard valve is required. As such, the valves (bodies) in question should be subject to an AMR. The staff asked the applicant to justify its exclusion of the outboard valve from an AMR.

In a letter dated September 10, 2004, the applicant stated that these valves are within the scope of license renewal and subject to an AMR as part of the nonsafety-related piping and supports up to and including the first equivalent anchor beyond the safety-related interface. The staff found the applicant's response acceptable because the applicant has included these outboard valves in scope and subject to an AMR for license renewal to meet 10 CFR 54.4(a)(2) criterion. Therefore, the issues associated with RAI 2.3.4.2-1 are resolved.

2.3.4.2.3 Conclusion

During its review of the information provided in the LRA, UFSAR, site documentation, the license renewal drawings, and licensing basis information, the staff did not identify any omissions or discrepancies in the applicant's scoping and screening results for the components of the main feedwater system. Therefore, the staff concludes that the applicant has adequately identified the components of the main feedwater 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 main feedwater system that are subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.4.3 Emergency Feedwater

2.3.4.3.1 Summary of Technical Information in the Application

In Section 2.3.4.3 of the LRA, the applicant described the emergency feedwater system. The emergency feedwater system provides a safety-related source of feedwater to the steam generators when main feedwater is not available. The system is the safety-related source of feedwater for cooling during design-basis events and is credited with operation for safe shutdown following a fire.

The emergency feedwater system consists of two safety-related pumps (one turbine-driven and one motor-driven), a third nonsafety-related auxiliary feedwater pump, and two independent feedwater trains, each capable of supplying feedwater to either of the two steam generators. The condensate storage tanks, backed up by the safety-related service water system, supply the emergency feedwater system.

The evaluation of the emergency feedwater system includes the condensate storage and transfer system. The condensate storage and transfer system consists of two condensate storage tanks, two condensate transfer pumps, and associated piping, controls, and instrumentation. The safety-grade condensate storage tank is connected to the Unit 2 emergency feedwater system as an available source of emergency feedwater. Locked, closed, double isolation valves isolate it from the system.

This system contains nonsafety-related components, evaluated in Section 2.3.3.11 of this SER, whose failure could impact safety-related components. The emergency feedwater system is required for compliance with the Commission's regulations for fire protection (10 CFR 50.48).

Section 2.3.3.8 of this SER evaluates the emergency feedwater suction supply valves from the service water system with the service water system because of the raw water environment internal to these valves. Section 2.3.4.1 evaluates certain emergency feedwater components in the main steam supply to the emergency feedwater turbine with the main steam system. The emergency feedwater system is within the scope of license renewal based on the criteria of 10 CFR 54.4(a)(1–3).

In Table 2.3.4-3 of the LRA, the applicant identified the emergency feedwater system component types that are within the scope of license renewal and subject to an AMR, including bearing housing, bolting, equalizer pipe, filter housing, governor housing, heat exchanger (tubes), heat exchanger (tubesheet), heater housing, orifice, piping, pump casing, servo housing, sight glass, sight glass (housing), steam trap, tank, thermowell, tubing, turbine casing, and valve.

2.3.4.3.2 Staff Evaluation

The staff reviewed LRA Section 2.3.4.3, ANO-2 UFSAR Sections 9.2.6, 10.4.9, 15.1.14, and 3.6.4.1, and site documentation in its scoping and screening review of the emergency feedwater system. The staff conducted its review, with support from the plant audit and the applicant's methodology described in Section 2.3 of this SER, in accordance with the guidance described in Section 2.3 of the SRP-LR.

In the performance of its review, the staff selected system functions described in the UFSAR, in accordance with the requirements of 10 CFR 54.4, and evaluated site documents to determine that the applicant did not inadvertently omit from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). In LRA Section 2.3.3.11, the applicant separately compiled scoping and screening results for all components with intended functions that are within the scope of license renewal, per 10 CFR 54.4(a)(2). The staff reviews those components for the emergency feedwater system in Section 2.3.3.11 of this SER. The staff then reviewed those components that the applicant identified as having an intended function to determine that the applicant did not omit any passive and long-lived components that should be subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

In reviewing LRA Section 2.3.4.3 and site documentation, the staff identified areas in which it needed additional information to complete its evaluation of the applicant's scoping and screening results. Therefore, by letter dated May 11, 2004, the staff issued RAIs, described below, to the applicant concerning the specific issues to determine whether the applicant has properly applied the scoping criteria of 10 CFR 54.4 and the screening criteria of 10 CFR 54.21(a)(1).

RAI 2.3.4.3-1

License renewal drawing LRA—2204 does not show the nonsafety-related auxiliary feedwater pump and its auxiliaries as subject to an AMR. In UFSAR Section 10.4.9.2, the applicant stated that the auxiliary feedwater pump provides feedwater to the steam generators when both safety-related emergency feedwater pumps are not available. In UFSAR Section 3.6.4.1.5.2, the applicant stated that a HELB is postulated in the common 4-in. steamline from both the steam generators at valve 2CV-0340-2 (license renewal drawing LRA—2202). The staff noted that, as a result of a postulated HELB, the turbine driven emergency feedwater pump would not be available to supply feedwater to the steam generators. In UFSAR Section 3.6, the applicant stated that a single failure of the remaining emergency feedwater pump would require the auxiliary feedwater pump to provide feedwater to the steam generators to bring the plant to safe-shutdown conditions.

However, the staff noted that UFSAR Section 3.6 does not explain how this postulated break would achieve plant safe shutdown. The staff also noted that, if the auxiliary feedwater pump is used to mitigate the consequences of a postulated HELB in the UFSAR, then the auxiliary feedwater pump should be within the scope of license renewal to meet the criteria of 10 CFR 54.4(a)(2). The staff asked the applicant to justify the exclusion of the auxiliary feedwater pump and its auxiliaries from an AMR.

Applicant's Response and Staff's Evaluation

In its response dated June 10, 2004, the applicant stated that UFSAR Section 3.6.4.1.5.2 notes that a break in the 4-in. steamline to the emergency feedwater pump driver will not require safety system actuation since the blowdown in the line is within the makeup of the main feedwater pumps to the steam generators. Isolation valves are available in the lines from the individual steam generators to isolate a break in the common steamline. The auxiliary feedwater pump and its auxiliaries are not subject to an AMR since the auxiliary feedwater pump and its auxiliaries have no intended functions that support the functions in the scoping criteria of 10 CFR 54.4(a)(1–3).

Based on its review, the staff finds the applicant's response to RAI 2.3.4.3-1 acceptable, because if the safety system actuation would not occur, there would be no need to assume a plant trip and postulate the failure of the remaining emergency feedwater pump. The plant could be shut down using nonsafety-related systems. Therefore, the staff considers its concern described in RAI 2.3.4.3-1 resolved.

RAI 2.3.4.3-2

License renewal drawing LRA—2204 shows only a portion of the minimum recirculation lines (upstream of valves 2EFW10A and 2EFW10B) as subject to an AMR. These valves are throttling valves, which do not necessarily provide an adequate pressure boundary function. The minimum recirculation piping extends beyond this drawing to another drawing, —2229, which the applicant did not provide. Failure of the downstream piping could result in a loss of pressure boundary intended function. The staff asked the applicant to provide drawing —2229 so that the staff can determine if any passive failures downstream could affect the intended function of the emergency feedwater system. The staff stated that, if passive failures (e.g., piping or valve failures) downstream could affect the intended function of the emergency feedwater system, then the applicant should include these components within the scope of license renewal and as subject to an AMR.

Applicant's Response and Staff's Evaluation

In its response dated June 10, 2004, the applicant stated that each minimum recirculation line contains an orifice and globe valve. The orifices allow the minimum required recirculation flow for the pumps while ensuring that sufficient flow is provided to the steam generators, as required for design-basis events. Thus, piping and components downstream of the orifices and globe valves are not required to maintain pressure boundary for the steam generators to receive sufficient flow for design-basis events, and they do not have an intended function based on the criteria of 10 CFR 54.4(a)(1) or 10 CFR 54.4(a)(3).

Passive components in the minimum recirculation line downstream of 2EFW10A and 2EFW10B do have a pressure boundary intended function for 10 CFR 54.4(a)(2). In accordance with LRA Section 2.1.1, the license renewal drawings do not indicate components subject to an AMR based only on the criteria of 10 CFR 54.4(a)(2). Table 3.3.2-11 of the LRA lists the nonsafety-related portions of the emergency feedwater system that are subject to an AMR based on the criteria of 10 CFR 54.4(a)(2).

Based on its review, the staff finds the applicant's response acceptable, because the applicant has evaluated the nonsafety-related piping for potential spatial interaction with safety-related SSCs, as addressed in Section 2.3.3.11 of this SER. Therefore, the staff considers its concern described in RAI 2.3.4.3-2 resolved.

2.3.4.3.3 Conclusion

During its review of the information provided in the LRA, UFSAR, site documentation, the license renewal drawings, and licensing basis information, the staff did not identify any omissions or discrepancies in the applicant's scoping and screening results for the components of the emergency feedwater system. Therefore, the staff concludes that the applicant has adequately identified the components of the emergency feedwater 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 emergency feedwater system that are subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.4 Scoping and Screening Results—Structures

Pursuant to 10 CFR 54.21(a)(1), an applicant must identify and list SCs subject to an AMR. These are passive, long-lived SCs that are within the scope of license renewal. To determine 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 the applicant has not omitted any structural components that are subject to an AMR. If the review identifies no omission, the staff has a basis to find that the applicant has identified the structural components that are subject to an AMR.

This SER section addresses the applicant's scoping and screening results for structures. Table 2.2-3 of the LRA identifies the following structures as within the scope of license renewal:

- containment and containment internals (LRA Section 2.4.1)
  - containment building
  - polar crane
- auxiliary building, turbine building, and yard structures (LRA Section 2.4.2)
  - alternate ac diesel generator building
  - auxiliary building
  - condensate storage tank T-41B foundation and pipe trenches
  - electrical manholes
  - emergency diesel fuel oil storage tank vault
  - fuel handling/refueling machines
  - fuel oil storage tank (T-25) foundation
  - postaccident sampling system building
  - RWT (2T3) foundation
  - switchyard/transformer yard
  - turbine building
- intake structure and emergency cooling pond (LRA Section 2.4.3)
  - emergency cooling pond
  - intake canal
  - intake structure
- bulk commodities (LRA Section 2.4.4)
  - fire fighting equipment hose reels
  - pipe hangers—plant systems

Sections 2.4.1, 2.4.2, 2.4.3, and 2.4.4 and Tables 2.4-1, 2.4-2, 2.4-3, and 2.4-4 of the LRA provide detailed lists of structures and structural components included in each of these four groups.

Table 2.2-4 of the LRA identifies the ANO-2 structures that the applicant has determined are not within the scope of license renewal. In reviewing LRA Table 2.2-4, the staff identified several areas in which it needed additional information to complete its evaluation of the applicant's scoping results. Therefore, by letter dated April 14, 2004, the staff issued RAI 2.4-1, given below, to the applicant concerning the specific issues to determine whether the applicant has properly applied the scoping criteria of 10 CFR 54.4(a):

(a) LRA Table 2.2-4 identifies structures that are not within the scope of license renewal. It is not obvious to the staff that all of the listed structures serve no intended function. Please provide a description of the discharge canal and the miscellaneous tank foundations, and the technical basis for the determination that they are not within the scope of license renewal.

(b) Verify that seismic II/I considerations are not applicable to any of the structures listed in LRA Table 2.2-4 (e.g., cooling tower).

(c) In addition, while the staff acknowledges that the tendon access gallery does not serve an intended function in the strictest interpretation of the License Renewal Rule, there is significant industry operating experience related to flooding and corrosive environments in the tendon access gallery that have contributed to degradation of the tendon anchorage components and surrounding concrete. Management of the condition of the tendon access gallery is a preventive step to minimize aging effects for the prestressing system. The applicant is requested to submit its plant-specific operating/aging experience related to (1) flooding and corrosive environments in the tendon access gallery, and (2) degradation of the prestressing system components (both steel and concrete) in the tendon access gallery, and based on the ANO-2 specific tendon gallery operating/aging experience, discuss ANO-2's basis for not including the tendon gallery structure within the AMR scope pursuant to 10 CFR 54.4(a)(2).

The following is the applicant's response to RAI 2.4-1, dated May 19, 2004:

(a) The discharge canal is an earthen structure with the primary function of discharging the ANO-1 condenser cooling water to the lake. As stated in ANO-2 Safety Analysis Report (SAR) Section 9.2.1.2.3.7, "Under accident conditions the service water system (SWS) discharge is automatically changed to the emergency cooling pond (ECP) upon the initiation of a safety injection actuation signal (SIAS) or main steam isolation signal (MSIS)." The discharge canal is not relied on as a discharge path for the service water system. Failure of discharge canal will not prevent accomplishment of required safety functions; therefore, the discharge canal has no intended function.

Miscellaneous tank foundations are reinforced concrete foundations for miscellaneous, nonsafety related tanks. Since the tanks have no intended functions, the foundations supporting them likewise have no intended functions. Examples of miscellaneous tanks are raw water holdup tank and concentrator bottoms tank. The raw water holdup tank holds water supplied from the Russellville city water system. It supplies the domestic water system that does not serve a safety-related function and is not required for safe shutdown of the plant. The concentrator bottoms tank is no longer in service. Neither of these examples are tanks with the potential for failures that could prevent the satisfactory accomplishment of safety functions. The foundations supporting an intended function are provided in Table 2.2-3 of the LRA.

(b) As part of LRA process, the structures (e.g., cooling tower) listed in LRA Table 2.2-4 have been reviewed for II/I considerations. Those structures required to be seismically qualified for II/I considerations have been included in the scope of license renewal. None of the structures listed in LRA Table 2.2-4 are a concern for seismic II/I considerations.

(c) Prestressing system components in the tendon access gallery are protected by end caps as appropriate. ANO-2 operating experience indicates no significant problems with prestressing system components due to flooding or corrosive environments in the tendon access gallery. The ANO-2 containment building 20-year tendon surveillance and concrete surface inspection indicated no abnormal degradation of the building or the post tensioning system. The gallery is open to the auxiliary building. Tendon access gallery ventilation fans operate in conjunction with the auxiliary building ventilation system so the environment is essentially the same as the auxiliary building environment. Since the tendon anchorages are in the overhead of the gallery, minor water inleakage has no effect on the lower tendon anchorage components and surrounding concrete. Neither significant levels of contaminants nor excessive humidity have been noted in the tendon access gallery.

The tendon access gallery provides no structural support to the reactor building. Since the tendon access gallery serves no license renewal intended function, it is not within the scope of license renewal and therefore, not subject to an aging management review.

Based on its review, the staff finds the applicant's response to RAI 2.4-1 parts (a), (b), and (c)) acceptable, because the information submitted is sufficient to address the staff's concern. The applicant has provided in part (a) an adequate description and technical basis for its determination that the discharge canal and the miscellaneous tank foundations are not within the scope of license renewal. The applicant has verified in part (b) that none of the structures listed in LRA Table 2.2-4 are a concern for seismic Category II/I considerations. The applicant has submitted in part (c)) a sufficient description of plant-specific operating/aging experience related to environmental degradation of the tendon access gallery and its prestressing system components. The tendon access gallery is ventilated and has not experienced any significant degradation that could potentially compromise the prestressing system components. The staff concludes that there is not a sufficient technical basis to include the tendon gallery structure within the license renewal scope, pursuant to 10 CFR 54.4(a)(2). Therefore, the staff considers its concern described in RAI 2.4-1 parts (a), (b), and (c)) resolved.

Load-handling systems have components that are both mechanical and structural in nature. The structural components are passive and long-lived. If a specific load-handling system serves an intended function, then it is subject to an AMR. To ensure a complete understanding of the ANO-2 scoping and screening for load-handling systems, the staff needed additional information. Therefore, by letter dated April 14, 2004, the staff issued RAI 2.4-3, given below, to the applicant concerning the specific issues to determine whether the applicant has properly applied the scoping criteria of 10 CFR 54.4(a) and the screening criteria of 10 CFR 54.21(a)(1):

> Please clarify the complete scope of load handling systems included in the ANO-2 LR scope. LRA Subsections 2.4.1, 2.4.2, 2.4.3 and 2.4.4 all make reference to one or more components of various load handling systems. In addition, LRA Section 2.1.1.2.2 states "The overhead-handling systems, whose structural failure could result in damage to any system that could prevent the accomplishment of a safety function, meet the criteria of 10CFR54.4(a)(2) and are within the scope of license renewal." The applicant is requested to (1) provide a listing of all load handling systems in the LR scope; (2) define the associated intended function; (3) identify the specific components that are subject to an AMR, for each in-scope load handling system; (4) identify the specific row in Table 2.4-1, 2.4-2, 2.4-3, or 2.4-4 that includes each identified component; and (5) identify the location in LRA Section 3 that contains the AMR for each component.

The applicant's response to RAI 2.4-3, dated May 19, 2004, is given below:

(1) The load handling systems included in the ANO-2 license renewal scope include the polar crane, fuel handling bridge, and spent fuel cranes (includes bridges, girders, trolleys and crane rails). Also included are monorails and their supports which meet the criteria of 10CFR54.4(a)(2).

(2) As shown in Tables 2.4-1, 2.4-2, and 2.4-4 of the LRA, the intended function of cranes and crane components is either support of a 10 CFR 54.4(a)(1) or 10 CFR 54.4(a)(2) function.

(3) The specific components, listed in the LRA as crane rails and support structures associated with the crane or monorail system, includes bridge, trolley, rails, and girders.

(4) The specific row in Table 2.4-1, 2.4-2, and 2.4-4 that includes each identified component are as follows:
Table 2.4 1 under "Polar crane (containment)"
Table 2.4 2 under "Fuel handling bridge assembly (2H3) crane rails and girders"
Table 2.4 2 under "Spent fuel overhead cranes (L3 and 2L35)"
Table 2.4 4 under "Monorails, crane rails and girders"

(5) Line items listed above are shown in Tables 3.5.2-1, 3.5.2-2, and 3.5.2-4 of the LRA under the same component entry.

Based on its review, the staff finds the applicant's response to RAI 2.4-3 acceptable, because the information submitted is sufficient to address the staff's concern. The applicant has adequately clarified (1) the complete scope of load-handling systems included in the ANO-2 license renewal scope, (2) intended functions, (3) the specific crane components subject to an AMR, (4) the scoping and screening references in LRA Section 2.4, and (5) the AMR references in LRA Section 3.5. The staff concludes that the applicant has properly applied the scoping criteria of 10 CFR 54.4(a) and the screening criteria of 10 CFR 54.21(a)(1) to the ANO-2 load-handling systems. Therefore, the staff considers its concern described in RAI 2.4-3 resolved.

2.4.1 Staff Evaluation Methodology

The staff performed its evaluation of the information provided in the LRA in the same manner for all SCs. Through its review, the staff sought to determine if the applicant identified the components and supporting structures for a specific containment structure or support that appear to meet the scoping criteria specified in the Rule as within the scope of license renewal, in accordance with 10 CFR 54.4. Similarly, the staff evaluated the applicant's screening results to determine that all long-lived, passive components are subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

To perform its scoping evaluation, the staff reviewed the applicable LRA section and associated component drawings, focusing its review on components that the applicant did not identify as within the scope of license renewal. The staff reviewed relevant licensing basis documents, including the UFSAR, for each SC to determine if the applicant had omitted system components with intended functions delineated under 10 CFR 54.4(a) from the scope of license renewal. The staff also reviewed the licensing basis documents to determine if the LRA specifies all intended functions delineated under 10 CFR 54.4(a). If it identified omissions, the staff requested additional information to resolve the discrepancy.

Once the staff completed its review of the scoping results, it evaluated the applicant's screening results. For those SCs with intended functions, the staff sought to determine if they perform their functions with moving parts or a change in configuration or properties, or if they are subject to replacement based on a qualified life or specified time period, as described in 10 CFR 54.21(a)(1). For those that do not meet either of these criteria, the staff sought to confirm that these SCs are subject to an AMR, as required by 10 CFR 54.21(a)(1). If it identified discrepancies, the staff requested additional information to resolve them.

2.4.2 Containment and Containment Internals

In Section 2.4.1 of the LRA, the applicant described the containment and containment internals.

2.4.2.1 Summary of Technical Information in the Application

The ANO-2 containment is a seismic Category 1, fully continuous, reinforced prestressed concrete cylindrical structure with a shallow dome roof and a mat foundation slab. The containment completely encloses the containment internals, the reactor vessel, and the RCS along with other vital electrical, mechanical, instrumentation, and structural components. The containment consists of (1) a flat circular base slab, (2) a right circular cylinder, and (3) a sphere-torus dome. It is constructed of reinforced concrete, prestressed by posttensioned tendons in the cylinder and the dome.

The containment houses the containment internal structures. The internal structures consist of the primary shield, secondary shield, refueling canal, removable missile shield above the reactor vessel, floor slabs, gratings and platforms, and equipment supports. Structures associated with the containment internals comprise structural members such as beams, girders, joists, columns, base plates, bearing plates, bracing, splice assemblies, connections, and other related steel items. The major structural steel components consist of the upper steam generator and RCP restraints, lower steam generator support (which includes steam generator support steel), reactor support, and pressurizer support steel.

The containment structure limits the release of radioactive fission products following an accident to reduce the dose to the public and the control room operators. The containment structure also provides physical support for itself, the RCS, engineered safety features, and other systems and equipment within the structure. The exterior walls and dome protect the reactor vessel and other safety-related SSCs from missiles (internal and external) and natural phenomena.

The applicant evaluated the following SSCs for the containment building:

- anchors/embedments/attachments for systems/components
- building foundations
- concrete beams
- containment concrete cylinder wall
- containment dome, includes coatings on roof
- containment sump structure (excluding piping, equipment, instrumentation, and controls associated with the sump)
- doors/hatches and hatch covers
- equipment hatch
- exterior and interior concrete walls
- floor and roof slabs
- fuel handling bridge, crane rails and supports
- fuel transfer canal (excludes tube portion and flanges)
- mechanical and electrical penetrations
- missile shield walls

- personnel airlock, emergency airlock
- pipe supports, cable trays, and other equipment supports (includes whip restraints) and conduits
- polar crane rails and crane support structures
- radiation shield walls
- reactor vessel closure head lifting rig assembly structure and miscellaneous components
- reactor structural supports (concrete and steel)
- stairways, platforms, ladders, handrails, gratings, and catwalks
- steam generator structural supports (concrete and steel)
- steel floor framing, columns, and bracing
- steel beams
- structural bolting
- structural steel that supports grating and catwalks, service platforms, ladders, and stairs (required for general access)
- structural steel members and shapes (includes steam generator, pressurizer, reactor vessel, RCPs, and safety injection tank support steel)
- tank supports (concrete and steel)

The supports for the RCS components (the reactor vessel, RCPs, steam generators, and pressurizer) are considered unique and are included in this evaluation. The bulk commodity evaluation addresses other component and piping supports, including RCS piping supports.

In Table 2.4.1 of the LRA, the applicant identified the containment structure components types that are within the scope of license renewal and subject to an AMR, including anchorage/embedment/attachments, CEDM support structure, electrical penetrations, equipment hatch, fuel handling bridge, crane rails and supports, liner plate, mechanical penetrations, personnel airlocks, polar crane (containment), pressurizer support steel, reactor vessel support column, refuel maintenance support structure, steam generator support, structural steel, sump penetrations, tendon anchorage, tendon wires, reactor vessel support bolted connections, various threaded fasteners, basement floor slab (includes sump and instrumentation tunnel), columns, other walls, hatches, dome, cylinder wall, buttress, ring girder, foundation, subfoundation, pressurizer support foundation, primary and secondary shield walls, reactor vessel missile shield, refuel canal, steam generator support foundation, and reactor vessel support foundation.

2.4.2.2 Staff Evaluation

The staff reviewed LRA Section 2.4.1 and the referenced ANO-2 UFSAR Sections 3.8.1 and 3.8.3. The staff conducted its review in accordance with the guidance described in Section 2.4 of the SRP-LR.

In the performance of the review, the staff evaluated the UFSAR to determine if the applicant failed to identify any structural or component functions of the containment and containment internals as an intended function, in accordance with the requirements of 10 CFR 54.4(a). The staff did not identify any omissions. The staff then verified that the passive, long-lived components are subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

The staff's review of LRA Section 2.4.1 identified an area in which it needed additional information to complete its evaluation of the applicant's scoping results. Therefore, by letter dated April 14, 2004, the staff issued RAI 2.4-6 (part b), given below, to the applicant concerning the specific issues to determine whether the applicant has properly applied the scoping criteria of 10 CFR 54.4(a):

> UFSAR Table 3.8-1 lists "Flued Head Penetrations" for the Containment. The applicant is requested to (1) verify that all of the listed penetrations are within the LR scope; and (2) if not, then provide the technical basis for any exclusions.

The applicant's response to RAI 2.4-6 (part b), dated May 19, 2004, is given below:

> All containment penetrations are within the scope of license renewal and subject to aging management review as indicated in LRA Table 2.4-1.

Based on its review, the staff finds the applicant's response to RAI 2.4-6 (part b) acceptable, because it verifies that all containment penetrations are within the scope of license renewal and subject to an AMR. The staff concludes that the applicant has properly applied the scoping criteria of 10 CFR 54.4(a) to the ANO-2 containment penetrations. Therefore, the staff considers its concern described in RAI 2.4-6 (part b) resolved.

The staff's review of the LRA Section 2.4.1 identified a second area in which it needed additional information to complete its evaluation of the applicant's scoping results. Therefore, by letter dated April 14, 2004, the staff issued RAI 2.4-8, given below, to the applicant concerning the specific issues to determine whether the applicant has properly applied the scoping criteria of 10 CFR 54.4(a):

> Section 2.4 of the LRA does not describe the cable feed-through assembly, which is part of containment electrical penetrations. This assembly serves a pressure boundary intended function. Therefore, the applicant is requested to clarify whether the cable feed-through assembly is in scope or not. If it is in scope, identify the applicable table number and component name in LRA Section 2.4, and the applicable AMR table number and component name in LRA Section 3.5. If it is not in scope, provide the justification for its exclusion.

The applicant's response to RAI 2.4-8, dated May 19, 2004, is given below:

> LRA Table 2.1-1 identifies electrical portions of electrical and instrumentation and control penetration assemblies (e.g., electrical penetration assembly cables and connections) as an electrical commodity group that serves an intended function. The cable feed-through assemblies are part of the penetration assemblies and are, therefore, in scope for license renewal. As described in LRA Section 2.1.2.3.32, most of the electrical penetration assemblies (including the cable feed-through assemblies) are included in the Environmental Qualification (EQ) Program.
>
> Under the EQ Program, the electrical penetrations, including the cable feed-through assemblies, are subject to replacement based on a qualified life and thus, in accordance with 10 CFR 54.21(a)(1)(ii), are not subject to aging management review.
>
> The non-EQ electrical penetrations are subject to an aging management review. The electrical portions of the non-EQ electrical and I&C penetration assemblies are included in the electrical scoping review. The structural portions of the electrical penetrations providing pressure boundary (essentially leak-tight radiological control barrier) are included in the structural review.
>
> Although the EQ electrical penetrations are not subject to aging management review, all electrical penetrations (EQ and non-EQ) are tested in accordance with the requirements of 10CFR50 Appendix J. The structural components of the electrical penetrations (EQ and non-EQ) were included in the containment and containment internals aging management review as "mechanical and electrical penetrations" listed in LRA Tables 2.4-1 and 3.5.2-1, on pages 2.4-10 and 3.5-25 through 3.5-26.

The staff did not find the applicant's response to RAI 2.4-8 completely acceptable, because it is not clear from the response that the applicant credited Type B local leak rate testing, in accordance with the requirements of Appendix J to 10 CFR Part 50, to manage the leaktightness of the cable feed-through assembly. In a meeting on July 20, 2004, the staff asked the applicant to clarify if it credited Type B local leak rate testing, in accordance with the requirements of Appendix J to 10 CFR Part 50, to manage the leaktightness of the cable feed-through assembly.

The applicant's clarification to its response to RAI 2.4-8, dated July 22, 2004, is given below:

> Leak tightness of electrical penetrations is tested in accordance with the requirements of 10 CFR 50 Appendix J as indicated in LRA table 3.5.2-1. The effects of aging on resilient seals of electrical penetration assemblies are managed by Type B testing performed as required by Appendix J. This includes resilient seals associated with the cable feed through assemblies. Line item 3.5.1-6 of Table 3.5.1 applies to resilient seals associated with cable feed-through assemblies of the electrical penetrations.

Based on its review, the staff finds the applicant's response to RAI 2.4-8 acceptable, because it verifies that the applicant credited Type B local leak rate testing, in accordance with the requirements of Appendix J to 10 CFR Part 50, to manage the leaktightness of the cable feed-through assembly. The staff concludes that the applicant has properly applied the scoping criteria of 10 CFR 54.4(a) to the ANO-2 containment penetrations. Therefore, the staff considers its concern described in RAI 2.4-8 resolved.

2.4.2.3 Conclusion

The staff reviewed the LRA and related structural/component information, including the accompanying scoping boundary drawings (if applicable), to determine if the applicant failed to identify any SSCs that should be within the scope of license renewal. The staff did not find any omissions. In addition, the staff performed an independent assessment to determine whether the applicant failed to identify any components that should be subject to an AMR. The staff did not find any omissions. On the basis of its review, the staff concludes that the applicant has adequately identified the components of the containment and containment internals 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 and containment internals that are subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.4.3 Auxiliary Buildings, Turbine Building, and Yard Structures

In Section 2.4.2 of the LRA, the applicant described the auxiliary buildings, turbine building, and yard structures.

2.4.3.1 Summary of Technical Information in the Application

The ANO-2 auxiliary building is a seismic Category 1 structure. The auxiliary building houses various systems that support operation of ANO-2. It is a conventionally designed, reinforced concrete structure founded on bedrock east of the ANO-2 containment. The auxiliary building consists of a reinforced concrete foundation, reinforced concrete floor slabs, and a tiered reinforced concrete roof with an elastomeric coating or sheet metal roof decking with builtup roofing on rigid insulation. The building is partly above grade (grade is at Elevation 354'-0") and partly below grade. Exterior concrete construction joints contain waterstops at joints below the plant's design flood level.

The auxiliary building contains reinforced masonry block walls that subdivide building areas into separate rooms. They may be seismic Category 1 or 2. Block walls may be fire barriers required for compliance with 10 CFR 50.48. Masonry block walls considered to have a safety function must meet the requirements of NRC IE Bulletin 80-11.

The spent fuel pool's concrete walls are resistant to missiles and are lined with a stainless steel liner plate. The liner plate protects the concrete walls from borated water leakage.

The post-accident sampling system (PASS) building contains seismic Category 2 equipment, but it is designed to seismic Category 1 criteria to avoid potential interaction with safety systems. It is also flood tight.

The turbine building is within the scope of license renewal since it contains fire protection commodities (e.g., fire doors and walls) and electrical cables required for regulated events listed in 10 CFR 54.4(a)(3).

Generally, yard structures within the scope of license renewal are seismic Category 1, and they support and protect seismic Category 1 and 2 equipment. The foundation for the safety-related condensate storage tank, T41B, is a seismic Category 1 structural component on the west side of the ANO-1 containment. The tank is supported on a reinforced concrete mat foundation. Two valve pits are partially underneath and on opposite (north and south) sides of the mat foundation. The south valve pit is for ANO-1 and the north valve pit serves ANO-2. A reinforced concrete wall surrounds the lower portion of the tank to protect against loss from an external missile. The missile wall is integral to the safety-related condensate storage tank foundation mat.

A reinforced concrete pipe trench runs from T41B to the ANO-2 auxiliary building wall. It is surrounded by backfill material and situated on natural soil or backfill material. Figure 3.8-34 of the SAR shows a section through the trench.

The emergency diesel fuel oil storage tank vault is a rigid reinforced concrete box structure on the northwest side of containment. It contains four diesel fuel storage tanks (T57A, T57B, 2T57A, and 2T57B) in separate rooms to protect against fire and flooding. The walls are designed to withstand hydrostatic loading over their full height. The structure has a mat foundation founded on rock. Entry to the vault is through a watertight door. Additionally, a 3-hour fireproof door separates each storage tank room from the others.

The alternate ac generator building is a seismic Category 2 structure north of and adjacent to the north side berm of the bulk fuel oil storage tank (T-25). The building is of steel-framed, precast concrete construction with a steel-framed roof and reinforced concrete slab, founded on grade beams supported by drilled in piers (caissons). This building houses the engine generator set, fuel oil transfer pump, fuel oil day tank, air start system, engine generator control cabinets, HVAC, and fire protection systems.

Seismic Category 1 electrical manholes 2MH01, 2MH02, and 2MH03 are at various locations on the plant site. They are relatively small, reinforced concrete structures founded either on natural soil or backfill materials. Backfill material surrounds these partially underground structures. An access opening in the top slab, at grade level, is provided with a missile-resistant steel or reinforced concrete cover.

The RWT, 2T-3, is on a concrete slab that is part of the auxiliary building. The slab is the roof of the 2T12 tank vault (Room 2020). A small ring wall, filled with oiled sand, placed on the top of the concrete slab separates the tank bottom from the concrete.

The applicant evaluated the following SCs for the auxiliary building, turbine building, and yard structures:

- alternate ac generator building
- auxiliary building sump (except valves and piping)
- building foundations
- concrete beams

- crane rails and crane support structures
- doors (e.g., flood doors and fire doors)
- external penetrations and louvers
- embedded items (including conduit, unistrut, and anchors)
- exterior and interior concrete walls
- floor and roof slabs
- fuel transfer tube support
- HELB barriers such as walls, floors, and doors
- main transformer foundations
- manway hatches (concrete and steel)
- masonry block walls
- *miscellaneous structural steel floor framing, columns, bracing, platforms, and catwalks*
- new fuel racks
- outside electrical concrete manholes and underground ducts
- outside pipe trenches
- pipe supports, cable trays, conduits, and other equipment supports
- safety-related condensate storage tank (T-41B) foundation and pipe trenches
- RWT (2T-3) foundation
- superstructure framing (over spent fuel pool)
- sump structures excluding piping, equipment, and I&C associated with the sump
- spent fuel pool concrete and liner plate
- spent fuel pool bulkhead gates
- spent fuel crane (L3)
- steel beams
- stairways, platforms, ladders, handrails, gratings, and catwalks
- steel floor framing, columns, and bracing
- tank foundations
- unit auxiliary transformer foundations
- Startup Transformer #3 foundations
- transformer yard concrete firewalls/missile barriers
- transformer bus structural steel supports and foundations
- switchyard startup #3 voltage regulator foundation
- switchyard bus structural steel supports and foundation
- switchyard circuit breaker 1262F03 foundation

The auxiliary building, turbine building, and yard structures have no unique supports. Instead, the bulk commodity review will address the supports.

In Table 2.4-2 of the LRA, the applicant identified the auxiliary building, turbine building, and yard structures component types that are within the scope of license renewal and subject to an AMR, including alternate ac generator building (framing and structural shapes), battery racks, control room extension substructure, EDG stack vent exterior louvers, exhaust stack supports (EDGs and EFW turbine), fuel handling bridge assembly (2H3) crane rails and girders, HELB doors, new fuel racks, spent fuel overhead cranes (L3 and 2L35), spent fuel pool bulkhead gates, spent fuel pool liner (auxiliary building), spent fuel pool superstructure framing (includes associated structural shapes, bars, and plates), switchyard bus structural steel supports, tank 2T12 vault beams, watertight and flood doors, alternate ac generator foundation slab, auxiliary building columns and beams, auxiliary building exterior walls (above grade), auxiliary building exterior walls (below grade), auxiliary building floor slabs, auxiliary building interior load-bearing walls, auxiliary building foundation mat, auxiliary building sump, seismic Category 1 electrical structures (manholes, walls, slabs, and ductwork), transformer bus structural supports, seismic Category 1 electrical manhole covers, seismic Category 1 masonry block walls, emergency diesel fuel oil storage tank vault (walls, floor slab, and columns), fuel oil storage tank T-25 foundation, PASS building substructure, roof slabs, RWT 2T-3 foundation slab, sodium hydroxide tank 2T10 foundation, spent fuel pool bottom slab and walls, Startup Transformer #3 foundation, Startup Transformer #3 concrete firewalls and missile shield, switchyard bus structural foundation, and switchyard circuit breaker foundation.

2.4.3.2 *Staff Evaluation*

The staff reviewed LRA Section 2.4.2 and the referenced ANO-2 UFSAR Sections 3.8.4.1.1, 3.8.4.1.5, 3.8.4.1.6, 3.8.4.1.7, 6.2.2.2.1.B, and 8.3.3.2.1. The staff conducted its review in accordance with the guidance described in Section 2.4 of the SRP-LR.

In the performance of the review, the staff evaluated the UFSAR to determine if the applicant failed to identify any structural or component functions of the auxiliary building, turbine building, and yard structures as an intended function, in accordance with the requirements of 10 CFR 54.4(a). The staff did not identify any omissions. The staff then verified that the passive, long-lived components are subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

The staff's review of LRA Section 2.4.2 identified an area in which it needed additional information to complete its evaluation of the applicant's scoping and screening results. Therefore, by letter dated April 14, 2004. the staff issued RAI 2.4-4, given below, to the applicant concerning the specific issues to determine whether the applicant has properly applied the scoping criteria of 10 CFR 54.4(a) and the screening criteria of 10 CFR 54.21(a)(1):

> Please clarify the complete scope of liquid storage tanks and tank foundations/supports included in the ANO-2 LR scope. UFSAR Tables 3.6-25, 3.6-26, and 3.6-27 list liquid storage tanks located outside buildings, inside containment, and in the auxiliary building, respectively. It is not clear to the staff (1) whether all the listed Seismic Category I tanks and their foundations/supports are included in the LR scope; and (2) whether any of the Seismic Category II tanks and/or their foundations/supports need to be included in the LR scope due to seismic II/I considerations. Furthermore, the foundations for tanks T-41B and T-25 are identified as structures within the scope of LR in LRA Table 2.2-3, but these tanks are not listed in the UFSAR tables.
>
> Therefore, the applicant is requested to (1) provide a list of all liquid storage tanks and tank foundations/supports included in the LR scope; (2) define the associated intended function(s); (3) provide the technical basis for exclusion of any tanks (and their foundations/supports) that are listed in the UFSAR tables; (4) identify the specific table and row in LRA Section 2.3 or 2.4 that includes each in-scope liquid storage tank and tank foundation/support; and (5) identify the location in LRA Section 3 that contains the AMR for each tank and tank foundation/support.

The applicant's response to RAI 2.4-4, dated May 19, 2004, is given below:

> The seismic category I tanks (and their foundations/supports) listed in SAR Table 3.6-25 through Table 3.6-27 are in scope and subject to aging management review. Some Seismic Category II tanks and their foundations are included in the license renewal scope due to seismic II/I considerations and due to other 10CFR54.4(a)(2) considerations. Tanks T-41B and T-25 are addressed in Section 1.2.2.10 of the ANO-2 SAR. Section 9.5.4 of the ANO-2 SAR provides additional information on the T-25 tank. These tanks are not listed in the referenced SAR tables since they are designated as ANO-1 components, which are shared with ANO-2. The following addresses the five requested items:
>
> (1) Even though not all tanks are in the scope of license renewal, all tank foundations in containment and the auxiliary building are in the scope of license renewal. The outside tanks which are in the scope of license renewal also include the foundation as being in scope. Tanks in the auxiliary building that are not subject to aging management review are those that are nonsafety-related and have no potential for failure to prevent accomplishment of a safety function.
>
> (2) As listed in Tables 2.4-2 and 2.4-4, intended functions for tank foundations/supports are support of (a)(1), (a)(2) or (a)(3) equipment. The intended function for tanks is "pressure boundary" as reflected in the various tables listed in Section 2.3 of the LRA.
>
> (3) Tanks in the auxiliary building (Table 3.6-27) that are excluded are those that are nonsafety-related and have no potential for failure to prevent accomplishment of a safety function. Most of the Seismic Category II tanks listed in Table 3.6-27 are in the turbine auxiliary building in areas containing nonsafety-related equipment or are abandoned in place. The waste tanks and the waste condensate tanks are in service and in the auxiliary building and are subject to aging management review. Tank foundations or supports in the auxiliary building and containment are included under the line items "anchors" and "equipment pads" in Table 2.4-4. Seismic category II tanks in SAR Table 3.6-25 are excluded on the technical basis that they do not perform a license renewal intended function. They are neither safety-related nor required for compliance with regulations governing the regulated events. Their failure cannot prevent the satisfactory accomplishment of a required safety function.
>
> (4) As listed under line item "Tank" Table 2.3.2-1, 2.3.2-2, 2.3.3-3, 2.3.3-4, 2.3.3-5, 2.3.3-6, 2.3.3-7, 2.3.3-8, 2.3.3-10, and 2.3.3-11.

As listed in Table 2.4 2 under line item: RWT 2T3 foundation, fuel oil storage tank T-25 foundation, sodium hydroxide tank 2T10 foundation, T41 tank foundation.

Inside tank foundations and supports are included in the LRA as reflected in Table 2.4-4 under "anchors" and "equipment pads."

(5) As shown under the same line item in Tables, 3.2.2-1, 3.2.2-2, 3.3.2-3, 3.3.2-4, 3.3.2-6, 3.3.2-7, 3.3.2-10, 3.3.2-11, 3.4.2-3, 3.5.2-2, and 3.5.2-4.

Based on its review, the staff finds the applicant's response to RAI 2.4-4 acceptable, because the information submitted is sufficient to address the staff's concerns. The applicant has adequately clarified (1) the complete scope of liquid storage tanks and tank foundations/supports included in the ANO-2 license renewal scope, (2) intended functions, (3) the technical basis for exclusion of any tanks (and their foundations/supports) that are listed in the UFSAR tables, (4) the scoping and screening references in LRA Sections 2.3 and 2.4, and (5) the AMR references in LRA Sections 3.2, 3.3, 3.4, and 3.5. The staff concludes that the applicant has properly applied the scoping criteria of 10 CFR 54.4(a) and the screening criteria of 10 CFR 54.21(a)(1) to the ANO-2 liquid storage tanks and tank foundations/supports. Therefore, the staff considers its concern described in RAI 2.4-4 resolved.

The staff's review of LRA Section 2.4.2 identified a second area in which it needed additional information to complete its evaluation of the applicant's scoping results. Therefore, by letter dated April 14, 2004, the staff issued RAI 2.4-6 (part a), given below, to the applicant concerning the specific issues to determine whether the applicant has properly applied the scoping criteria of 10 CFR 54.4(a):

> UFSAR Tables 3.7-12, 3.7-13, and 3.7-14 list concrete block walls that appear to serve intended functions, as defined by 10 CFR 54.4(a). The applicant is requested to (1) verify that all of the listed walls are within the LR scope; (2) if not, then provide the technical basis for any exclusions; (3) identify any additional block walls, not listed in the tables, that are included in the LR scope; and (4) explain the statement "No Access For xx-B-xx" in UFSAR Table 3.7-14 under "Remarks".

The applicant's response to RAI 2.4-6 (part a), dated May 19, 2004, is given below:

(1) The walls listed in SAR Tables 3.7-12, 3.7-13 and 3.7-14 are within the scope of license renewal and subject to aging management review.

(2) There are no exclusions from the above list of block walls.

(3) All seismic category I block walls located within the auxiliary building are included in scope. Also included are 50.48 required block walls located in the turbine building.

(4) "No Access For xx-B-xx" indicates that one side of the wall is in a high radiation area making it inaccessible for routine inspection (e.g., 24-B-29 is the front face of the wall and 24-B-30 is the opposite face).

Based on its review, the staff finds the applicant's response to RAI 2.4- 6 (part a) acceptable, because the information submitted is sufficient to address the staff's concerns. The applicant has (1) verified that all walls listed in UFSAR Tables 3.7-12, 3.7-13, and 3.7-14 are within the scope of license renewal and subject to an AMR, (2) identified that the block walls located in the turbine building and required by 10 CFR 50.48 are also included within the scope of license renewal and subject to an AMR, and (3) adequately explained the statement "No Access for xx-B-xx" in UFSAR Table 3.7-14, under "Remarks." The staff concludes that the applicant has properly applied the scoping criteria of 10 CFR 54.4(a) to the ANO-2 concrete block walls. Therefore, the staff considers its concern described in RAI 2.4- 6 (part a) resolved.

The staff's review of LRA Section 2.4.2 identified a third area in which it needed additional information to complete its evaluation of the applicant's scoping and screening results. Therefore, by letter dated April 14, 2004, the staff issued RAI 2.4-7, given below, to the applicant concerning the specific issues to determine whether the applicant has properly applied the scoping criteria of 10 CFR 54.4(a) and the screening criteria of 10 CFR 54.21(a)(1):

> LRA Section 2.4.2 covers the very broad structural category "Auxiliary Building, Turbine Building and Yard Structures". LRA Section 2.4.2 describes the in-scope structures and structural components under both "Description" and "Evaluation Boundaries"; and then refers to LRA Table 2.4-2 for "Components Subject to AMR". The staff cannot clearly define the specific scope of structures and structural components addressed in LRA Section 2.4.2 and cannot correlate which in-scope structures and structural components are subject to AMR. Consequently, the applicant is requested to provide the following additional information:
>
> (a) A complete and concise list of all the structures and structural components that are included in LRA Section 2.4.2.
>
> (b) For each listed structure and structural component, identify the intended function(s).
>
> (c) For each listed structure and structural component, identify whether it is subject to AMR.
>
> (d) If only part or none of the structure or structural component is subject to AMR, then provide the technical basis for the determination.
>
> NOTE: The staff has requested additional information for load handling systems, tank foundations/supports, and concrete block walls in other RAIs. For these items, the applicant may reference the responses to the other RAIs in its response to (b), (c)), and (d) above.

The applicant's response to RAI 2.4-7, dated May 19, 2004, is given below:

(a) The applicant provided a listing of all structures and components that are within the scope of the auxiliary building, turbine building, and yard structures.

(b) The intended functions for the structures and structural components are provided in Tables 2.4-2 and 2.4-4 of the application.

(c) The components subject to an aging management review are summarized in the above table and specifically addressed in Tables 3.5.2-2 and 3.5.2-4.

(d) The turbine building has been included in the scope of license renewal because part of the building contains commodities that are subject to aging management review. These commodities include 10 CFR 50.48 fire walls/floors, missile barriers, and component supports (associated with the station blackout function) which are located in the turbine building at various locations. The remaining portions do not perform an intended function.

Based on its review, the staff concluded that the table presented in part (a) of the applicant's response, which summarizes the structures and structural components included in LRA Section 2.4.2 and identifies the applicable LRA Section 2.4 and 3.5 table entries, provides sufficient information to address parts (a), (b), and (c)) of the RAI. The staff finds the applicant's response to parts (a), (b), and (c)) of the RAI to be acceptable.

However, based on its review, the staff did not find the applicant's response to RAI 2.4- 7, part (d), to be acceptable. It does not address the unit auxiliary transformer foundation and the main transformer foundation. In addition, from the discussion of the turbine building in part (d) of the response, the staff could not determine if the applicant included the entire turbine building within the scope of license renewal, or if the building has been zoned to include only portions that contain commodities that are subject to an AMR. In a meeting on July 20, 2004, the staff requested the applicant to submit the technical basis for concluding that the unit auxiliary transformer foundation and the main transformer foundation are not subject to an AMR, and to clarify its treatment of the turbine building.

The applicant's supplemental response to RAI 2.4-7, part (d), dated July 22, 2004, is given below:

> As noted in the response to RAI 2.5-2 (correspondence dated June 21, 2004 (2CAN060404)), neither the main transformers nor the auxiliary transformer are included in the station blackout recovery path. Neither the main transformers nor the auxiliary transformer perform a safety-related function, affect a safety-related function, or are credited for a regulated event, so they are not subject to aging management review. Thus, their foundations are not subject to aging management review. The turbine building (as a whole) is in the scope of license renewal because it contains commodities that are subject to aging management review.

Based on its review, the staff finds the applicant's supplemental response to RAI 2.4-7, part (d), acceptable because it adequately describes the basis for excluding the unit auxiliary transformer foundation and the main transformer foundation from the scope of license renewal. In addition, it clarifies that the whole turbine building is included within the scope of license renewal. The staff concludes that the applicant has properly applied the scoping criteria of 10 CFR 54.4(a). Therefore, the staff considers its concern described in RAI 2.4-7 resolved.

On March 1 to 5, 2004, the NRC staff performed a scoping and screening inspection at ANO-2. During the inspection, the NRC staff noted that cabling necessary for coping with a station blackout event was supported by the concrete floor slab in the switchyard control house. In accordance with 10 CFR 54.4(a)(3), the applicant had appropriately included the cabling in the scope of license renewal as a system relied on for meeting the NRC's station blackout rule (10 CFR 50.63). However, the applicant did not include the structure on which it was mounted. The staff stated that as the cabling could not perform it's station blackout coping function without adequate support, its structural support system must also be in the scope of license renewal. The applicant agreed to include the entire structure in the scope of license renewal. Subsequent to the inspection, the applicant told the staff that despite this omission, the floor slab was included in a program for managing the effects of aging.

The NRC staff inspection identified an item requiring action by the applicant. The item listed above is identified in the ANO-2 Inspection Report, dated April 19, 2004 (ML0411006481). The applicant indicated that the concrete floor slab was included in an aging management program. The aging management review is discussed in Section 3.5.2.3.2. The final disposition of this item was addressed by the Aging Management Review Inspection Report, dated January 9, 2005.

2.4.3.3 Conclusion

The staff reviewed the LRA and related structural/component information, including the accompanying scoping boundary drawings (if applicable), to determine whether the applicant failed to identify any SSCs that should be within the scope of license renewal. The staff found one omission as indicated above. The staff concludes that the omission was a human error made in implementing the scoping and screening process and not indicative of an inadequate scoping and screening methodology. In addition, the staff performed an independent assessment to determine whether the applicant failed to identify any components that should be subject to an AMR. On the basis of its review, the staff concludes that the applicant has adequately identified the components of the auxiliary building, turbine building, and yard structures that are within the scope of license renewal, as required by 10 CFR 54.4(a), and the components of the auxiliary building, turbine building, and yard structures that are subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.4.4 Intake Structure and Emergency Cooling Pond

2.4.4.1 Summary of Technical Information in the Application

In Section 2.4.3 of the LRA, the applicant described the intake structure and emergency cooling pond. The intake structure is in the southeast corner of the plant site. It is a reinforced concrete seismic Category I structure considered an extension of the ANO-1 intake structure.

There is no separation between the two structures, and both are founded on rock. It supports a common gantry crane to service the equipment. The structure can be divided into two major sections. The first section is the portion of the building above grade elevation (Elevation 353'-3").

The remaining section is the pump bay area below grade and partially submerged in water. The intake section of the building has two bays. The back section of the building is a box-type structure that houses the major equipment (e.g., service water pumps and associated equipment). The abovegrade section consists of three predominant elevations—Elevation 354'-0", Elevation 366'-0", and Elevation 378'-0". Missile shield walls are provided at the exterior of the intake structure doorways. Roof plugs above service water pumps function as missile shields and can be removed to provide maintenance access.

The ANO-1 intake structure is integrally connected to the ANO-2 intake structure with a shear key and a row of reinforcing bars near the Elevation 354'-0" slabs. The ANO-1 structure houses the common fire pumps and accessories in the seismic Category 1 portion of the structure.

The intake canal associated with the intake structure provides a suction source for fire water and service water pumps. The canal is approximately 1219 meters (4000 feet) long, with an average depth of 4 meters (14 feet). The normal water elevation is Elevation 338'-0".

The emergency cooling pond is a seismic Category 1, 14-acre, kidney-shaped pond northwest of the plant. Plant discharge (emergency cooling pond inlet) flows into a structure that is surrounded by a 30-meter- (100-foot-) long weir. The emergency cooling pond is excavated in an impervious clay stratum, with the bottom of the pond above bedrock. Riprap placed on the north side of the pond protects the pond side slopes against wave action.

The applicant evaluated the following SSCs for the intake structure and emergency cooling pond:

- structural steel elements, such as floor framing, columns, bracing, platforms, and catwalks
- external penetrations and doors
- bar grates and fish baskets
- building foundations
- concrete beams
- concrete missile barriers
- crane rails and crane support structures
- discharge canal concrete flume
- embedded items (including unistruts and anchors)

- exterior and interior concrete walls
- emergency cooling pond concrete intake
- emergency cooling pond and intake canal
- floor and roof slabs (including portions associated with ANO-1 fire water pump)
- hatches (including ANO-1)
- louvered doors (including ANO-1)
- pipe supports, cable trays, and other equipment supports
- service water screens/filters/strainers
- steel beams
- traveling screens

The intake structure and emergency cooling pond evaluation has no unique supports. Instead, the supports are addressed with the bulk commodities.

In Table 2.4-3 of the LRA, the applicant identified the intake structure and emergency cooling pond component types that are within the scope of license renewal and subject to an AMR, including beams in service water and circulating water bays, floor hatches, louvered doors, support for roof hatches, submerged pump shaft supports, building foundation, columns and beams, emergency cooling pond concrete intake, exterior walls (above grade), exterior walls (below grade), floor slabs, interior walls, roof slab, emergency cooling pond, and intake canal.

2.4.4.2 Staff Evaluation

The staff reviewed LRA Section 2.4.3 and the referenced ANO-2 UFSAR Sections 9.2.5, 3.8.4.1.2, and 3.8.4.1.4. The staff conducted its review in accordance with the guidance described in Section 2.4 of the SRP-LR.

In the performance of the review, the staff evaluated the UFSAR to determine if the applicant failed to identify any structural or component functions of the intake structure and emergency cooling pond as an intended function, in accordance with the requirements of 10 CFR 54.4(a). The staff did not identify any omissions. The staff then verified that the passive, long-lived components are subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

The staff's review of the LRA Section 2.4.3 identified an area in which it needed additional information to complete its evaluation of the applicant's scoping and screening results. Therefore, by letter dated April 14, 2004, the staff issued RAI 2.4-5, given below, to the applicant concerning the specific issue to determine whether the applicant has properly applied the scoping criteria of 10 CFR 54.4(a) and the screening criteria of 10 CFR 54.21(a)(1):

Based on review of ANO-2 LRA Section 2.4.3, the referenced UFSAR Section 9.2.5, and the ANO-1 LRA, the staff requires additional information before it can conclude that all the necessary elements of the "ultimate heat sink" for ANO-2 have been included in the LR scope.

(a) From LRA Section 2.4.3, it appears that only the water in the emergency cooling pond and the intake canal are needed for safe shutdown of ANO-2. However, for ANO-1, the discharge canal was also included as part of the "ultimate heat sink". The applicant is requested to explain this apparent discrepancy.

(b) UFSAR Section 9.2.5.2.1 and (to a lesser extent) ANO-2 LRA Section 2.4.3 describe various components of the ECP, such as the pipe inlet and outlet structures, the 100 foot long weir, and the ECP spillway. It is not evident to the staff which components described in UFSAR Section 9.2.5.2.1 are essential to the "ultimate heat sink" function and are included within the LR scope. The applicant is requested to (1) identify all components essential to the "ultimate heat sink" function and included in the LR scope; (2) provide the technical basis for exclusion from the LR scope of any components described in UFSAR Section 9.2.5.2.1; (3) identify the specific row in LRA Table 2.4-3 that includes each in-scope component; and (4) identify the location in LRA Section 3 that contains the AMR for each component.

The applicant's response to RAI 2.4-5, dated May 19, 2004, is given below:

(a) The discharge canal is not credited as part of ANO-2's ultimate heat sink. As stated in ANO-2 SAR Section 9.2.1.2.3.7, "Under accident conditions the SWS discharge is automatically changed to the ECP upon the initiation of an SIAS or MSIS." The ANO-1 service water system discharge is not automatically changed to the ECP under accident conditions so the discharge canal is credited as part of the ultimate heat sink for ANO-1.

(b) (1) Structural ECP components essential to the "ultimate heat sink" function and included in the license renewal scope are the pond, the pond inlet and pond outlet structures and the ECP spillway. Associated piping to and from tie points to the service water system is in scope as part of the service water system.

(2) The 225-acre watershed area listed in SAR Section 9.2.5.2.1 is excluded from the license renewal scope since no makeup to the pond is credited after an accident begins.

(3) The specific rows in LRA Table 2.4-3 that address the inlet and outlet structures and the pond are "ECP concrete intake" and "emergency cooling pond". The row labeled "piping" in Table 2.3.3-8 addresses the

piping to and from the ECP. The spillway and 100-foot long weir are included in the line item "emergency cooling pond."

(4) As listed under the same line items in Tables 3.5.2-3 and 3.3.2-8.

Based on its review, the staff finds the applicant's response to RAI 2.4-5 acceptable, because the information submitted is sufficient to address the staff's concern. The response to part (a) of the RAI adequately explains why the discharge canal does not serve an intended function for ANO-2 and is not included within the scope of license renewal for ANO-2. The response to part (b) of the RAI (1) clarifies which components are essential to the ultimate heat sink function and included within the scope of license renewal, (2) provides an adequate technical basis for exclusion of the 225-acre watershed area, (3) identifies the specific rows in LRA Tables 2.4-3 and 2.3.3-8 that include each in-scope component, and (4) identifies the location in LRA Tables 3.5.2-3 and 3.3.2-8 that contain the AMR for each component. The staff concludes that the applicant has properly applied the scoping criteria of 10 CFR 54.4(a) and the screening criteria of 10 CFR 54.21(a)(1) to the ANO-2 ultimate heat sink. Therefore, the staff considers its concern described in RAI 2.4-5 resolved.

2.4.4.3 Conclusion

The staff reviewed the LRA and related structural/component information, including the accompanying scoping boundary drawings (if applicable), to determine whether the applicant failed to identify any SSCs that should be within the scope of license renewal. The staff did not find any omissions. In addition, the staff performed an independent assessment to determine whether the applicant failed to identify any components that should be subject to an AMR. The staff did not find any omissions. On the basis of its review, the staff concludes that the applicant has adequately identified the components of the intake structure and emergency cooling pond that are within the scope of license renewal, as required by 10 CFR 54.4(a), and the components of the intake structure and emergency cooling pond that are subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.4.5 Bulk Commodities

2.4.5.1 Summary of Technical Information in the Application

In Section 2.4.4 of the LRA, the applicant described bulk commodities. Structural commodities are structural members that support or protect system components, mechanical piping, electrical lines, and plant equipment. Structural commodities that are unique to a specific structure are evaluated with that structure. Structural commodities which are common to ANO-2 in-scope systems and structures (e.g., anchors, embedments, equipment supports, instrument panels, racks, cable trays, and conduits) are evaluated as bulk commodities.

To support a system component within the scope of license renewal, the structure may transfer dead, live, thermal, vibration, impact, seismic, or wind loads applied to or generated by the affected system component. For a structure to perform a protective function for an in-scope system component, the structure must have sufficient strength and resiliency to ensure that the system component is protected from the effects of design-basis events, such as flood, fire, jet impingement, and missiles.

The SSCs reviewed as bulk commodities include the following:

- anchor bolts
- base plates and embedded unistrut
- battery racks
- cable tray and conduit supports
- cable trays
- component supports
- damming material (fire barrier)
- electrical instrument panels and enclosures
- fire barrier seals
- fire damper framing (in-wall)
- fire doors
- flood curbs
- floor plugs
- hatches
- HVAC duct supports
- instrument line supports
- instrument racks and frames
- joint elastomers at seismic gaps
- lightning protection poles and attachments
- main steamline support structure
- manhole covers
- miscellaneous embedment
- miscellaneous doors, louvers, wire mesh, safety chains, and safety gates
- missile barriers

- monorails, crane rails, and girders
- penetration seals
- pipe sleeves (mechanical/electrical, not penetrating the containment liner plate)
- piping supports (includes whip restraints)
- RCS component support threaded fasteners (for steam generators, RCPs, and pressurizer)
- roofing
- stairs, ladders, handrails, catwalks, platforms, and grating
- support pedestals (pads)
- threaded fasteners
- trisodium phosphate baskets
- waterstops

In Table 2.4-4 of the LRA, the applicant identified the bulk commodities component types that are within the scope of license renewal and subject to an AMR, including base plates, cable tray and conduit supports, embedded unistrut, components supports (e.g., instrument racks and frames), electrical instrument panels and enclosures, fire damper framing, fire doors, fire hose reels, HVAC missile barriers, main steamline support structure, monorails, crane rails and girders, pipe sleeves (not penetrating containment liner plate), piping supports, piping whip restraints, stairs, ladders, platforms, grating (supports), anchor bolts, other threaded fasteners, reactor cavity missile block tie-downs, equipment pads, fireproofing, flood curbs, hatches and plugs, missile shields, support pedestals, equipment hatch seals, fire barrier seals, fire wrap, joint elastomers at seismic gaps, penetration seals, and waterstops.

2.4.5.2 Staff Evaluation

The staff reviewed LRA Section 2.4.4, which does not include any references to the UFSAR for the bulk commodities. The staff conducted its review in accordance with the guidance described in Section 2.4 of the SRP-LR.

In the performance of the review, the staff determined if the applicant failed to identify any structural or component functions of the bulk commodities as an intended function, in accordance with the requirements of 10 CFR 54.4(a). The staff also verified that the passive, long-lived components are subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

The staff's review of the LRA Section 2.4.4 identified several areas in which it needed additional information to complete its evaluation of the applicant's scoping and screening results. Therefore, by letter dated April 14, 2004, the staff issued RAI 2.4-2, given below, to the applicant concerning the specific issues to determine whether the applicant has properly applied the scoping criteria of 10 CFR 54.4(a) and the screening criteria of 10 CFR 54.21(a)(1):

> Based on its review of LRA Sections 2.1, 2.2, 2.3, 2.4, and 2.5, the staff identified a number of scoping and screening issues that require clarification and additional information. It is not clear to the staff how the applicant has addressed the following commodities in its scoping and screening evaluation: cable trays, conduit, instrument lines, TubeTrac (if applicable), thermal insulation on piping and/or structures that performs an intended function. The applicant is requested to (1) specifically describe the treatment of each of these commodities in its scoping and screening evaluation; (2) identify the specific table and row in LRA Section 2.3, 2.4, or 2.5 that includes each commodity; and (3) identify the location in LRA Section 3 that contains the AMR for each commodity.

The applicant's response to RAI 2.4-2, dated May 19, 2004, is given below:

Cable trays:

(1) Cable trays were treated as in scope and subject to aging management review.
(2) Table 2.4-4, under the entry "Cable tray and conduit supports, embedded unistrut."
(3) As shown in Table 3.5.2-4 under the same component entry.

Conduit:

(1) Conduit was treated as in scope and subject to aging management review.
(2) Table 2.4-4, under the entry "Cable tray and conduit supports, embedded unistrut."
(3) As shown in Table 3.5.2-4 under the same component entry.

Instrument lines:

(1) Instrument lines were treated as in scope and subject to aging management review. This component is referred to as tubing in the LRA.
(2) As shown in the following tables.

2.3.1-3	2.3.2-1	2.3.2-2	2.3.2-4	2.3.2-5
				2.3.3-2
2.3.3-3	2.3.3-4	2.3.3-5	2.3.3-6	2.3.3-7
				2.3.3-8
2.3.3-9	2.3.3-10	2.3.3-11	2.3.4-1	2.3.4-2
				2.3.4-3
2.4-4				

(3) Instrument line/tubing aging management review is addressed in the following table:

3.1.2-3	3.2.2-1	3.2.2-2	3.2.2-4	3.2.2-5
				3.3.2-2
3.3.2-3	3.3.2-4	3.3.2-5	3.3.2-6	3.3.2-7
				3.3.2-8
3.3.2-9	3.3.2-10	3.3.2-11	3.4.2-1	3.4.2-2
				3.4.2-3
3.5.2-4				

TubeTrac:

(1) Tubing support systems, considered component supports, are in scope and subject to aging management review.
(2) As listed in Table 2.4-4, under the entry "component supports."
(3) As shown in Table 3.5.2 4 under the same component entry.

Thermal insulation on piping and/or structures that performs an intended function:

In some internal plant locations at ANO-2, insulation on piping has the intended function to limit heat loss in order to reduce area heat loads during accident conditions. This insulation is indoors and hence is protected from the weather. A review of ANO-2 operating experience verified that the plant has not experienced aging related degradation of piping insulation in indoor environments. Therefore, based on operating experience, there are no aging effects requiring management for indoor insulation at ANO-2. This is consistent with NUREG 1705, which states: "The staff concludes that, even if the chemical volume control system relied on the insulation to perform any accident mitigation functions, there are no plausible aging effects for the insulation that would warrant an aging management program."

Based on its review, the staff finds the applicant's response to RAI 2.4-2 acceptable for cable trays, conduit, instrument lines, and TubeTrac, because the information submitted is sufficient to address the staff's concerns. The applicant identified cable trays, conduit, instrument lines, and TubeTrac as within the scope of license renewal and subject to an AMR. The applicant identified the relevant applicable tables and row entries for the scoping and screening review and for the AMR for each of these commodities. The staff concludes that the applicant has properly applied the scoping criteria of 10 CFR 54.4(a) and the screening criteria of 10 CFR 54.21(a)(1) to ANO-2 cable trays, conduit, instrument lines, and TubeTrac. Therefore, the staff considers its concern described in RAI 2.4-2 resolved for cable trays, conduit, instrument lines, and TubeTrac.

Based on its review, the staff did not find the applicant's response to RAI 2.4-2 acceptable for thermal insulation, because the applicant's scoping and screening evaluation for thermal insulation appears to be flawed. In its RAI response, the applicant indicated that some thermal insulation has an intended function. However, the applicant apparently excluded this insulation from the scope of license renewal on the basis that there are no aging effects requiring management.

The staff noted that the scoping process for thermal insulation serves to identify all thermal insulation at ANO-2 that provides an intended function, in accordance with 10 CFR 54.4(a)(1–3). All thermal insulation that serves an intended function is within the scope of license renewal.

In a meeting on July 20, 2004, the staff requested the applicant to identify any thermal insulation at ANO-2 that serves an intended function, in accordance with 10 CFR 54.4(a)(1–3), describe plant-specific operating experience related to degradation of thermal insulation in general and thermal insulation that serves an intended function, and describe the scoping and screening evaluation for thermal insulation that serves an intended function, including the technical basis for either inclusion within or exclusion from the scope of license renewal. The staff indicated that the requested clarification should focus on insulation on hot containment piping penetrations.

The applicant's supplemental response to RAI 2.4-2 for thermal insulation, dated August 18, 2004, is given below:

> The insulation on hot containment piping penetrations is not required to ensure the functions of 10 CFR 54.4(a)(1) are accomplished or to demonstrate compliance with Commission regulations identified in 10 CFR 54.4(a)(3). The insulation does not meet 10 CFR 54.4(a)(2) as its failure will not prevent satisfactory accomplishment of any of the functions identified in 10 CFR 54.4(a)(1). Insulation on hot piping at containment penetrations does support normal ventilation systems in maintaining the environment for surrounding structural elements. However, maintaining the environment during normal operation is not an intended function identified in 10 CFR 54.4(a)(1). The fact that normal ventilation systems are not in the scope of license renewal supports this conclusion. In summary, thermal insulation on hot piping at containment penetration does not meet the scoping criteria of 10 CFR 54.4. This is consistent with the previously approved staff position documented in the safety evaluation report (SER) related to the license renewal of North Anna and Surry power stations, NUREG-1766, Section 2.1.3.1.
>
> Notwithstanding the above, Entergy performed an aging management review of the insulation on hot containment piping penetrations for ANO-2 even though it is not considered in the scope of license renewal. The aging management review did not identify any aging effects requiring management. ANO-2 hot piping penetration insulation is protected by its installation indoors in the annulus between the penetration piping and the penetration sleeve. The review of plant-specific operating experience for license renewal identified no age-related degradation of thermal insulation indoors, including insulation on hot piping at containment penetrations.

Degradation of concrete due to exposure to elevated temperatures is a long-term process. Maintaining concrete temperatures below the degradation threshold values during long-term, normal operation is essential to ensure that there is no degradation of concrete properties. If thermal insulation on hot piping that penetrates containment is relied on (solely or in conjunction with ventilation systems) to meet the concrete temperature criteria, then the staff concludes that it serves an intended function for license renewal, in accordance with 10 CFR 54.4(a)(2), and needs to be included in the scope of license renewal.

In a letter dated September 15, 2004, the applicant stated that thermal insulation around hot piping penetrations is included in the scope of license renewal for ANO-2. The applicant performed an aging management review of the insulation. Based on the consideration of the materia and environment, its protected location, and operating experience, there are no aging effects requiring management for the insulation around hot piping penetrations. The staff considers its concern described in RAI 2.4-2 resolved.

2.4.5.3 Conclusion

The staff reviewed the LRA and related structural/component information, including the accompanying scoping boundary drawings (if applicable), to determine whether the applicant failed to identify any SSCs that should be within the scope of license renewal. In addition, the staff performed an independent assessment to determine whether the applicant failed to identify any components that should be subject to an AMR. On the basis of its review, the staff concludes that the applicant has adequately identified the components of the bulk commodities that are within the scope of license renewal, as required by 10 CFR 54.4(a), and the components of the bulk commodities that are subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.5 Scoping and Screening Results—Electrical and Instrumentation and Controls Systems

This section addresses the scoping and screening results of electrical and I&C systems at ANO-2 for license renewal. According to 10 CFR 54.21(a)(1), an applicant must identify and list SCs subject to an AMR, which are passive, long-lived SCs that are within the scope of license renewal. To determine whether that the applicant has properly implemented its methodology, the staff focuses its review on the implementation results. Such focus allows the staff to confirm that the applicant did not omit any electrical system components that are subject to an AMR. If the review identifies no omission, the staff has a basis to find that the applicant has identified the electrical system components that are subject to an AMR.

2.5.1 Summary of Technical Information in the Application

In LRA Table 2.5.1, the applicant listed electrical and instrumentation and control system components that are within the scope of license renewal. The following structure and component/commodity groups were identified by the applicant as within the scope of license renewal:

- Electrical cables and connections not subject to 10 CFR 50.49 EQ requirements
- Inaccessible medium-voltage ($.16kV to 34.5kV) cables not subject to 10 CFR 50.49 EQ requirements
- Electrical connectors not subject to 10 CFR 50.49 EQ requirements that are exposed to borated water leakage
- Switchyard bus (switchyard bus for SBO) bus bars, connections
- High voltage insulators

2.5.2 Staff Evaluation

The staff performed its evaluation of the information provided in the LRA in the same manner for all electrical and I&C systems. Through its review, the staff sought to determine if the applicant identified as within the scope of license renewal those SSCs for a specific electrical or I&C system that appear to meet the scoping criteria, in accordance with 10 CFR 54.4. Similarly, the staff evaluated the applicant's screening results to determine whether all long-lived, passive components are subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

To perform its evaluation, the staff reviewed the applicable LRA section and associated component drawings, focusing its review on components that the applicant did not identify as within the scope of renewal. The staff reviewed relevant licensing basis documents, including the UFSAR, for each electrical and I&C component to determine if the applicant omitted components with intended functions delineated under 10 CFR 54.4(a) from the scope of license renewal. The staff also reviewed the licensing basis documents to determine if all intended functions delineated under 10 CFR 54.4(a) are specified in the LRA. If it identified omissions, the staff requested additional information to resolve the discrepancy.

Once the staff completed its review of the scoping results, it evaluated the applicant's screening results. For those SCs with intended functions, the staff sought to determine if the functions are performed with moving parts or a change in configuration or properties (i.e., passive), or if they are subject to replacement based on a qualified life or specified time period (i.e., long-lived), as described in 10 CFR 54.21(a)(1). For those that do not meet either of these criteria, the staff sought to confirm that these electrical and I&C components are subject to an AMR as required by 10 CFR 54.21(a)(1). If it identified discrepancies, the staff requested additional information to resolve them.

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

In performing the review, the staff selected system functions described in the FSAR and set forth in 10 CFR 54.4 to determine whether the applicant did not omit components having intended functions from the scope of the Rule. The staff also reviewed drawings and focused on components that the applicant did not identify as subject to an AMR to determine if it omitted any components.

As part of its review, the staff requested additional information in a letter dated May 25, 2004. In RAI 2.5-1, the staff requested that the applicant explain why uninsulated ground conductors are not subject to AMR. The applicant responded to the RAI in a letter to the staff dated June 21, 2004. In its response, the applicant stated that uninsulated ground conductors (e.g., grounding rods, buried ground cables, and cathodic protection) are not subject to AMR because this commodity group does not perform a license renewal intended function. Furthermore, noninsulated ground conductors do not meet any of the scoping criteria specified in 10 CFR 54.4. These components are not safety related per 10 CFR 54.4(a)(1) and are not credited for mitigation of regulated events listed in 10 CFR 54.4(a)(3).

The applicant stated that industry and plant-specific operating experience for uninsulated ground conductors does not indicate credible failure modes that would adversely impact an intended function; therefore, equipment failures caused by uninsulated ground conductors are considered hypothetical. As discussed in SRP-LR Section 2.1.3.1.2 and SOC Section III.c(iii) (Volume 60 of the *Federal Register*, page 22467 (60 FR 22467)), hypothetical failures are not required to be considered for license renewal if they are not included in the CLB. The applicant also stated that the failure of an uninsulated ground conductor will not prevent satisfactory accomplishment of any of the functions identified in 10 CFR 54.4(a)(1).

Based on this response, the staff concludes that uninsulated ground conductors do not perform or support any safety-related functions or any of the regulated events identified in 10 CFR 54.4(a). Therefore, the passive electrical commodity of uninsulated ground conductors is not within the scope of license renewal.

Table 2.5-1 of the LRA lists the commodity group "switchyard bus (switchyard bus for SBO), bus bars, connections)." The staff requested the applicant to clarify whether this commodity group includes the phase bus (e.g., isolated-phase bus and segregated and nonsegregated phase bus). In its response to the staff RAI, the applicant stated that the commodity group "switchyard bus (switchyard bus for SBO), bus bars, and connections" includes the phase bus (e.g., isolated-phase bus and segregated and nonsegregated phase bus). This commodity group is subject to AMR since ANO-2 uses a nonsegregated phase bus to connect the offsite ac power source (via the startup transformer) to the 4.16-kilovolt (kV) switchgear. Table 3.6.2-1 of the LRA includes the phase bus; however, the applicant did not identify any aging effects requiring management for the phase bus. Plant-specific operating experience confirms that the phase bus has satisfactorily performed its intended function since initial plant operation without aging effects requiring management. Based on this information, the staff concludes that the applicant did not omit the phase bus at ANO-2.

Table 2.5-1 of the LRA lists the commodity group "electrical cables and connections not subject to 10 CFR 50.49 EQ requirements." The staff requested the applicant to clarify whether this commodity group includes the electrical portions of electrical and I&C penetration assemblies (e.g., electrical penetration assembly cables and connections). In its response to the staff RAI, the applicant stated that the commodity group "electrical cables and connections not subject to 10 CFR 50.49 EQ requirements" includes the electrical portions of electrical and I&C penetration assemblies (e.g., electrical penetration assembly cables and connections), and that the applicant performed an AMR. The item on electrical cables and connections not subject to 10 CFR 50.49 EQ requirements in Table 3.6.2-1 identifies the aging effects and AMP for non-EQ electrical and I&C penetration cables and connections. Based on this information, the staff concludes that the applicant did not omit the electrical penetration assembly cables and connections at ANO-2.

Interim Staff Guidance (ISG)-2, "NRC Staff Position on License Renewal Rule (10 CFR 54.4) As It Relates to the Station Blackout Rule (10 CFR 50.63)," states the following:

> The offsite power systems consist of a transmission system (grid) component that provides a source of power and a plant system component that connects the power source to a plant's onsite electrical distribution systems which power safety equipment. For the purpose of the license renewal rule, the staff has determined that the plant system portion of the offsite power system that is used to connect the plant to the offsite power source should be included within the scope of the rule.

The staff requested the applicant to provide a detailed description of the ANO-2 recovery path and discuss how the recovery path is included within the scope of license renewal to comply with ISG-2.

In response to the staff's request, the applicant, in a letter dated June 21, 2004, responded that per ISG-2, the ANO-2 LRA scope for SBO includes the switchyard circuit breakers feeding Startup Transformer #3, Startup Transformer #3, the circuit breaker-to-transformer and transformer-to-onsite electrical interconnections, and the associated control circuits and structures. Additionally, the applicant stated that it also included the voltage regulator since it is part of the interconnection between the switchyard circuit breaker and the startup transformer.

The applicant further explained that the boundary between the transmission system (grid) offsite power source and the plant system components is the 22-kV/4.16-kV startup transformer (Startup Transformer #3). The 22-kV switchyard circuit breaker (B0126) that feeds Startup Transformer #3 at ANO-2 is the offsite power connection point to the transmission system that is the boundary point described in ISG-2 (first switchyard breaker). Medium-voltage insulated cable, installed in an underground duct bank, runs between the switchyard circuit breaker

B0126 and the Startup Transformer #3 voltage regulator. A switchyard bus connects breaker B0126 and the voltage regulator to the medium-voltage insulated cables. Medium-voltage insulated cable, installed in an underground duct bank, runs between the voltage regulator and Startup Transformer #3. A switchyard bus connects the voltage regulator and Startup Transformer #3 to the medium-voltage insulated cables. High-voltage insulators, which are used with the switchyard bus, are included in the scope of license renewal for the SBO recovery path. Startup Transformer #3 is connected to the 4.16-kV safety buses with a nonsegregated phase bus.

Instrument and control cables for the switchyard circuit breaker B0126, the voltage regulator, and Startup Transformer #3 are also included in the scope of license renewal for this recovery path. The item for the program covering electrical cables and connections not subject to 10 CFR 50.49 EQ requirements, listed in LRA Table 3.6.2-1, includes these cables.

As described above, the applicant only included a single path for SBO recovery in its LRA. That SBO recovery path includes the connections from Startup Transformer #3 to switchyard circuit breaker B0126. During a July 20, 2004, public meeting, the staff requested that the applicant include an alternate offsite power source in the scope of license renewal.

In a letter dated August 18, 2004, the applicant provided an alternate offsite power source in the scope of license renewal. In the letter, the applicant stated that the alternate offsite power source for Startup Transformer #2 is a component from ANO-1 credited for meeting General Design Criterion (GDC) 17, "Electric Power Systems." As stated in the ANO-2 FSAR Section 8.1.4, ANO-2 can supply electric power to the onsite electric distribution system from two physically independent transmission network circuits, Startup Transformer #3, which is an ANO-2 offsite power component, and Startup Transformer #2, which is an ANO-1 offsite power component. The switchyard autotransformer bank supplies Startup Transformer #3 through underground cables. The 161-kV switchyard ring bus supplies Startup Transformer #2.

Two 161-kV circuit breakers separate the 161-kV switchyard from the autotransformer. The failure of any one of the 161-kV circuit breakers will trip the adjacent circuit breakers and interrupt only one of the plant offsite power sources. The 500-kV lines and the autotransformer will remain available during that event. Conversely, the failure of a 500-kV circuit breaker which feeds the autotransformer will trip the two 161-kV circuit breakers connected to the autotransformer but will not interrupt the 161-kV circuit to the plant.

Section 8.2.1.2.G of the FSAR describes the overhead 161-kV transmission conductors from 161-kV switchyard circuit breakers B1291 and B1250 to Startup Transformer #2. The high-voltage insulators associated with the transmission conductors are similar to the high-voltage insulators for the switchyard bus, which the applicant addressed in Section 3.6 of its LRA.

The inclusion of 161-kV switchyard circuit breakers B1291 and B1250 (first switchyard breakers), the associated overhead transmission conductors, and Startup Transformer #2 in the scope of license renewal required modification of the applicant's response to RAI 2.5-1(c)), provided in its June 21, 2004, letter.

In the revised response, the applicant stated that, based on the inclusion of Startup Transformer #2, transmission conductors, strain and suspension insulators, and insulated cables are subject to an AMR. The LRA includes insulated cables. The transmission conductors component type includes the transmission conductors and the hardware used to secure the conductors to insulators. Section 3.6 of this SER provides details of the applicant's AMR of transmission conductors. Based on this information, the staff concludes that the applicant did not omit transmission conductors at ANO-2.

2.5.3 Conclusion

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

2.6 Conclusion

The staff has reviewed the information in Section , "Scoping and Screening Methodology for Identifying Structures and Components Subject to Aging Management Review and Implementation Results " of the LRA. On the basis of its review, the staff concludes that the applicant has identified those structures and components 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).

With regard to these matters, the NRC staff has concluded that there is reasonable assurance that the activities authorized by the renewed license will continue to be conducted in accordance with the current licensing basis, and that any changes made to the ANO-2 current licensing basis in order to comply with 10 CFR 54.29(a) are in accord with the ACT and the Commission's regulations.

3. AGING MANAGEMENT REVIEW RESULTS

This Section of the SER contains the staff's evaluation of the applicant's aging management programs (AMPs) and aging management reviews (AMRs). In Appendix B of the LRA, the applicant described the 33 AMPs that it relies on to manage or monitor the aging of long-lived, passive components and structures. In Section 3 of the LRA, the applicant provided the results of the AMRs for those structures and components that were identified in Section 2 of the LRA as being within the scope of license renewal and subject to an AMR.

3.0 Applicant's Use of the Generic Aging Lessons Learned Report

In preparing its license renewal application (LRA), Entergy Operations, Inc. (Entergy, the applicant) credited NUREG-1801, "Generic Aging Lessons Learned (GALL) Report," dated July 2001. The GALL Report contains the staff's generic evaluation of the existing plant programs and documents the technical basis for determining where existing programs are adequate without modification and where existing programs should be augmented for the extended period of operation. The evaluation results documented in the GALL Report indicate that many of the existing programs are adequate to manage the aging effects for particular structures or components for license renewal without change. The GALL Report also contains recommendations on specific areas for which existing programs should be augmented for license renewal. An applicant may reference the GALL Report in its LRA to demonstrate that the programs at its facility correspond to those reviewed and approved in the report.

The purpose of the GALL Report is to provide the staff with a summary of staff-approved AMPs to manage or monitor the aging of structures and components 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 also serves as a reference for applicants and staff reviewers to quickly identify those AMPs and activities that the staff has determined will adequately manage or monitor aging during the period of extended operation.

The GALL Report identifies (1) systems, structures, and components (SSCs), (2) structure and component (SC) materials, (3) the environments to which the SCs are exposed, (4) the aging effects associated with the materials and environments, (5) the AMPs that are credited with managing or monitoring the aging effects, and (6) recommendations for further applicant evaluations of aging management for certain component types.

To determine whether using the GALL Report 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 focus on public health and safety. NUREG-1800, "Standard Review Plan for the Review of License Renewal Applications," dated April 2001 (SRP-LR), was prepared based on both the GALL Report model and lessons learned from the demonstration project.

The staff performed its work in accordance with the requirements of Title 10 of the *Code of Federal Regulations*, Part 54 (10 CFR 54), "Requirements for Renewal of Operating Licenses for Nuclear Power Plants;" the guidance provided in NUREG-1800, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants" (SRP-LR), dated July 2001; the guidance provided in NUREG-1801, "Generic Aging Lessons Learned (GALL) Report," dated July 2001; and the "Audit and Review Plan for Plant Aging Management Reviews and Programs - Arkansas Nuclear One, Unit 2" dated July 29, 2004 (ML041550872).

The staff performed audits and technical reviews of the license renewal applicant's AMPs and AMRs. These audits and reviews are to determine whether the effects of aging on structures and components can be adequately managed so that their intended functions can be maintained consistently with the plant's current licensing basis (CLB) for the period of extended operation as required by 10 CFR 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants."

During its review of the Arkansas Nuclear One, Unit 2 (ANO-2) LRA, the staff performed on-site audits and reviews during the weeks of December 1, 2003, and February 9, 2004, to determine that AMP and AMR results that the applicant claimed were consistent with the GALL Report were actually consistent as claimed. Details of the staff's evaluation of the audits and reviews are documented in the "Audit and Review Report for Plant Aging Management Reviews - Arkansas Nuclear One, Unit 2 ," (ANO-2 Audit and Review Report) dated August 19, 2004 (ML0422400840).

The on-site audits and reviews are designed to maximize the efficiencies of the staff's review of the LRA. The need for formal correspondence between staff and the applicant was reduced, and therefore, improved the efficiency of the review. Also the applicant could respond to questions, and the staff could readily evaluate the responses made by the applicant.

Overall, as set out in the SER, the staff determined that the applicant's aging management activities and programs can adequately manage the effects of aging on structures and components, so that their intended functions can be maintained consistent with the current licensing basis (CLB) for the period of extended operation.

3.0.1 Format of the Licence Renewal Application (LRA)

Entergy Operations, Inc. (Entergy, the applicant) submitted an application that followed the standard LRA format, as agreed to between the NRC staff and the Nuclear Energy Institute (NEI) (see letter dated April 7, 2003). This revised LRA format incorporates lessons learned from the staff's reviews of the previous LRAs. These previous applications used a format developed from information gained during an NRC staff and NEI demonstration project conducted to evaluate the use of the GALL Report in the staff's review process.

The organization of Section 3 of the LRA parallels Chapter 3 of the SRP-LR. The AMR results information in Section 3 of the LRA is presented in the following two table types.

- Table 1: Table 3.x.1 - where "3" indicates the LRA section number, "x" indicates the subsection number from the GALL Report, and "1" indicates that this is the first table type in Section 3 of the LRA.

- Table 2: Table 3.x.2-y - where "3" indicates the LRA section number, "x" indicates the subsection number of the GALL Report, "2" indicates that this is the second table type in Section 3 of the LRA, and "y" indicates the system table number.

The content of the previous applications and the ANO-2 application is essentially the same. The intent of the revised format used for the ANO-2 application was to modify the tables in Chapter 3 to provide additional information to assist the staff in its review. In Table 1 the applicant summarized the portions of the application it considered to be consistent with the GALL Report. In Table 2, the applicant identified the linkage between the scoping and screening results in Chapter 2 and the AMRs in Chapter 3.

3.0.1.1 Overview of Table 1

Table 3.x.1 (Table 1) provides a summary comparison of how the facility aligns with the corresponding tables of the GALL Report, Volume 1. The table is essentially the same as Tables 1 through 6 provided in the GALL Report, Volume 1, except that the "Type" column has been replaced by an "Item Number" column and the "Item Number in GALL" column has been replaced by a "Discussion" column. The "Item Number" column provides the reviewer with a means to cross-reference from Table 2 to Table 1. The "Discussion" column is used by the applicant to provide clarifying/amplifying information. The following are examples of information that might be contained within this column:

- Further Evaluation Recommended - information or reference to where that information is located
- The name of a plant-specific program being used
- Exceptions to the GALL Report assumptions
- A discussion of how the line is consistent with the corresponding line item in the GALL Report when that may not be intuitively obvious
- A discussion of how the item is different than the corresponding line item in the GALL Report (e.g., when there is exception taken to an aging management program that is listed in the GALL Report)

The format of Table 1 allows the staff to align a specific Table 1 row with the corresponding NUREG-1801, Volume 1, table row so that consistency can be checked easily.

3.0.1.2 Overview of Table 2

Table 2 provides the detailed results of the AMRs for those components identified in LRA Section 2 as being subject to an AMR. The LRA contains a Table 2 for each of the components or systems within a system grouping (e.g., reactor coolant systems, engineered safety features, auxiliary systems, etc.). For example, the engineered safety features group contains tables specific to the containment spray system, containment isolation system, and emergency core cooling system, Table 2 consists of the following nine columns:

Component Type - The first column identifies the component types from Section 2 of the LRA that are subject to aging management review. They are listed in alphabetical order.

Intended Function - The second column contains the license renewal intended functions (including abbreviations where applicable) for the listed component types. Definitions and abbreviations of intended functions are contained within the Intended Functions table of LRA Section 2.

Material - The third column lists the particular materials of construction for the component type.

Environment - The fourth column lists the environment to which the component types are exposed. Internal and external service environments are indicated and a list of these environments is provided in the Internal Service Environments and External Service Environments tables of LRA Section 3.

Aging Effect Requiring Management - The fifth column lists aging effects requiring management. As part of the aging management review process, the applicant determined any aging effects requiring management for each material and environment combination.

Aging Management Programs - The sixth column lists the aging management programs the applicant used to manage the identified aging effects.

GALL Vol. 2 Item - The seventh column lists the GALL Report item(s) that the applicant identified as being similar to the AMR results in its LRA. The applicant compared each combination of component type, material, environment, aging effect requiring management, and aging management program in Table 2 of the SER to the items in the GALL Report. If there were no corresponding item in the GALL Report, the applicant left the column blank. In this way, the applicant identified the AMR results in the LRA tables that corresponded to items in the GALL Report tables.

Table 1 Item - The eighth column lists the corresponding summary item number from Table 1. If the applicant identifies AMR results in Table 2 that are consistent with the GALL Report, then the associated Table 3.x.1 line summary item number should be listed in Table 2. If there is no corresponding item in the GALL Report, then column eight is left blank. That way, the information from the two tables can be correlated.

Notes - The ninth column lists the corresponding notes that the applicant used to identify how the information in Table 2 aligns with the information in the GALL Report. The notes identified by letters were developed by a Nuclear Energy Institute working group and will be used in future license renewal applications. Any plant-specific notes are identified by a number and provide additional information concerning the consistency of the line item with the GALL Report.

3.0.2 Staff's Review Process

The staff evaluated each row in Table 1 by moving from left to right across the table. Since the applicant reproduced the component, aging effect/mechanism, aging management programs and further evaluation recommended information from the SRP-LR, these table columns required no further staff review. The staff reviewed information provided by the applicant in the

Discussion column or other sections of the LRA to determine whether the applicant's AMR results and AMPs were consistent with the AMRs and AMP items in the GALL Report.

The staff conducted the following three types of evaluations of the AMRs and associated AMPs.

- For items the applicant stated were consistent with the GALL Report or consistent with a previously approved staff position, the staff conducted an audit.
- For items the applicant stated were consistent with the GALL Report with exceptions, the staff conducted an audit and review of the item and of the applicant's technical justification for the exceptions.
- For other items, the staff conducted a technical review. Additionally, the staff conducted a technical review for some items that were consistent with the GALL Report but associated with emerging technical issues.

3.0.2.1 Review of AMPs

For those AMPs for which the applicant claimed consistency with the GALL AMPs, the staff conducted an audit to confirm that the applicant's AMPs were consistent with the AMPs in the GALL Report.

For each AMP that had one or more deviations, the staff evaluated each deviation to determine (1) whether the deviation was acceptable, and (2) whether the AMP, as modified, would adequately manage the aging effect(s) for which it was credited.

For each AMP that was not evaluated in the GALL Report, the staff performed a full review to determine the adequacy of the AMP. The staff evaluated the AMP against the following 10 program elements defined in SRP-LR Appendix A.

1. Scope of program - Scope of the program should include the specific structures and components subject to an AMR for license renewal.

2. Preventive actions - Preventive actions should prevent or mitigate aging degradation.

3. Parameters monitored or inspected - Parameters monitored or inspected should be linked to the degradation of the particular structure or component intended functions(s).

4. Detection of aging effects - Detection of aging effects should occur before there is a loss of structure or component intended functions(s). This includes aspects such as method or technique (i.e., visual, volumetric, surface inspection), frequency, sample size, data collection and timing of new/one-time inspections to ensure timely detection of aging effects.

5. Monitoring and trending - Monitoring and trending should provide predictability of the extent of degradation, and timely corrective or mitigative actions.

6. Acceptance criteria - Acceptance criteria, against which the need for corrective action will be evaluated, should ensure that the structure or component intended function(s) are maintained under all CLB design conditions during the period of extended operation.

7. Corrective actions - Corrective actions, including root cause determination and prevention of recurrence, should be timely.

8. Confirmation process - Confirmation process should ensure that preventive actions are adequate and that appropriate corrective actions have been completed and are effective.

9. Administrative controls - Administrative controls should provide a formal review and approval process.

10. Operating experience - Operating experience of the aging management program, including past corrective actions resulting in program enhancements or additional programs, should provide objective evidence to support the conclusion that the effects of aging will be managed adequately so that the structure and component intended function(s) will be maintained during the period of extended operation.

The staff reviewed the applicant's corrective action program and documented its findings in Section 3.0.3 of this SER. The staff's evaluation of the corrective action program included assessment of the Corrective Actions, Confirmation Process, and Administrative Controls program elements. Consequently, the staff's documentation of its review of AMPs not consistent with the GALL Report AMPs only addresses 7 of the 10 program elements.

The staff reviewed the information concerning the operating experience program element for the AMPs that are consistent with GALL Report AMPs. Details of the staff's evaluation of the audit and review are documented in the ANO-2 Audit and Review Report.

The staff reviewed the Updated Final Safety Analysis Report (UFSAR) supplement for each AMP to determine if it provided an adequate description of the program or activity, as required by 10 CFR 54.21(d).

3.0.2.2 Review of AMR Results

Table 2 of the LRA contains information concerning whether or not the AMRs align with the AMRs identified in the GALL Report. For a given AMR in Table 2, the staff reviewed the intended function, material, environment, aging effect requiring management and aging management program combination for a particular component type within a system. The AMRs that correlate between a combination in Table 2 and a combination in the GALL Report were identified by a referenced item number in column seven, "GALL, Volume 2 Item." The staff conducted an audit to determine the correlation. A blank column seven indicates that the applicant was unable to locate an appropriate corresponding combination in the GALL Report. The staff conducted a technical review of these combinations that were not consistent with the GALL Report. The next column, "Table 1 Item," provided a reference number that indicated the corresponding row in Table 1.

3.0.2.3 NRC-Approved Positions

To help facilitate the staff review of the LRA, an applicant may reference NRC-approved positions to demonstrate that its non-GALL programs correspond to programs that the staff had approved for other plants during its review of previous applications for license renewal. When an applicant elects to proceed in this way , the staff determines whether the previously approved position is applicable to the applicant's facility, determines whether the plant program is bounded by the conditions for which the position was evaluated and approved, and determines whether that the plant program contains the program elements (or attributes) of the referenced NRC-approved position. In general, if the staff determines that these conditions are satisfied, it will use the information in the previously approved position to frame and focus its review of the applicant's program.

It is important to note that the reference information on previously approved positions provided by the applicant is not a part of the LRA; it is supplementary information voluntarily provided by the applicant as a reviewer's aid. The existence of a previously approved position, in and of itself, is not a sufficient basis to accept the applicant's program. Rather, the previously approved position facilitates the review of the substance of the matters described in the applicant's program. As such, in the NRC staff's documentation of its reviews of programs that are based on previously approved positions, the reference information is typically implicit in the evaluation rather than explicit. If the staff determines that a previously approved position identified by the applicant is not applicable to the particular plant program for which it is credited, it refers the program to the NRR, Division of Engineering (DE) for review in the traditional manner, i.e., as described in the SRP-LR, without consideration of the reference information provided by the applicant. The applicant chose to provide reference information on previously approved positions to support its selection of certain programs. Therefore, some of the staff reviews documented in this SER considered the reference information in the manner described above.

3.0.2.4 UFSAR Supplement

Consistent with the SRP-LR, for the AMRs and associated AMPs that it reviewed, the staff also reviewed the UFSAR supplement that summarizes the applicant's programs and activities for managing the effects of aging for the period of extended operation.

3.0.2.5 Documentation and Documents Reviewed

In performing its work, the staff relied heavily on the LRA, the SRP-LR, and the GALL Report. The staff also examined the applicant's precedent review documents and AMP basis documents (a catalog of the documentation used by the applicant to develop or justify its AMPs), and other applicant documents, including selected implementing procedures, to determine that the applicant's activities and programs will adequately manage the effects of aging on SCs.

Any discrepancies or issues discovered during the audit and review that required a formal response on the docket are documented in the staff's ANO-2 Audit and Review Report. If an issue was resolved prior to issuing the Report, a request for additional information (RAI) was prepared by the staff describing the issue and the information needed to disposition the issue. The RAI, if needed, is included and dispositioned in this ANO-2 SER related to the LRA. The list of RAIs associated with the audit and review is provided in Attachment 3 to the staff's ANO-2 Audit and Review Report.

A list of documents reviewed by the staff is listed as Attachment 4 to the staff's ANO-2 Audit and Review Report. During its site visits, the staff also conducted detailed discussions and interviews with the applicant's license renewal project personnel and others with technical expertise relevant to aging management.

3.0.3 Aging Management Programs

Table 3.0.3-1 presents the AMPs credited by the applicant and described in Appendix B of the LRA. The table also indicates the GALL program that the applicant claimed its AMP was consistent with (if applicable) and the systems, structures, or components that credit the program for managing or monitoring aging. The section of the safety evaluation report in which the staff's evaluation of the program is documented also is provided.

Table 3.0.3-1
ANO-2's Aging Management Programs

ANO-2's AMP (LRA Section)	GALL Comparison	GALL AMP(s)	LRA Systems or Structures that Credit the AMP	Staff's SER Section
Existing AMPs				
Bolting and Torquing Activities Program (B.1.2)	Plant-specific	N/A	Reactor Vessel, Internals, and Reactor Coolant System; Engineered Safety Features Systems; Auxiliary Systems; Steam and Power Conversion Systems	3.0.3.3.2
Boric Acid Corrosion Prevention Program (B.1.3)	Consistent with enhancements	XI.M10	Reactor Vessel, Internals, and Reactor Coolant System; Engineered Safety Features Systems; Auxiliary Systems; Structures and Component Supports; Electrical and Instrumentation and Controls	3.0.3.2.1
Containment Leak Rate Program (B.1.6)	Consistent	XI.S4	Engineered Safety Features Systems; Structures and Component Supports	3.0.3.1
Diesel Fuel Monitoring Program (B.1.7)	Consistent with exceptions	XI.M30	Auxiliary Systems	3.0.3.2.3
Environmental Qualification (EQ) of Electric Components Program (B.1.8)	Consistent	X.E1	Electrical and Instrumentation and Controls	3.0.3.1 3.6.2.1.4
Fatigue Monitoring Program (B.1.9)	Consistent with exceptions	X.M1	Reactor Vessel, Internals, and Reactor Coolant System	3.0.3.2.4

ANO-2's AMP (LRA Section)	GALL Comparison	GALL AMP(s)	LRA Systems or Structures that Credit the AMP	Staff's SER Section
Fire Protection Program (B.1.10.1)	Consistent with *exceptions*	XI.M26	Auxiliary Systems; Structures *and Component Supports*	3.0.3.2.5.1
Fire Water System Program (B.1.10.2)	Consistent with one exception; one enhancement	XI.M27	Auxiliary Systems; Structures and Component Supports	3.0.3.2.5.2
Flow-Accelerated Corrosion Program (B.1.11)	Consistent	XI.M17	Reactor Vessel, Internals, and Reactor Coolant System; Engineered Safety Features Systems; Auxiliary Systems; Steam and Power Conversion Systems	3.0.3.1
Inservice Inspection – Containment Inservice Inspection (CII) Program (B.1.13)	Plant-specific	N/A	Structures and Component Supports	3.0.3.3.4
Inservice Inspection – Inservice Inspection (ISI) Program (B.1.14)	Plant-specific	N/A	Reactor Vessel, Internals, and Reactor Coolant System; Structures and Component Supports	3.0.3.3.5
Oil Analysis Program (B.1.17)	Plant-specific	N/A	Auxiliary Systems; Steam and Power Conversion Systems	3.0.3.3.6
Periodic Surveillance and Preventive Maintenance Program (B.1.18)	Plant-specific	N/A	Engineered Safety Features Systems; Auxiliary Systems; Steam and Power Conversion Systems; Structures and Component Supports	3.0.3.3.7
Pressurizer Examinations Program (B.1.19)	Plant-specific	N/A	Reactor Vessel, Internals, and Reactor Coolant System	3.0.3.3.8
Reactor Vessel Head Penetration Program (B.1.20)	Consistent	XI.M11	Reactor Vessel, Internals, and Reactor Coolant System	3.0.3.1
Reactor Vessel Integrity Program (B.1.21)	Consistent with enhancement	XI.M31	Reactor Vessel, Internals, and Reactor Coolant System	3.0.3.2.6
Service Water Integrity Program (B.1.24)	Consistent with exceptions/ enhancement	XI.M20	Engineered Safety Features Systems; Auxiliary Systems; Structures and Component Supports	3.0.3.2.7
Steam Generator Integrity Program (B.1.25)	Consistent	XI.M19	Reactor Vessel, Internals, and Reactor Coolant System	3.0.3.1

ANO-2's AMP (LRA Section)	GALL Comparison	GALL AMP(s)	LRA Systems or Structures that Credit the AMP	Staff's SER Section
Structures Monitoring – Masonry Wall Program (B.1.26)	Consistent	XI.S5	Structures and Component Supports	3.0.3.1
Structures Monitoring – Structures Monitoring Program (B.1.27)	Consistent	XI.S6	Structures and Component Supports	3.0.3.1
System Walkdown Program (B.1.28)	Plant-specific	N/A	Reactor Vessel, Internals, and Reactor Coolant System; Engineered Safety Features Systems; Auxiliary Systems; Steam and Power Conversion Systems	3.0.3.3.9
Water Chemistry Control – Auxiliary Systems Water Chemistry Control Program (B.1.30.1)	Plant-specific	N/A	Auxiliary Systems; Steam and Power Conversion Systems	3.0.3.3.11
Water Chemistry Control – Closed Cooling Water Chemistry Control Program (B.1.30.2)	Consistent with exceptions	XI.M21	Reactor Vessel, Internals, and Reactor Coolant System; Auxiliary Systems; Steam and Power Conversion Systems; Structures and Component Supports	3.0.3.2.8
Water Chemistry Control – Primary and Secondary Water Chemistry Control Program (B.1.30.3)	Consistent	XI.M2	Reactor Vessel, Internals, and Reactor Coolant System; Engineered Safety Features Systems; Auxiliary Systems; Steam and Power Conversion Systems; Structures and Component Supports	3.0.3.1
New AMPs				
Alloy 600 Aging Management Program (B.1.1)	Plant-specific	N/A	Reactor Vessel, Internals, and Reactor Coolant System	3.0.3.3.1
Buried Piping Inspection Program (B.1.4)	Consistent with exceptions	XI.M34	Auxiliary Systems	3.0.3.2.2
Cast Austenitic Stainless Steel (CASS) Evaluation Program (B.1.5)	Consistent	XI.M12	Reactor Vessel, Internals, and Reactor Coolant System	3.0.3.1
Heat Exchanger Monitoring Program (B.1.12)	Plant-specific	N/A	Engineered Safety Features Systems; Auxiliary Systems	3.0.3.3.3

ANO-2's AMP (LRA Section)	GALL Comparison	GALL AMP(s)	LRA Systems or Structures that Credit the AMP	Staff's SER Section
Non-EQ Inaccessible Medium-Voltage Cable Program (B.1.15)	Consistent	XI.E3	Electrical and Instrumentation and Controls	3.0.3.1
Non-EQ Insulated Cables and Connections Program (B.1.16)	Consistent	XI.E1	Electrical and Instrumentation and Controls	3.0.3.1
Reactor Vessel Internals Cast Austenitic Stainless Steel Components Program (B.1.22)	Consistent	XI.M13	Reactor Vessel, Internals, and Reactor Coolant System	3.0.3.1
Reactor Vessel Internals Stainless Steel Plates, Forgings, Welds, and Bolting Program (B.1.23)	Consistent	XI.M16	Reactor Vessel, Internals, and Reactor Coolant System	3.0.3.1
Wall Thinning Monitoring Program (B.1.29)	Plant-specific	N/A	Auxiliary Systems	3.0.3.3.10

3.0.3.1 AMPs that are Consistent with the GALL Report

In Appendix B of the LRA, the applicant indicated that the following AMPs were consistent with the GALL Report:

- Cast Austenitic Stainless Steel (CASS) Evaluation Program (B.1.5)
- Containment Leak Rate Program (B.1.6)
- Environmental Qualification (EQ) of Electric Components Program (B.1.8)
- Flow-Accelerated Corrosion Program (B.1.11)
- Non-EQ Inaccessible Medium-Voltage Cable Program (B.1.15)
- Non-EQ Insulated Cables and Connections Program (B.1.16)
- Reactor Vessel Head Penetration Program (B.1.20)
- Reactor Vessel Internals Cast Austenitic Stainless Steel Components Program (B.1.22)
- Reactor Vessel Internals Stainless Steel Plates, Forgings, Welds, and Bolting Program (B.1.23)
- Steam Generator Integrity Program (B.1.25)
- Structures Monitoring – Masonry Wall Program (B.1.26)
- Structures Monitoring – Structures Monitoring Program (B.1.27)
- Water Chemistry Control – Primary and Secondary Water Chemistry Control Program (B.1.30.3)

During the audit that was conducted by the staff on December 1-5, 2003, the staff reviewed selected documents and procedures associated with the AMPs that are listed above. During the technical review of the Reactor Vessel Internals Cast Austenitic Stainless Steel

Components Program (B.1.22) and Reactor Vessel Internals Stainless Steel Plates, Forgings, Welds, and Bolting Program (B.1.23), aspects pertaining to void swelling were under development and not available for staff review. The applicant has committed to further understanding of this aging effect through industry programs to provide additional bases for supplemental examinations or component-specific evaluations.

3.0.3.1.1 Reactor Vessel Internal Programs

Since the details of the Reactor Vessel Internals Cast Austenitic Stainless Steel Components Program have yet to be developed, including the details on location of components for examination, inspection methods and qualifications, and frequency of examinations, the scope of the AMP has yet to be finalized. The staff therefore issued RAI B.1.22-1 and requested that the applicant formally make a commitment to submit a description of the program, including its inspection plan, to the NRC staff for review and approval no later than three years prior to the period of extended operation.

The applicant responded to RAI B.1.22-1 in a letter dated October 15, 2004. In this letter, the applicant provided a commitment to submit a description of the Reactor Vessel Internals Cast Austenitic Stainless Steel Components Program, including its inspection plan, to the NRC staff for review and approval at least 24 months prior to entering the period of extended operation for ANO-2.

The staff concludes that the following technical and regulatory bases justify the acceptance of the Reactor Vessel Internals Cast Austenitic Stainless Steel Program, as discussed in Section B.1.22 of the ANO-2 LRA and amended in the applicant's response to RAI B.1.22-1 dated October 15, 2004:

1. The applicant will implement the AMP in accordance with the recommended guidance in GALL AMP XI.M13, "Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS)."

2. The applicant has committed to submit a description of the aging management program, including the inspection plan, for the RV internal CASS components for NRC review and approval at least 24 months prior to entering the extended period of operation for ANO-2. The staff has confirmed that the applicant has included this commitment in the Commitment Tracking List for the ANO-2 LRA.

3. The applicant's commitment will provide the NRC with an opportunity to review the inspection program for the RV internal CASS components and to resolve any potential issues that may develop during the staff's review of the program. The staff considers 24 months to be sufficient evaluation time for reviewing the program and inspection plan and for addressing any issues that may develop during the review process.

To obtain NRC staff approval its proposed inspection plan regarding CASS components prior to entering the period of extended operation for ANO-2, the applicant must submit a license amendment request. After the NRC staff's approval of the inspection plan, any future changes to the inspection plan will be evaluate in accordance with 10 CFR 50.59.

Similarly, since the details of the Reactor Vessel Internals Stainless Steel Plates, Forgings, Welds and Bolts Program have yet to be developed, including the details on location of components for examination, inspection methods and qualifications, and frequency of examinations, the scope of the AMP has yet to be finalized. The staff therefore issued RAI B.1.23-1 and requested that the applicant formally make a commitment to submit a description of the program, including its inspection plan, to the NRC for review and approval no later than three years prior to the period of extended operation.

The applicant responded to RAI B.1.23-1 in a letter, dated October 15, 2004. In this letter, the applicant provided a commitment to submit a description of the Reactor Vessel Internals Stainless Steel Plates, Forgings, Welds, and Bolting Program, including the inspection plan, to the staff for review and approval at least 24 months prior to entering the period of extended operation for ANO-2.

The staff concludes that the following technical and regulatory bases justify the acceptance of the Reactor Vessel Internals Stainless Steel Plates, Forgings, Welds, and Bolting Program, as discussed in Section B.1.23 of the ANO-2 LRA and amended in the applicant's responses to RAI B.1.23-1 dated October 15, 2004:

1. The applicant will implement the AMP in accordance with the recommended guidance in GALL AMP XI.M16, "PWR Vessel Internals."

2. The applicant has committed to submit a description of the management program, including the inspection plan, for the RV internal stainless steel plate, forging, weld and bolting components for NRC review and approval at least 24 months prior to entering the extended period of operation for ANO-2. The staff has confirmed that the applicant has included this commitment in the Commitment Tracking List for the ANO-2 LRA.

3. The applicant's commitment will provide the NRC with an opportunity to review the inspection program for the RV internal stainless steel plate, forging, weld and bolting components and to resolve any potential issues that may develop during the staff's review of the program. The staff considers 24 months to be sufficient evaluation time for reviewing the program and inspection plan and for addressing any issues that may develop during the review process.

To obtain NRC staff approval its proposed inspection plan regarding Reactor Vessel Internals prior to entering the period of extended operation for ANO-2, the applicant must submit a license amendment request. After the NRC staff's approval of the inspection plan, any future changes to the inspection plan will be evaluate in accordance with 10 CFR 50.59.

3.0.3.1.2 Reactor Vessel Head Penetration Program

The applicant credits the Reactor Vessel Head Penetration Program with the management of cracking in the upper vessel head penetration (VHP) nozzles adjoined to the upper RV head for ANO-2. The applicant describes the Reactor Vessel Head Penetration AMP in LRA Section B.1.20. The applicant stated that the purpose of the Reactor Vessel Head Penetration AMP is to manage PWSSC-induced cracking of the nickel-based alloy upper VHP nozzles to assure that the pressure boundary function is maintained during the period of extended operation.

The applicant identified that the ANO-2 Reactor Vessel Head Penetration AMP is an existing AMP whose program attributes are consistent with the comparable program attributes in GALL AMP XI.M11, "Nickel-Alloy Nozzles and Penetrations," without any enhancements or exceptions. The applicant also provided an applicable UFSAR Supplement summary description for the Reactor Vessel Head Penetration AMP in Section A.2.1.21 of the ANO LRA.

Staff Evaluation

The staff evaluated the Reactor Vessel Head Penetration AMP against the corresponding program elements in GALL AMP XI.M11, "Nickel-Alloy Nozzles and Penetrations." GALL Section XI.M11 currently relies on the staff's original Alloy 600 inspection program recommendations provided in GL 97-01, "Degradation of Control Rod Drive Mechanism Nozzle and Other Vessel Head Penetrations," issued on April 1, 1997. However, between November 2000 and April 2001 and subsequent to the issuance of GL 97-01, reactor coolant pressure boundary (RCPB) leakage was identified from the vessel head penetration (VHP) nozzles adjoined to the upper RV heads of four U.S. PWR-design light water reactor facilities. In NRC Bulletin 2001-01, "Circumferential Cracking of Reactor Pressure Vessel Head Penetration Nozzles," issued on August 3, 2001, the staff discussed the generic safety significance and impacts of these cracks on RVH penetration nozzles and recommended that enhanced visual examination or volumetric examination methods be used for the inspection of RVH penetration nozzles. In March 2002, during a refueling outage at the Davis-Besse Nuclear Power Station, the licensee for the plant reported the identification of reactor coolant leakage from RVH penetration nozzles. On March 18, 2002, the staff issued NRC Bulletin 2002-01, "Reactor Pressure Vessel Head Degradation and Reactor Coolant Pressure Boundary Integrity," to owners of PWR pressure vessels, requesting that the licensees address the impact of the Davis-Besse event on the structural integrity of their RVHs and associated penetration nozzles. On August 9, 2002, the staff issued NRC Bulletin 2002-02, "Reactor Pressure Vessel Head and Vessel Head Penetration Nozzle Inspection Programs," to address additional technical issues resulting from the Davis-Besse event. In NRC Bulletin 2002-02, the staff specifically suggested that further augmented inspections, more comprehensive than those suggested in NRC Bulletin 2001-01, be performed on RV head penetration nozzles.

The applicant stated that the Corrective Action Program was used to incorporate industry operating experience in order to develop inspections specific to ANO-2. Entergy Letter No. 0CAN040201, dated April 1, 2002, "15-Day Response to NRC Bulletin 2002-01, Reactor Pressure Vessel Head Degradation and Reactor Coolant Pressure Boundary Integrity," provided Entergy's response to the NRC regarding potential VHP nozzle and RV head degradation issues applicable to ANO-2. An assessment of the examination of ANO-2 upper VHP nozzles was completed during refueling outage (RFO) No. 2R15 in 2002. This assessment concluded that the examination of the ANO-2 upper VHP nozzles during RFO No. 2R15 was performed in accordance with the commitments stated in Entergy's response to NRC Bulletin 2001-01 for ANO-2.

On February 11, 2003, the NRC issued Order EA-03-009 to all holders of operating licenses for pressurized light-water reactors (PWRs). This NRC order superceded NRC Bulletins 2001-01 and 2002-01, and required that licensees assess the susceptibility of the RV head to PWSCC-related degradation. The Order also required licensees to perform augmented inspections for the reactor pressure vessel head based upon the susceptibility to PWSCC. The NRC amended EA-03-009 in a second order dated February 20, 2004, to more clearly define the applicable requirements and to clarify which locations of the upper VHP nozzles were subject inspection (henceforth NRC Order EA-03-009, as amended, will be referred to as "the Order, as amended"). The staff therefore included Entergy Operations Inc., (Entergy's) responses to the Order, as amended, within the scope of its review of the ANO-2 Reactor Vessel Head Penetration AMP.

In RAI B.1.20-1, the staff requested additional clarification on the status of the applicant's implementation of the Order, as amended, for ANO-2. In response to RAI B.1.20-1, the applicant stated that issues that are relevant to current plant operation are being addressed by the existing regulatory process within the present license term rather than deferred until the time of license renewal. Consequently, the existing regulatory process provides assurance that ongoing interaction between Entergy and the NRC staff is occurring to ensure appropriate measures are included in the Reactor Vessel Head Penetration Program in response to the Order, as amended, and subsequent relevant industry experience and regulatory requirements.

In addition, the applicant stated that the Reactor Vessel Head Penetration Program identifies both visual and volumetric examination in accordance with the requirements of the Order, as amended, and will be modified as appropriate to include measures taken to implement evolving commitments in response to industry experience and regulatory requirements.

The actions that were required by the Order, as amended, have been evaluated by the staff. The bases for the staff's acceptance of the applicant's request for relaxation of certain requirements of the Order, as amended, are provided in NRC safety evaluations dated October 2, 2003 (Vent Line Nozzle Relaxation Approval), October 9, 2003 (CEDM Nozzles Relaxation Approval), October 9, 2003 (Incore Instrumentation Nozzles Relaxation Approval), and October 9, 2003 (Bare Metal Visual Relaxation Approval). Therefore, the staff finds the applicant's response to RAI B.1.20-1 and the applicant's Reactor Vessel Head Penetration AMP are acceptable and considers this issue closed.

FSAR Supplement

The applicant provided the following UFSAR Supplement summary description for the Reactor Vessel Head Penetration Program in Section A.2.1.21 of the ANO-2 LRA:

> The Reactor Vessel Head Penetration Program manages cracking of nickel based alloy reactor vessel head penetrations exposed to borated water to assure that the pressure boundary function is maintained. The program consists of both visual and volumetric examinations in accordance with NRC Order EA-03-009. In addition, the program includes ANO-2 commitments in response to NRC Generic Letter 97-01. The program will be modified as appropriate to implement evolving commitments in response to industry experience and regulatory requirements. The Inservice Inspection (Section A.2.1.15) and Water Chemistry Control Programs (Section A.2.1.33) are used in conjunction with this program to manage cracking of the reactor vessel head penetrations.

The applicant's FSAR Supplement summary description for the Reactor Vessel Head Penetration Program is consistent the applicant's obligations imposed by the Order, as amended. Since the FSAR Supplement summary description is current with the CLB for the facility, the staff finds the FSAR Supplement summary description for the Reactor Vessel head Penetration Program to be acceptable.

Conclusion

The staff has reviewed the Reactor Vessel Head Penetration Program, as discussed in Section B.1.20 of the ANO-2 LRA. On the basis of its review of the applicant's program, as described above, the staff finds that those portions of the program for which the applicant claims consistency with the GALL program are consistent with the GALL program. In addition, for the reasons set forth above, the staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the UFSAR Supplement summary description for this AMP, as described in Section A.2.1.21 of the ANO-2 LRA, and finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

For all the other AMP's reviewed in this section, the staff confirmed the applicant's claim of consistency. Details of the staff's evaluation of the audit and review are documented in the ANO-2 Audit and Review Report. The staff determined that these AMPs are consistent with the AMPs described in the GALL Report, including the associated operating experience attribute.

In Appendix A of the LRA, the applicant provided the Updated Final Safety Analysis Report (UFSAR) supplement required by 10 CFR 54.21(d). The applicant will incorporate the information presented in Appendix A into the UFSAR as Chapter 18 following the issuance of the renewed operating licenses. The staff reviewed the information in Appendix A and verified that the information in the UFSAR supplement provides an adequate summary of the program activities. The staff reviewed the following sections of Appendix A of the LRA.

- Section A.2.1.5 of the LRA for the Cast Austenitic Stainless Steel (CASS) Evaluation Program
- Section A.2.1.6 of the LRA for the Containment Leak Rate Program
- Section A.2.1.8 of the LRA for the Environmental Qualification (EQ) of Electric Components Program
- Section A.2.1.12 of the LRA for the Flow-Accelerated Corrosion Program
- Section A.2.1.16 of the LRA for the Non-EQ Inaccessible Medium-Voltage Cable Program
- Section A.2.1.17 of the LRA for the Non-EQ Insulated Cables and Connections Program
- Section A.2.1.21 of the LRA for the Reactor Vessel Head Penetration Program
- Section A.2.1.23 of the LRA for the Reactor Vessel Internals Cast Austenitic Stainless Steel Components Program

- Section A.2.1.24 of the LRA for the Reactor Vessel Internals Stainless Steel Plates, Forgings, Welds, and Bolting Program
- Section A.2.1.26 of the LRA for the Steam Generator Integrity Program
- Section A.2.1.27 of the LRA for the Structures Monitoring – Masonry Wall Program
- Section A.2.1.28 of the LRA for the Structures Monitoring – Structures Monitoring Program
- Section A.2.1.33 of the LRA for the Water Chemistry Control – Primary and Secondary Water Chemistry Control Program

The applicant provided the following UFSAR Supplement summary description for the Reactor Vessel Internal Cast Austenitic Stainless Components AMP in Section A.2.1.23 of the ANO-2 LRA:

> The Reactor Vessel Internals Cast Austenitic Stainless Steel (CASS) Program will manage aging effects of cast austenitic stainless steel reactor vessel internals components. This program will supplement the reactor vessel internals inspections required by the ASME Section XI Inservice Inspection Program. The program will manage cracking, reduction of fracture toughness, and dimensional changes using inspections of applicable components which will be determined based on the neutron fluence and thermal embrittlement susceptibility of the component. The Reactor Vessel Internals Cast Austenitic Stainless Steel Program will be initiated prior to the period of extended operation.

The applicant provided the following UFSAR Supplement summary description for the Reactor Vessel Internals Stainless Steel Plates, Forgings, Welds, and Bolting Program in Section A.2.1.24 of the ANO-2 LRA:

> The Reactor Vessel Internals Stainless Steel Plates, Forgings, Welds, and Bolting Program will manage aging effects of reactor vessel internals plates, forgings, welds, and bolting. This program will supplement the reactor vessel internals inspections required by the ASME Section XI Inservice Inspection Program. This program will manage the effects of crack initiation and growth due to stress corrosion cracking or irradiation assisted stress corrosion cracking, loss of fracture toughness due to neutron irradiation embrittlement, and distortion due to void swelling. This program will provide visual inspections and non-destructive examinations of reactor vessel internals. The Reactor Vessel Internals Stainless Steel Plates, Forgings, Welds, and Bolting Program will be initiated prior to the period of extended operation.

The staff noted that the water chemistry system and the enhanced examination of non-bolted components are not discussed In LRA UFSAR Supplement, Section A.2.1.24 as is recommended in NUREG-1800, Table 3.1-2, page 3.1-27, for GALL AMP XI.M16, "PWR Vessel Internals." In RAI B.1.23-2, the staff requested that the applicant revise LRA Section A.2.1.24 to be consistent with Table 3.1-2 of NUREG-1800 (page 3.1-27).

In response to RAI B.1.23-2 the applicant stated that control of ANO-2 primary water chemistry in accordance with the appropriate EPRI guidelines is discussed in the Water Chemistry Control Program section of the UFSAR Supplement, Section A.2.1.33. As indicated in LRA Table 3.1.2-2, the Water Chemistry Control Program applies to reactor vessel internals items. Therefore, UFSAR Supplement Section A.2.1.33. is an acceptable alternative summary description for describing the mitigative effect of the Water Chemistry Program on potential corrosive degradation mechanisms for the RV internal components.

On the basis of its audit, the staff finds that those programs for which the applicant claimed consistency with the GALL Report are consistent with the AMPs described in the GALL Report. Details of the staff's evaluation of the audit and review are documented in the ANO-2 Audit and Review Report.

The staff concludes that for the AMPs listed above, the applicant has demonstrated that the effects of aging can be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff reviewed the associated UFSAR supplements for these AMPs and concludes that the UFSAR supplements provide an adequate summary description of the programs, as required by 10 CFR 54.21(d).

3.0.3.2 AMPs that are Consistent with the GALL Report with Exceptions and/or Enhancements

In Appendix B of the LRA, the applicant indicated that the following AMPs were consistent with the GALL Report with exceptions and/or enhancement.

- Boric Acid Corrosion Prevention Program (B.1.3)
- Buried Piping Inspection Program (B.1.4)
- Diesel Fuel Monitoring Program (B.1.7)
- Fatigue Monitoring Program (B.1.9)
- Fire Protection and Fire Water System Program (B.1.10.1 and B.1.10.2)
- Reactor Vessel Integrity Program (B.1.21)
- Service Water Integrity Program (B.1.24)
- Water Chemistry Control - Closed Cooling Water Chemistry Control Program (B.1.30.2)

For AMPs that the applicant claimed are consistent with the GALL Report with exceptions and/or enhancement, the staff performed an audit to determine whether those elements or features of the program for which the applicant claimed consistency with the GALL Report were indeed consistent. Furthermore, the staff reviewed the exceptions and/or enhancement and its justification to determine whether the AMP, with the exceptions and/or enhancement, remains adequate to manage the aging effects for which it is credited. Details of the staff's evaluation of the audit and review are documented in the ANO-2 Audit and Review Report. The staff also reviewed the exceptions and/or enhancements to the GALL Report to determine whether they were acceptable. The results of the staff's audit and review are documented in the following sections of this SER.

3.0.3.2.1 Boric Acid Corrosion Prevention Program

<u>Summary of Technical Information</u>

The applicant credits the Boric Acid Corrosion Prevention Program with aging management of boric acid-induced corrosion of carbon steel and low alloy steel components and discusses this program is Section B.1.3 of the ANO-2 LRA. The applicant identified this program as a program that was consistent with the GALL Report and stated that this program was consistent with the corresponding program discussed in GALL AMP XI.M10, "Boric Acid Corrosion," with the following enhancements:

- The program scope will be revised to include identification and evaluation of the effects of borated water leakage on electrical components in addition to ferritic steel.

- The program acceptance criteria will be revised to address electrical components in addition to ferritic steel.

The applicant also include an applicable UFSAR Supplement summary description for the Boric Acid Corrosion Prevention Program in Section A.2.1.3 of the ANO-2 LRA.

<u>Staff Evaluation</u>

The staff reviewed the information provided in Section B.1.3 of Appendix B to the LRA and compared the program description for the Boric Acid Corrosion Prevention Program to the 10 program elements in GALL AMP XI.M10, "Boric Acid Corrosion," which provide detailed programmatic characteristics and criteria that the staff considers to be necessary to manage boric acid-induced corrosion of low alloy steel and carbon steel RCS components.

In RAI B.1.3-1, the staff requested that the applicant provide the basis for the proposed acceptance criteria that will be developed as part of the following enhancement to the Boric Acid Corrosion Prevention AMP:

- The program scope will be revised to include identification and evaluation of the effects of borated water leakage on electrical components in addition to ferritic steel.

- The program acceptance criteria will be revised to address electrical components in addition to ferritic steel.

In response to RAI B.1.3-1, the applicant stated that NUREG-1801 will be the basis for the acceptance criteria for electrical components exposed to boric acid. In accordance with "Acceptance Criteria" of NUREG-1801, Section XI.M10, acceptance criteria will be the absence of any detected leakage or crystal buildup. If identified during inspections, evidence of leakage or crystal buildup will be evaluated to determine the need for corrective actions prior to continued service. The acceptance criteria will apply to electrical components as well as ferritic steel components. The staff finds the response acceptable and considers this issue closed.

The applicant retains the program description of the Boric Acid Corrosion Prevention Program, as well as the descriptions of the program's 10 elements, on record at the ANO-2 facility.

Operating Experience

In the Operating Experience Section of B.1.3, Boric Acid Corrosion Prevention, the applicant states that recent industry events regarding RV head degradation required assessments at each ANO site to ensure that the Boric Acid Corrosion Prevention Programs for ANO-1 and ANO-2 are adequate and functioning effectively. The applicant also states that a self assessment was performed in February 2003, and no significant findings were identified during this assessment. In RAI B.1.3-2, the staff requested additional information on how program revisions have incorporated lessons learned from the Davis Besse vessel head degradation and the control rod drive mechanism penetration cracking discussed in Bulletins 2001-01, 2002-01, 2002-02, and Order EA-03-009. The staff also requested a discussion on implementation of corrective actions in the program which would prevent reoccurrences of degradation caused by boric acid leakage, as addressed in Generic Letter 88-05.

In response to B.1.3-2 the applicant stated that the Boric Acid Corrosion Prevention Program addresses the loss of material of carbon and low-alloy steel components exposed to a treated (borated) water environment. An assessment performed in 2003 concluded that the ANO-2 Boric Acid Corrosion Prevention Program was sufficient to detect loss of material by boric acid wastage of the RV head in the event of leaking CEDM penetrations. However, ANO-2 does not rely on leak detection through the Boric Acid Corrosion Prevention Program to manage cracking of CEDM penetrations. The ANO-2 Reactor Vessel Head Penetration Program described in Section B.1.20 of the LRA addresses RV head degradation and CEDM penetration cracking as discussed in the referenced NRC Bulletins and NRC Order EA-03-009. Measures taken in response to NRC Order EA-03-009 and its successors carry forward into the period of extended operation.

The applicant also stated that the ANO-2 Boric Acid Corrosion Prevention Program is consistent with NUREG-1801, Section XI.M.10 and ANO-2 commitments in response to NRC Generic Letter 88-05. ANO-2 applies the requirements of 10 CFR 50, Appendix B to the Boric Acid Corrosion Prevention Program through the ANO-2 Corrective Action Program.

It should be noted that NRC Bulletin 2004-01, "Inspection of Alloy 82/182/600 Materials Used in the Fabrication of Pressurizer Penetrations and Steam Space Piping Connections at Pressurized-Water Reactors," was issued on May 28, 2004. Bulletin 2004-01 summarizes industry experience, and has demonstrated that Alloy 600 base metal and Alloy 82/182 weld components used in pressurizer penetration nozzles and steam space piping connections may be susceptible to PWSCC and consequential reactor coolant leakage.

The staff and the industry are currently pursuing resolution of the issues raised and discussed in NRC Bulletin 2004-01 on PWSCC and reactor coolant leakage in pressurizer penetration nozzles and steam space piping connections. Because this is an emerging issue that has yet to be resolved, but will be resolved during the current operating terms for ANO-2, consideration of these issues is beyond the scope of this license renewal review, pursuant to 10 CFR54.30(b).

On the basis of its review of the above operating experience and on discussions with the applicant's technical staff, the staff concludes that AMP B.1.3 adequately manages the aging effects that have been observed at the applicant's plant.

UFSAR Supplement

The applicant provided the following UFSAR Supplement summary description for the Boric Acid Corrosion Prevention Program in Section A.2.1.3 of the ANO-2 LRA:

> The Boric Acid Corrosion Prevention Program relies on implementation of recommendations of NRC Generic Letter (GL) 88-05 to monitor the condition of ferritic steel and electrical components on which borated water may leak. The program will detect borated water leakage by periodic visual inspection of borated water containing systems for deposits of boric acid crystals and the presence of moisture. This program will manage loss of material, loss of mechanical closure integrity, and corrosion of connector surfaces.

The applicant's program description for the Boric Acid Corrosion Prevention Program is consistent with the corresponding FSAR Supplement summary description for GALL AMP XI.M10, "Boric Acid Corrosion," as described in Table 3.1-2 of the SRP-LR, and is therefore acceptable.

Conclusion

The staff has reviewed the Boric Acid Corrosion Prevention Program, as discussed in Section B.1.3 of the ANO-2 LRA. The staff finds this AMP acceptable because the program has been effectively managing aging effects in all applicable SSCs constructed of carbon steel, low-alloy steel, and other susceptible materials that may be affected by borated water leakage. On the basis of its review of the applicant's program, the staff finds that those portions of the for which the applicant claims consistency with the GALL program are consistent with the GALL program. In addition, the staff has reviewed the enhancements to the GALL program and finds that the applicant has demonstrated that the effects of aging can be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the UFSAR Supplement summary description for this AMP, as described in Section A.2.1.3 of the ANO-2 LRA, and finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.2 Buried Piping Inspection

Summary of Technical Information in the Application

The applicant's buried piping inspection program is described in LRA Section B.1.4, "Buried Piping Inspection." In the LRA, the applicant stated that this is a new program that will be initiated prior to the period of extended operation. This program will be consistent, with exceptions, with GALL AMP XI.M34, "Buried Piping and Tanks Inspection." This AMP is credited with preventive measures to mitigate corrosion and with inspections to manage the effects of corrosion on the pressure-retaining capability of buried carbon steel components.

Staff Evaluation

During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report. Details of the staff's evaluation of the audit and review are documented in the ANO-2 Audit and Review Report. Furthermore, the staff reviewed the exceptions and their justifications to determine whether the AMP, with the exceptions, remains adequate to manage the aging effects for which it is credited.

In Appendix B, Section B.1.4, of the LRA, the applicant stated that the buried piping inspection program will include (a) preventive measures to mitigate corrosion and (b) inspections to manage the effects of corrosion on the pressure-retaining capability of buried carbon steel components. Preventive measures will be in accordance with standard industry practice for maintaining external coatings and wrappings. Buried components will be inspected when excavated during maintenance. With the following exceptions, which will be initiated prior to the period of extended operation, the applicant stated that the buried piping inspection program will be consistent with GALL AMP XI.M34:

Element: 1: Scope of Program
Exception: (1) Buried valves and bolting that are not included in the GALL AMP will be inspected as part of this AMP.
(2) Tanks will not be inspected.

Element: 4: Detection of Aging Effects
Exception: Buried components will be inspected only when excavated during maintenance activities, not based on a scheduled inspection frequency.

In the LRA, the applicant stated the buried piping inspection program will include buried valves and bolting that are not included in the GALL AMP. The applicant stated that the additional components are of the same material, exposed to the same environment, and are expected to have the same aging effects as the other components covered by this AMP. Thus, the effects of aging will be identified prior to loss of intended function regardless of component type. In addition, the applicant stated that there are no buried tanks subject to an AMR.

In addition, the buried piping inspection program will require inspections of the buried components only when excavated during maintenance activities, which is inconsistent with the GALL AMP. The applicant stated that excavating such components solely to perform inspections poses undue risk of damage to protective coatings. Operating experience shows that the frequency of excavating buried components for maintenance activities is sufficient to provide assurance that the effects of aging will be identified prior to loss of intended function.

The staff finds that including the buried valves and bolting within the program scope is acceptable because they are the same material, exposed to the same environment, and are expected to have the same aging effects as the carbon steel piping covered by the buried piping inspection program. Because none of the ANO-2 buried tanks are within the scope of license renewal and subject to an AMR, the staff finds excluding buried tanks for inspection to be acceptable as well.

The GALL Report program description in Section XI.M34 recommends further evaluation of an applicant's operating experience with buried components in determinations of the adequacy of this program element. The staff reviewed the ANO-2 operating experience with excavations over the past few years and, based on the review as well as the applicant's discussion of this exception in the LRA, the staff finds that the frequency of excavating buried components for maintenance activities will be sufficient to provide assurance that the effects of aging will be identified prior to loss of intended function. Excavating such components solely to perform inspections could pose undue risk of damage to protective coatings. The staff finds that this exception is acceptable.

On the basis of its review of this AMP, the associated engineering report, and the operating experience, the staff determined that the buried piping inspection program is consistent with the GALL Report and that the exceptions in the buried piping inspection program are acceptable.

Operating Experience

The applicant stated that there have been multiple excavations at the site which provide some plant-specific operating experience even though the buried piping inspection program is a new program.

The staff reviewed the documentation for multiple excavations performed at the site for several maintenance activities. These excavations indicate that corrosion has not been a problem.

During the audit, the staff asked the applicant to clarify and/or provide the operating experience reviews for new programs. In its response, the applicant stated that the plant corrective action program, which captures internal and external plant operating experience issues, provides assurance that operating experience will be reviewed and incorporated in the future to provide objective evidence to support the conclusion that the effects of aging will be adequately managed.

On the basis of its review of the above operating experience and the applicant's response, and on discussions with the applicant's technical staff, the staff concludes that the buried piping inspection program will adequately manage the aging effects that have been observed at the applicant's plant.

UFSAR Supplement

In Appendix A, Section A.2.1.4, of the LRA, the applicant provided the UFSAR supplement for the buried piping inspection program. The staff reviewed this section and determined that the information in the UFSAR supplement provides an adequate summary of the program activities. The staff finds this section of the UFSAR supplement sufficient.

Conclusion

On the basis of its review and audit of the applicant's program, the staff finds that those elements of the program for which the applicant claimed consistency with the GALL Report program are consistent with the GALL Report program. In addition, the staff has reviewed the exceptions to the GALL Report program and finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the UFSAR supplement for this AMP and finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.3 Diesel Fuel Monitoring

Summary of Technical Information in the Application

The applicant's diesel fuel monitoring program is described in LRA Section B.1.7, "Diesel Fuel Monitoring." In the LRA, the applicant stated that the program is consistent with, but includes exceptions to, GALL AMP XI.M30, "Fuel Oil Chemistry Program." This AMP is credited with ensuring that adequate diesel fuel quality is maintained to prevent plugging of filters, fouling of injectors, and corrosion of the fuel systems.

Staff Evaluation

During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report. Details of the staff's evaluation of the audit and review are documented in the ANO-2 Audit and Review Report. Furthermore, the staff reviewed the exceptions and their justifications to determine whether the AMP, with the exceptions, remains adequate to manage the aging effects for which it is credited.

In Appendix B, Section B.1.7, of the LRA, the applicant stated the following exceptions to GALL AMP XI.M30:

Element: 2: Preventive Actions
Exception: No additives are used (other than biocide) beyond what the refiner adds during production.

Elements: 3: Parameters Monitored/Inspected
6: Acceptance Criteria
Exceptions: (1) Only American Society for Testing Materials (ASTM) standard D 1796 is used for determination of water and sediment, rather than standards D 1796 and D 2709.
(2) The LRA AMP specifies the method of ASTM standard D 2276 with 0.8 μm filter, instead of the modified ASTM standard D 2276, Method A, with a 3 μm filter.

Element: 4: Detection of Aging Effects
Exception: The program does not include ultrasonic measurements of tank bottoms.

The GALL Report identifies the following criterion for the preventive actions program element associated with the exception taken:

> The quality of fuel oil is maintained by additions of biocides to minimize biological activity, stabilizers to prevent biological breakdown of the diesel fuel, and corrosion inhibitors to mitigate corrosion.

The applicant stated that the #2 diesel fuel used at ANO-2 contains a comprehensive additive package. On the basis of its review of operating experience for the ANO-2 diesel fuel monitoring program (see discussion below), the staff finds this exception to be acceptable.

The GALL Report recommended the following criteria: (1) ASTM standard D 4057 is used for guidance on oil sampling and (2) ASTM standards D 1796 and D 2709 are used for determination of water and sediment contamination in diesel fuel. The staff determined that of the three standards recommended by the GALL Report, only the guidance presented in ASTM standard D 1796 applies to fuel oils with the viscosity of that used at ANO-2, and therefore finds this exception to be acceptable.

The guidance in the GALL Report concerning the use of modified ASTM standard D 2276, Method A, recommends a maximum pore size for determination of particulates. Use of a filter with a smaller pore size would not increase the likelihood that aging effects would go undetected and thus potentially affect the ability of components to perform their intended functions consistent with the CLB during the period of extended operation. The staff finds that the applicant's use of ASTM standard D 2276, which specifies the use of a filter with a smaller 0.8 μm pore size than that recommended in ASTM standard D 2276, Method A, is acceptable since the use of a 0.8 μm filter is more conservative than use of the 3.0 μm filter specified in the GALL Report.

The GALL Report states that corrosion may occur at locations in which contaminants may accumulate, such as a tank bottom, and an ultrasonic thickness measurement of the tank bottom surface ensures that significant degradation is not occurring.

The staff reviewed recent fuel oil operating experience and determined that compliance with diesel fuel oil standards and periodic sampling provide assurance that fuel oil contaminants that cause degradation are below allowable limits. Specifically, the review of recent operating experience did not identify unacceptable levels of water, particulate contamination, or biological fouling in the fuel oil. A review of condition reports did not identify instances of fuel oil system component failures attributed to the condition of the fuel oil. Condition report trending data did not identify a need for improvements to this program. Quarterly assessments are performed to review diesel fuel quality parameters to ensure that acceptance criteria are being met and to identify early indications of problems. In addition, the applicant stated that internal surfaces of tanks that are drained for cleaning are visually inspected for degradation. Based on the above discussion, the staff finds that the exception to preclude ultrasonic measurements of tank bottoms is acceptable.

On the basis of its review of this AMP, the associated engineering report, and the operating experience, the staff determined that this AMP is consistent with the GALL Report and that the exceptions in the diesel fuel monitoring program are acceptable.

Operating Experience

The staff reviewed the operating experience for the diesel fuel monitoring program. The applicant stated that it had experienced fuel oil related problems in 1986. Significant program improvements were implemented as a result of these events. One of the recommendations addressed the addition of an oxidation inhibitor to stored fuel. This is consistent with the need for adding corrosion inhibitors.

The staff's review of recent operating experience did not identify unacceptable levels of water, particulate contamination, or biological fouling in the fuel oil. A review of condition reports did not identify instances of fuel oil system component failures attributed to the condition of the fuel oil. Condition report trending data did not identify a need for improvements to this program. In addition, the applicant stated that it will perform quarterly assessments to review diesel fuel quality parameters to ensure that acceptance criteria are being met and to identify early indications of problems.

On the basis of its review of the above operating experience and on discussions with the applicant's technical staff, the staff concludes that diesel fuel monitoring program adequately manages the aging effects that have been observed at the applicant's plant.

UFSAR Supplement

In Appendix A, Section A.2.1.7, of the LRA, the applicant provided the UFSAR supplement for the diesel fuel monitoring program. The staff reviewed this section and determined that the information in the UFSAR supplement provides an adequate summary of the program activities. The staff finds this section of the UFSAR supplement sufficient.

Conclusion

On the basis of its review and audit of the applicant's program, the staff finds that those elements of the program for which the applicant claimed consistency with the GALL Report program are consistent with the GALL Report program. In addition, the staff has reviewed the exceptions to the GALL Report program and finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the UFSAR supplement for this AMP and finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.4 Fatigue Monitoring Program

Summary of Technical Information in the Application

The applicant's fatigue monitoring program is described in LRA Section B.1.9, "Fatigue Monitoring." In the LRA, the applicant stated that the program is consistent with, but includes exceptions to, GALL AMP XI.M1, "Metal Fatigue of Reactor Coolant Pressure Boundary." This AMP is credited with tracking the number of critical thermal and pressure transients for selected reactor coolant system components.

Staff Evaluation

During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report. Details of the staff's evaluation of the audit and review are documented in the ANO-2 Audit and Review Report. Furthermore, the staff reviewed the exceptions and their justifications to determine whether the AMP, with the exceptions, remains adequate to manage the aging effects for which it is credited.

In Appendix B, Section B.1.9, of the LRA, the applicant stated the following exceptions to GALL AMP XI.M1:

Element: 2: Preventive Actions
Exception: The program only involves tracking the number of transient cycles.

Element: 4: Detection of Aging Effects
Exception: The program does not provide for periodic update of fatigue usage calculations. Corrective actions are initiated only when the number of accumulated cycles approaches the number of component design cycles.

The GALL Report states that maintaining the fatigue usage factor below the design code limit and considering the effect of the reactor water environment will provide adequate margin against fatigue cracking of RCS components due to anticipated cyclic strains.

The effect of the reactor water environment on fatigue is addressed as a TLAA in the LRA, Section 4.3.3.1 (Generic Safety Issue 190). The staff's evaluation of this is addressed in Section 4 of this SER.

The GALL Report states that the program provides for periodic update of the fatigue usage calculations. The applicant stated that updates of fatigue usage calculations, as recommended in the GALL Report, are not necessary unless the number of accumulated fatigue cycles approaches the number of assumed design cycles, and commits to implement corrective actions at that time. This is an alternative method for ensuring that the design code limit is not exceeded.

On the basis of its review of this AMP, the associated engineering report, and the operating experience, the staff determined that this AMP is consistent with the GALL Report and that the exceptions in the fatigue monitoring program are acceptable.

Operating Experience

The staff reviewed operating experience for the fatigue monitoring program. The applicant issues quarterly reports documenting operating history, the total number of critical types of transients, and the design limits. Condition report trending data does not reveal a need for improvements to this program. The number of pressure and temperature transient cycles is monitored and periodically compared with the design cycle count, as required by the program, to ensure that fatigue-sensitive components do not exceed their allowable number of design cycles. Based on the above discussion, the staff finds the exception to preclude the periodic update of fatigue usage calculations and that corrective actions are initiated only when the number of accumulated cycles approaches the number of component design cycles to be acceptable.

On the basis of its review of the above operating experience and on discussions with the applicant's technical staff, the staff concludes that AMP B.1.9 is sufficient to support the management of the aging effects of fatigue that has been monitored and predicted at the applicant's plant.

UFSAR Supplement

In Appendix A, Section A.2.1.9, of the LRA, the applicant provided the UFSAR supplement for the fatigue monitoring program. The staff reviewed this section and determined that the information in the UFSAR supplement provides an adequate summary of the program activities. The staff finds this section of the UFSAR supplement sufficient.

Conclusion

On the basis of its review and audit of the applicant's program, the staff finds that those elements of the program for which the applicant claimed consistency with the GALL program are consistent with the GALL program. In addition, the staff has reviewed the exceptions to the GALL program and finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the UFSAR supplement for this AMP and finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.5 Fire Protection Program

The applicant's fire protection program is described in LRA Section B.1.10, "Fire Protection." The AMP comprises two programs: Fire Protection and Fire Water System. Each program is discussed below.

3.0.3.2.5.1 Fire Protection

Summary of Technical Information in the Application

The applicant's fire protection is described in LRA Section B.1.10.1, "Fire Protection." In the LRA, the applicant stated that the program is consistent with, but includes exceptions to, GALL program XI.M26, "Fire Protection." This AMP is credited with performing periodic inspections and functional tests of the fire barriers and a diesel-driven fire pump to ensure that the operability of the fire barriers is maintained and that the fire pump fuel supply line can perform the intended function, respectively.

Staff Evaluation

During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report. Details of the staff's evaluation of the audit and review are documented in the ANO-2 Audit and Review Report. Furthermore, the staff reviewed the exceptions and their justifications to determine whether the AMP, with the exceptions, remains adequate to manage the aging effects for which it is credited.

In Appendix B, Section B.1.10.1, of the LRA, the applicant stated the following exceptions to GALL AMP XI.M26:

Element: 3: Parameters Monitored/Inspected

Exceptions: (1) Fire doors are inspected and clearances checked annually, not bi-monthly.
(2) Function tests of fire doors are performed annually, not daily, weekly, or monthly.

Elements: 1: Scope
3: Parameters Monitored/Inspected
4: Detection of Aging Effects
5: Monitoring and Trending
6: Acceptance Criteria

Exception: This program is not necessary to manage aging effects on halon fire protection system components.

The GALL Report identifies the following criteria for the parameters monitored/inspected program element associated with those exceptions taken:

- Hollow metal fire doors are visually inspected at least once bi-monthly for holes in the skin of the door. Fire door clearances are also checked at least once bi-monthly as part of an inspection program.
- Function tests of fire doors are performed daily, weekly, or monthly (which may be plant-specific) to determine the operability of automatic hold-open, release, closing mechanisms, and latches.

The applicant stated that inspection intervals are determined by engineering evaluation to detect degradation of the fire doors prior to the loss of intended function. Interim Staff Guidance (ISG) 04 revised criteria for the GALL AMP XI.M26 parameters monitored/inspected program element to no longer require fire doors to be visually inspected or function tested on a specific frequency. Rather, the applicant can establish a plant-specific interval to determine whether the integrity of door surfaces and for clearances, with plant-specific inspection intervals to be determined by engineering evaluation to detect degradation of the fire doors. The applicant's program meets ISG-04. Therefore, the staff finds this exception to be acceptable.

The GALL Report identifies the following criteria for program elements: scope, parameters monitored/inspected, detection of aging effects, monitoring and trending, and acceptance criteria. These criteria are associated with the exception that the fire protection program is not necessary to manage the aging effects on halon fire protection system components:

(1) The scope of this program includes the management of the aging effects on the intended function of the halon/carbon dioxide fire suppression system.
(2) Periodic visual inspection and function tests are to be performed at least once every six months to examine the signs of degradation of the halon/carbon dioxide fire suppression system.

In LRA Section 3.3.2.1.6 and Table 3.3.2-6, the staff reviewed the halon fire protection and reactor coolant pump motor oil leakage collection system AMR. The applicant credited the *periodic surveillance and preventive maintenance program* with managing the aging effect of loss of material for the halon fire protection system components. The applicant credited the periodic surveillance and preventive maintenance and boric acid corrosion programs with managing the aging effect of loss of material for the RCP motor oil leakage collection system. The staff reviewed the periodic surveillance and preventive maintenance program and finds that its scope includes aging management of components in the halon fire protection and RCP motor oil leakage collection system.

On the basis of its review of the applicant's programs, the staff finds that the boric acid corrosion program and periodic surveillance and preventive maintenance program effectively manage the aging effect of loss of material on halon fire protection system components so that their intended functions will be maintained during the period of extended operation.

The staff concludes that the periodic surveillance and preventive maintenance program, in lieu of the fire protection program, adequately manage the aging effects of halon and RCP motor oil leakage collection system components during the period of extended operation.

On November 1 through 5 and 15 through 19, 2004, the NRC staff performed an AMP inspection at ANO-2. During the inspection, the NRC staff noted that replacement components for valve 2CV-5017-1 stored in the warehouse and required for cold shutdown repair were not included in the scope of license renewal. The inspection staff believed that these components should be in-scope for license renewal and referred to NRR for guidance.

NRR staff evaluated the post-fire cold shutdown replacement components (stem clamp key, stem clamp, set screw) for Low Pressure Safety Injection Valve 2CV-5017-1. During the ANO-2 - NRC License Renewal Aging Management Review Inspection (NRC Inspection Report 05000368/2004-007), conducted November 1-5, 2004, and November 15-19, 2004, the inspectors questioned whether the components should be within the scope of license renewal since the components are safety-related, relied on to perform a function that demonstrates compliance with 10 CFR 50.48, and the status of the components staged in the warehouse for 10 CFR 50.48 use is passive. In response, the applicant conservatively elected to add the spare parts to the scope of license renewal. The applicant credited 10 CFR Part 50, Appendix B, Criterion XIII for managing the aging of the spare parts. The staff agreed that this program addresses the immediate and ongoing serviceability of the replacement components and will adequately manage the aging effects of the spare parts during the period of extended operation. This inspection issue is closed.

Operating Experience

The staff reviewed operating experience for the fire protection program. The applicant identified condition report trending data that discovered discrepancies with fire barrier components, and resolved the negative trend data and specific conditions by implementing revised design methods for sealing penetrations.

On the basis of its review of the above operating experience and on discussions with the applicant's technical staff, the staff concludes that AMP B.1.10.1 adequately manages the aging effects that have been observed at the applicant's plant.

UFSAR Supplement

In Appendix A, Section A.2.1.10, of the LRA, the applicant provided the UFSAR supplement for the fire protection program. The staff reviewed this section and determined that the information in the UFSAR supplement provides an adequate summary of the program activities. The staff finds this section of the UFSAR supplement sufficient.

Conclusion

On the basis of its review and audit of the applicant's program, the staff finds that those elements of the program for which the applicant claimed consistency with the GALL program are consistent with the GALL program. In addition, the staff has reviewed the exceptions to the GALL program and finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the UFSAR supplement for this AMP and finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.5.2 Fire Water System

Summary of Technical Information in the Application

The applicant's fire water system is described in LRA Section B.1.10.2, "Fire Water System." In the LRA, the applicant stated that the program is consistent with, but includes an exception and enhancement to, GALL AMP XI.M27, "Fire Service Water." This AMP is credited with performing periodic inspections and functional tests of the fire barriers and a diesel-driven fire pump to ensure that the operability of the fire barriers is maintained and that the fuel supply line can perform the intended function, respectively.

Staff Evaluation

During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report. Details of the staff's evaluation of the audit and review are documented in the ANO-2 Audit and Review Report. Furthermore, the staff reviewed the exception and its justification, and the enhancement, to determine whether the AMP, with the exception and enhancement, remains adequate to manage the aging effects for which it is credited.

In Appendix B, Section B.1.10.2, of the LRA, the applicant stated the following exception to GALL AMP XI.M27:

Element: 3: Parameters Monitored/Inspected

Exception: The applicant does not implement NRC Generic Letter (GL) 89-13, "Service Water System Problems Affecting Safety-Related Equipment," commitments in the fire water system program.

The GALL Report identifies the following criterion for the parameters monitored/inspected program element associated with the exception taken:

> GL 89-13 recommends periodic flow testing of infrequently used loops of the fire water system at the maximum design flow to ensure that the system maintains its intended function.

The applicant verifies that every fire main segment (excluding individual system supplies) is clear of obstruction by performing a full-flow test at least once every three years. ISG-04 revised criteria for the GALL AMP XI.M27 parameters monitored/inspected program element to no longer recommend use of GL 89-13 in determining the system's ability to maintain pressure and internal system corrosion conditions. Rather, ISG-04 recommends either periodic flow testing of the fire water system using the guidelines of National Fire Protection Association (NFPA) 25, Chapter 13, Annexes A and D, at the maximum design flow, or periodic wall thickness evaluations to ensure that the system maintains its intended function. On the basis of the applicant's commitment to test fire water system components in accordance with the applicable NFPA codes and standards, the staff finds that this exception meets the criteria of ISG-04 and is, therefore, acceptable.

In Appendix B, Section B.1.10.2, of the LRA, the applicant stated the enhancement to GALL AMP XI.M27:

Elements: 1: Scope of Program
4: Detection of Aging Effects

Enhancement A sample of sprinkler heads will be inspected using the guidance of NFPA 25, Section 2.3.3.1. The NFPA 25 also contains guidance to repeat this sampling every 10 years after the initial field service testing.

The GALL Report identifies the following criterion for the scope of program and detection of aging effects program elements associated with the enhancement:

> Sprinkler systems are inspected once every refueling outage to ensure that signs of degradation, such as corrosion, are detected in a timely manner.

ISG-04 revised criteria for the GALL AMP XI.M27 detection of aging effects program element to recommend sprinkler head inspections before the end of the 50-year sprinkler head service life and at 10-year intervals thereafter during the extended period of operation to ensure that signs of degradation are detected in a timely manner. On the basis of the revised GALL criteria in ISG-04 and the applicant's commitment to rely upon applicable codes and standards to develop test procedures, the staff finds this enhancement to be acceptable.

On the basis of its review of the fire protection and fire water system, the associated engineering report, and the operating experience, the staff determined that the fire protection program is consistent with the GALL Report and that the exceptions and enhancement in the fire protection program are acceptable.

Operating Experience

The staff reviewed operating experience for the fire water system program. Trending data did not identify a need for improvement to this program. The applicant has incorporated industry operating experience regarding the opening of "wet" fire protection systems. Operating experience shows that opening fire protection systems results in oxygenation of the water, leading to increased corrosion of the pipe. The applicant revised its quarterly test requirements for fire protection systems such that they will not open system piping during these tests. The staff reviewed the results and confirmed that no significant aging of fire protection components was identified in the review.

On the basis of its review of the above operating experience and on discussions with the applicant's technical staff, the staff concludes that AMP B.1.10.2 adequately manages the aging effects that have been observed at the applicant's plant or at other nuclear plants.

UFSAR Supplement

In Appendix A, Section A.2.1.10, of the LRA, the applicant provided the UFSAR supplement for the fire protection program. In Section A.2.1.11 the applicant provides the UFSAR supplement for the fire water system program. The staff reviewed these sections and determined that the information in the UFSAR supplements provides an adequate summary of the program activities. The staff finds these sections of the UFSAR supplement sufficient.

Conclusion

On the basis of its review and audit of the applicant's program, the staff finds that those elements of the program for which the applicant claimed consistency with the GALL Report program are consistent with the GALL Report program. In addition, the staff has reviewed the exceptions and enhancement to the GALL Report program and finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the UFSAR supplements for this AMP and finds that they provide an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.6 Reactor Vessel Integrity

Summary of Technical Information in the Application

The applicant credits the Reactor Vessel Integrity AMP with the monitoring of the fracture toughness properties for the ferritic (low alloy steel) base metal and weld materials in the ANO-2 RV. The applicant describes the Reactor Vessel Integrity AMP in Section B.1.21 of the ANO-2 LRA and identifies that the AMP is consistent with the program attributes discussed in GALL AMP XI.M31, "Reactor Vessel Surveillance," with the following enhancement:

- The ANO-2 specimen capsule withdrawal schedule will be revised to withdraw and test a standby capsule to cover the peak fluence expected through the end of the period of extended operation.

Staff Evaluation

Criteria for the first 40 years are specified in 10 CFR Part 50, Appendix H (henceforth Appendix H), "Reactor Vessel Materials Surveillance Program," for monitoring changes in the fracture toughness of ferritic materials in the reactor beltline region due to neutron irradiation and the thermal environment. Appendix H requires that the surveillance program design and withdrawal schedule for the RV surveillance capsules must meet the requirements of American Society for Testing and Materials (ASTM) E-185, "Standard Practice for Conducting Surveillance Tests for Light Water Cooled Nuclear Power Vessels."

Regulatory Guide (RG) 1.99, Revision 2, "Radiation Embrittlement of Reactor Vessel Materials (May 1988)," describes general procedures acceptable to the NRC staff for calculating the effects of neutron irradiation embrittlement of the low-alloy steels used for light-water-cooled RVs. Surveillance data from the Appendix H program are used in RG 1.99, Revision 2 calculations, if applicable. The surveillance data is monitored and trended in accordance with RG 1.99, Revision 2, and RG 1.190, "Calculational and Dosimetry Methods for Determining Pressure Vessel Neutron Fluence (March 2001)". The fluence was calculated using the methodology reported in the Babcock and Wilcox report BAW-2241P-A, Revision 1, "Fluence and Uncertainty Methodologies," which was published in April 1999. This methodology has been approved by the NRC Division of Systems, Safety, and Analysis staff and meets the uncertainty requirements of RG 1.190.

The applicant's description of the Reactor Vessel Integrity Program also demonstrates that the program is designed and implemented in compliance with the requirements of 10 CFR Part 50, Appendix H, and ASTM E185-82, "Recommended Practice for Surveillance Tests for Nuclear Reactor Vessels", and discusses how the implementation of the AMP will be used to provide inputs to the structural integrity assessments required under the requirements of 10 CFR Part 50, Appendix G for upper shelf energy (USE) assessments and pressure-temperature (P-T) limit assessments, and the requirements of 10 CFR 50.61 for providing the RV with adequate protection against pressurized thermal shock (PTS) events.[1] However, the applicant did not include a revised RV surveillance capsule withdrawal schedule for ANO-2 to account for the impact of additional neutron fluence exposure that would result from operating through the period of extended operation. The staff is imposing a license condition on the Reactor Vessel Integrity Program to ensure that changes to the AMP, as made to accommodate the extended period of operation, will continue to be reviewed and approved by the staff. The details of this license condition are discussed in the staff's evaluation of the UFSAR Supplement summary description for this AMP, which follows directly after this section. With the addition of this license condition, the staff concludes that applicant's Reactor Vessel Integrity Program is consistent with GALL AMP XI.M31, and will continue to comply with the requirements of 10 CFR Part 50, Appendix H, as amended by the license condition and is acceptable.

Operating Experience

The design of the RV Integrity Program was originally reported to the NRC in Combustion Engineering Topical Report No. A-NLM-005, dated October 30, 1974 and the unirradiated, baseline test data for the ANO-2 RV base metal and weld materials were reported to the NRC in Combustion Engineering Topical Report No. TR-MCD-002, dated March 1976. This topical report indicated that the ANO-2 RV Integrity Program was designed with the RV surveillance capsules identified as Capsules W83, W97, W104, W263, W277 and W284. To date, the applicant has removed two surveillance capsules, Capsules W97 and W104 from the ANO-2 RV in compliance with its 10 CFR Part 50, Appendix H, program. The applicant reported the test results for the plates and welds in the capsules to the NRC in the following topical reports:

- Capsule W97 - data reported in a Batelle Topical Report that was submitted to the NRC in Arkansas Power and Light Company Letter No. 2CAN028503 (February 8, 1985).

- Capsule W104 - data report in Babcock and Wilcox Topical Report BAW-2399, *Analysis of Capsule W-104, Entergy Operations, Inc., Arkansas Nuclear One Unit 2 Power Plant* (September 2001).

The applicant's submittal of these topical reports complied with the test data reporting requirements of Section IV of 10 CFR Part 50, Appendix H.

Section 4.2 of the ANO-2 LRA demonstrates that the applicant has appropriately considered the applicable RV surveillance in the calculations for the TLAAs on neutron irradiation

---

[1] The data from implementation of the Reactor Vessel Integrity Program provide critical fracture toughness data inputs for the applicant's time-limited aging analyses (TLAAs) for USE, PTS, and P-T limits. Refer the staff's evaluations in Section 4.2 of this SER on the related TLAAs on USE, PTS, and P-T limits for the ANO-2 LRA.

embrittlement, including the TLAAs for pressurized thermal shock (PTS) calculations, upper shelf energy (USE) calculations, and pressure-temperature (P-T) limit calculations.
This complies with applicable evaluation criteria in Paragraph §(c))(2) of 10 CFR 50.61 for the TLAA on PTS and in Paragraph §IV.A. of 10 CFR Part 50, Appendix G, for the TLAAs on USE and P-T limits. The staff's evaluations of the TLAAs on PTS, USE, and P-T limits are provided in Section 4.2 of this SER.

On the basis of the review of the above operating experience, the staff concludes that AMP B.1.21 will adequately manage the aging effects that have been observed at the applicant's plant or at other nuclear plants.

UFSAR Supplement

The applicant provides the following UFSAR Supplement summary description for the Reactor Vessel Integrity AMP in Section A.2.1.22 of the ANO-2 LRA:

> The Reactor Vessel Integrity Program manages reduction of fracture toughness of reactor vessel beltline materials to assure that the pressure boundary function of the reactor vessel is maintained. The program is based on ASTM E-185-82, "Standard Recommended Practice for Surveillance Tests for Nuclear Reactor Vessels," and includes an evaluation of radiation damage based on pre-irradiation and post irradiation testing of Charpy V-notch and tensile specimens. Through the Reactor Vessel Integrity Program, reports are submitted as required by 10CFR Part 50 Appendix H.

The applicant's UFSAR Supplement summary description for this AMP provides an acceptable general description of the Reactor Vessel Integrity AMP and the RV surveillance capsule withdrawal schedule for ANO-2 that is implemented as part of the AMP. However, the UFSAR Supplement summary description for this AMP does not include the specific surveillance capsule withdrawal schedule for the period of extended operation. The applicant has three standby capsules (capsules 4, 5, and 6) which can be repositioned to address the applicant's program enhancement. In RAI B.1.21-1, the staff requested that the applicant submit a specific RV surveillance capsule withdrawal schedule through the end of the period of extended operation for staff review and approval. In addition, the staff requested that the applicant revise the UFSAR Table 5.2-12 accordingly.

In response to RAI B.1.21-1, the applicant stated that Capsule 3 is scheduled to be removed at 30 effective full power years (EFPY). The applicant estimated that this capsule will receive approximately 4.9E19 n/cm^2 (E $\geq$ 1.0 MeV) at 30 EFPY, which is slightly less than the expected 48 EFPY fluence of 5.0E19 n/cm^2 (E $\geq$ 1.0 MeV) discussed in the ANO-2 LRA, Section 4.2.2. As discussed in Section B.1.21 of the ANO-2 LRA, the ANO-2 specimen capsule withdrawal schedule will be revised to withdraw and test a standby capsule to cover the peak fluence expected through the end of the period of extended operation. As specified in Note (a) to Table 5.2-12 in the ANO-2 LRA, if required, Capsules 4, 5, or 6 will be repositioned to address the applicant's program enhancement. Alternatively, Entergy may decide to delay the withdrawal of Capsule 3 to cover the period of extended operation and would, at that time, notify the NRC of the change to the withdrawal schedule as required by 10 CFR 50, Appendix H.

10 CFR Part 50, Appendix H, requires licensees to submit any proposed changes to their withdrawal schedules to the NRC for review and approval. As mentioned, Table 5.2-12 of the ANO-2 LRA contains a statement that says prior to changing removal intervals, NRC approval is required per 10 CFR 50, Appendix H.

To ensure that this requirement will carry forward after the ANO-2 operating license has been renewed, the staff will impose the following condition in the renewed license for ANO-2 that requires Entergy to submit any further changes to the surveillance capsule withdrawal schedule for NRC review and approval:

> All capsules in the reactor vessel that are removed and tested must meet the test procedures and reporting requirements of ASTM E 185-82 to the extent practicable for the configuration of the specimens in the capsule. Any changes to the capsule withdrawal schedule, including spare capsules, must be approved by the NRC prior to implementation. All capsules placed in storage must be maintained for future insertion. Any changes to storage requirements must be approved by the NRC.

With the addition of the license condition, the staff finds that the applicant's response to RAI B.1.21-1 and the Reactor Vessel Integrity Program are acceptable, and considers this issue closed.

Conclusion

The staff has reviewed the Reactor Vessel Integrity Program, as discussed in Section B.1.21 of the ANO-2 LRA. On the basis of its review of the applicant's program and with the addition of the license condition discussed above, the staff finds that those portions of the AMP for which the applicant claims consistency with the GALL program are consistent with the GALL program. In addition, the staff has reviewed the enhancements to the GALL program and finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the UFSAR Supplement summary description for this AMP, as described in Section A.2.1.22 of the ANO-2 LRA, and finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.7 Service Water Integrity

Summary of Technical Information in the Application

The applicant's service water integrity program is described in LRA Section B.1.24, "Service Water Integrity." In the LRA, the applicant stated that the program will be consistent with, but include exceptions and an enhancement to, GALL program XI.M20, "Open-Cycle Cooling Water System." This AMP is credited with relying on surveillance and control techniques, based on the recommendations of NRC Generic Letter 89-13, to ensure that the effects of aging on the service water system will be managed for the period of extended operation.

Staff Evaluation

During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report. Details of the staff's evaluation of the audit and review are documented in the ANO-2 Audit and Review Report.. Furthermore, the staff reviewed the exceptions and their justifications, and the enhancement, to determine whether the AMP, with the exceptions and enhancement, remains adequate to manage the aging effects for which it is credited.

In Appendix B, Section B.1.24, of the LRA, the applicant stated the exceptions to GALL AMP XI.M20:

Element:	2: Preventive Actions
Exception:	The SWIP components are lined or coated only as deemed necessary, they are not all lined or coated.

Element:	5: Monitoring and Trending
Exception:	The frequency of inspections and testing is established according to results, the frequency of these activities is not set to commence annually and during refueling outages.

The applicant stated that the service water integrity program uses lining or coating on components as deemed necessary, whereas GALL program XI.M20 requires the system components to be constructed of appropriate materials, and lined or coated for protection of the underlying metal components against aggressive cooling water environments. The applicant stated that it has conducted various inspections of components over time and either upgraded the material of the component such that no coating is required, or coated the components requiring lining or coating. The staff reviewed the service water integrity program and finds that this exception is acceptable.

The applicant stated that the service water integrity program varies the frequency of inspections and testing frequency according to results, whereas GALL program XI.M20 requires annual testing and testing during refueling outages. The staff finds that the difference in inspection and testing frequency is insignificant since aging effects typically manifest over several years. The inspection frequencies are determined based on engineering evaluation of inspection results and in accordance with the applicant's commitments under GL 89-13. The staff finds this exception to be acceptable.

In Appendix B, Section B.1.24, of the LRA, the applicant stated the enhancement to GALL AMP XI.M20:

Element:	4: Detection of Aging Effects
Enhancement:	The program will check for evidence of selective leaching during visual inspections.

The GALL Report identifies the following criterion for the detection of aging effects program element associated with the enhancement:

> Inspections for biofouling, damaged coatings, and degraded material condition are conducted.

During the audit, the staff asked the applicant to provide the technical justification for performing visual inspections without hardness testing to detect selective leaching. In its response, the applicant stated that details on the enhancements to programs to manage loss of material due to selective leaching are provided in clarification letter 2CAN010401, dated January 22, 2004. The applicant committed to providing these details prior to the period of extended operation. The staff finds this acceptable.

On the basis of its review of this AMP, the associated engineering report, and the operating experience, the staff determined that this AMP is consistent with the GALL Report and that the exceptions and enhancement in the service water integrity program are acceptable.

Operating Experience

The staff reviewed correspondence and reports dealing with the applicant's response to GL 89-13 and subsequent activities related to the SW system. This included a sample of condition reports related to the SW system as well as periodic monitoring and trending data.

During the audit, the staff noted that the LRA indicates that minor through wall piping leaks have occurred and the service water components are routinely inspected to ensure loss of material and cracking will not degrade the ability of the service water system to perform its intended function. The staff asked the applicant to provide the type of inspection used to detect the aging effects of loss of material and cracking and the justification for the inspection method.

In its response, the applicant stated that details on the enhancements to programs to manage loss of material due to selective leaching are provided in clarification letter 2CAN010401, dated January 22, 2004. The applicant committed to providing these details prior to the period of extended operation. The staff finds this acceptable.

On the basis of the its review of the above operating experience and on discussions with the applicant's technical staff, the staff concludes that AMP B.1.24 adequately manages the aging effects that have been observed at the applicant's plant.

UFSAR Supplement

In Appendix A, Section A.2.1.25, of the LRA, the applicant provided the UFSAR supplement for the service water integrity program. The staff reviewed this section and determined that the information in the UFSAR supplement provides an adequate summary of the program activities. The staff finds this section of the UFSAR supplement sufficient.

Conclusion.

On the basis of its review and audit of the applicant's program, the staff finds that those elements of the program for which the applicant claimed consistency with the GALL Report program are consistent with the GALL Report program. In addition, the staff has reviewed the exceptions and enhancement to the GALL Report program and finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the UFSAR supplement for this AMP and finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.8 Closed Cooling Water Chemistry Control Program

Summary of Technical Information in the Application

The applicant's closed cooling water chemistry control program is described in LRA Section B.1.30.2, "Closed Cooling Water Chemistry Control." In the LRA, the applicant stated that the program is consistent with, but includes exceptions to, GALL program XI.M21, "Closed-cycle Cooling Water System". This AMP is credited with monitoring and inspecting chemistry parameters as preventive measures to manage loss of material, cracking, and fouling for closed cooling water system components.

Staff Evaluation

During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report. Details of the staff's evaluation of the audit and review are documented in the ANO-2 Audit and Review Report. Furthermore, the staff reviewed the exceptions and their justifications to determine whether the AMP, with the exceptions, remains adequate to manage the aging effects for which it is credited.

The applicant states that it's closed cooling water chemistry control program includes preventive measures that manage loss of material, cracking, and fouling for component cooling water system components. These chemistry activities provide for monitoring and controlling component cooling water chemistry using ANO-2 procedures and processes based on EPRI TR-107396, "Closed Cooling Water Chemistry Guidelines."

In Appendix B, Section B.1.30.2, of the LRA, the applicant stated the exceptions GALL AMP XI.M21:

Element: 3: Parameters Monitored/Inspected
5: Monitoring and Trending
6: Acceptance Criteria
Exception: The program only monitors chemistry parameters.

Element: 4: Detection of Aging Effects
Exception: The program is a preventive program that claims no credit for the detection of aging effects through performance and functional testing.

Element: 6: Acceptance Criteria
Exception: The nitrite corrosion inhibitor concentrations are maintained within specified limits, which allow for larger variance (1200 parts per million, or ppm - 4000 ppm) than recommended (500 ppm - 1000 ppm) in EPRI TR-107396.

The GALL Report identifies the following criteria for program elements: (1) parameters monitored/inspected, (2) monitoring and trending, and (3) acceptance criteria:

(1) The AMP monitors the effects of corrosion by surveillance testing and inspection in accordance with standards in EPRI TR-107396 to evaluate system and component performance. For pumps, the parameters monitored include flow and discharge and suction pressures. For heat exchangers, the parameters monitored include flow, inlet and outlet temperatures, and differential pressure.

(2) Performance and functional tests are performed at least every 18 months to demonstrate system operability, and tests to evaluate heat removal capability of the system and degradation of system components are performed every five years.

(3) System and component performance test results are evaluated in accordance with the guidelines of EPRI TR-107396. Acceptance criteria and tolerances are also based on system design parameters and functions.

The staff determined that EPRI TR-107396 does not recommend equipment performance and functional testing for monitoring the effectiveness of a water chemistry control program. Monitoring pump performance parameters is of little value in managing the effects of aging on long-lived, passive closed cooling water system components. EPRI TR-107396, Section 5.7, stated that performance monitoring is typically part of an engineering program, which would not be part of water chemistry. The report further stated that performance monitoring "...can be used to confirm that conditions in the closed cooling water system are not degrading heat exchanger performance...."

The staff finds that this EPRI guidance neither requires nor negates performance monitoring. The staff reviewed the applicant's procedure on chemistry inspections of plant systems and heat exchangers, and finds that implementation of this procedure enables the applicant to continue to confirm the effectiveness of the closed cooling water chemistry control program via plant inspections. The staff finds this exception to be acceptable.

The GALL Report identifies the following criterion for the detection of aging effects program element associated with the exception taken:

- The extent and schedule of inspections and testing, in accordance with EPRI TR-107396, assure detection of corrosion before the loss of intended function of the component. Performance and functional testing, in accordance with EPRI TR-107396, ensures acceptable functioning of the closed cooling water system or components serviced by the closed cooling water system.

The staff reviewed the applicant's implementation procedure which enables the applicant to confirm the effectiveness of the closed cooling water chemistry control program. Inspections are performed when systems are opened for maintenance, when an adverse trend exists, or when desired by the chemistry department. The component cooling water heat exchangers are inspected to assess the effectiveness of chemistry control every time the heat exchangers are put in wet lay-up. In the past three years, component cooling water heat exchangers have been inspected more than eight times. These inspections have been performed for many years.

The staff finds that aging effects on passive mechanical components in the closed cooling water system are adequately managed without reliance on performance and functional testing. Therefore, the staff finds this exception to be acceptable.

The GALL Report identifies the following criterion for the "acceptance criteria" program element associated with the exception taken:

- Corrosion inhibitor concentrations are maintained within the limits specified in the EPRI water chemistry guidelines for closed cooling water systems.

The staff noted that the applicant is currently drafting changes to a procedure to incorporate the EPRI guidelines on nitrite corrosion inhibitor. The procedure will specify that nitrite inhibitor concentrations are to be maintained in accordance with EPRI TR-107396.

By letter dated May 19, 2004, the applicant stated, in response to question B.1.30.2-5, that it had revised its procedure to incorporate the EPRI guidelines on nitrite corrosion inhibitor. Therefore, this is no longer an exception to the GALL program.

On the basis of the applicant's response, the staff finds this exception to no longer apply. The staff confirms that the acceptance criteria program element is consistent with the GALL Report with respect to nitrite corrosion inhibitor concentrations, and therefore, finds this to be acceptable.

On the basis of its review of this AMP, the associated engineering report, and the operating experience, the staff determined that this AMP is consistent with the GALL Report and that the exceptions in the closed cooling water chemistry control program are acceptable.

Operating Experience

The operating experience review, performed by the applicant, did not identify any condition reports or licensee event reports relating to chemical excursions in the systems covered under the closed cooling water chemistry control program . Also, the condition report trending data did not identify recurrent component degradation in the systems covered under this AMP. The review of condition reports, condition report trending data, and interviews with the plant technical staff confirmed the program requirements are effectively implemented.

On the basis of its review of the above operating experience and on discussions with the applicant's technical staff, the staff concludes that AMP B.1.30.2 adequately manages the aging effects that have been observed at the applicant's plant.

UFSAR Supplement

In Appendix A, Section A.2.1.32, of the LRA, the applicant provided the UFSAR supplement for the water chemistry control – closed cooling water chemistry control program, which states that the closed cooling water chemistry control program includes preventive measures that manage loss of material, cracking, and fouling, as applicable, for component cooling water system components. These chemistry activities provide for monitoring and controlling component cooling water chemistry using procedures and processes based on EPRI TR-107396, "Closed Cooling Water Chemistry Guidelines."

During the audit, the staff noted that for the closed cycle cooling water system described in the SRP-LR, Table 3.3-2, it is stated that "...The program relies on preventive measures to minimize corrosion by maintaining inhibitors and by performing non-chemistry monitoring consisting of inspection and nondestructive evaluations based on the guidelines of EPRI-TR-107396 for closed-cycle cooling water systems." During the audit, in question B.1.30.2-7, the staff noted that the applicant neither referred to the inspections performed nor specified the exceptions to GALL AMP XI.M21, "Closed-Cycle Cooling Water System" in LRA Appendix A, Section A.2.1.32. The staff requested that the applicant revise the LRA Appendix A, Section A.2.1.32 to be consistent with the GALL Report, Table 3.3-2, or justify its acceptability (RAI B.1.30.2-1).

In its response dated May 19, 2004, the applicant stated LRA Section B.1.30.2 provides justification for the exceptions between the closed cooling water chemistry control program and GALL AMP XI.M21, including the exception for inspection and nondestructive evaluations; therefore additional information is not required. The applicant stated that the UFSAR Supplement, LRA, Appendix A, Section A.2.1.32 contains a summary description of the program as required by 10 CFR 50.54.21(d).

The staff reviewed the applicant's response and the UFSAR supplement and confirms that it provides an adequate summary description of the program, as identified in the SRP-LR UFSAR supplement table and as required by 10 CFR 54.21(d).

Conclusion

On the basis of its review and audit of the applicant's program, the staff finds that those elements of the program for which the applicant claimed consistency with the GALL Report program are consistent with the GALL Report program. In addition, the staff has reviewed the exceptions to the GALL Report program and finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the UFSAR supplement for this AMP and finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.3 AMPs that are Plant-Specific

In Appendix B of the LRA, the applicant indicated that the following AMPs were plant-specific:

- Alloy 600 Aging Management Program (B.1.1)
- Bolting and Torquing Activities Program (B.1.2)
- Heat Exchanger Monitoring Program (B.1.12)
- Inservice Inspection - Containment Inservice Inspection (CII) Program (B.1.13)
- Inservice Inspection - Inservice Inspection (ISI) Program (B.1.14)
- Oil Analysis Program (B.1.17)
- Periodic Surveillance and Preventive Maintenance Program (B.1.18)
- Pressurizer Examinations Program (B.1.19)
- System Walkdown Program (B.1.28)
- Wall Thinning Program (B.1.29)
- Water Chemistry Control - Auxiliary Systems Water Chemistry Control Program (B.1.30.1)

For AMPs that are not consistent with or not addressed by the GALL Report, the staff performed a complete review of the AMPs to determine if they were adequate to monitor or manage aging. The staff's review of these plant-specific AMPs is documented in the following sections of this SER.

3.0.3.3.1 Alloy 600 Aging Management Program

Summary of Technical Information in the Application

The applicant credits the Alloy 600 Aging Management Program with the management of the cracking due to primary water stress-corrosion cracking (PWSCC) in Alloy 600 and Alloy 690 components and Alloy 52/152 and Alloy 82/182 welds not covered by the applicant's Reactor Vessel Head Penetration Program or by the Steam Generator Integrity Program. The applicant discusses this program in Section B.1.1 of the ANO-2 LRA. The applicant's Reactor Vessel Head Penetration Program, AMP B.1.20, is credited with the management of cracking of the Alloy 600 RV head penetrations and the Steam Generator Integrity Program, AMP B.1.25, is credited with the management of cracking of the Alloy 690 steam generator tubes and plugs for the period of extended operation.

The applicant indicated that the Alloy 600 Aging Management Program is a plant-specific program for the ANO-2 LRA and discussed the AMP in terms of the 10 program elements recommended in NUREG-1800, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants" (SRP-LR) and the ability of this program to manage the applicable effects of aging. The applicant also included an applicable UFSAR Supplement summary description for the Alloy 600 Aging Management Program in Section A.2.1.1 of the ANO-2 LRA.

Staff Evaluation

The staff assessed the corrective actions, confirmation process, and administrative controls program attributes of the Alloy 600 Aging Management Program as part of the staff's assessment of the applicant's Quality Assurance Program, which is evaluated in Section 3.0.4 of this SER. The staff evaluation of the remaining program attributes for the ANO-2 Alloy 600 Management Program is given in the following evaluations.

[Program Scope] The scope of the Alloy 600 AMP includes the RCS piping, the pressurizer, the reactor pressure vessel, and the steam generators. The staff concludes that the program scope program attribute is acceptable because it includes ASME Code Class 1 Nickel-Alloy base metal and weld components in the scope of the program, including those used in the fabrication of the ANO-2 reactor vessel, pressurizer, RCS piping, and steam generator systems.

[Preventive Actions] The applicant stated that no actions are taken as part of this program to prevent aging effects or mitigate aging degradation. In RAI B.1.1-2, the staff noted that several preventive actions and common industry practices have been used to manage Alloy 600/82/182 PWSCC, and requested that the applicant provide a description of any preventive actions and/or water chemistry monitoring programs that ANO-2 is currently implementing that may be used to address the Alloy 600/82/182 cracking issue.

In response to RAI B.1.1-2, the applicant stated that ANO-2 has taken preventive actions to address the Alloy 600/82/182 cracking issue, however, these actions are not part of the Alloy 600 Aging Management Program. Various Alloy 600 pressurizer heater sleeves, instrument nozzles, and hot leg instrument nozzles have been repaired due to PWSCC. The repairs involve one of two methods, both of which remove Alloy 600 material from a pressure boundary function. One repair method replaces the Alloy 600 nozzles with Alloy 690 nozzles while the other utilizes no nickel-based alloy material in a pressure boundary role (i.e., the repairs involve installation of mechanical nozzle seal assemblies). Alloy 690 is an industry standard for replacement of Alloy-600 components. In addition, the ANO-2 Water Chemistry Control Program controls contaminants known to contribute to PWSCC. As described in Section B.1.30.3 of the LRA, the ANO-2 Primary Water Chemistry Control Program is based on EPRI TR-105714.

The applicant concludes that ANO-2 does take preventive actions to mitigate degradation of Alloy 600 components and Alloy 82/182 filler welds. Actions that are taken are consistent with industry practice and include maintenance of stringent water chemistry controls in accordance with industry accepted guidelines and replacement of faulty Alloy 600/82/182 components with materials significantly less susceptible to PWSCC. The staff finds the response acceptable and considers this issue closed.

[Parameters Monitored or Inspected] The applicant stated that the Alloy 600 Aging Management Program monitors the effect of PWSCC cracking using the examination and inspection requirements of the ASME Code, Section XI. The aging effects monitored by the Alloy 600 Aging Management Program are consistent with those evaluated and accepted by the staff in Sections 3.1.2.1.1, 3.1.2.1.3, and 3.1.2.1.4 of this SER. The aging effect monitored by the Alloy 600 Aging Management Program (i.e., cracking) is therefore acceptable to the staff.

[Detection of Aging Effects and Monitoring and Trending] The applicant stated that the Alloy 600 Aging Management Program will detect cracking by PWSCC prior to loss of component intended function. Selected Alloy 600, Alloy 52/152 and Alloy 82/182 locations receive examination in accordance with the requirements of the ASME Code, Section XI. The applicant stated that pressure measurement, vent, upper level, and temperature nozzles, heater sheaths, heater sleeves, and end plugs will receive visual examination (VT-2) from the exterior of the vessel in accordance with the requirements of the ASME Code, Section XI, Examination Category B-P. In RAI B.1.1-3, the staff noted that for many of these components the Alloy 600 pressure boundary welds are covered by insulation. Service experience has shown that early indications of through-wall leakage (e.g., boric acid on the component surface) are very difficult to detect when VT-2 examinations are performed with the insulation in-place. The staff requested that the applicant provide justification for not removing insulation when performing VT-2 examinations on the components mentioned above. The staff also requested that the applicant provide the frequency of inspection and the results of any volumetric non-destructive examination that has been performed.

In response to RAI B.1.1-3, the applicant stated that, as described in Section B1.1.4 on page B-12 of the LRA, the ANO-2 pressurizer heater and small-bore nozzles are visually inspected in addition to the ASME Code, Section XI, Examination Category B-P inspections. Insulation is removed if required to allow for bare metal examination of an area 360 degrees around the small nozzles and penetrations for evidence of boric acid residue. The inspections are performed each refueling outage. The staff finds the response acceptable and considers this issue closed.

In the Alloy 600 Aging Management Program under the program attribute, "Detection of Aging Effects," the applicant states that guidance from the MRP in conjunction with the PWR owners groups will be used to identify critical locations for inspection and augmentation of existing ISI inspections at ANO-2 where appropriate. In RAI B.1.1-4, the staff requested that the applicant identify the date that ANO-2 commits to submit, for review and approval, an augmented aging management program that includes all recommendations from the industry's strategic plan, and meets the 10 elements in accordance with the guidance in NUREG-1800, Appendix A.1, "Aging Management Review - Generic," Table A.1-1, "Elements of an Aging Management Program for License Renewal." The staff noted that the date must be prior to the period of extended operation. The staff also noted that this commitment should be documented in the UFSAR.

In response to RAI B.1.1-4, the applicant stated that PWSCC of nickel-based alloys is a current license term issue. The applicant stated that issues that are relevant to current plant operation will be addressed by the existing regulatory process within the present license term rather than deferred until the time of license renewal. With regard to updating the UFSAR, the applicant stated that a commitment will be added to the UFSAR supplement. During development of the ANO-2 Alloy 600 Aging Management Program, the applicant stated that guidance developed by the EPRI MRP for the selection, inspection, and evaluation of nickel-based alloy components will be considered.

In RAI B.1.1-1, the staff requested that the applicant confirm that all of the components listed in the Alloy 600 Aging Management Program are covered under the ISI requirements of Section XI of the ASME Code. The staff also requested that the applicant identify any components that are not covered by the ASME Code, Section XI ISI requirements. In addition, the staff requested that the applicant provide a complete description of the proposed inspections including a technical justification for the inspection method and frequency for any components that are identified.

In response to RAI B.1.1-1, dated July 22, 2004 (refer to Entergy Letter No. 2CAN070405), the applicant stated that all nickel-based alloy items listed in Section B.1.1 of the LRA are included in the ANO-2 ISI.Program with the exception of the thermal sleeves, the cladding on the pressurizer lower head, the RV lower shell and head, and the steam generator tubesheet, the steam generator channel head divider plate and primary nozzle rings, and the pressurizer heater support plates and heater support plate brackets. The applicant contends that the items that are inspected as part of the ANO-2 ISI Program have a greater susceptibility to PWSCC due to physical configuration or operational conditions (e.g., temperature) than those listed above, and the items listed above that are not volumetrically or visually inspected are bounded by the items that receive examinations in accordance with the ASME Code, Section XI. The applicant acknowledges that the EPRI Materials Reliability Project (MRP) in conjunction with the PWR owners groups is developing a strategic plan to manage PWSCC of nickel-based alloy components, and states that guidance developed by the MRP and the owners groups will be used to identify the need for augmenting existing ISI inspections at ANO-2 where appropriate.

The applicant also provided the following supplemental response to RAI B.1.1-1 in Entergy Letter No. 2CAN090402, dated September 10, 2004:

Primary water stress corrosion cracking (PWSCC) of nickel-based alloys is a current license term issue. As such, interaction between Entergy and the NRC Staff is ongoing to develop a program to manage the effects of aging due to this mechanism. In accordance with the statements of consideration, issues that are relevant to current plant operation are addressed by the existing regulatory process within the present license term rather than deferred until the time of license renewal. Consequently, the existing regulatory process provides assurance that aging effects caused by PWSCC of nickel-based alloys will be adequately managed during the period of extended operation. Consistent with all programs credited for license renewal at ANO-2, the Alloy-600 Program will be available on-site for NRC review. In addition, as requested by the NRC Staff, a description of the program will be submitted to the NRC for review and approval. The submittal date will be at least 24 months prior to the period of extended operation.

The applicant's descriptions for the Alloy 600 AMP, as discussed in Section B.1.1 of the ANO-2 LRA and in the applicant's responses to RAI B.1.1-1 dated July 22, 2004, and September 10, 2004, clarify two important attributes for the Alloy 600 AMP:

4. The applicant will participate in the EPRI-MRP's studies on PWSCC of ASME Code Class 1 Nickel-Alloy components and will use the guidance developed by the EPRI-MRP and the owners groups to identify the need for augmenting existing ISI inspections at ANO-2, where appropriate.

5. The applicant has committed to submitting an inspection plan for the ANO-2 ASME Code Class 1 Nickel-Alloy components to the staff for review and approval at least 24 months prior to entering the period of extended operation for the unit.

The staff has confirmed that the applicant manages PWSCC of the ANO-2 upper reactor vessel (RV) head penetration nozzles in accordance with a NRC-approved program that complies with the applicable augmented inspection requirements of NRC Order EA-03-009. This program is implemented through the applicant's Reactor Vessel Head Penetration Program. The staff has also confirmed that the applicant plans to manage PWSCC of Nickel-Alloy base metal and weld components in the pressurizer system in accordance with commitments made in the applicant's response to NRC Bulletin 2004-01, *Inspection of Alloy 82/182/600 Materials Used in the Fabrication of Pressurizer Penetrations and Steam Space Piping Connections at Pressurized Water Reactors (May 28, 2004).* This response is provided in Entergy Letter No. 0CAN070404, dated July 27, 2004.

For the remaining ASME Code Class 1 Nickel-Alloy components, the EPRI MRP's initiatives on PWSCC of ASME Code Class 1 Nickel-Alloy components are being performed to assess the need to implement augmented inspection of the components beyond those currently required by Section XI of the ASME Code, as invoked by 10 CFR 50.55a. The staff concludes that this is an acceptable process for managing aging in these components, because: (1) Entergy will apply acceptable industry guidelines that will ensure that only those inspections will be used that are capable of detecting degradation prior to a loss of component intended function, (2) it will allow the staff to review the applicant's inspection plans for these components as based on the industry recommendations, and (3) it will provide the staff an opportunity to resolve with the applicant any issues that may potentially arise with the inspection plan.

Records of the inspection program, examination and test procedures, examination/test data, and corrective actions taken are maintained in accordance with the requirements of ASME Section XI, Subsection IWA. The staff finds this approach acceptable since the ASME Code requires that the applicant maintain inspection records, and the corresponding corrective actions.

Based on the applicant's commitments for performing augmented inspections of the Alloy 82/182/600 materials used in the fabrication of the ANO-2 upper RV head penetration nozzles and pressurizer penetration nozzles and steam space piping components, and the applicant's commitment to submit an inspection plan for NRC review and approval 24 months prior to the entering the period of extended operation for the remaining Nickel-Alloy components, the staff concludes that the Detection of Aging Effects and Monitoring and Trending program attributes are acceptable. To obtain NRC staff approval of its proposed inspection plan regarding Nickel - Alloy components prior to entering the period of extended operation for ANO-2, the applicant must submit a license amendment request. After the NRC staff's approval of the inspection plan, any future changes to the inspection plan will be evaluated in accordance with 10 CFR 50.59.

[Monitoring and Trending] Records of the inspection program, examination and test procedures, examination/test data, and corrective actions taken are maintained in accordance with the requirements of ASME Section XI, Subsection IWA. The staff finds this approach acceptable since the ASME Code requires that the applicant maintain inspection records, and the corresponding corrective actions.

[Acceptance Criteria] The applicant stated that the acceptance standards specified in IWB-3500 will be applied to component locations that receive ASME Section XI volumetric, surface, and visual examinations. The applicant also stated that the acceptance criteria for visual inspections require that cognizant members of the system engineering, quality control and design engineering departments review the inspection results for indications of leakage. If abnormalities are identified, a condition report is issued. All through-wall pressure boundary leakage must be corrected prior to plant start-up. The staff notes that for the ASME Code Class 1 Alloy 600 components within the scope of the applicant's Alloy 600 Aging Management Program, the results of these industry initiatives may include recommendations for implementing more stringent alternative acceptance criteria to those currently required by Section XI of the ASME Code. These actions are consistent with current industry practices and the staff finds this to be acceptable.

[Operating Experience] The applicant stated that the Alloy 600 Aging Management Program is a new program for which there is no specific operating experience for ANO-2. The staff is aware of several reported cases of degradation in Alloy 600 weld components of other U.S. PWRs, including several reported cases of degradation in other Combustion Engineering (CE) Nuclear Steam Supply Systems (NSSS) design units. Specifically, PWSCC has been reported in Alloy 82/182 J-groove welds that are used to join Alloy 600 small bore nozzles to CE-designed pressurizers, steam generators, and/or hot legs. In RAI B.1.1-5, the staff noted that it is important for the applicant to review relevant industry service experience and incorporate lessons learned into the Alloy 600 program. Therefore, the staff requested that the applicant discuss what industry initiatives it plans to follow in order to incorporate experience related to Alloy 600 into the ANO-2 Alloy 600 AMP.

In response to RAI B.1.1-5, the applicant stated that, as defined in the Standard Review Plan (NUREG-1800), the Operating Experience program element describes the operating experience of the aging management program, including past corrective actions resulting in program enhancements or additional programs. Therefore, the applicant concluded that, as a new program, the ANO-2 Alloy 600 Aging Management Program has no relevant operating experience as defined in NUREG-1800. The applicant repeated its statement that guidance developed by the EPRI MRP and the PWR owners groups will be used to identify critical locations for inspection and augmentation of existing ISI inspections at ANO-2 where appropriate.

However, there is current generic operating experience that is applicable to the detection of PWSCC in the Alloy 82/182/600 components of the ANO-2 RCPB. These operating experience events that are discussed in NRC Order EA-03-009, and in NRC Bulletin 2004-01. The applicant is using its commitments made in response to the augmented inspection requirements of NRC Order EA-03-009 and Revision 1 of the Order and the Reactor Vessel Head Penetrations Program as the basis for managing PWSCC in the ANO-2 upper RV head penetration nozzles. These commitments are discussed and evaluated in Section B.1.20, *Reactor Vessel Head Penetration,* of this SER. The applicant is using its commitments that were made in response to NRC Bulletin 2004-01 as the basis for managing PWSCC in the ANO-2 pressurizer penetration nozzles. These commitments are identified in Entergy Letter No. 0CAN070404, *Response to NRC 2004-01 Regarding Inspection of Alloy 82/182/600 Materials Used in Pressurizer Penetrations and Steam Space Piping Components (July 27, 2004),* and include a commitment to perform bare-metal visual examinations of the Nickel-Alloy components in pressurizer penetrations during subsequent refueling outages, starting with refueling outage No. 17 in Spring 2005.

The staff concludes that the Operating Experience program attribute for the Alloy 600 Aging Management Program is acceptable because the applicant has addressed the safety implications of the generic operating experience and has used the experience to augment the inspection program for the upper RV head penetration nozzles, as required by NRC Order EA-03-009 and for Nickel-Alloy pressurizer penetration components, as recommended in NRC Bulleting 2004-01.

<u>UFSAR Supplement</u>

The applicant provides the following Updated Final Safety Analysis Report summary description for the Alloy 600 Aging Management Program in Section A.2.1.1. of the ANO-2 LRA:

> This program will manage aging effects of alloy 600/690 items and alloy 52/152 and 82/182 welds in the reactor coolant system that are not addressed by the Reactor Vessel Head Penetration Inspection Program, Section A.2.1.21, and the Steam Generator Integrity Program, Section A.2.1.26. This program will detect cracking from primary water stress corrosion cracking (PWSCC) by using the examination and inspection requirements specified in ASME Section XI. The Alloy 600 Aging Management Program will be initiated prior to the period of extended operation.

The applicant also provided the following revised FSAR Supplement summary description for the Alloy 600 Aging Management Program in Entergy Letter No. 2CAN090403, dated September 23, 2004:

A.2.1.1 Alloy 600 Aging Management Program

This program will manage aging effects of alloy 600/690 items and alloy 52/152 and 82/182 welds in the reactor coolant system that are not addressed by the Reactor Vessel Head Penetration Inspection Program, Section A.2.1.21, and the Steam Generator Integrity Program, Section A.2.1.26. This program will detect cracking from primary water stress corrosion cracking (PWSCC) by using the examination and inspection requirements specified of ASME Section XI, as augmented by commitments made in response to NRC correspondence. The Alloy 600 Aging Management Program will be initiated prior to the period of extended operation.

For the CLB for ANO-2, the applicant has proposed some augmentation of the ASME Section XI ISI requirements for ASME Code Class 1 Nickel-Alloy components. The staff has confirmed that the applicant has committed to implementing the augmented inspection requirements of NRC Order EA-03-009 and Revision 1 of the Order for inspections of the upper RV head and its penetration nozzles. For the period of extended operation, the applicant will implement these requirements and manage PWSCC in the ANO-2 upper RV head penetration nozzles through implementation of the Reactor Vessel Head Penetrations Program. These requirements and commitments are discussed and evaluated in Section B.1.20, *Reactor Vessel Head Penetration,* of this SER. The staff has also confirmed that the applicant is using its commitments that were made in response to NRC Bulletin 2004-01 as the basis for managing PWSCC in the ANO-2 pressurizer penetration nozzles. These commitments are identified in Entergy Letter No. 0CAN070404, *Response to NRC 2004-01 Regarding Inspection of Alloy 82/182/600 Materials Used in Pressurizer Penetrations and Steam Space Piping Components (July 27, 2004),* and include a commitment to perform bare-metal visual examinations of the Nickel-Alloy components in pressurizer penetrations during subsequent refueling outages, starting with refueling outage No. 17 in Spring 2005. These commitments comply with augmented inspection requirements of NRC Order EA-03-009 and conform to the staff's recommendations for augmented examinations of pressurizer penetration nozzles and steam space piping components, as recommended in NRC Bulletin 2004-01.

The staff has also confirmed that the applicant has committed to submit the inspection plan for the Alloy 600 Aging Management Program to the staff for review and approval at least 24 months prior to entering the period of extended operation for ANO-2 and has incorporated this commitment into the Commitment Tracking List for the ANO-2 LRA, as specified in Entergy Letter No. Letter No. 2CAN090402, dated September 10, 2004. Based on the FSAR Supplement Summary description for the Alloy 600 Aging Management Program and the applicant's commitments for augmented inspections of the upper RV head penetration nozzles and pressurizer penetration nozzles and for submittal of the inspection plan for the AMP, the staff concludes that the revised FSAR Supplement summary description for the Alloy 600 Aging Management Program is acceptable.

Conclusion

The staff has reviewed the Alloy 600 Aging Management Program, as discussed in Section B.1.1 of the ANO-2 LRA. On the basis of its review of the applicant's program including the applicant's commitment to request NRC staff review and approval of the Nickel-Alloy inspection program, the staff finds that the program adequately addresses the 10 program elements defined in Branch Technical Position (BTS) RLSB-1 in Appendix A.1 of the SRP-LR, and that the program will adequately manage the aging effects for which it is credited so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the UFSAR Supplement summary description for this AMP, as described in Section A.2.1.1 of the ANO-2 LRA, and finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.3.2 Bolting and Torquing Activities Program

Summary of Technical Information in the Application

The applicant described its Bolting and Torquing Activities Program in Section B.1.2 of Appendix B to the Application. It is a plant-specific program in ANO-2. The applicant stated that this program relies on recommendations for a comprehensive bolting integrity program, as delineated in the Electric Power Research Institute EPRI NP-5067, "Good Bolting Practices." This program also relies on industry recommendations for comprehensive bolting maintenance, as delineated in EPRI TR-104213, "Bolted Joint Maintenance & Applications Guide," for pressure retaining bolting. The applicant stated that a similar program based on EPRI NP-5067 and EPRI TR-104213 has previously been evaluated and approved by the NRC as documented in NUREG-1743, "Safety Evaluation Report Related to the License Renewal of Arkansas Nuclear One, Unit 1."

Staff Evaluation

The staff evaluation of the ANO-2 Bolting and Torquing Activities Program focused on how the program manages the aging effect through effective incorporation of the following ten attributes: program scope, preventive or mitigative actions, parameters monitored/inspected, detection of aging effects, monitoring and trending, acceptance criteria, corrective actions, confirmation process, administrative controls, and operating experience.

[Program Scope] The applicant stated that the program covers bolting in high temperature systems and in applications subject to significant vibration as determined during aging management review.

In RAI B.1.2-1, the staff requested that the applicant clarify whether the program covers all bolting within the scope of license renewal, greater than or smaller than 2-inch diameter, including safety-related bolting, bolting for NSSS component supports, bolting for other pressure retaining components, and structural bolting. The staff requested that the applicant provide assurance that the recommendations and guidelines for the plant-specific bolting program conform to industry's technical guidelines. By letter dated April 6, 2004, the applicant stated that the Bolting and Torquing Activities Program applies to closure bolting for components subject to aging management review in high temperature systems and in applications subject to significant vibration. Thus, it applies to safety-related bolting, nonsafety-related bolting, and bolting for pressure retaining components. It does not apply, however, to bolting for NSSS components supports and structural bolting. The programs managing aging effects of component supports and structural bolting are listed in the tables in LRA Section 3.5, Structures and Component Supports. In addition, the applicant stated that the program covers both larger than and smaller than or equal to 2-inch diameter bolting.

The applicant reiterated the statement in GALL XI.M18, Bolting Integrity, "The industry's technical basis for the program for safety-related bolting and guidelines for material selection and testing, bolting preload control, inservice inspection (ISI), plant operation and maintenance, and evaluation of structural integrity of bolted joints, are outlined in EPRI NP-5769, with the exceptions noted in NUREG 1339. For other bolting, this information is set forth in EPRI TR-104213." Also, EPRI NP-5769 states that EPRI NP-5067, Good Bolting Practices, satisfies the industry's need for guidance on assembly of bolted joints. In ANO-2 LRA, EPRI NP-5067 and EPRI TR-104213, Bolted Joint Maintenance & Application Guide are utilized as guidance in the Bolting and Torquing Activities Program. Based on the above, the staff considered that the guidelines utilized for the Bolting and Torquing Activities Program reflect industry practice. RAI B.1.2-1 is, therefore, closed.

[Preventive Actions] The applicant stated that preventive actions include proper selection of bolting material and the use of the appropriate lubricants and sealants in accordance with the guidelines of EPRI NP-5067. Initial inspection of bolting for pressure retaining components includes a check of the bolt torque and uniformity of the gasket compression after assembly. Hot torque checks are not applied to all bolted closures within the scope of this program, but are procedurally controlled if vendor-recommended or if determined necessary on a case-by-case basis. The staff considered the preventive actions taken by the applicant to be adequate in preventing the aging effect of loss of mechanical closure integrity, due to loss of preload or vibration, and are, therefore, acceptable.

[Parameters Monitored/Inspected] The applicant stated that torque values are monitored when the bolted closure is assembled. Maintenance personnel visually inspect components used in the bolted closures to assess their general condition during maintenance.

In RAI B.1.2-2, the staff requested the applicant to discuss the specifics of the conditions of the closure bolting to be inspected, and to explain why torque values are the only parameters to be monitored. The staff also requested the applicant to provide details of the methods of its visual inspection, and explain why inspection techniques other than visual inspection are not included in the program. By letter dated April 6, 2004, the applicant stated that under the Bolting and Torquing Activities Program, loss of mechanical closure integrity is managed by proper torquing during assembly of the bolted closure. The program is a preventive program rather than an inspection program to detect the effects of aging. Visual inspections to manage the effects of aging are not included in this program. Instead, as described in LRA Section B.1.2 under Parameters Monitored/Inspected, maintenance personnel visually inspect components used in the bolted closures to assess their general condition during maintenance. Prior to assembly, the mating surfaces and bolting components are inspected for manufacturing defects, galls, spurs, or dirt. After assembly; the closure is inspected for uniformity of gasket compression, proper thread engagement and proper locking tab installation. The applicant stated that torque values are the only parameters specified to be monitored because the aging effect being managed is loss of mechanical closure integrity due to loss of pre-load, not loss of material. If loss of material is an aging effect requiring management for the same bolted closures, it is managed by another program such as System Walkdown or Boric Acid Corrosion Prevention Program. The staff considered the applicant's response to be adequate in explaining how the mating surfaces and bolting components are inspected prior to and after assembly, and why torque values are the only parameters to be monitored. RAI B.1.2-2 is, therefore, closed

[Detection of Aging Effects] As stated earlier, the program is a preventive program, not an inspection program for detecting the effects of aging. Preventive actions under the program prevent loss of mechanical closure integrity.

There was no discussion in LRA as to what aging effects/mechanisms requiring management are included under the aging effect of loss of mechanical closure integrity. In RAI B.1.2-3, the staff requested that the applicant provide a detailed description of the aging effects which attribute to loss of mechanical closure integrity, and to discuss how the aging management program is expected to manage them. The staff also requested that the applicant ensure that, as delineated in GALL XI.M18, Bolting Integrity, the inspection requirements of the ASME Code, Section XI, are met. By letter dated April 6, 2004, the applicant stated that loss of mechanical closure integrity is the aging effect caused by loss of preload due to high temperature or vibration. If loss of material is an aging effect requiring management for the same bolted closures, it is managed by another program such as System Walkdown or Boric Acid Corrosion Prevention Program. The GALL program XI.M18, "Bolting Integrity," stipulates the inservice inspection requirements of the ASME Code, Section XI. These ISI requirements are included in the ANO-2 Inservice Inspection Program for Class 1, 2, and 3 bolted closures. However, these inspection requirements are focused on identifying the aging effect of cracking. Since cracking is not an aging effect requiring management for Non-Class 1 bolted closures, the applicant stated that the Inservice Inspection Program was not credited as an aging management program for the ASME Class 2 and 3 bolted closures. The applicant also stated that inspection requirements of ASME Code, Section XI, will continue to be met as required by 10CFR50.55a during the period of extended operation. The staff considered the applicant's response to be adequate in explaining the difference between the Bolting and Torquing Activities Program and the GALL XI.M18, Bolting Integrity, and in ensuring that inspection requirements of ASME Code, Section XI, will continue to be met. RAI B.1.2-3 is, therefore, closed.

[Monitoring and Trending] The applicant stated that torque values are monitored during the bolt torquing process. Trending is not applicable to this program. The ANO-2 Corrective Action Program applies. This provides assurance that trends entailing repeat failures to meet acceptance criteria will be identified and addressed with appropriate corrective actions.

In RAI B.1.2-4, the staff requested the applicant to discuss the details of the inspection schedule and its basis. By letter dated April 6, 2004, the applicant stated that under the Bolting and Torquing Activities Program, loss of mechanical closure integrity is managed by proper torquing during assembly of the bolted closure. The applicant stated that visual inspections to find evidence of aging effects are not performed under this program, thus there is no frequency to be provided. The staff considered the applicant's response to be adequate in explaining why there is no inspection frequency involved in the Bolting and Torquing Activities Program, as versus to the Inservice Inspection Program included in GALL XI.M18, Bolting Integrity. RAI B.1.2-4 is, therefore, closed.

[Acceptance Criteria] The applicant stated that acceptance criteria are provided in site procedures. Typical criteria are that mating surfaces are smooth and free of major defects. Other criteria include proper and adequate thread engagement and use of appropriate torque values.

To ensure that mating surfaces perform their intended function as a pressure retaining boundary, the staff requested in RAI B.1.2-5 that the applicant enhance the criteria by requiring that the surfaces be thoroughly inspected, for potential aging effects, such as corrosion, cracking, and/or leaking. This includes identification of all relevant indications and signs of degradation at the surfaces. By letter dated April 6, 2004, the applicant stated that under the Bolting and Torquing Activities Program, loss of mechanical closure integrity is managed by proper torquing during assembly of the bolted closure. As discussed in its response to RAI B.1.2-2, the applicant stated that the inspection of mating surfaces under this program is an inspection for manufacturing defects, galls, spurs, or dirt prior to assembly of the bolted closure. Management of aging of component mating surfaces to ensure that they perform their intended function as a pressure retaining boundary is performed by the program which manages aging of the component itself. The staff considered the applicant's response to be adequate in defining the acceptance criteria of the program, which is the smoothness of the mating surfaces and the proper torque values. RAI B.1.2-5 is, therefore, closed.

[Operating Experience] The applicant stated that the ANO-2 Bolting and Torquing Activities Program is the same program credited for ANO-1 license renewal. ANO bolting and torquing practices were evaluated during NRC review of the ANO-1 LRA. On the basis of the review, the NRC staff found that the Bolting and Torquing Activities Program, which is part of the CLB, will continue to be adequate to assure that threaded joints will perform their intended functions during the period of extended operation.

The applicant stated that repetitive occurrences of deficient bolting and torquing activities are identified by the ANO staff. Corrective actions are established to address deficient conditions regarding torquing of mechanical fasteners and to preclude their recurrence. The applicant stated that this operating experience demonstrates that the Bolting and Torquing Activities Program will provide assurance that the aging effects associated with bolted closures will be managed such that applicable structures and components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation. In RAI B.1.2-6, the staff requested that the applicant elaborate on the types of repetitive occurrences of deficient bolting and torquing activities, and how the deficiencies were dispositioned. By letter dated April 6, 2004, the applicant stated that in 1998 the ANO staff identified repetitive occurrences of improper torquing requirements resulting from inadequate personnel work practices, evidenced by leaking connections. Corrective actions, such as procedure changes and training were taken to address the deficient conditions and to preclude their recurrence. The applicant stated that independent verification of proper torque values was also added to work instructions. Subsequent trending data revealed the corrective actions were effective in precluding the identified conditions. The staff considered the applicant has adequately identified the cause of the earlier deficient bolting and torquing practice, and has properly implemented the corrective actions. RAI B.1.2-6 is, therefore, closed.

The staff considered the applicant's operating experience to be an asset to the Bolting and Torquing Activities Program in managing the loss of mechanical closure integrity. This operating experience will help minimize recurrence of deficient conditions of closure bolting, and thus provide assurance that the aging effects associated with bolted closures will be managed such that applicable structures and components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

UFSAR Supplement

The Bolting and Torquing Activities Program manages the loss of mechanical closure integrity for bolted connections and bolted closures in high temperature systems and in applications subject to significant vibration. The program relies on recommendations for a comprehensive bolting integrity program, as delineated in the Electric Power Research Institute EPRI NP-5067, Good Bolting Practices. The program also relies on industry recommendations for comprehensive bolting maintenance, as delineated in the EPRI TR-104213, Bolted Joint Maintenance & Applications Guide.

Conclusion

Based on the information provided by the applicant, the staff finds that the Bolting and Torquing Activities Program is adequate for managing the loss of mechanical closure integrity for bolted connections and bolted closures in high temperature systems and in applications subject to significant vibration. On the basis of its review, the staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the UFSAR supplement for this AMP and finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.3.3 Heat Exchanger Monitoring Program

Summary of Technical Information in the Application

The applicant's heat exchanger monitoring program is described in LRA Section B.1.12, "Heat Exchanger Monitoring." In the LRA, the applicant stated that the program is plant-specific and will be initiated prior to the period of extended operation. This AMP is credited with inspecting heat exchangers to detect degradation and, if warranted, evaluating the effects of the degradation on the design functions, including seismic operability.

Staff Evaluation

In accordance with 10 CFR 54.21(a)(3), the staff reviewed the information included in Appendix B, Section B.1.12, of the LRA, regarding the applicant's demonstration of the heat exchanger monitoring program to ensure that the effects of aging, as discussed above, will be adequately managed so that the intended functions will be maintained consistent with the CLB throughout the period of extended operation.

The staff reviewed the heat exchanger monitoring program against the AMP elements found in the SRP-LR, Appendix A, Section A.1.2.3, and SRP-LR Table A.1-1 and focused on how the program manages aging effects through the effective incorporation of 10 elements (i.e., program scope, preventive actions, parameters monitored or inspected, detection of aging effects, monitoring and trending, acceptance criteria, corrective actions, confirmation process, administrative controls, and operating experience.)

The applicant indicated that the corrective actions, confirmation process, and administrative controls are part of the site-controlled quality assurance program. The staff's evaluation of the quality assurance program is provided separately in Section 3.0.4 of this SER. The remaining seven elements are discussed below.

[Scope of the Program] The applicant stated that this program element encompasses managing aging effects on selected heat exchangers as identified in Section 3 of the LRA. The staff reviewed Section 3 of the LRA and determined that the heat exchanger monitoring program is credited with managing aging effects for specific heat exchanger components in the containment spray and emergency diesel generator systems. The staff confirmed that the specific components for which the heat exchanger monitoring program manages aging effect are identified, which satisfies the criterion defined in Appendix A.1 of the SRP-LR. On this basis, the staff finds that the applicant's proposed scope is acceptable.

[Preventive Maintenance] The applicant stated that this is an inspection program and no actions are taken as part of this program to prevent degradation. The staff finds that the heat exchanger monitoring program is a condition monitoring program. It provides early indication and detection of the onset of aging degradation. It does not rely on preventive actions. Therefore, staff finds this acceptable.

[Parameters Monitored or Inspected] The applicant stated that non-destructive examinations will be performed. Eddy current testing will be used to identify wall thinning and cracking in shell-and-tube heat exchangers. Heat exchanger heads, covers, and tube sheets will be inspected using visual inspection methods.

The staff noted that although traditional eddy current testing methods can be applied to most heat exchangers, the shutdown heat exchanger contains ferritic stainless steel tubes. Traditional eddy current testing methods cannot be used in this application. The applicant plans to use a testing method similar to eddy current testing that will detect wall thinning and cracking in these tubes. During the audit, the staff requested details on this inspection methodology from the applicant. By letter dated January 22, 2004, the applicant provided details on this methodology. Specifically, the applicant identified a modified version of eddy current testing method called remote field testing as the selected technique, and stated that other appropriate examination techniques may be available at the time of program implementation and will be based on industry operating experience.

The staff reviewed the applicant's response, and finds that the inspection technique is sufficient to provide assurance that the aging effects for the components addressed by the heat exchangers monitoring program will be detected before loss of intended function.

The staff confirmed that this program element satisfies the criteria defined in Appendix A of the SRP-LR. The heat exchanger monitoring program is acceptable because the non-destructive examinations of the heat exchangers are intended to detect the presence and extent of aging effects. On this basis, the staff finds that the parameters monitored or inspected is acceptable.

[Detection of Aging Effects] The applicant stated, in Appendix B, Section B.1.12 of the LRA, that

- The aging effects being managed by this program for the tubes are loss of material and cracking. An appropriate sample population of heat exchangers will be determined based on operating experience prior to the inspections. The extent and schedule of the inspections prescribed by the program are designed to maintain seismic qualification and ensure that aging effects will be discovered and repaired before the loss of intended function.

- The eddy current inspection of the tubes will be every 10 years, or more frequently if inspection results indicate a need for more frequent inspections. The visual inspections of the accessible heat exchangers will be performed on the same frequency as the eddy current inspections.
- Inspection can reveal cracking and loss of material that could result in degradation in the seismic qualification of the heat exchangers. Fouling is not addressed by this program.

The staff noted that, although traditional eddy current testing methods can be applied to most heat exchanges, the shutdown heat exchanger contains ferritic stainless steel tubes. Traditional eddy current testing methods cannot be used in this application. The applicant has developed a testing method, similar to eddy current testing, that will be used to detect wall thinning and cracking in these tubes. During the audit, the staff requested details on this inspection methodology from the applicant. By letter dated January 22, 2004, the applicant provided details on this methodology. Specifically, the applicant identified a modified version of eddy current testing method called remote field testing as the selected technique, and stated that other appropriate examination techniques may be available at the time of program implementation and will be based on industry operating experience. The staff reviewed the applicant's response, and finds that the inspection technique is acceptable (see discussion above).

The staff confirmed that this program element satisfies the criteria defined in Appendix A.1 of the SRP-LR. Testing techniques will be developed, based on industry operating experience; sample population of heat exchangers will be determined based on operating experience prior to the inspections; and eddy current inspection of the tubes will be every 10 years, or more frequently if inspection results indicate a need for more frequent inspections. On this basis, the staff concludes that the detection of aging effects is acceptable.

[Monitoring and Trending] The applicant stated, in Appendix B, Section B.1.12, of the LRA, that the wall thickness of heat exchanger tubing and the material condition of heat exchanger heads, covers, and tube sheets will be trended. Results will be evaluated against established acceptance criteria and an assessment will be made regarding the applicable degradation mechanism, degradation growth rate, and the allowable degradation level. This information will be used to develop future inspection scope and inspection frequency.

The staff confirmed that this program element satisfies the criteria defined in Appendix A.1 of the SRP-LR. Trending of inspection results will be performed and will enhance the applicant's ability to detect aging effects before there is a loss of intended function. On this basis, the staff finds that the monitoring and trending is acceptable.

[Acceptance Criteria] The applicant stated, in Appendix B, Section B.1.12, of the LRA, that

- The tube plugging limit for each heat exchanger to be eddy-current inspected will be established based upon a component-specific engineering evaluation. This evaluation will determine conservative acceptance criteria that will identify when degraded tubes must be removed from service.

- The acceptance criterion for visual inspections of heat exchanger heads, covers, and tube sheets will be no evidence of degradation that could lead to loss of function. If degradation that could lead to loss of intended function is detected, a condition report will be written and the issue resolved in accordance with the site corrective action program.

During the audit, the staff requested that the applicant provide specific and detailed acceptance criteria and its basis for the heat exchanger monitoring program. By letter dated January 22, 2004, the applicant provided the heat exchanger monitoring program specific acceptance criterion. In its response, the applicant identified that the acceptance criterion for the tube eddy-current inspections will be wall loss less than 60 percent through wall, which follows the industry practice that considers this a conservative standard for requiring evaluation of the need for potential corrective action. In its response, the applicant also stated that the acceptance criterion for eddy current testing of heat exchanger tubes is conservatively based on a combination of ASME code requirements and industry practice. The staff reviewed the applicant's response, and finds it to be acceptable.

The staff confirmed that this program element satisfies the criteria defined in Appendix A.1 of the SRP-LR. Any degradation that could lead to loss of function will be found unacceptable and corrective measures implemented. On this basis, the staff finds that the acceptance criteria is acceptable.

[Operating Experience] The applicant stated, in Appendix B, Section B.1.12, of the LRA, that the heat exchanger monitoring program is a new program for which there is no operating experience. The elements that constitute this program are consistent with years of industry practice. The applicant stated that the program will be administered under the site quality assurance (QA) program, which is subject to the requirements of 10 CFR 50, Appendix B.

During the audit, the staff asked the applicant to clarify and/or provide the operating experience reviews for new programs. In its response, the applicant stated that the plant corrective action program, which captures internal and external plant operating experience issues, provides assurance that operating experience will be reviewed and incorporated in the future to provide objective evidence to support the conclusion that the effects of aging will be adequately managed.

On the basis of its review of the applicant's response and on discussions with the applicant's technical staff, the staff concludes that the heat exchanger monitoring program will adequately manage the aging effects that have been observed at the applicant's plant.

UFSAR Supplement

In Appendix A, Section A.2.1.13, of the LRA, the applicant provided the UFSAR supplement for the heat exchanger monitoring program and stated that the program will manage loss of material and cracking, as applicable, on heat exchangers in various systems. The program will inspect heat exchangers for degradation using non-destructive examinations, such as eddy-current inspections and visual inspections. If degradation is found, then an evaluation will be performed to determine its effects on the heat exchanger's design functions. The applicant stated in Appendix A that the heat exchanger monitoring program will be initiated prior to the period of extended operation. The staff reviewed this section and determined that the information in the UFSAR supplement provides an adequate summary of the program activities, as identified in the SRP-LR UFSAR supplement table and as required by 10 CFR 54.21(d).

Conclusion

On the basis of its review and audit of the applicant's program, the staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the UFSAR supplement for this AMP and finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.3.4 Inservice Inspection – Containment Inservice Inspection

Summary of Technical Information in the Application

The applicant's inservice inspection – containment inservice inspection program is described in LRA Section B.1.13, "Inservice Inspection – Containment Inservice Inspection." In the LRA, the applicant stated that the program is plant-specific. The applicant also stated that the program implements the applicable requirements of the ASME Boiler and Pressure Vessel Code, Section XI, Subsections IWE and IWL, as modified by 10 CFR 50.55a. Every 10 years the program is updated to the latest ASME Section XI code edition and addendum approved by the NRC in 10 CFR 50.55a. The applicant credits the program, under ASME Section XI, Subsection IWE, with managing loss of material for the steel containment liner and its integral attachments. The applicant credited the program, under ASME Section XI, Subsection IWL, with confirming that the effects of aging on the reinforced concrete containment shell and post-tensioning systems will not prevent the performance of intended functions consistent with the CLB for the period of extended operation.

Staff Evaluation

In accordance with 10 CFR 54.21(a)(3), the staff reviewed the information included in Appendix B, Section B.1.13, of the LRA, regarding the applicant's demonstration of the inservice inspection – containment inservice inspection program to ensure that the effects of aging, as discussed above, will be adequately managed so that the intended functions will be maintained consistent with the CLB throughout the period of extended operation.

The staff reviewed the inservice inspection – containment inservice inspection program against the AMP elements found in the SRP-LR, Appendix A, Section A.1.2.3, and SRP-LR Table A.1-1 and focused on how the program manages aging effects through the effective incorporation of 10 elements (i.e., program scope, preventive actions, parameters monitored or inspected, detection of aging effects, monitoring and trending, acceptance criteria, corrective actions, confirmation process, administrative controls, and operating experience.)

The applicant indicated that the corrective actions, confirmation process, and administrative controls are part of the site-controlled quality assurance program. The staff's evaluation of the quality assurance program is provided separately in Section 3.0.4 of this SER. The remaining seven elements are discussed below.

[Scope of Program] The applicant stated that the inservice inspection - containment inservice inspection program, under ASME Section XI, Subsection IWE, manages loss of material for the steel containment liner and its integral attachments. This is within the scope of Subsection IWE-1000. Under ASME Section XI, Subsection IWL, the program manages the effects of aging on the reinforced concrete containment shell and post-tensioning systems to ensure that they will perform in accordance with the CLB. This is within the scope of Subsection IWE-1000.

The staff confirmed that the specific components for which the inservice inspection - containment inservice inspection program are identified. The program scope program element satisfies the criterion defined in Appendix A.1 of the SRP-LR. On this basis, staff finds that the applicant's proposed scope is acceptable.

[Preventive Action] The applicant stated that this is a monitoring program that does not include preventive actions. The staff confirmed that the preventive actions program element satisfies the criterion defined in Appendix A.1 of the SRP-LR. The staff did not identify the need for preventive actions for AMP B.1.13 because it is a condition monitoring program.

[Parameters Monitored/Inspected] The applicant stated, in Appendix B, Section B.1.13, of the LRA, that visual inspections for Subsection IWE monitor for corrosion and loss of material of the steel containment liner and its attachments by inspecting the surface for evidence of flaking, blistering, peeling, discoloration, and other signs of distress. For Subsection IWL, prestressing force is measured by lift-off testing or equivalent test which is a TLAA. The staff's review of the applicant's evaluation of this TLAA is documented in Section 4.5 of this SER. In performing this review, the staff followed the guidance in Section 4.5 of the SRP-LR.

In addition, the applicant stated that tendon surveillance testing consists of inspection of the sheathing filler material and anchorage, tendon wire continuity testing, and tendon wire inspection.

The staff confirmed that this program element satisfies the criteria defined in Appendix A.1 of the SRP-LR. The visual inspections (Subsection IWE) and prestressing force measurements (Subsection IWL) are intended to detect the presence and extent of aging effects. On this basis, the staff finds that the parameters monitored or inspected is acceptable.

[Detection of Aging Effects] The applicant stated that the aging effect being managed under ASME Section XI, Subsection IWE, is loss of material for the steel containment liner and its integral attachments. Under ASME Section XI, Subsection IWL, the program manages the effects of aging on the reinforced concrete containment shell and post-tensioning system. The primary inspection method for the steel containment liner and its integral attachments is visual examination (general visual, VT-3, VT-1). Limited volumetric examination (ultrasonic thickness measurement) and surface examination (e.g., liquid penetrant) may be necessary in some instances. The primary inspection method for the concrete containment shell is visual examination (general, VT-1). The tendon prestressing force is measured by lift-off or equivalent test. Tendon surveillance testing consists of the sheathing filler material and anchorage inspection, tendon lift-off force measurement, tendon wire continuity testing, tendon wire inspection, and tensile testing. The tendon surveillance is performed periodically on a randomly selected group of tendons to provide confidence in the functional capability of the system.

The GALL Report Volume 2, Item IIA.3-1d recommends that examination categories E-B and E-F and additional examinations be performed during the period of extended operation to detect stress corrosion cracking (SCC) of stainless steel and dissimilar metal welds' containment penetration bellows assemblies. This recommendation is addressed in LRA Table 3.5.1, Item Number 3.5.1-2. During the audit, the staff noted that these examination categories were not committed to.

In pursuing this issue, the staff noted that in response to a separate staff RAI 3.5-1, by letter dated May 19, 2004, the applicant stated that no bellows are used for piping system containment penetrations. The fuel transfer tube is equipped with bellows type expansion joints that connect the transfer tube to the liner of the refueling canal in containment and to the liner of the spent fuel pool in the auxiliary building. The applicant stated that Table 3.5.1, Item Number 3.5.1-2 of Table 3.5.1 applies to the fuel transfer tube sleeve but not to the bellows since the bellows is not part of the containment penetration boundary. The bellows connecting the transfer tube to the refueling canal liner is an extension of the refueling canal liner which has no license renewal intended function. The bellows on the other end of the transfer tube connects the transfer tube to the liner in the fuel tilt pit portion of the spent fuel pool. The low point of the opening connecting the spent fuel pool to the tilt pit is above the top of the spent fuel stored in the storage racks so failure of the bellows cannot result in uncovering of the fuel. Therefore, neither bellows attached to the fuel transfer tube performs a license renewal intended function.

On the basis of its review and of the applicant's response to RAI 3.5-1, the staff confirmed that this program element satisfies the criteria defined in Appendix A.1 of the SRP-LR. The staff acknowledges that the frequency and scope of examination specified in 10 CFR 50.55a and ASME Section XI, Subsections IWE and IWL, ensure that aging effects will be detected before they compromise the design basis requirements. The inspections use a frequency and sample size based on existing codes and operating experience to detect the presence and extent of aging effects. On this basis, the staff concludes that the parameters monitored or inspected is acceptable.

[Monitoring and Trending] The applicant stated, in Appendix B, Section B.1.13, of the LRA, that that the responsible engineer periodically trends the measured prestressing forces from surveillances. If this review indicates a trend that would result in the tendon forces for a tendon or a group of tendons to be less than the minimum prestress value before the next inspection period, the responsible engineer (or designee) prepares a condition report.

The staff determined that with the exception of inaccessible areas, all metal and concrete surfaces within the scope are monitored by examination requirements of Subsections IWE and IWL. Periodically measured tendon prestressing forces are monitored in accordance with the requirements specified in Subsection IWL and trended to ensure that they remain above the minimum required level. The staff confirmed that this program element satisfies the criteria defined in Appendix A.1 of the SRP-LR. Trending of the surveillance results will enhance the applicant's ability to detect aging effects before there is a loss of intended function. On this basis, the staff finds that the monitoring and trending is acceptable.

[Acceptance Criteria] The applicant stated, in Appendix B, Section B.1.13, of the LRA, that the numerical acceptance standards provided in IWE-3000 for wall thickness and the numerical values provided in IWL-3000 for post-tensioning systems are utilized. No other numerical acceptance standards are provided for the steel containment liner and its integral attachments or for the reinforced concrete containment. The expertise and engineering judgment of the responsible engineer are relied upon to detect conditions that could affect the leak-tightness or structural integrity of the containment or prevent an inspected component from performing its intended function.

The staff confirmed that this program element satisfies the criteria defined in Appendix A.1 of the SRP-LR. Any wall thickness post-tensioning system values that are projected to fall below the minimum allowable, as determined by the applicable design code, will be found unacceptable and corrective measures implemented. On this basis, the staff finds that the acceptance criteria is acceptable.

[Operating Experience] The staff reviewed the applicant's engineering report related to the operating experience for this program. Condition report trending data for the period 1998 through 2002 did not identify a need for improvements to this program. The applicant also stated that the plant corrective action program, which captures internal and external plant operating experience issues, provides assurance that operating experience will be reviewed in the future to provide objective evidence to support the conclusion that the effects of aging will be adequately managed.

The staff agrees that even though limited operating experience was available, the inservice inspection – containment inservice inspection programs provided assurance that the applicable aging effects would be adequately managed for the period of extended operation.

UFSAR Supplement

In Appendix A, Section A.2.1.14, of the LRA, the applicant provided the UFSAR supplement for the inservice inspection – containment inservice inspection program and stated that the program implements the applicable requirements of ASME Section XI, Subsections IWE and IWL as modified by 10 CFR 50.55a. Every 10 years the containment inservice inspection program for ANO-2 is updated to the latest ASME Section XI code edition and addendum approved by the NRC in 10 CFR 50. The staff reviewed this section and determined that the information in the UFSAR supplement provides an adequate summary of the program activities, as identified in the SRP-LR UFSAR supplement table and as required by 10 CFR 54.21(d).

Conclusion

On the basis of its review and audit of the applicant's program, the staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.3.5 Inservice Inspection – Inservice Inspection

Summary of Technical Information in the Application

The applicant's inservice inspection – inservice inspection program is described in LRA Section B.1.14, "Inservice Inspection – Inservice Inspection" The applicant stated that this is a plant-specific program. The applicant credited this program with managing cracking, wear, loss of mechanical closure integrity, and loss of material of RCS piping and components, including RCP items and austenitic stainless steel small bore piping. This program implements the applicable requirements of the ASME Boiler and Pressure Vessel Code, Section XI, Subsections IWB, IWC, IWD, and IWF. In March 2000, ANO-2 entered the third ISI interval and began implementing the applicable requirements of the 1992 Edition of ASME Section XI, with pressure-testing criteria from the 1993 Addenda, approved NRC alternatives and relief requests, and other requirements specified in 10 CFR 50.55a.

Staff Evaluation

In accordance with 10 CFR 54.21(a)(3), the staff reviewed the information included in Appendix B, Section B.1.14, of the LRA, regarding the applicant's demonstration of the inservice inspection – inservice inspection program to ensure that the effects of aging, as discussed above, will be adequately managed so that the intended functions will be maintained consistent with the CLB throughout the period of extended operation.

The staff reviewed the inservice inspection – inservice inspection program against the AMP elements found in the SRP-LR, Appendix A, Section A.1.2.3, and SRP-LR Table A.1-1 and focused on how the program manages aging effects through the effective incorporation of 10 elements (i.e., program scope, preventive actions, parameters monitored or inspected, detection of aging effects, monitoring and trending, acceptance criteria, corrective actions, confirmation process, administrative controls, and operating experience.)

The applicant indicated that the corrective actions, confirmation process, and administrative controls are part of the site-controlled quality assurance program. The staff's evaluation of the quality assurance program is provided separately in Section 3.0.4 of this SER. The remaining seven elements are discussed below.

[Program Scope] The applicant stated, in Appendix B, Section B.1.14, of the LRA, that the inservice inspection program manages cracking, wear, loss of mechanical closure integrity, and loss of material of RCS piping and components, including RCP items and austenitic stainless steel small bore piping. The inservice inspection program is updated as required to the latest ASME Section XI code edition and addendum approved by the NRC in 10 CFR 50.55a. A risk-informed methodology is used to select Class 1, 2, and 3 piping welds for inspection in lieu of the requirements specified in the 1992 Edition of the ASME Section XI.

The staff reviewed the risk-informed inservice inspection (RI-ISI) methodology to determine if this approach is applicable to the period of extended operation. The applicant stated that there are no time-dependent parameters used that would change the determination of risk for a component as a result of operating during the license renewal period. The applicant also stated that any new degradation mechanism or change in consequence of piping failures that occurs over the license of the plant, including the period of extended operation, is incorporated into the RI-ISI program.

In order to evaluate the applicant's position, the staff reviewed the technical bases of the RI-ISI program and determined that the program scope is capable of managing the identified aging mechanisms. The applicant demonstrated that the aging effects identified for Class 1 piping are managed by the RI-ISI program. This was accomplished by identifying all the Class 1 piping aging effects that credit the RI-ISI program for aging management. These aging effects were compared with the aging effects identified in one of the RI-ISI program bases documents (EPRI TR-106706). All credited aging effects were found to be included in the program. The applicant also clarified that although the RI-ISI program addresses Class 1, 2, and 3, only the Class 1 portion of the risk-informed program is included in the LRA.

The staff confirmed that the program scope program element satisfies the criterion defined in Appendix A.1 of the SRP-LR. The proposed scope identifies the specific components for which the program manages aging. On this basis, the staff finds that the applicant's proposed program scope is acceptable.

[Preventive Action] The applicant stated that this program element is not applicable because the inservice inspection - inservice inspection program is an inspection program.

The staff confirmed that the preventive actions program element satisfies the criterion defined in Appendix A.1 of the SRP-LR. The staff did not identify the need for preventive actions for this program because it is a condition monitoring program.

[Parameters Monitored/Inspected] The applicant stated, in Appendix B, Section B.1.14, of the LRA, that the program uses non-destructive examination techniques to detect and characterize flaws. *The three different types of examinations are volumetric, surface, and visual.* Volumetric examinations are the most extensive, using methods such as radiographic, ultrasonic, or eddy current examinations to locate surface and subsurface flaws. Surface examinations, such as magnetic particle or dye penetrant testing, are used to locate surface flaws.

Three levels of visual examinations are specified. The VT-1 visual examination is conducted to assess the condition of the surface of the part being examined, looking for cracks and symptoms of wear, corrosion, erosion, or physical damage. It can be done with either direct visual observation or with remote examination using various optical/video devices. The VT-2 examination is conducted specifically to locate evidence of leakage from pressure-retaining components (period pressure tests). While the system is under pressure for a leakage test, visual examinations are conducted to detect direct or indirect indication of leakage. The VT-3 examination is conducted to determine the general mechanical and structural condition of components and supports and to detect discontinuities and imperfections.

The staff confirmed that this program element satisfies the criteria defined in Appendix A.1 of the SRP-LR. Measurements of wall thickness are intended to detect the presence and extent of aging effects. On this basis, the staff finds that the parameters monitored or inspected are acceptable.

[Detection of Aging Effects] The applicant stated that:

(1) The aging effects being managed by this program are cracking, wear, loss of mechanical closure integrity, and loss of material of RCS piping, valves and RCP items including bolting, valve bolting, and flange bolted connections. ASME Section XI, Subsection IWB, examination categories manage the aging effects of the Class 1 piping, valves, and RCP items. This program manages the aging effects through a combination of visual, surface, and volumetric examinations. Pressure boundary items undergo a system leakage test including a visual examination (VT-2) in accordance with ASME Section XI requirements.

(2) This program manages cracking of austenitic stainless steel small bore piping. The applicant defined small bore piping and small bore nozzles as those less than four-inch nominal pipe size that do not normally receive volumetric inspection in accordance with ASME Section XI. This program includes inspection of selected RCS piping welds. The inspection of RCS piping appropriately addresses cracking of piping greater than one-inch nominal pipe size for the period of extended operation.

(3) Cracking of the RCP covers is managed by visual examinations conducted in accordance with ASME Section XI examination Category B-L-2. Volumetric inspections of the pump casing welds are no longer performed at ANO-2 due to implementation of code case –481. Visual examination of pressure-retaining surfaces is performed in accordance with ASME Section XI requirements.

(4) This program manages cracking of the shell, lower heads and nozzles, and manway bolting, and supplements the boric acid corrosion prevention program in managing loss of material at external surfaces of the pressurizer. ASME Section XI, Subsection IWB, examination categories manage cracking and loss of material of the pressurizer pressure boundary and support items. This program manages cracking through a combination of visual, surface, and volumetric examinations.

(5) This program manages cracking of the reactor vessel, lower head, closure head, nozzles, and reactor vessel bolting, and supplements the boric acid corrosion prevention program in detecting loss of material at external surfaces of the reactor vessel and control element drive mechanism pressure boundary. ASME Section XI, Subsection IWB, examination categories manage cracking and loss of material of the reactor vessel and control element drive mechanism pressure boundary and support items. In addition to managing cracking, this program detects degradation as a result of wear. Closure studs, washers, nuts, and threaded holes of the vessel closure flange are visually inspected for wear in accordance with ASME Section XI requirements.

(6) Under ASME Section XI, Subsection IWB, the program manages cracking, wear, loss of preload, and loss of material of the reactor vessel internals items through visual examinations. Interior attachments and core support structures associated with the reactor vessel internals undergo a (VT-3) visual examination at the weld (for the attachments) and at the surface (for the core support structures).

(7) Under ASME Section XI, Subsections IWB, IWC, and IWD, the program manages cracking, wear, and loss of material of the steam generator pressure boundary and support items through a combination of visual, surface, and volumetric examinations.

(8) Under ASME Section XI, Subsection IWF, the program manages loss of material for ASME Class 1, 2, and 3 steel piping supports and steel component supports within the containment. The program also manages loss of material for steel base plates, component supports, and threaded fasteners, and cracking for threaded fasteners for ASME Class 1, 2, and 3 steel piping supports and steel component supports.

The staff confirmed that this program element satisfies the criteria defined in Appendix A.1 of the SRP-LR. The inspections use a frequency and sample size based on existing codes and operating experience to detect the presence and extent of aging effects. On that basis, the staff finds the program is capable of detecting aging effects.

[Monitoring and Trending] The applicant stated that this program does not require monitoring or trending of progressive, time-dependent degradation. Flaws detected are evaluated by comparing the examination results to the acceptance standards in ASME Section XI. Flaw indications require detailed analyses, repair, or replacement. The ISI results are recorded and provided to the NRC in accordance with ASME Section XI requirements. Reports describe the scope of the inspection and significant inspection results.

The staff agreed that the frequency of inspection and the inspection method are specified by the Code. Indications found by nondestructive examinations are evaluated in accordance with the Code and, if allowed to remain, will require monitoring and will be used for comparison with future inservice examination results. This provides for trending of the aging effect and establishes a baseline for the degradation process and the extent of degradation with time. The staff accepts this methodology to undertake further programmatic actions, such as repair and replacement, as necessary, to manage these aging effects.

The staff also confirms that this program element satisfies the criteria defined in Appendix A.1 of the SRP-LR. Trending of the inspection results enhances the applicant's ability to detect aging effects before there is a loss of intended function. On this basis, the staff finds that the monitoring and trending is acceptable.

[Acceptance Criteria] The applicant stated in Appendix B, Section B.1.14, of the LRA, that if a flaw is discovered during the performance of an ISI examination, an evaluation is conducted in accordance with article IWA-3000, IWB-3000, IWC-3000, IWD-3000, or IWF-3000.

The staff confirmed that this program element satisfies the criteria defined in Appendix A.1 of the SRP-LR. The staff reviewed the applicant's acceptance criteria and finds that any flaws discovered in the process of performing the inspections are deemed unacceptable and corrective measures are implemented. On this basis, the staff finds that the acceptance criteria is acceptable.

[Operating Experience] The applicant stated, in Appendix B, Section B.1.14, of the LRA, that condition report trending data does not identify a need for improvements to this program. A 2002 self assessment evaluated the inservice inspection programs using the NRC Inspections

Guideline 71111.08, "Inservice Inspection Activities." Minor deficiencies were noted and resolved during the evaluation.

The applicant also stated that the plant corrective action program, which captures internal and external plant operating experience issues, provides assurance that operating experience will be reviewed in the future to provide objective evidence to support the conclusion that the effects of aging will be adequately managed.

On the basis of its review of the above operating experience on the discussions with the applicant's technical staff, the staff finds that the inservice inspection – inservice inspection program adequately manages the aging effects that have been observed at the applicant's plant and can do so during the period of extended operation.

UFSAR Supplement

In Appendix A, Section A.2.1.15, of the LRA, the applicant provided the UFSAR supplement for the inservice inspection program and stated that the program implements the applicable requirements of ASME Section XI, Subsections IWB, IWC, IWD and IWF, and other requirements specified in 10 CFR 50.55a with approved NRC alternatives and relief requests. Every 10 years the inservice inspection program for ANO-2 is updated to the latest ASME Section XI code edition and addendum approved by the NRC in 10 CFR 50. The staff reviewed this section and determined that the information in the UFSAR supplement provides an adequate summary of the program activities, as identified in the SRP-LR UFSAR supplement table and as required by 10 CFR 54.21(d).

Conclusion

On the basis of its review and audit of the applicant's program, the staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.3.6 Oil Analysis

Summary of Technical Information in the Application

The applicant's oil analysis program is described in Section B.1.17, "Oil Analysis," of the LRA. In the LRA, the applicant stated that the program is plant-specific. This AMP is credited with ensuring the oil environment in the mechanical systems is maintained to the required quality.

Staff Evaluation

In accordance with 10 CFR 54.21(a)(3), the staff reviewed the information included in LRA Appendix B, Section B.1.17, of the LRA regarding the applicant's demonstration of the oil analysis program to ensure that the effects of aging, as discussed above, will be adequately managed so that the intended functions will be maintained consistent with the CLB throughout the period of extended operation.

The staff reviewed the oil analysis program against the AMP elements found in the SRP-LR, Appendix A, Section A.1.2.3, and SRP-LR Table A.1-1 and focused on how the program manages aging effects through the effective incorporation of 10 elements (i.e., program scope, preventive actions, parameters monitored or inspected, detection of aging effects, monitoring and trending, acceptance criteria, corrective actions, confirmation process, administrative controls, and operating experience.)

The applicant indicated that the corrective actions, confirmation process, and administrative controls are part of the site-controlled quality assurance program. The staff's evaluation of the quality assurance program is provided separately in Section 3.0.4 of this SER. The remaining seven elements are discussed below.

[Scope of Program] The applicant stated, in Appendix B, Section B.1.17, of the LRA, that the oil analysis program encompasses periodic sampling of the lubricating oil to which plant components subject to an AMR are exposed. The purpose of the program is to ensure the oil environment in the mechanical systems is maintained to the required quality.

The staff also confirmed that the specific components for which the oil analysis program manages aging are identified and that this program element satisfies the criteria defined in Appendix A.1 of the SRP-LR. On this basis, the staff finds that the applicant's proposed scope is acceptable.

[Preventive Actions] The applicant stated that the oil analysis program maintains oil systems free of contaminants (primarily water and particulates) thereby preserving an environment that is not conducive to aging mechanisms.

The staff confirmed that the preventive actions program element satisfies the criterion defined in Appendix A.1 of the SRP-LR. The staff finds that the preventive actions program element is acceptable because maintenance of contaminant-free oil systems prevents and mitigates the identified aging effects.

[Parameters Monitored/Inspected] The applicant stated that for components with periodic oil changes in accordance with manufacturer's recommendations, a particle count and check for water are performed to detect evidence of abnormal wear rates, contamination by moisture, or excessive corrosion. For components that do not have regular oil changes, viscosity and neutralization number are also determined to evaluate the oil is suitable for continued use.

The staff reviewed the applicant's program, procedures, and database of lube oil sample results. The staff confirmed that this program element satisfies the criteria defined in Appendix A.1 of the SRP-LR. The oil sampling program activities detect the conditions that potentiate degradation and also detect the presence and extent of aging effects. On this basis, the staff finds that the parameters monitored or inspected program element is acceptable.

[Detection of Aging Effects] The applicant stated, in Appendix B, Section B.1.17, of the LRA, that periodic sampling and compliance with the acceptance criteria provide assurance that lube oil contaminants do not exceed acceptable levels. This manages the aging effects of cracking, loss of material, and fouling.

The staff confirmed that this program element satisfies the criteria defined in Appendix A.1 of the SRP-LR. (Sampling from a population is not applicable to this AMP.) Sampling is appropriately described and linked to the aging effects and compliance with the acceptance criteria allow for the timely detection of their presence and extent. Appropriate industry standards such as SAE749D, ISO 4406, ISO 112218, and NAS 1638 are used in the development of sampling methods and frequencies. On this basis, the staff finds that the detection of aging effects is acceptable.

[Monitoring and Trending] The applicant stated that oil analysis results are reviewed to determine if alert levels or limits have been reached or exceeded. This review also checks for unusual trends. The staff examined the procedures and tools used for this purpose and considers them to be effective.

The staff confirmed that this program element satisfies the criteria defined in Appendix A.1 of the SRP-LR. The staff also examined the procedures and tools used for this purpose. Trending of the analysis results is performed and enhances the applicant's ability to detect aging effects before there is a loss of intended function. On this basis, the staff finds that the monitoring and trending is acceptable.

[Acceptance Criteria] The applicant stated for the oil analysis program that particle concentration limits are based on industry standards and water concentration will not exceed 0.1%. Viscosity bands are based on a tolerance of 10% around the base viscosity of the lubricating oil. Metal limits by spectral analysis and ferrography are based on original baseline data and manufacturer's recommendations.

The staff confirmed that this program element satisfies the criteria defined in Appendix A.1 of the SRP-LR. Any contaminant values that are projected to exceed limits (determined on the basis of the applicable standards and manufacturers' recommendations documented in the implementing procedures), result in the implementation of corrective measures. On this basis, the staff finds the acceptance criteria acceptable.

[Operating Experience] The applicant stated, in Appendix B, Section B.1.17, of the LRA, that condition report trending data does not identify a need for improvements to this program.

The staff has reviewed past test results and noted that the data are maintained within specifications. That evaluation concluded that the oil analysis program is being implemented as described in plant procedures and is an effective preventive maintenance program. During the audit, the staff reviewed more recent data on oil in contact with components subject to aging management and confirmed that lubricating oils continue to be maintained free of excess water and contamination. Proper additives remain present to neutralize acids that may form during component operation. This operating experience indicates that the program has maintained the quality of lubricating oils within specified limits to mitigate aging effects that could compromise the intended functions of components in this environment.

On the basis of its review of the above operating experience and on the discussions with the applicant's technical staff, the staff finds that the oil analysis program adequately manages the aging effects that have been observed at the applicant's plant and can do so during the period of extended operation.

UFSAR Supplement

In Appendix A, Section A.2.1.18, of the LRA, the applicant provided the UFSAR supplement for the oil analysis program and stated that the program ensures the oil environment in mechanical systems in the scope of license renewal is maintained to the required quality. By monitoring oil quality, the program maintains oil systems free of contaminants (primarily water and particulates) thereby preserving an environment that is not conducive to loss of material, cracking, or fouling. The staff reviewed this section and determined that the information in the UFSAR supplement provides an adequate summary of the program activities, as identified in the SRP-LR UFSAR supplement table and as required by 10 CFR 54.21(d).

Conclusion

On the basis of its review and audit of the applicant's program, the staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.3.7 Periodic Surveillance and Preventive Maintenance

Summary of Technical Information in the Application

The applicant's periodic surveillance and preventive maintenance program is described in LRA Section B.1.18, "Periodic Surveillance and Preventive Maintenance." In the LRA, the applicant stated that the program is plant-specific. This AMP is credited with performing periodic inspections and tests that are relied on to manage aging effects that are not managed by other AMPs. The periodic inspections and tests are generally implemented through repetitive tasks or routine monitoring of plant operations.

Staff Evaluation

In accordance with 10 CFR 54.21(a)(3), the staff reviewed the information included in Appendix B, Section B.1.18, of the LRA regarding the applicant's demonstration of the periodic surveillance and preventive maintenance program to ensure that the effects of aging, as discussed above, will be adequately managed so that the intended functions will be maintained consistent with the CLB throughout the period of extended operation.

The staff reviewed the periodic surveillance and preventive maintenance program against the AMP elements found in the SRP-LR, Appendix A, Section A.1.2.3, and SRP-LR Table A.1-1 and focused on how the program manages aging effects through the effective incorporation of 10 elements (i.e., program scope, preventive actions, parameters monitored or inspected, detection of aging effects, monitoring and trending, acceptance criteria, corrective actions, confirmation process, administrative controls, and operating experience.)

The applicant indicated that the corrective actions, confirmation process, and administrative controls are part of the site-controlled quality assurance program. The staff's evaluation of the quality assurance program is provided separately in Section 3.0.4 of this SER. The remaining seven elements are discussed below.

[Scope of Program] The applicant stated that periodic surveillance and preventive maintenance program encompasses those tasks credited with managing the aging effects identified in the AMRs. The preventive maintenance and surveillance testing activities are generally implemented through repetitive tasks or routine monitoring of plant operations.

The staff examined the applicant's summary engineering report of aging management reviews in which the preventive maintenance and surveillance program is credited for the aging management of a large number of items. Components are identified with this program only if management of one or more of the aging effects to which they are susceptible is not addressed in other AMPs. The following systems credit this program for management of aging effects: (1) emergency core cooling; (2) containment spray; (3) containment cooling; (4) containment penetrations; (5) EDG; (6) chemical and volume control; (7) alternate AC (AAC) diesel generator; (8) halon fire protection and RCP motor oil leakage collection; (9) fuel oil; (10) service water (SW); (11) auxiliary building ventilation; (12) control room ventilation; (13) emergency feedwater; (14) auxiliary building, turbine building, and yard structures; and (15) intake structure and emergency cooling pond.

The staff confirmed that the program scope program element satisfies the criterion defined in Appendix A.1 of the SRP-LR. The proposed scope identifies the specific components for which the program manages aging. On this basis, the staff finds that the applicant's proposed program is acceptable.

[Preventive Action] The applicant stated that the inspections and testing activities used to identify component aging effects do not prevent aging effects. However, the activities are intended to prevent failures of components that might be caused by aging effects.

The staff confirmed that the preventive actions program element satisfies the criterion defined in Appendix A.1 of the SRP-LR. The periodic surveillance and preventive maintenance program activities are intended to identified component aging effect and prevent failures of components that might be caused by aging effects and is consistent with Branch Technical Position RLSB-1. On this basis, the staff finds the preventive action acceptable.

[Parameters Monitored/Inspected] The applicant stated that this program provides instructions for monitoring SSCs to detect degradation. Inspection and testing activities monitor various parameters including system flow, system pressure, surface condition, loss of material, presence of corrosion products, and signs of cracking.

The staff sampled components in the engineered safety features systems and auxiliary systems. Periodic surveillance and preventive maintenance program activities that are credited for aging management were reviewed according to their associated repetitive task numbers. The applicant's commitment tracking system has been invoked to ensure that the surveillance and preventive maintenance requirements will remain subject to appropriate administrative controls. The applicant's method of controlling such commitments was examined in sufficient detail to permit confidence that once correctly identified, parameters relevant to extended operation would be monitored as required. For those components audited, the parameters monitored were reviewed and determined to be closely linked to the intended function of components managed under the periodic surveillance and preventive maintenance program.

The inspection and testing activities are planned so as to detect the presence and extent of aging effects.

The staff confirmed that this program element satisfies the criteria defined in Appendix A of the SRP-LR. On the basis of interviews with the applicant's technical staff, the staff finds the applicant's parameters monitored or inspected to be acceptable.

[Detection of Aging Effects] The applicant stated, for the periodic surveillance and preventive maintenance program, that

(1) Preventive maintenance activities provide for periodic component inspections and testing to detect aging effects. Inspection intervals are established such that they provide for timely detection of degradation. Inspection intervals are dependent on the component material and environment and take into consideration industry and plant-specific operating experience and manufacturer's recommendations.

(2) The extent and schedule of inspections and testing assure detection of component degradation prior to loss of intended functions. Established techniques such as visual inspections are used.

(3) Containment spray system pump seal heat exchanger testing manages fouling on the borated water side of the heat exchanger tubing. Containment sump inspection manages loss of material on stainless steel components in the containment sump. Emergency diesel generator maintenance inspections manage loss of material (including that due to selective leaching), cracking, fouling, and change in material properties for various materials. Emergency diesel generator surveillance testing manages fouling on air and treated water sides of the EDG air cooler heat exchangers. Chemical and volume control system periodic surveillance testing manages loss of material of charging pump casings. AAC diesel generator maintenance inspections manage loss of material (including that due to selective leaching), cracking, and change in material properties for various materials. AAC diesel generator surveillance testing manages fouling on heat exchanger tubing of the engine cooling water radiator, aftercooler heat exchanger, and lube oil heat exchanger. The CPC room halon system visual inspection manages loss of material for external and internal surfaces of carbon steel components. The RCP motor oil leakage collection system visual inspection manages loss of material for carbon steel and stainless steel components. Maintenance inspections of fuel oil system components manage loss of material, cracking, and change in material properties for various materials. Diesel generator surveillance testing manages fouling on the heat exchanger tubing of the diesel fuel oil return cooler. Service water system surveillance testing manages loss of material on bolting, filters, and pump casings. Auxiliary building ventilation system testing manages fouling on both the water and air sides of copper alloy cooling coils, and loss of material for external copper alloy cooling coil surfaces and for internal surfaces of the carbon steel cooling coil housing. Auxiliary building ventilation system testing manages change in material properties and cracking of elastomer flexible connections. Control room ventilation system testing manages loss of material and fouling for copper alloy, carbon steel, and stainless steel components. Control room ventilation system testing manages cracking and change in material properties of elastomer flexible connections. Emergency feedwater system testing and inspections manage loss of material and fouling on carbon

steel and copper components in the emergency feedwater system. Battery rack inspection manages loss of material for in-scope battery racks.

(4) Low pressure safety injection (LPSI) and high-pressure safety injection (HPSI) pump surveillance testing currently manages fouling on the borated water side of heat exchanger tubing of LPSI and HPSI pump seal coolers and fouling on the raw water side of HPSI pump bearing housings internal surfaces. For license renewal, the program will additionally inspect the interior of the bearing housings for the HPSI pumps for loss of material (including that due to selective leaching). Acceptance criteria and corrective actions for this enhancement will be specified.

(5) Periodic inspection of the external (air) side of containment SW cooling coils currently manages fouling and loss of material for the copper alloy cooling coils. For license renewal, the work orders for cleaning and inspecting the cooling coils of 2VCC-2A/B/C/D will be enhanced to include inspections to confirm the following conditions: no corroded parts or areas; and no accumulation of dirt or sludge that would affect the cooling ability of the coils.

(6) Periodic inspection of the interior and exterior of the cooling coil housing currently manages the effect of loss of material on carbon and stainless steel components. This includes inspection of the housing floor, coils, coil mounting bolts, frame, drain pans, and flanges. For license renewal, the work orders for cleaning and inspecting the housings of 2VCC-2A/B/C/D will be enhanced to include inspections of the interior and exterior of the housings to confirm the following conditions: no degradation of housing floor that would impact seismic qualification or affect required pressure boundary; no loose or degraded upper or lower coil mounting fasteners that would allow the coil to fall and block the drop-out dampers if an earthquake were to occur; and no significant corrosion or degradation of exterior surfaces, including the flanges of the SW coils, that could affect coil seismic qualification, required pressure boundary, or the ability to transfer the required heat load.

(7) During the monthly electrical penetration nitrogen leak rate test, if bottle pressure is too low, the bottles are replaced. The elastomer flex hoses in the electrical penetration nitrogen pressurization system are checked for cracking and change in material properties during replacement of nitrogen bottles.

(8) Annual emergency cooling pond sounding manages loss of form for the emergency cooling pond natural soils. Accessible and exposed surfaces are visually inspected along with sounding for pond level. Areas of the cooling pond are inspected for excessive erosion, degradation of riprap, or silt buildup.

During its review, the staff requested that the applicant identify how specific aging effects are detected and the associated technical basis, because different aging mechanisms require different detection methods. The staff requested that the applicant provide the emergency diesel generator maintenance inspections and emergency diesel generator surveillance testing as examples.

In its response dated July 22, 2004, the applicant provided a table listing the aging effect detection methods for aging effects such as loss of material (including that due to selective leaching), cracking, fouling, and change in material properties, and the technical basis for emergency diesel generator maintenance inspections. On the basis that the applicant provided adequate technical justification for the aging effect detection methods, the staff finds this acceptable.

Additionally, the staff asked the applicant to clarify, with regard to the chemical and volume control system (CVCS) periodic surveillance testing, what specific inspections or tests are conducted to assure that aging is not occurring in the charging pump casings, and to identify the frequency and acceptance criteria applicable to this surveillance testing. The staff also asked the applicant to identify specific criteria and operating experience that demonstrate loss of material in the charging pump casings is being effectively managed.

In its response dated July 22, 2004, the applicant provided the parameters monitored, detection of aging effects, monitoring and trending, acceptance criteria, and operating experience for loss of material due to wear and cracking due to fatigue aging effects for the CVCS charging pump casings. On the basis that the applicant provided the inspections and tests, acceptance criteria, and operating experience related to loss of material and cracking aging effects for the CVCS charging pump casings, the project team finds this acceptable.

The staff observed that measurements and inspections of other selected systems' surveillances use a frequency and sample size based on operating experience to detect the presence and extent of aging effects. The staff confirmed that this program element satisfies the criteria defined in Appendix A.1 of the SRP-LR. On the basis of its review of the applicant's responses, the staff finds that the detection of aging effects is acceptable.

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

The staff confirmed that this program element satisfies the criteria defined in Appendix A.1 of the SRP-LR. The staff noted that there are specific activities that will not be within the scope of the program until the license is renewed. The staff reviewed the applicant's commitment management program, which is used to ensure that these changes will be properly implemented, as well as the specific record originated to track the implementation of modifications necessitated by license renewal. Trending of the inspection results will enhance the applicant's ability to detect aging effects before there is a loss of intended function. On the basis of its review of the monitoring and trending, the staff finds it acceptable.

[Acceptance Criteria] The applicant stated that the periodic surveillance and preventive maintenance program acceptance criteria are defined in specific inspection and testing procedures. The acceptance criteria confirm component integrity by evaluating the absence of aging effect or by comparing applicable parameters to limits based on applicable intended functions established by the plant design basis.

The staff confirmed that this program element satisfies the criteria defined in Appendix A of the SRP-LR. The staff reviewed a selection of the repetitive tasks and associated procedures. In all cases where an aging effect had been identified, appropriate acceptance criteria were provided. While this offers some confidence that additional aging effects will be appropriately monitored, the codes and/or standards to be applied (and methods of assessment) have yet to be specified for the full license renewal scope. On the basis of its review of the applicant's acceptance criteria program element, the staff finds that any degradation to component integrity below the minimum allowable is unacceptable and corrective measures are implemented. On this basis, the staff finds the acceptance criteria program element to be acceptable.

[Operating Experience] The applicant stated that the plant's history of successful operation demonstrates that typical surveillance and preventive maintenance activities have been effective in managing the effects of aging on components.

The staff reviewed the applicant's programmatic experience with surveillance and maintenance activities. Although numerous deficiencies were identified, corrective actions were implemented and their effectiveness has been documented. This supports the conclusion that the program has been effective and will support license renewal. The applicant also stated that the plant corrective action program, which captures internal and external plant operating experience issues, provides assurance that operating experience will be reviewed in the future to provide objective evidence to support the conclusion that the effects of aging will be adequately managed. On the basis of its review of the above operating experience and on discussions with the applicant's technical staff, the staff concludes that the periodic surveillance and preventive maintenance program adequately manages the aging effects that have been observed at the applicant's plant.

UFSAR Supplement

In Appendix A, Section A.2.1.19, of the LRA, the applicant provided the UFSAR supplement for the periodic surveillance and preventive maintenance program and stated that the program consists of periodic inspections and tests that are relied on to manage aging effects that are not managed by other AMPs. Preventive maintenance and surveillance testing activities provide for periodic component inspections and testing to detect various aging effects applicable to those components included in the program for license renewal. The staff reviewed this section and determined that the information in the UFSAR supplement provides an adequate summary of the program activities, as identified in the SRP-LR UFSAR supplement table and as required by 10 CFR 54.21(d).

Conclusion

On the basis of its review and audit of the applicant's program, the staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the UFSAR supplement for this AMP and finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.3.8 Pressurizer Examinations Program

Summary of Technical Information in the Application

The applicant's pressurizer examinations program is described in LRA Section B.1.19, "Pressurizer Examinations." In the LRA, the applicant stated that the program is plant-specific. The AMP is credited with identification of pressurizer cladding cracking, which could potentially cause loss of intended function of the pressurizer.

Staff Evaluation

In accordance with 10 CFR 54.21(a)(3), the staff reviewed the information included in Appendix B, Section B.1.19, of the LRA, regarding the applicant's demonstration of the pressurizer examinations program to ensure that the effects of aging, as discussed above, will be adequately managed so that the intended functions will be maintained consistent with the CLB throughout the period of extended operation.

The staff reviewed the pressurizer examinations program against the AMP elements found in the SRP-LR, Appendix A, Section A.1.2.3, and SRP-LR Table A.1-1 and focused on how the program manages aging effects through the effective incorporation of 10 elements (i.e., program scope, preventive actions, parameters monitored or inspected, detection of aging effects, monitoring and trending, acceptance criteria, corrective actions, confirmation process, administrative controls, and operating experience.)

The applicant indicated that the corrective actions, confirmation process, and administrative controls are part of the site-controlled quality assurance program. The staff's evaluation of the quality assurance program is provided separately in Section 3.0.4 of this SER. The remaining seven elements are discussed below.

[Program Scope] The applicant stated, in Appendix B, Section B.1.19, of the LRA, that the pressurizer examinations program will manage cracking of the stainless steel and nickel-based alloy cladding and attachment welds to the cladding of the pressurizer by examination of the adjacent base metal. The pressurizer shell and upper head are clad with austenitic stainless steel. The lower head is clad with nickel-based alloy.

During the audit, in RAI B.1.19-1, the staff asked the applicant to confirm that the pressurizer examinations program comprises activities performed under the existing inservice inspection program, and if it is an existing program, to update the UFSAR supplement, LRA Section A.2.1.20.

In its response to RAI B.1.19-1, by letter dated July 22, 2004, the applicant stated that the pressurizer examinations program comprises activities performed under the existing inservice inspection program and that, upon incorporation into the safety analysis report, the UFSAR supplement LRA Section A.2.1.20 will be revised to indicate that the pressurizer examinations program is an existing program. On the basis of its review of the applicant's response, the staff finds this acceptance, and the RAI is resolved.

The staff confirmed that the program scope program element satisfies the criterion defined in Appendix A.1 of the SRP-LR. The proposed scope identifies the specific components for which the program manages aging. On this basis, the staff finds that the applicant's proposed program scope is acceptable.

[Preventive Actions] The applicant stated the pressurizer examinations program is an inspection program and that no actions will be taken as part of this program to prevent aging effects or mitigate aging degradation. However, the applicant added that the its water chemistry control program includes effective actions to avoid SCC of the cladding and attachment welds.

The staff confirmed that the preventive actions program element satisfies the criterion defined in Appendix A.1 of the SRP-LR. The staff did not identify the need for preventive actions for this program because it is a condition monitoring program.

[Parameters Monitored] The applicant stated that (1) in order to provide assurance that cracking of the pressurizer cladding has not propagated into the underlying base metal of the pressurizer, volumetric examination of pressurizer items that are susceptible to cracking will be performed. Cracking of the pressurizer stainless steel cladding would most likely result from thermal fatigue and cracking of the nickel-based alloy cladding would most likely result from primary water SCC and fatigue. The pressurizer pressure boundary items with high fatigue cumulative usage factors include the circumferential weld at the head-to-shell junction and the surge nozzle to shell junction and (2) in accordance with ASME Section XI, Examination Category B-B, volumetric examination of essentially 100% of the circumferential shell-to-head weld will be performed. In addition, the weld metal between the surge nozzle and the vessel lower head will be subjected to high stress cycles. Periodic monitoring of this area provides monitoring for cracking of the nickel-based alloy cladding that may propagate to the underlying ferritic steel. The weld that connects the surge nozzle to the lower head will receive volumetric examination in accordance with Examination Category B-D. These examinations will continue through the period of extended operation to manage cracking of cladding that may extend into the base metal at susceptible locations.

The staff confirmed that this program element satisfies the criteria defined in Appendix A of the SRP-LR. The evaluations of cladding and weld integrity are intended to detect the presence and extent of aging effects. On this basis, the staff finds that the parameters monitored or inspected are acceptable.

[Detection of Aging Effects] The applicant stated that detection of cracking in the pressurizer cladding will be achieved through periodic volumetric inspections of the base metal as required by ASME Section XI. Inspection of these items constitutes an appropriate sample of the remaining stainless steel and nickel-based alloy clad items in the pressurizer. Information in Table IWB 2500-1 describes the inspection sampling requirements, the examination methods, and the examination frequencies for the pressurizer. Detection of cracking will be achieved through periodic volumetric inspections as required by ASME Section XI.

The staff confirmed that this program element satisfies the criteria defined in Appendix A.1 of the SRP-LR. The applicant stated that inspections will use a frequency and sample size based on existing codes and operating experience, to detect the presence and extent of aging effects. On this basis, the staff finds that the detection of aging effects is acceptable.

[Monitoring and Trending] The applicant stated that (1) during the course of the inspections, the extent of surface or volumetric flaws will be characterized by non-destructive examinations. Anomalous indications that are signs of degradation will be recorded on non-destructive examination reports in accordance with plant procedures and (2) the corrective action program and the requirements of ASME Section XI will address trending of flaws detected.

The staff confirmed that this program element satisfies the criteria defined in Appendix A of the SRP-LR. Trending of the inspection results will enhance the applicant's ability to detect aging effects before there is a loss of intended function. On this basis, the staff finds that the monitoring and trending is acceptable.

[Acceptance Criteria] The applicant stated that acceptance criteria for volumetric examinations will be in accordance with ASME Section XI, IWB-3510 and IWB-3512.

The staff confirmed that this program element satisfies the criteria defined in Appendix A.1 of the SRP-LR. The staff finds that any volumetric examination results that fall below the minimum allowable, as determined by the applicable design code, will be found unacceptable and corrective measures implemented. On that basis, the staff finds that the acceptance criteria is acceptable.

[Operating Experience] The applicant stated, in Appendix B, Section B.1.19, of the LRA, that its pressurizer examinations program is a new program for which there is no operating experience. The program will include volumetric examinations of pressurizer items having high susceptibility to thermal fatigue. Cracking of the cladding that extends into the base metal will be detected by ASME Section XI volumetric examinations at these locations. The volumetric inspections will be performed with ISI techniques that have been proven effective within the industry at detecting cracking before loss of function occurs.

In the LRA, the applicant stated that the program is based on proven ISI techniques that can effectively manage cracking of pressurizer cladding. This program will provide assurance that the aging effects will be managed so that the pressurizer will continue to perform its intended functions consistent with the CLB for the period of extended operation.

During the audit, the staff asked the applicant to clarify and/or provide the operating experience reviews for new programs. In its response, the applicant stated that the plant corrective action program, which captures internal and external plant operating experience issues, provides assurance that operating experience will be reviewed and incorporated in the future to provide objective evidence to support the conclusion that the effects of aging will be adequately managed.

The staff agrees that even though limited operating experience was available, the pressurizer examinations program provided assurance that the applicable aging effects would be adequately managed for the period of extended operation.

UFSAR Supplement

In Appendix A, Section A.2.1.20, of the LRA, the applicant provided the UFSAR supplement for the pressurizer examinations program and stated that the program will use volumetric examinations required by ASME Section XI to manage cracking of the stainless steel and nickel-based alloy cladding and attachment welds to the cladding which may propagate into the underlying ferritic steel. Volumetric examination of the circumferential shell-to-head weld and the weld metal between the surge nozzle and the vessel lower head will be performed each ISI inspection interval. The applicant stated in Appendix A that the pressurizer examinations program will be implemented prior to the period of extended operation. As stated in its response to RAI B.1.19-1, the applicant stated that UFSAR supplement A.2.1.20 will be revised to indicate that the pressurizer examinations program is an existing program. The staff reviewed this section and determined that the information in the UFSAR supplement provides an adequate summary of the program activities, as identified in the SRP-LR UFSAR supplement table and as required by 10 CFR 54.21(d).

Conclusion

On the basis of its review and audit of the applicant's program, the staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.3.9 System Walkdown Program

Summary of Technical Information in the Application

The applicant's system walkdown program is described in LRA Section B.1.28, "System Walkdown." In the LRA, the applicant stated that the program is plant-specific. The AMP is credited with managing aging effects on systems and components within the scope of license renewal and subject to aging management review.

Staff Evaluation

In accordance with 10 CFR 54.21(a)(3), the staff reviewed the information included in Appendix B, Section B.1.19, of the LRA, regarding the applicant's demonstration of the system walkdown program to ensure that the effects of aging, as discussed above, will be adequately managed so that the intended functions will be maintained consistent with the CLB throughout the period of extended operation.

The staff reviewed the system walkdown program against the AMP elements found in the SRP-LR, Appendix A, Section A.1.2.3, and SRP-LR Table A.1-1 and focused on how the program manages aging effects through the effective incorporation of 10 elements (i.e., program scope, preventive actions, parameters monitored or inspected, detection of aging effects, monitoring and trending, acceptance criteria, corrective actions, confirmation process, administrative controls, and operating experience.)

The applicant indicated that the corrective actions, confirmation process, and administrative controls are part of the site-controlled quality assurance program. The staff's evaluation of the quality assurance program is provided separately in Section 3.0.4 of this SER. The remaining seven elements are discussed below.

[Program Scope] The applicant stated, in Appendix B, Section B.1.28, of the LRA, that the system walkdown program includes inspections of external surfaces of ANO-2 components within the scope of license renewal and subject to an aging management review. The program is credited with managing loss of material from internal surfaces for situations in which the external surface condition is representative of the internal surface condition and both have the same environment. The program is also credited with detecting leakage and spray from liquid-filled low-energy systems before such leakage can prevent satisfactory accomplishment of safety functions.

The staff confirmed that the program scope program element satisfies the criterion defined in Appendix A.1 of the SRP-LR. The proposed scope identifies the specific components for which the program manages aging. On this basis, the staff finds that the applicant's proposed program scope is acceptable.

[Preventive Actions] The applicant stated that the system walkdown program is an inspection program and no actions will be taken as part of this program to prevent or mitigate aging degradation.

The staff confirmed that the program element satisfies the criterion defined in Appendix A.1 of the SRP-LR. The staff did not identify the need for preventive actions since the system walkdown program is a condition monitoring program.

[Parameters Monitored/Inspected] The applicant stated that during a walkdown, the engineer monitors for items which could affect system performance, safety, or reliability as well as general housekeeping, personnel safety hazards, and radiological concerns. Examples of parameters inspected during the system walkdown are condition and placement of coatings, evidence of corrosion, and indications of leakage.

The staff confirmed that this program element satisfies the criteria defined in Appendix A.1 of the SRP-LR. The system walkdown activities are intended to detect the presence and extent of aging effects. On this basis, the staff finds that the parameters monitored or inspected is acceptable.

[Detection of Aging Effects] The applicant stated (1) a general visual inspection is conducted on readily accessible system and component surfaces during walkdowns, (2) component walkdowns are performed periodically at a frequency dependent on the component being inspected and (3) for each system that credits the program, system engineers are expected to perform a walkdown at least once per refueling cycle. The frequency of inspection is acceptable because aging effects are typically caused by relatively long-term degradation mechanisms such as corrosion.

The staff confirmed that this program element satisfies the criteria defined in Appendix A.1 of the SRP-LR. The walkdowns are conducted, using a frequency and sample size based on operating experience, to detect the presence and extent of aging effects. On that basis, the staff finds that the detection of aging effects is acceptable.

[Monitoring and Trending] The applicant stated that (1) the program uses standardized monitoring and trending activities to track degradation. Deficiencies are documented so that results can be trended. In addition to preparing a written description and noting the location, this may also include collecting measurements to determine the severity of deterioration, taking photographs, or drawing sketches and (2) component inspections are conducted by qualified engineers using predefined checklists. Personnel are qualified in accordance with the engineering support personnel training program that provides assurance of an appropriate level of knowledge and experience prior to performing engineering activities.

The staff confirmed that this program element satisfies the criteria defined in Appendix A of the SRP-LR. Trending of the inspection results will enhance the applicant's ability to detect aging effects before there is a loss of intended function. On this basis, the staff finds that the monitoring and trending is acceptable.

[Acceptance Criteria] The applicant stated that, for the system walkdown program, all unacceptable visual indications of cracking, loss of material, or change of material properties of components are documented as deficiencies.

The staff confirmed that this program element satisfies the criteria defined in Appendix A.1 of the SRP-LR. The staff finds that any deficiencies will be found unacceptable and corrective measures implemented. On this basis, the staff finds that the acceptance criteria is acceptable.

[Operating Experience] The applicant stated, in Appendix B, Section B.1.28, of the LRA, that the condition reports document conditions identified during walkdowns, including instances of corrosion, paint flaking, excessive wear, plant environment issues, leakage, loose parts, bent or broken parts, and numerous other material conditions. Condition report trending data did not identify a need for improvement to this program. Operating experience demonstrated that under the program coating deficiencies, evidence of corrosion, and indications of leakage were being adequately detected and corrective action was initiated as required. The applicant also stated that the plant corrective action program, which captures internal and external plant operating experience issues, provides assurance that operating experience will be reviewed in the future to provide objective evidence to support the conclusion that the effects of aging will be adequately managed.

On the basis of its review of the above operating experience on the discussions with the applicant's technical staff, the staff finds that the system walkdown program adequately manages the aging effects that have been observed at the applicant's plant and can do so during the period of extended operation.

UFSAR Supplement

In Appendix A, Section A.2.1.29, of the LRA, the applicant provided the UFSAR supplement for the system walkdown program and stated that the program conducts inspections to manage loss of material, loss of mechanical closure integrity, and cracking, as applicable, for SCs within the scope of license renewal. The program uses general visual inspections of readily accessible system and component surfaces during system walkdowns. The staff reviewed this section and determined that the information in the UFSAR supplement provides an adequate summary of the program activities, as identified in the SRP-LR UFSAR supplement table and as required by 10 CFR 54.21(d).

Conclusion

On the basis of its review and audit of the applicant's program, the staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.3.10 Wall Thinning Monitoring Program

Summary of Technical Information in the Application

The applicant's wall thinning monitoring program is described in LRA Section B.1.29, "Wall Thinning Monitoring." In the LRA, the applicant stated that the program is plant-specific and is credited with ensuring that wall thickness is above the minimum required in order to avoid failures under normal, transient, and accident conditions, including seismic events.

Staff Evaluation

In accordance with 10 CFR 54.21(a)(3), the staff reviewed the information included in Appendix B, Section B.1.19, of the LRA, regarding the applicant's demonstration of the wall thinning monitoring program to ensure that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB throughout the period of extended operation.

The staff reviewed the wall thinning monitoring program against the AMP elements found in the SRP-LR, Appendix A, Section A.1.2.3, and SRP-LR, Table A.1-1 and focused on how the program manages aging effects through the effective incorporation of 10 elements (i.e., program scope,.preventive actions, parameters monitored or inspected, detection of aging effects, monitoring and trending, acceptance criteria, corrective actions, confirmation process, administrative controls, and operating experience.)

The applicant indicated that the corrective actions, confirmation process, and administrative controls are part of the site-controlled quality assurance program. The staff's evaluation of the quality assurance program is provided separately in Section 3.0.4 of this SER. The remaining seven elements are discussed below.

[Scope of Program] The applicant stated, in Appendix B, Section B.1.29, of the LRA, that the wall thinning monitoring program encompasses wall thinning monitoring inspections for carbon and stainless steel components.

The staff confirmed that the program scope program element satisfies the criterion defined in Appendix A.1 of the SRP-LR. The proposed scope identifies the specific components for which the program manages aging. On this basis, the staff finds that the applicant's proposed program scope is acceptable.

[Preventive Actions] The applicant stated the wall thinning monitoring program is an inspection program and no actions will be taken as part of this program to prevent or mitigate degradation due to aging.

The staff confirmed that the preventive actions program element satisfies the criterion defined in Appendix A.1 of the SRP-LR. The staff did not identify the need for preventive actions for the wall thinning monitoring program since it is a condition monitoring program.

[Parameters Monitored] The applicant stated that non-destructive examinations will be performed on susceptible components to determine wall thickness.

The staff confirmed that this program element satisfies the criteria defined in Appendix A.1 of the SRP-LR. During the audit, the staff observed that the applicant did not identify the parameters monitored nor the type of non-destructive examinations to be performed. By letter dated January 22, 2004, the applicant stated that the wall thinning program was modified to identify that the parameter monitored will be wall thickness. In its letter, the applicant also stated that the wall thinning program was modified to reflect that non-destructive examinations using industry-accepted methods such as ultrasonic testing will be performed on susceptible components to determine wall thickness. The parameters monitored or inspected program element is acceptable because the measurements of wall thickness are intended to detect the presence and extent of aging effects. On this basis, the staff finds that the parameters monitored or inspected is acceptable.

[Detection of Aging Effects] The applicant stated that (1) the aging effect being managed by this program is loss of material. An appropriate sample size will be determined based on operating experience prior to these inspection activities. The extent and schedule of the examinations prescribed by the program will be designed to ensure that aging effects will be discovered and repaired before loss of intended function and (2) inspections will be performed periodically at a frequency to be determined prior to implementation. The frequency of inspections will depend upon results of previous inspections, calculated rate of material loss, and industry and plant operating experience.

The staff confirmed that this program element satisfies the criteria defined in Appendix A.1 of the SRP-LR. However, the staff observed that applicant did not specify the type of non-destructive examinations to be performed. By letter dated January 22, 2004, the applicant stated that the wall thinning program was modified to reflect that non-destructive examinations using industry-accepted methods such as ultrasonic testing will be performed on susceptible components to determine wall thickness. The staff finds, based on its review of the detection of aging effects program element and the applicant's January 22, 2004 letter, that the detection of aging effects program element is acceptable because the inspections will be developed, using a frequency and sample size based on operating experience, to detect the presence and extent of aging effects. With this additional information the staff finds that the criteria of SRP-LR Appendix A.1 are satisfied and so the program element is acceptable.

[Monitoring and Trending] The applicant stated that wall thickness will be trended and projected to the next inspection, and corrective actions will be taken if the projections indicate that the acceptance criteria of minimum wall thickness may not be met at the next inspection.

The staff confirmed that this program element satisfies the criteria defined in Appendix A of the SRP-LR. Trending of the inspection results will enhance the applicant's ability to detect aging effects before there is a loss of intended function. On this basis, the staff finds that the monitoring and trending is acceptable.

[Acceptance Criteria] The applicant stated that wall thickness measurements greater than minimum wall thickness values for the components' design code of record will be acceptable.

The staff confirmed that this program element satisfies the criteria defined in Appendix A.1 of the SRP-LR. The staff finds that any wall thickness values that are projected to fall below the minimum allowable, as determined by the applicable design code, will be found unacceptable and corrective measures implemented. On this basis, the staff finds that the acceptance criteria is acceptable.

[Operating Experience] The applicant stated, in Appendix B, Section B.1.29, of the LRA, that wall thinning monitoring program is a new program for which there is no operating experience.

The staff observed that ultrasonic wall thickness examinations are consistent with industry standards and the applicant had indicated that if initial or periodic examinations reveal the need to expand the sample size or increase the frequency of these activities, such actions would occur. The operating experience associated with the wall thinning monitoring program will be accrued over the period of extended operation.

During the audit, the staff asked the applicant to clarify and/or provide the operating experience reviews for new programs. In its response, the applicant stated that the plant corrective action program, which captures internal and external plant operating experience issues, provides assurance that operating experience will be reviewed and incorporated in the future to provide objective evidence to support the conclusion that the effects of aging will be adequately managed.

The staff agrees that even though limited operating experience was available, the wall thinning program provides assurance that the applicable aging effects would be adequately managed for the period of extended operation.

UFSAR Supplement

In Appendix A, Section A.2.1.30, of the LRA, the applicant provided the UFSAR supplement for the wall thinning monitoring program and stated that it will manage loss of material from components, as applicable, within the scope of license renewal. Inspections will be performed to ensure wall thickness is above the minimum required in order to avoid failures. The applicant stated in Appendix A that the wall thinning monitoring program will be initiated prior to the period of extended operation. The staff reviewed this section and determined that the information in the UFSAR supplement provides an adequate summary of the program activities, as identified in the SRP-LR UFSAR supplement table and as required by 10 CFR 54.21(d).

Conclusion

On the basis of its review and audit of the applicant's program, the staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.3.11 Auxiliary Systems Water Chemistry Control Program

Summary of Technical Information in the Application

The applicant's auxiliary systems water chemistry control program is described in LRA Section B.1.30.1, "Auxiliary Systems Water Chemistry Control." In the LRA, the applicant stated that the program is plant-specific and is credited with managing loss of material, cracking, and fouling of components exposed to treated water environments.

Staff Evaluation

In accordance with 10 CFR 54.21(a)(3), the staff reviewed the information included in Appendix B, Section B.1.30.1, of the LRA, regarding the applicant's demonstration of the auxiliary systems water chemistry control program to ensure that the effects of aging, as discussed above, will be adequately managed so that the intended functions will be maintained consistent with the CLB throughout the period of extended operation.

The staff reviewed the auxiliary systems water chemistry control program against the AMP elements found in the SRP-LR, Appendix A, Section A.1.2.3 and SRP-LR Table A.1-1 and focused on how the program manages aging effects through the effective incorporation of 10 elements (i.e., program scope, preventive actions, parameters monitored or inspected, detection of aging effects, monitoring and trending, acceptance criteria, corrective actions, confirmation process, administrative controls, and operating experience.)

The applicant indicated that the corrective actions, confirmation process, and administrative controls are part of the site-controlled quality assurance program. The staff's evaluation of the quality assurance program is provided separately in Section 3.0.4 of this SER. The remaining seven elements are discussed below.

[Scope of Program] The applicant stated, in Appendix B, Section B.1.30.1, of the LRA, that the auxiliary systems water chemistry control program encompasses sampling activities that include analyses on the EDG and AAC diesel generator cooling water systems. In addition, the program includes chemistry monitoring and inspection activities on selected systems included in the scope of license renewal due to possible spatial interactions with safety-related systems. These are systems containing treated water that are not covered by other chemistry programs.

The applicant stated that LRA Section 2.3.3.11 contains the non-safety-related SCs. In Section 2.3.3.11 of the LRA, the applicant described the systems that are in-scope for 10 CFR 54.4(a)(2). Specifically, LRA Table 2.3.3-11, "Miscellaneous Systems in scope for 10 CFR 54.4(a)(2) Components Subject to Aging Management Review," described non-safety-related system components. LRA Table 3.3.2-11, "Miscellaneous Systems in scope for 10 CFR 54.4(a)(2) Summary of Aging Management Evaluation," identifies component types that credit the auxiliary systems water chemistry control program as an AMP.

The staff confirmed that the program scope program element satisfies the criterion defined in Appendix A.1 of the SRP-LR. The proposed scope identifies the specific components for which the program manages aging. On this basis, the staff finds that the applicant's proposed program scope is acceptable.

[Preventive Actions] The applicant stated that this program monitors and controls water chemistry in the cooling water systems to manage the effects of aging.

The staff confirmed that the preventive actions program element satisfies the criterion defined in Appendix A.1 of the SRP-LR. On the basis of its audit of the implementation procedures and review of the program basis documents, the staff finds that preventive actions program element is acceptable because it identifies and describes the activities from managing aging effects.

[Parameters Monitored/Inspected] The applicant stated that the program inspects components for visible corrosion, deposits, structural damage, and biological growth. The systems are inspected when opened for maintenance. The program typically monitors pH, conductivity, solids, hardness, nitrite, freeze point, and biological count.

During its audit, the staff asked the applicant to (1) clarify whether iron and copper are monitored in the applicant's auxiliary systems water chemistry control program, and (2) discuss whether the parameters monitored/inspected under this program are consistent with the industry guidance credited. The applicant stated that iron and copper are monitored under the program, and that the program covers a wide variety of equipment and parameters that are monitored/inspected in accordance with vendor recommendations for the individual components. The component inspections and water chemistry monitoring activities are intended to detect the presence and extent of aging effects.

During its audit, the staff asked the applicant to (1) discuss the systems and components that have been inspected (i.e., scope of inspection) under the auxiliary system water chemistry control program (AMP B.1.30.1) in the past and which systems and components would be inspected during the extended period of operation; and (2) discuss whether any systems covered under this program have never been inspected and whether component failures (e.g., leakage) have occurred in these systems.

In its response dated May 19, 2004, the applicant stated that visual inspections have been performed on components in the emergency diesel generator, condensate storage, feedwater, chilled water, and main steam systems during disassembly for various reasons. A number of components such as piping, tanks, heat exchangers and valves that are managed by the auxiliary systems water chemistry control program have been inspected on both the emergency diesel generators and the AAC diesel generator. Many of the components in these cooling water systems are subject to inspection on a routine basis and, as a result, will be inspected during the period of extended operation.

In its response dated May 19, 2004 to the second question above, the applicant stated that during operation, all systems with components that rely only on the auxiliary systems water chemistry control program for managing aging effects have been inspected during maintenance. If leakage were to occur in a system covered by this program, it would have been opened during maintenance to repair the leak and, therefore, would have been inspected.

On the basis of its review of the applicant's responses, the staff confirmed that this program element satisfies the criteria defined in Appendix A.1 of the SRP-LR and finds that the parameters monitored or inspected program element is acceptable.

[Detection of Aging Effects] The applicant stated that this program manages aging effects in the systems included in the scope.

The staff confirmed that this program element satisfies the criteria defined in Appendix A.1 of the SRP-LR. In its engineering report, the applicant stated that the aging effects being managed include loss of material (including that due to selective leaching) from the components containing treated water in the emergency diesel generator system; fouling of the heat exchanger tubes of the emergency diesel generator system; loss of material (including that due to selective leaching) from the alternate AC diesel generator components exposed to treated water; fouling on the heat exchanger tubes of the alternate AC diesel generator system; and loss of material and cracking for certain systems containing treated water. The staff reviewed the engineering report, and finds that the component inspections are conducted to detect the presence and extent of aging effects. On this basis, the staff finds that the detection of aging effects program element is acceptable.

[Monitoring and Trending] The applicant stated that values from analyses are archived for long-term trending and review.

The staff confirmed that this program element satisfies the criteria defined in Appendix A.1 of the SRP-LR. Trending of the inspection results will enhance the applicant's ability to detect aging effects before there is a loss of intended function. On this basis, the staff finds that the monitoring and trending are acceptable.

[Acceptance Criteria] The applicant stated that the acceptance criteria for chemistry parameters are in accordance with the manufacturer's recommendations or industry guidance. The acceptance criteria for visual inspections are satisfactory general cleanliness and no unacceptable corrosion, deposits, or structural damage.

The staff confirmed that this program element satisfies the criteria defined in Appendix A.1 of the SRP-LR. The staff finds that any inspection results that indicate component degradation or any chemistry parameters that fall outside those contained in applicable industry and manufacturers' guidelines will be found unacceptable and corrective measures implemented.

During the audit, the staff asked the applicant to identify specific industry guidance documents used as the basis for the acceptance criteria.

In its response dated May 19, 2004, the applicant replied that EPRI TR-107396 was used to develop the auxiliary systems water chemistry control program and implementing procedure 1052.027. The applicant further stated that more specific guidance was also used to develop the program, including EPRI NP-5569, "Chromate Substitutes for Corrosion Inhibitors in Cooling Systems"; CE-NPSD-448, "Review of Inhibitors used in Closed Cycle Cooling Water Systems"; EPRI TR-105504, "Primer on Maintaining the Integrity of Water-Cooled Generator Stator Windings"; and the Technical Manual for Alternate AC Diesel Generator System.

On the basis of the applicant's response to the above question and its review, the staff finds the acceptance criteria acceptable.

[Operating Experience] The applicant stated that during the review of the ANO-1 LRA (0CNA040109), the NRC staff reviewed the ANO auxiliary systems water chemistry control program. The governing procedure for the auxiliary systems water chemistry program applies to both units.

The staff asked the applicant to discuss whether there have been any condition reports or licensee event reports related to chemical excursions or component degradation occurring in the systems within the scope of the auxiliary systems water chemistry control program. The applicant responded that the operating experience discussed in its engineering report included a review of condition reports, condition report trending data, and interviews with the applicant's technical staff regarding plant system and program operating experience. The review did not identify any condition reports or licensee event reports related to chemical excursions in the systems covered under this program. Also, the condition report trending data did not identify recurrent component degradation occurring in the systems covered under this program.

On the basis of its review of the above operating experience and on discussions with the applicant's technical staff, the staff concludes that auxiliary systems water chemistry control program adequately manages the aging effects that have been observed at the applicant's plant.

UFSAR Supplement

In Appendix A, Section A.2.1.31, of the LRA, the applicant provided the UFSAR supplement for the water chemistry control – auxiliary systems water chemistry control program and stated that the program manages loss of material, cracking, and fouling, as applicable, of components in the scope of license renewal. The program monitors and controls the relevant chemistry conditions for components exposed to treated water environments.

During the audit, the staff noted that for the water chemistry related systems described in the SRP-LR, Table 3.1-2 and Table 3.3-2, industry guidance and/or reports are identified. The staff requested, in question B.1.30.1-6, that the applicant include in its LRA Section A.2.1.31 specific industry guidance for the auxiliary water chemistry program similar to that in the SRP-LR, Tables 3.1-2 and 3.3-2, or justify not including the industry guidance in this section (RAI B.1.30.1-2).

In its response dated May 19, 2004, the applicant stated that a reference to industry guidance used for the auxiliary systems water chemistry control program will be provided in LRA SAR Section A.2.1.31 and committed to completing this action upon issuance of the renewed license.

The staff asked the applicant to clarify what industry guidance would be referenced. In its subsequent response to the staff's question, by letter dated July 22, 2004, the applicant stated that the auxiliary water systems chemistry control program covers a variety of miscellaneous systems and components using many different references such as EPRI reports, vendor technical manuals, and other industry guidance. Applicable references can change frequently based on industry experience or component replacements. Since the references change frequently, the staff rescinded its request that the applicant revise the SAR Section A.2.1.31.

On the basis of its review of the applicant's response to the above question, the staff finds that the applicant provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion

On the basis of its review and audit of the applicant's program, the staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the UFSAR supplement for this AMP and finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.4 Quality Assurance Program Attributes Integral to Aging Management Programs

The NRC staff has reviewed LRA Appendix A, Section A.2.1, "Aging Management Programs and Activities" and Appendix B, Section B.0.3, "ANO-2 Corrective Actions, Confirmation Process and Administrative Controls," 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.

The license renewal applicant 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

Appendix B, Section B.0.3, "ANO-2 Corrective Actions, Confirmation Process and Administrative Controls," of the LRA provides the aging management activity description for each activity credited for managing aging effects. The applicant stated that it uses the existing ANO-2, 10 CFR Part 50, Appendix B, quality assurance program to address the elements of corrective action, confirmation process, and administrative controls for all of its AMPs. 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.

3.0.4.2 Staff Evaluation

During the audit of the applicant's renewal scoping and screening process, the staff also examined the applicant's processes for addressing corrective action, confirmation processes, and document control (the quality assurance attributes) associated with the various aging management programs credited for managing the potential aging effects of SSCs over the period of extended operation of the plant.

The audit team determined that the applicant had not described the AMP quality attributes in Appendix A, "Updated Final Safety Analysis Report Supplement." Consistent with Branch Technical Position IQMB-1, the applicant should either document a commitment to expand the scope of its 10 CFR Part 50 Appendix B program to include nonsafety-related structures and components subject to an AMP to address the AMP quality attributes during the period of extended operation or propose an alternative means to address this issue. The staff requested that the applicant clarify their commitments related to addressing the quality attributes of AMPs applicable to nonsafety-related structures and components subject to aging management. The description in Appendix A should provide sufficient information for the staff to determine if the quality attributes for the Appendix A.1 aging management programs are consistent with the review acceptance criteria contained in NUREG-1800, Section A.2, "Quality Assurance for Aging Management Programs (Branch Technical Position IQMB-1)." (This request for information was documented as RAI 2.1-6).

The applicant responded by a letter to the NRC dated May 19, 2004. The following paragraph will be added to Appendix A of the LRA. "The Quality Assurance Program implements the requirements of 10CFR50, Appendix B. The Quality Assurance Program includes the elements of corrective action, confirmation process, and administrative controls and is applicable to all aging management programs credited for license renewal including programs for safety-related and non-safety related structures, systems and components."

The staff concluded that the applicant response had clarified their commitments related to addressing the quality attributes of AMPs applicable to nonsafety-related structures and components subject to aging management and had adequately addressed the questions documented in RAI 2.1-6.

The audit team reviewed that the discussions of corrective actions contained in section B.0.3, "Corrective Actions, Confirmation Process and Administrative Controls," of Appendix B, "Aging Management Programs and Activities." The discussion stated that "in the case of significant conditions adverse to quality... corrective action is taken to lessen the likelihood of recurrence." This is not in agreement with the regulations contained in 10 CFR Part 50, Appendix B, section XVI, "Corrective Actions," which states, in part, "in the case of significant conditions adverse to quality, the measures shall assure that the cause of the condition is determined and corrective actions taken to preclude repetition." The applicant was requested to address this discrepancy. This request for information was documented as RAI 2.1-5.

The applicant responded by a letter to the NRC dated May 19, 2004, which stated that Appendix B, Section B.0.3 under the heading of "Corrective Actions" would be clarified as follows: "In the case of significant conditions adverse to quality, measures are implemented to ensure that the cause of the nonconformance is determined and that corrective action is taken to preclude repetition."

The staff concluded that the applicant's response had addressed the discrepancy between the definition of corrective action contained in Appendix B of the LRA and 10 CFR Part 50 be rewording that portion of Appendix B of the LRA to consistent with 10 CFR Part 50 and had adequately responded to the questions documented in RAI 2.1-7.

3.0.4.3 Conclusion

The audit team did not observe any exceptions to the use of the site Appendix B quality assurance program for the evaluation of the three quality assurance attributes. On the basis of this review, the staff finds that the quality assurance attributes are consistent with 10 CFR 54.21(a)(3). Therefore, the applicant's quality assurance attributes within the AMPs credited for license renewal are acceptable.

THIS PAGE IS INTENTIONALLY LEFT BLANK

3.1 Aging Management of Reactor Vessel, Internals, and Reactor Coolant System

This section of the SER documents the staff's review of the applicant's AMR results for the reactor vessel, internals, and reactor coolant system components and component groups associated with the following systems:

- reactor vessel and control element drive mechanism
- reactor vessel internals
- Class 1 piping, valves, and reactor coolant pumps
- pressurizer
- steam generators

3.1.1 Summary of Technical Information in the Application

In LRA Section 3.1, the applicant provided AMR results for the reactor vessel, internals, and reactor coolant system components and component groups. Table 3.1.1 of the LRA, "Summary of Aging Management Programs for the Reactor Coolant System in Chapter IV of NUREG-1801," provides a summary of the programs evaluated in the GALL Report for the RCS component groups.

3.1.2 Staff Evaluation

The staff reviewed LRA Section 3.1 to determine if the applicant provided sufficient information to demonstrate that the effects of aging for the reactor system components that are within the scope of license renewal and subject to an AMR will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff performed an audit to confirm the applicant's claim that certain identified AMRs were consistent with the GALL Report. The staff did not repeat its review of the matters described in the GALL Report. However, the staff did determine that the material presented in the LRA was applicable and that the applicant had identified the appropriate GALL AMPs. Section 3.0.3 of this SER documents the staff's evaluations of the AMPs. The ANO-2 Audit and Review Report documents the staff's audit findings, which are also summarized in Section 3.1.2.1 of this SER.

The staff also audited and reviewed those AMRs that are consistent with the GALL Report and for which further evaluation is recommended. The staff determined that the applicant's further evaluations were consistent with the acceptance criteria in Section 3.1.3.2 of the SRP-LR. Section 3.1.2.2 of the SER summarizes the staff's audit findings.

The staff conducted a technical review of the remaining AMRs that are not consistent with the GALL Report. The review included evaluating whether all plausible aging effects were identified and whether the aging effects listed were appropriate for the combination of materials and environments specified. Section 3.1.2.3 of the SER summarizes the staff's review findings.

Finally, the staff reviewed the AMP summary descriptions in the UFSAR Supplement to ensure that they provide an adequate description of the programs credited with managing or monitoring aging for the reactor vessel, internals, and reactor coolant system components and component groups.

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 for Reactor Vessel, Internals, and Reactor Coolant 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 (Item Number 3.1.1-1)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c))	TLAA-Metal Fatigue	Consistent with GALL, which recommends further evaluation (See Section 3.1.2.2.1)
Steam generator shell assembly (Item Number 3.1.1-2)	Loss of material due to pitting and crevice corrosion	Inservice inspection; water chemistry	Inservice Inspection (B.1.14), Water Chemistry Control (B.1.30)	Consistent with GALL, which recommends further evaluation (See Section 3.1.2.2.2)
Pressure vessel ferritic materials that have a neutron fluence greater than 10^{17} n/cm^2 (E>1 MeV) (Item Number 3.1.1-4)	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-Reactor Vessel	Consistent with GALL, which recommends further evaluation (See Section 3.1.2.2.3)
Reactor vessel beltline shell and welds (Item Number 3.1.1-5)	Loss of fracture toughness due to neutron irradiation embrittlement	Reactor vessel surveillance	Reactor Vessel Integrity (B.1.21)	Consistent with GALL, which recommends further evaluation (See Section 3.1.2.2.3)
Westinghouse and Babcock & Wilcox (B&W) baffle/former bolts (Item Number 3.1.1-6)	Loss of fracture toughness due to neutron irradiation embrittlement and void swelling	Plant specific	Not Applicable to ANO-2. Core shroud plates are welded.	Consistent with GALL, which recommends further evaluation (See Section 3.1.2.2.3)
Small-bore reactor coolant system and connected systems piping (Item Number 3.1.1-7)	Crack initiation and growth due to stress corrosion cracking (SCC), intergrangular stress corrosion cracking (IGSCC), and thermal and mechanical loading	Inservice inspection; water chemistry; one-time inspection	Inservice Inspection (B.1.14), Water Chemistry Control (B.1.30)	Consistent with GALL, which recommends further evaluation (See Section 3.1.2.2.4)
Vessel Shell (Item Number 3.1.1-10)	Crack growth due to cyclic loading	TLAA	Not Applicable to ANO-2	Consistent with GALL, which recommends further evaluation (See Section 3.1.2.2.5)

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Reactor internals (Item Number 3.1.1-11)	Changes in dimension due to void swelling	Plant specific	RV Internal CASS (B.1.22), RV Internals Stainless Steel (B.1.23)	Consistent with GALL, which recommends further evaluation (See Section 3.1.2.2.6)
PWR core support pads, instrument tubes (bottom head penetrations), pressurizer spray heads, and nozzles for the steam generator instruments and drains (Item Number 3.1.1-12)	Crack initiation and growth due to SCC and/or primary water stress corrosion cracking (PWSCC)	Plant specific	Water Chemistry Control (B.1.30), Alloy 600 Aging Management (B.1.1), Inservice Inspection (B.1.14)	Consistent with GALL, which recommends further evaluation (See Section 3.1.2.2.7)
Cass austenitic stainless steel (CASS) reactor coolant system piping (Item Number 3.1.1-13)	Crack initiation and growth due to SCC	Plant specific	Water Chemistry Control (B.1.30), Inservice Inspection (B.1.14)	Consistent with GALL, which recommends further evaluation (See Section 3.1.2.2.7)
Pressurizer instrumentation penetrations and heater sheaths and sleeves made of Ni-alloys (Item Number 3.1.1-14)	Crack initiation and growth due to PWSCC	Inservice inspection; water chemistry	Inservice Inspection(B.1.14), Alloy 600 (B.1.1), Water Chemistry Control (B.1.30)	Consistent with GALL, which recommends further evaluation (See Section 3.1.2.2.7)
Westinghouse and B&W baffle former bolts (Item Number 3.1.1-15)	Crack initiation and growth due to SCC and irradiation-assisted stress corrosion cracking (IASCC)	Plant specific	Not Applicable to ANO-2	Consistent with GALL, which recommends further evaluation (See Section 3.1.2.2.8)
Westinghouse and B&W baffle former baffle bolts (Item Number 3.1.1-16)	Loss of preload due to stress relaxation	Plant specific	Not Applicable to ANO-2	Consistent with GALL, which recommends further evaluation (See Section 3.1.2.2.9)
Steam generator feedwater impingement plate and support (Item Number 3.1.1-17)	Loss of section thickness due to erosion	Plant specific	Not Applicable to ANO-2	Consistent with GALL, which recommends further evaluation (See Section 3.1.2.2.10)

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
(Alloy 600) Steam generator tubes, repair sleeves, and plugs (Item Number 3.1.1-18)	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 Integrity (B.1.25), Water Chemistry Control (B.1.30)	Consistent with GALL, which recommends further evaluation (See Section 3.1.2.2.11)
Tube support lattice bars made of carbon steel (Item Number 3.1.1-19)	Loss of section thickness due to flow-accelerated corrosion (FAC)	Plant specific	Not Applicable to ANO-2	Consistent with GALL, which recommends further evaluation (See Section 3.1.2.2.12)
Carbon steel tube support plate (Item Number 3.1.1-20)	Ligament cracking due to corrosion	Plant specific	Not Applicable to ANO-2	Consistent with GALL, which recommends further evaluation (See Section 3.1.2.2.13)
Steam generator feedwater inlet ring and supports (Item Number 3.1.1-21)	Loss of material due to flow accelerated corrosion	Combustion Engineering (CE) steam generator feedwater ring inspection	Not Applicable to ANO-2	Consistent with GALL, which recommends further evaluation (See Section 3.1.2.2.14)
Reactor vessel closure studs and stud assembly (Item Number 3.1.1-22)	Crack initiation and growth due to SCC and/or IGSCC	Reactor head closure studs	Inservice Inspection (B.1.14)	Consistent with GALL, which recommends no further evaluation (See Section 3.1.2.1)
CASS pump casing and valve body (Item Number 3.1.1-23)	Loss of fracture toughness due to thermal aging embrittlement	Inservice inspection	Inservice Inspection (B.1.14)	Consistent with GALL, which recommends no further evaluation (See Section 3.1.2.1)
CASS piping (Item Number 3.1.1-24)	Loss if fracture toughness due to thermal aging embrittlement	Thermal aging embrittlement of CASS	Inservice Inspection (B.1.14)	Consistent with GALL, which recommends no further evaluation (See Section 3.1.2.1)

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
BWR piping and fittings; steam generator components (Item Number 3.1.1-25)	Wall thinning due to flow accelerated corrosion	Flow accelerated corrosion	Flow-Accelerated Corrosion (B.1.11), Water Chemistry Control (B.1.30)	Consistent with GALL, which recommends no further evaluation (See Section 3.1.2.1)
Reactor coolant pressure boundary (RCPB) valve closure bolting, manway and holding bolting, and closure bolting in high-pressure and high temperature systems (Item Number 3.1.1-26)	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	Inservice Inspection (B.1.14), Bolting and Torquing Activities (B.1.2)	Consistent with GALL, which recommends no further evaluation (See Section 3.1.2.1)
CRD nozzle (Item Number 3.1.1-35)	Crack initiation and growth due to PWSCC	Ni-alloy nozzles and penetrations; water chemistry	Inservice Inspection (B.1.14), Water Chemistry Control (B.1.30), RV Head Penetrations (B.1.20)	Consistent with GALL, which recommends no further evaluation (See Section 3.1.2.1)
Reactor vessel nozzles safe ends and CRD housing; reactor coolant system components (except CASS and bolting) (Item Number 3.1.1-36)	Crack initiation and growth due to cyclic loading and/or SCC, and PWSCC	Inservice inspection; water chemistry	Inservice Inspection (B.1.14), Water Chemistry Control (B.1.30).	Consistent with GALL, which recommends no further evaluation (See Section 3.1.2.1)
Reactor vessel internals CALL components (Item Number 3.1.1-37)	Loss of fracture toughness due to thermal aging, neutron irradiation embrittlement and void swelling	Thermal aging and neutron irradiation embrittlement	RV Internal CASS (B.1.22)	Consistent with GALL, which recommends no further evaluation (See Section 3.1.2.1)
External surfaces of carbon steel components in reactor coolant system pressure boundary (Item Number 3.1.1-38)	Loss of material due to boric acid corrosion	Boric acid corrosion	Boron Acid Corrosion Prevention (B.1.3)	Consistent with GALL, which recommends no further evaluation (See Section 3.1.2.1)

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Steam generator secondary manways and handholds (carbon steel) (Item Number 3.1.1-39)	Loss of material due to erosion	Inservice inspection	Not Applicable to ANO-2	Consistent with GALL, which recommends no further evaluation (See Section 3.1.2.3.5)
Reactor internals, reactor vessel closure studs, and core support pad (Item Number 3.1.1-40)	Loss of material due to wear	Inservice inspection	Inservice Inspection (B.1.14)	Consistent with GALL, which recommends no further evaluation (See Section 3.1.2.1)
Pressurizer integral support (Item Number 3.1.1-41)	Crack initiation and growth due to cyclic loading	Inservice inspection	Inservice Inspection (B.1.14)	Consistent with GALL, which recommends no further evaluation (See Section 3.1.2.1)
Upper and lower internals assembly (Westinghouse) (Item Number 3.1.1-42)	Loss of preload due to stress relaxation	Inservice inspection; loose part and/or neutron noise monitoring	RV Internals SS (B.1.23), Inservice Inspection (B.1.14)	Consistent with GALL, which recommends no further evaluation (See Section 3.1.2.1)
Reactor vessel internals in fuel zone region (except Westinghouse and B&W baffle former bolts) (Item Number 3.1.1-43)	Loss of fracture toughness due to neutron irradiation embrittlement and void swelling	PWR vessel internals; water chemistry	RV Internals SS (B.1.23)	Consistent with GALL, which recommends no further evaluation (See Section 3.1.2.1)
Steam generator upper and lower heads, tubesheets, and primary nozzles and safe ends (Item Number 3.1.1-44)	Crack initiation and growth due to SCC, PWSCC, and or IASCC	Inservice inspection; water chemistry	Water Chemistry Control (B.1.30), Alloy 600 (B.1.1), Inservice Inspection (B.1.14)	Consistent with GALL, which recommends no further evaluation (See Section 3.1.2.1)
Vessel Internals (except Westinghouse and B&W baffle former bolts) (Item Number 3.1.1-45)	Loss of fracture toughness due to neutron irradiation embrittlement and void swelling	PWR vessel internals; water chemistry	RV Internals CASS (B.1.23), RV Internals Stainless Steel (B.1.23), Water Chemistry Control (B.1.30), Inservice Inspection (B.1.14)	Consistent with GALL, which recommends no further evaluation (See Section 3.1.2.1)

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Reactor internals (B&W screws and bolts) (Item Number 3.1.1-46)	Loss of preload due to stress relaxation	Inservice inspection; loose part monitoring	Not Applicable to ANO-2	Consistent with GALL, which recommends no further evaluation (See Section 3.1.2.1)
Reactor vessel closure studs and stud assembly (Item Number 3.1.1-47)	Loss of material due to wear	Reactor head closure studs	Inservice Inspection (B.1.14)	Consistent with GALL, which recommends no further evaluation (See Section 3.1.2.1)
Reactor internals (Westinghouse upper and lower internal assemblies, CE bolts and tie rods) (Item Number 3.1.1-48)	Loss of preload due to stress relaxation	Inservice inspection; loose part monitoring	RV Internals Stainless Steel (B.1.23), Inservice Inspection (B.1.14)	Consistent with GALL, which recommends no further evaluation (See Section 3.1.2.1)

The staff's review of the ANO-2 RCS and associated components followed one of several approaches. One approach, documented in Section 3.1.2.1 of this SER, involves the staff's audit and review of the AMR results for components in the RCS that the applicant indicated are consistent with the GALL Report and do not require further evaluation. Another approach, documented in Section 3.1.2.2 of this SER, involves the staff's audit and review of the AMR results for components in the RCS that the applicant indicated are consistent with the GALL Report and for which further evaluation is recommended. A third approach, documented in Section 3.1.2.3 of this SER, involves the staff's technical review of the AMR results for components in the RCS that the applicant indicated are not consistent with the GALL Report or are not addressed in the GALL Report. Section 3.0.3 of this SER documents the staff's review of AMPs that are credited to manage or monitor aging effects of the RCS.

3.1.2.1 AMR Results That Are Consistent with the GALL Report

Summary of Technical Information in the Application

In Section 3.1.2.1 of the LRA, the applicant identified the materials, environments, and aging effects requiring management. The applicant identified the following programs that manage the aging effects related to the reactor vessel, internals, RCS, pressurizer, and SG components:

- Reactor Vessel Integrity Program
- Inservice Inspection Program
- Water Chemistry Control Program
- Boric Acid Corrosion Prevention Program
- Alloy 600 Aging Management Program
- Reactor Vessel Head Penetration Program
- Bolting and Torquing Activities Program

- Reactor Vessel Internals Cast Austenitic Stainless Steel Components Program
- Reactor Vessel Internals Stainless Steel Plates, Forgings, Welds, and Bolting Program
- Cast Austenitic Stainless Steel Evaluation Program
- Pressurizer Examinations Program
- Steam Generator Integrity Program
- Flow-Accelerated Corrosion Program

Staff Evaluation

In Tables 3.1.2-1 through 3.1.2-5 of the LRA, the applicant provided a summary of AMRs for the reactor vessel, internals, RCS, pressurizer, and SGs, and identified which AMRs it considered to be consistent with the GALL Report.

For component groups evaluated in the GALL Report for which the applicant claimed consistency with the GALL Report, and for which the GALL Report does not recommend further evaluation, the staff performed an audit and review to determine whether the plant-specific components contained in these GALL Report component groups are bounded by the GALL evaluation.

The applicant provided a note for each AMR line item. The notes describe how the information in the tables aligns with the information in the GALL Report. The staff audited those AMRs identified by notes A through E, which indicate that the AMR is consistent with the GALL Report.

Note A indicates that the AMR line item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP is consistent with the AMP identified in the GALL Report. The staff audited these line items to determine consistency with the GALL Report and the validity of the AMR for the site-specific conditions.

Note B indicates that the AMR line item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The staff audited these line items to determine consistency with the GALL Report. The staff determined that it reviewed and accepted the identified exceptions to the GALL AMPs. The staff also determined whether the AMP identified by the applicant is consistent with the AMP identified in the GALL Report and whether the AMR is valid for the site-specific conditions.

Note C indicates that the component for the AMR line item is different, but consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP is consistent with the AMP identified by the GALL Report. This note indicates that the applicant could not find a listing of some system components in the GALL Report. However, the applicant identified a different component in the GALL Report that has the same material, environment, aging effect, and AMP as the component under review. The staff audited these line items to determine consistency with the GALL Report. The staff also determined whether the AMR line item of the different component applies to the component under review and whether the AMR is valid for the site-specific conditions.

Note D indicates that the component for the AMR line item is different, but consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The staff audited these line items to determine consistency with the GALL Report. The staff determined whether the AMR line item of the different component applies to the component under review. The staff determined that it reviewed and accepted the identified exceptions to the GALL AMPs. The staff also determined whether the AMP identified by the applicant is consistent with the AMP identified in the GALL Report and whether the AMR is valid for the site-specific conditions.

Note E indicates that the AMR line item is consistent with the GALL Report for material, environment, and aging effect, but a different AMP is credited. The staff audited these line items to determine consistency with the GALL Report. The staff also determined whether the identified AMP would manage the aging effect consistent with the AMP identified by the GALL Report and whether the AMR is valid for the site-specific conditions.

The staff conducted an audit and review of the information provided in the LRA and program bases documents, which are available at the applicant's engineering office. On the basis of its audit and review, the staff finds that the AMR results, which the applicant claimed to be consistent with the GALL Report, are in fact consistent with the AMRs in the GALL Report. Therefore, the staff finds that the applicant identified applicable aging effects that are appropriate for the combination of materials and environments listed.

On the basis of its audit and review, the staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so 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).

Conclusion

The staff has evaluated the applicant's claim of consistency with the GALL Report. The staff also has reviewed information pertaining to the applicant's consideration of recent operating experience and proposals for managing associated aging effects. On the basis of its review, the staff finds that the AMR results, which the applicant claimed to be consistent with the GALL Report, are in fact consistent with the AMRs in the GALL Report. Therefore, the staff finds that the applicant has demonstrated that the effects of aging for these components can be adequately managed so that their intended functions can be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.2 AMR Results That Are Consistent with the GALL Report, for Which Further Evaluation Is Recommended

Summary of Technical Information in the Application

In Section 3.1.2.2 of the LRA, the applicant provided further evaluation of aging management as recommended by the GALL Report for reactor vessel, internals, and RCS components. The applicant provided information concerning how it will manage the following aging effects:

- cumulative fatigue damage
- loss of material from pitting and crevice corrosion

- loss of fracture toughness as a resulting of neutron irradiation embrittlement
- crack initiation and growth caused by thermal and mechanical loading or SCC
- crack growth resulting from cyclic loading
- changes in dimension caused by void swelling
- crack initiation and growth resulting from SCC or PWSCC
- crack initiation and growth resulting from SCC or IASCC
- loss of preload caused by stress relaxation
- loss of section thickness as a result of erosion
- crack initiation and growth from PWSCC, ODSCC, or IGA or loss of material resulting from wastage and pitting corrosion or loss of section thickness caused by fretting and wear or denting from corrosion of carbon steel tube support plate
- loss of section thickness caused by flow-accelerated corrosion
- ligament cracking resulting from corrosion
- loss of material caused by flow-accelerated corrosion
- quality assurance for aging management of nonsafety-related components

Staff Evaluation

For component groups evaluated in the GALL Report for which the applicant claimed consistency with the GALL Report, and for which the GALL Report recommends further evaluation, the staff reviewed the applicant's evaluation to determine whether it adequately addressed the issues that were further evaluated. In addition, the staff reviewed the applicant's further evaluations against the criteria contained in Section 3.1.2.2 of the SRP-LR. The ANO-2 ANO-2 Audit and Review Report documents the details of the staff's onsite audit and review.

The GALL Report indicates that further evaluation should be performed for the aging effects described in the following sections of this SER.

3.1.2.2.1 Cumulative Fatigue Damage

As stated in the SRP-LR, fatigue is a TLAA, as defined in 10 CFR 54.3. TLAAs must be evaluated in accordance with 10 CFR 54.21(c)(1). Section 4.3 of this SER documents the staff's review of the applicant's evaluation of this TLAA. In performing this review, the staff followed the guidance in Section 4.3 of the SRP-LR.

3.1.2.2.2 Loss of Material from Pitting and Crevice Corrosion

In Section 3.1.2.2.2 of the LRA, the applicant addressed loss of material of SG assemblies due to pitting and crevice corrosion.

SRP-LR Section 3.1.2.2.2 states that loss of material due to pitting and crevice corrosion could occur in the SG shell assembly. The existing program relies on control of water chemistry to mitigate corrosion and ISI to detect loss of material. NRC IN 90-04, "Cracking of the Upper Shell-to-Transition Cone Girth Welds in Steam Generators," states that if general corrosion pitting of the shell exists, the existing program may not be sufficient. In that case, the GALL Report recommends augmented inspections to manage the aging effect.

The AMPs recommended by the GALL Report for managing the aging of SG assemblies due to pitting and crevice corrosion are ASME Section XI inservice inspection, Subsections IWB, IWC, and IWD (XI.M1) program to detect loss of material and the water chemistry (XI.M2) program to mitigate corrosion. The GALL Report recommends a plant-specific program to conduct augmented inspections.

The applicant credited the inservice inspection program (AMP B.1.14) and the primary and secondary water chemistry control program (AMP B.1.30.3) for managing loss of material due to pitting and crevice corrosion on the internal surfaces of the SG shell. The staff reviewed the inservice inspection program and the primary and secondary water chemistry control program and its evaluation of these programs is documented in Sections 3.0.3.3.5 and 3.0.3.1 of this SER, respectively.

The staff reviewed IN 90-04, which identifies the need to augment inspections beyond the requirements of ASME Section XI if general corrosion pitting of the SG shell is known to exist in order to differentiate isolated cracks from inherent geometric conditions. The applicant replaced its SGs in 2000. The staff reviewed operating experience which indicated that no pitting corrosion of the SG shell has been detected to date, and that water chemistry has been maintained for these new SGs per EPRI guidelines. The staff finds that the augmented inspections recommended by NRC IN 90-04, as referenced in the SRP-LR, do not currently apply to the the applicant's SGs.

Since pitting corrosion has not been detected on the SG shell since installation, the staff finds that augmented inspections are not required and that the current water chemistry control and inservice inspection programs are adequate to manage aging.

The staff finds that the applicant has demonstrated that the effect of aging for loss of material due to pitting and crevice corrosion will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation.

3.1.2.2.3 Loss of Fracture Toughness from Neutron Irradiation Embrittlement

In Section 3.1.2.2.3 of the LRA, the applicant addressed (1) loss of fracture toughness due to neutron irradiation embrittlement of the reactor vessel (RV) beltline materials, as managed using both a plant-specific AMP and the TLAAs on neutron irradiation embrittlement, and (2) loss of fracture toughness of RV internal components as a result of neutron irradiation embrittlement and void swelling.

Section 3.1.2.2.3 of the SRP-LR states that neutron irradiation embrittlement of RV beltline materials (i.e., with neutron fluences greater than $1.0x10^{17}$ n/cm^2 [E $\geq$ 1.0 MeV]) are to be treated as TLAAs, as defined in 10 CFR 54.3. Section 3.1.2.2.3 of the SRP-LR also states that loss of fracture toughness due to neutron irradiation embrittlement of the RV beltline materials is to be managed using a plant-specific AMP. In this case the plant-specific AMP is required to be the RV materials surveillance program that is mandated by 10 CFR Part 50, Appendix H. These RV materials surveillance programs monitor for neutron irradiation embrittlement by testing irradiated material test specimens that are representative of the materials located in the beltline region of the RV.

The plant-specific AMP recommended by the GALL Report for managing loss of fracture toughness/neutron irradiation embrittlement of the RV beltline materials is AMP XI.M31, "Reactor Vessel Surveillance," which complies with the requirements of 10 CFR Part 50, Appendices G and H, and 10 CFR Part 50.61.

The applicant stated that loss of fracture toughness due to neutron irradiation embrittlement of the ferritic RV materials meets the definition of a TLAA, as defined in 10 CFR 54.3. The applicant stated that this TLAA is described in Section 4.2 of the LRA. The staff evaluates the TLAA on neutron irradiation embrittlement in Section 4.2 of this SER.

The applicant stated in the LRA that loss of fracture toughness due to irradiation embrittlement of the reactor vessel beltline materials is managed by the Reactor Vessel Integrity Program (AMP B.1.21). This program is a plant-specific material surveillance program which monitors the effect of operational fluence levels on material test specimens that are contained in surveillance capsules positioned within the RV cavity. These surveillance capsule test specimens are representative of materials with the beltline region of the RV and are irradiated during power operations. These surveillance capsules are periodically withdrawn and the specimens within the capsules are tested and analyzed for fracture toughness and other material properties. The staff's evaluation of the Reactor Vessel Integrity Program is documented in Section 3.0.3.2.6 of this SER.

SRP-LR Section 3.1.2.2.3 states that loss of fracture toughness due to neutron irradiation embrittlement and void swelling could occur in Westinghouse and B&W baffle/former bolts. Section IV.B3 of GALL, Volume 2, identifies additional RV internal components that may be subject to loss of fracture toughness due to irradiation embrittlement and/or void swelling.

The applicant stated that this item is not applicable to ANO-2 because ANO-2 reactor vessel internals do not include baffle/former bolts. This does not address the potential for loss of fracture toughness due to neutron irradiation embrittlement and void swelling to occur in other RV internal components, as itemized in particular AMR line items in Section IV.B3 of GALL, Volume 2. The applicant, however, is participating in the EPRI MRP's industry initiative studies on RV internal components and has, as part of its Reactor Vessel Internals Program, committed to submit its program description for the ANO-2 RV internals, including the inspection plan, to the staff for review and approval. This commitment will address aging management of void swelling and neutron irradiation embrittement of the RV internal components. The staff evaluation of the Reactor Vessel Internals Program is given in Section 3.0.3.1 of this SER.

3.1.2.2.4 Crack Initiation and Growth from Thermal and Mechanical Loading or Stress-Corrosion Cracking

In Section 3.1.2.2.4 of the LRA, the applicant addressed the potential crack initiation and growth due to thermal and mechanical loading or stress corrosion cracking (SCC) (including intergranular SCC) that could occur in small-bore RCS and connected system piping less than 4-inch nominal pipe size (NPS 4).

Section 3.1.2.2.4 of the SRP-LR states that the GALL Report recommends that a plant-specific destructive examination or a nondestructive examination (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 applicant should assess service-induced weld cracking is not occurring in small-bore piping less than NPS 4. A one-time inspection of a sample of locations is an acceptable method to ensure that the aging effect is not occurring and the component's intended function will be maintained during the period of extended operation. Per ASME Section XI, 1995 Edition, Examination Category B-J or B-F, small bore piping, defined as piping less than NPS 4, does not receive volumetric inspection.

The AMPs recommended by the GALL Report are XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," to detect loss of material and XI.M2, "Water Chemistry," to mitigate SCC. The GALL Report recommends GALL AMP XI.M32, "One-Time Inspection," as an acceptable verification method to ensure that cracking is not occurring in small bore piping.

The applicant credited the inservice inspection program (AMP B.1.14) and the primary and secondary water chemistry control program (AMP B.1.30.3) to mitigate cracking of reactor coolant piping. The staff's review of these programs is documented in Sections 3.0.3.3.5 and 3.0.3.1 of this SER, respectively.

To address the GALL Report recommendation of a plant-specific destructive examination or an NDE for inspection of inside surfaces of small bore piping, the applicant stated, in LRA Section 3.1.2.2.4 and Table 3.1.1-7, that it has implemented a risk-informed methodology at ANO-2 to select, for small bore RCS and connected systems piping, RCS piping welds for inspection. The applicant stated, in LRA Section 3.1.2.2.4, that the current inspection methods as described in the inservice inspection program appropriately address cracking of small bore piping systems less than four inch nominal pipe schedule (NPS 4) and greater than 1-inch (NPS 1). The staff finds that this methodology appropriately addresses cracking of small bore piping greater than NPS 1, and the risk-informed methodology adequately manages cracking initiation and growth aging mechanisms during the period of extended operation.

In Section 3.1.2.2.4 of the LRA, the applicant stated that, for NPS 1 RCS piping and smaller, the piping is austenitic stainless steel and is not within the scope of the risk-informed selection of piping welds for inspection. The applicant further stated that volumetric examinations of NPS 1 RCS piping and smaller are not effective, and the applicant performs system leakage testing, in accordance with ASME Section XI, as the preferred alternative to inspection of the inside surfaces of small bore piping NPS 1 and smaller.

In discussions with the applicant, the staff asked the applicant to clarify how the alternative of system leakage testing for NPS 1 RCS piping and smaller will adequately manage aging of small bore piping and to provide the technical basis for not including piping NPS 1 and smaller in the sample inspections from the risk-informed selections.

In its response, the applicant stated that operating experience has confirmed that leakage from NPS 1 and smaller piping is readily detected and corrected prior to loss of system function. Additionally, the applicant stated that it had implemented a program to investigate the potential for cracking of welded joints in RCS piping less than or equal to NPS 1 since the discovery of a cracked weld in an ANO-1 RCS drain line in 1989. Additionally, the applicant stated that the risk (based on probability and consequences) of failure of the 1-inch and smaller piping is less than the risk of failures of locations selected for inspection in the small-bore piping inspection program.

On the basis of the applicant's response and its review, the staff finds that visual inspection of NPS 1 and smaller RCS piping using systems leakage testing, in conjunction with volumetric examinations of NPS 1 to NPS 4 RCS piping of the same material and environment, adequately manages the effects of crack initiation and growth due to thermal and mechanical loading or stress corrosion cracking prior to loss of intended function. This approach is consistent with that for ANO-1 which was evaluated and approved by the staff in NUREG-1743, "Safety Evaluation Report Related to the License Renewal of Arkansas Nuclear One, Unit 1.

The staff finds that the applicant has demonstrated that crack initiation and growth due to thermal and mechanical loading or SCC on small-bore RCS and connected systems piping will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation.

3.1.2.2.5 Crack Growth from Cyclic Loading

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's review of the applicant's evaluation of this TLAA is documented in Section 4.3 of this SER. In performing this review, the staff followed the guidance in Section 4.3 of the SRP-LR.

3.1.2.2.6 Changes in Dimension from Void Swelling

In Section 3.1.2.2.6 of the LRA, the applicant addressed changes in dimension due to void swelling that could occur in reactor internal components.

Section 3.1.2.2.6 of the SRP-LR states that the GALL Report recommends that changes in dimension due to void swelling in reactor internal components be evaluated to ensure that this aging effect is adequately managed. The GALL Report recommends that a plant-specific AMP be evaluated to manage the effects of changes in dimension due to void swelling and the loss of fracture toughness associated with swelling.

The applicant stated that the void swelling of reactor vessel internals is managed by the reactor vessel internals cast austenitic stainless steel (CASS) program (AMP B.1.22) and the reactor vessel internals stainless steel plates, welds, forgings, and bolting program (AMP B.1.23) using supplemental examinations or component-specific evaluations. The applicant has committed to further understanding of this aging effect through industry programs to provide additional bases for supplemental examinations or component-specific evaluations.

The staff evaluated the reactor vessel internals CASS program and the reactor vessel internals stainless steel plates, welds, forgings, and bolting program. The staff documented its results in Section 3.0.3.1 of this SER. These programs will be consistent with GALL AMPs XI.M13, "Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS)," and XI.M16, "PWR Vessel Internals," respectively.

The staff finds the applicant's approach for managing changes in dimension due to void swelling reasonable because the approach will be based on the guidelines developed by the ongoing industry activities related to void swelling. The applicant has committed to submitting both AMPs B.1.22 and B.1.23 to the staff for review and approval 24 months prior to the period of extended operation. To obtain NRC staff approval of its proposed inspection plans regarding CASS components and Reactor Vessel Internals prior to entering the period of extended operation for ANO-2, the applicant must submit a license amendment request. After the NRC staff's approval of the inspection plan, and future changes to the inspection plan will be evaluated in accordance with 10 CFR 50.59.

3.1.2.2.7 Crack Initiation and Growth from Stress-Corrosion Cracking or Primary Water Stress-Corrosion Cracking

The staff reviewed Section 3.1.2.2.7 of the LRA against the criteria in SRP-LR Section 3.1.2.2.7, which recommends plant-specific programs to address these aging mechanisms.

In Section 3.1.2.2.7 of the LRA, the applicant addressed (1) crack initiation and growth due to SCC and primary water stress corrosion cracking (PWSCC) in the surge nozzle thermal sleeve, safety injection nozzle thermal sleeve, charging inlet nozzle thermal sleeve, resistance temperature detector nozzles, pressure measurement nozzle, sampling nozzle, and partial nozzle replacement. Reactor vessel items included in this grouping are the lower shell and bottom head cladding, surveillance capsule holders, core stabilizing lugs, core stop and support lugs, and the flow baffle and skirt. Steam generator items included in this grouping are the tube plate cladding, channel head divider plate, and primary nozzle closure rings; (2) crack initiation and growth due to SCC in the pressurizer surge line piping and fittings fabricated of CASS; and (3) crack initiation and growth due to PWSCC in nickel-based alloy material such as the pressurizer instrumentation nozzles, heater sheaths and sleeves, and thermal sleeves. ANO-2 pressurizer components included in this grouping are the instrument nozzles, X-1 and T-4 heater penetration nozzles and plugs, original heater sheath, heater sleeve, and end plugs.

Section 3.1.2.2.7 of the SRP-LR states that:

- Crack initiation and growth due to SCC and PWSCC could occur in core support pads (or core guide lugs), instrument tubes (bottom head penetrations), pressurizer spray heads, and nozzles for the SG instruments and drains. The GALL Report recommends further evaluation to ensure that these aging effects are adequately managed. The GALL Report 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.

- Crack initiation and growth due to SCC could occur in CASS RCS piping and fittings and pressurizer surge line nozzle. The GALL Report recommends further evaluation of piping that does not meet either the reactor water chemistry guidelines of TR-105714 or material guidelines of NUREG-0313.
- Crack initiation and growth due to PWSCC could occur in pressurizer instrumentation penetrations and heater sheaths and sleeves made of nickel alloys. The existing program relies on 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 the intended function of nickel-alloy components. The GALL Report recommends that the applicant provide a plant-specific AMP or participate in industry programs to determine appropriate AMPs for PWSCC of the Alloy 182 weld.

The applicant credited the following plant-specific programs for each of the three SRP-LR criteria:

- Cracking of nickel-based alloy components due to PWSCC is managed by the Alloy 600 aging management program (AMP B.1.1) supplemented by the water chemistry control program and the inservice inspection program. Additionally, EPRI, through its material reliability program (MRP) and in conjunction with the PWR owners groups, is developing a strategic plan to manage and mitigate cracking of nickel-based alloy items. The applicant has stated that the guidance developed by the MRP will be used to identify critical locations for inspection and to augment existing ISI inspections, as appropriate. Since RCS pressure control using the pressurizer sprays is not an intended function of the pressurizer, the pressurizer spray assembly is not subject to aging management for ANO-2.
- Crack initiation and growth due to SCC at welded connections, including the pressurizer surge line and fittings, is managed by the water chemistry control program and the inservice inspection program.
- The programs credited for the management of PWSCC of these nickel-based alloy items are the Alloy 600 aging management program and the water chemistry control program, supplemented by the inservice inspection program. As described in Item 1 above, the applicant committed to participation in the Alloy 600 industry programs to identify critical locations for inspection and augment existing ISI, where appropriate.

The staff reviewed the plant-specific programs for these aging effects as follows:

- The staff's evaluation of the primary and secondary water chemistry control program (AMP B1.30.3) is documented in Section 3.0.3.1 of this SER.
- The staff's evaluation of the inservice inspection program (AMP B.1.14) is documented in Section 3.0.3.3.5 of this SER.

The staff's evaluation of the Alloy 600 aging management program (AMP B.1.1) is documented in Section 3.0.3.3.1 of this SER.

The staff finds that the applicant appropriately evaluated AMR results which address these aging mechanisms, as recommended in the GALL Report.

On the basis of its review, the staff finds that the applicant appropriately evaluated AMR results involving management of crack initiation and growth due to SCC or PWSCC, as recommended in the GALL Report.

3.1.2.2.8 Crack Initiation and Growth from Stress-Corrosion Cracking or Irradiation-Assisted Stress-Corrosion Cracking

In Section 3.1.2.2.8 of the LRA, the applicant stated that its reactor vessel internals do not include baffle/former bolts. The core shroud plates are joined in a welded configuration and that the discussion in this paragraph of NUREG-1800 is not applicable.

On the basis that the baffle/former bolts are not part of the design of reactor vessel internals, the staff finds that this aging effect is not applicable.

3.1.2.2.9 Loss of Preload from Stress Relaxation

In Section 3.1.2.2.9 of the LRA, the applicant stated that its reactor vessel internals do not include baffle/former bolts. The core shroud plates are joined in a welded configuration and that the discussion in this paragraph of NUREG-1800 is not applicable.

On the basis that the baffle/former bolts are not part of the design of reactor vessel internals, the staff finds that this aging effect is not applicable.

3.1.2.2.10 Loss of Section Thickness from Erosion

In Section 3.1.2.2.10 of the LRA, the applicant stated that its steam generators do not include impingement plates and that the discussion in this paragraph is not applicable.

Section 3.1.2.2.10 of the SRP-LR states that 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.

On the basis that impingement plates are not part of the steam generator design, the staff finds that this aging effect is not applicable.

3.1.2.2.11 Crack Initiation and Growth from Primary Water Stress-Corrosion Cracking, Outside-Diameter Stress-Corrosion Cracking, or Intergranular Attack or Loss of Material from Wastage and Pitting Corrosion, or Loss of Section Thickness from Fretting and Wear, or Denting from Corrosion of Carbon Steel Tube Support Plate

In Section 3.1.2.2.11 of the LRA, the applicant addressed crack initiation and growth due to PWSCC, outside diameter SCC (ODSCC,) or intergranular attack (IGA) or loss of material due to wastage and pitting corrosion or deformation due to corrosion that could occur in nickel-based alloy components of the SG tubes and plugs.

Section 3.1.2.11 of the SRP-LR states that 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 a SG degradation management program described in NEI 97-06; these guidelines are currently under NRC staff review. The GALL Report recommends that an AMP based on the recommendations of staff-approved NEI 97-06 guidelines, or other alternate regulatory basis for SG degradation management, should be developed to ensure that this aging effect is adequately managed.

The SRP-LR also states that 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 nickel-based alloy components of the SG tubes and plugs.

To manage the effects of aging, the applicant credited the SG integrity program (AMP B.1.25) supplemented by the primary and secondary water chemistry control program (AMP B.1.30.3) and the inservice inspection program (AMP B.1.14).

The staff's evaluation of the SG integrity program is documented in Section 3.0.3.1 of this SER. The staff evaluated the primary and secondary water chemistry control and the inservice inspection program and its evaluations are documented in Sections 3.0.3.1 and 3.0.3.3.5 of this SER, respectively. For general and pitting corrosion and for the assessment of tube integrity and plugging or repair criteria of flawed tubes, the SG integrity program acceptance criteria are in accordance with NEI 97-06 guidelines.

On the basis of its review of the primary and secondary water chemistry control program and the inservice inspection program, the staff finds that the applicant appropriately evaluated AMR results involving plant-specific programs to address these aging mechanisms, as recommended in the GALL Report.

3.1.2.2.12 Loss of Section Thickness from Flow-Accelerated Corrosion

In Section 3.1.2.2.12 of the LRA, the applicant states that its steam generators do not include carbon steel tube support lattice bars. Therefore, loss of section thickness of these bars is not an applicable aging effect.

On the basis that carbon steel tube support lattice bars are not part of the SG design, the staff finds that this aging effect is not applicable.

3.1.2.2.13 Ligament Cracking from Corrosion

In Section 3.1.2.2.13 of the LRA, the applicant states that the steam generators have stainless steel tube support plates. Therefore, ligament cracking due to corrosion is not an applicable aging effect.

On the basis that carbon steel components are not part of the SG tube support plate design, the staff finds that this aging effect is not applicable to ANO-2.

3.1.2.2.14 Loss of Material from Flow-Accelerated Corrosion

In Section 3.1.2.2.14 of the LRA, the applicant stated that the discussion in this paragraph of NUREG-1800 is applicable to CE System 80 steam generators only, whereas it has Westinghouse Delta 109 steam generators.

On the basis that CE System 80 SGs are not part of the ANO-2 SGs design, the staff finds that ANO-2 components are not subject to this aging effect and that this aging effect is not applicable to ANO-2.

3.1.2.2.15 Quality Assurance for Aging Management of Nonsafety-Related Components

Section 3.0.4 of this SER provides a separate evaluation of the applicant's Quality Assurance Program.

Conclusion

On the basis of its review of component groups evaluated in the GALL Report for which the applicant has claimed consistency with GALL, and for which the GALL Report recommends further evaluation, the staff concludes that the applicant has adequately addressed the issues that were further evaluated. In addition, the staff reviewed the applicant's additional evaluations against the criteria contained in Section 3.1.2.2 of the SRP-LR. Because the applicant's AMR results are otherwise consistent with the GALL Report, the staff finds that the applicant has demonstrated that the effects of aging can be adequately managed so that the component intended functions can 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 AMR Results That Are Not Consistent With or Not Addressed in the GALL Report

Summary of Technical Information in the Application

In Tables 3.1.2-1 through 3.1.2-5 of the LRA, the applicant indicated, by means of notes F through J, that neither the identified component nor the material and environment combination is evaluated in the GALL Report. Thus, the applicant provided information concerning how the aging effect will be managed. LRA Tables 3.1.2-1 through 3.1.2-5 use the following notes to indicate the status of a specific component, environment, material, and/or aging effect in the GALL Report:

- Note F indicates that the material is not in the GALL Report for the identified component.
- Note G indicates that the environment is not in the GALL Report for the identified component and material.
- Note H indicates that the aging effect is not in the GALL Report for the identified component, material, and environment combination.
- Note I indicates that the aging effect in the GALL Report for the identified component, material, and environment combination is not applicable

- Note J indicates that the GALL Report does not evaluate either the identified component or the material and environment combination.

Staff Evaluation

For component type and material and environment combinations that are not evaluated in the GALL Report, the staff reviewed the applicant's evaluation to determine whether the applicant had demonstrated that the effects of aging will be adequately managed so that the component intended functions will be maintained consistent with the CLB during the period of extended operation.

The following sections discuss the staff's evaluation.

3.1.2.3.1 Reactor Vessel and Control Element Drive Mechanism Pressure Boundary

Summary of Technical Information in the Application

In Section 3.1.2.1.1 of the LRA, the applicant identified the materials, environments, and aging effects requiring management. The applicant identified the following programs that manage the aging effects for the reactor vessel (RV) and control element drive mechanism (CEDM) and associated pressure boundary components:

- Reactor Vessel Integrity Program
- Inservice Inspection Program
- Water Chemistry Control Program
- Boric Acid Corrosion Prevention Program
- Alloy 600 Aging Management Program
- Reactor Vessel Head Penetration Program
- Bolting and Torquing Activities Program

Table 2.3.1-1 of the LRA lists the following individual system components within the scope of license renewal and subject to an AMR:

- closure head lifting lugs
- closure studs, nuts, and washers
- core stabilizing lugs
- core stop lugs
- flow skirt
- grayloc clamp
- grayloc clamp studs
- grayloc clamp nuts
- in-core instrumentation drive nuts
- in-core instrumentation spacer sleeves
- reactor vessel support pads
- shear lugs
- surveillance capsule holders
- CEDM motor housing
- CEDM upper pressure housing

- CEDM ball seal housing
- CEDM upper pressure housing upper fitting
- CEDM motor housing upper and lower end fittings
- CEDM upper pressure housing lower fitting
- CEDM nozzle
- in-core instrumentation nozzle tubes
- CEDM steel ball
- in-core instrumentation flange adapter/seal plate
- reactor vessel vent pipe
- reactor vessel vent pipe flange
- bottom head (torus and dome)
- upper shell
- closure head dome (torus and dome)
- closure head flange
- intermediate shell
- lower shell
- primary inlet nozzles
- primary outlet nozzles
- primary inlet nozzle safe ends
- primary outlet nozzle safe ends
- vessel flange

In Table 3.1.2-1 of the LRA, the applicant provided a summary of AMRs for the RV and CEDM and associated pressure boundary components and identified which AMRs it considered to be consistent with the GALL Report.

Staff Evaluation

The staff reviewed Table 3.1.2-1 of the LRA, which summarizes the results of AMR evaluations in the SRP-LR for the RV and CEDM pressure boundary component groups.

Aging Effects

Aging Management of Low-Alloy Steel RV Components In External Air Environments. The applicant identified that low-alloy steel components that are exposed to an external air environment are subject to cracking, cracking (fatigue), loss of material, and loss of mechanical closure integrity.

The applicant did not identify in Section 3.1 of the LRA, or in Table 3.1.2-1, which aging mechanisms could lead to cracking in low-alloy steel components exposed to an external air environment. The staff forwarded RAIs on the RV internals and the RCS by letter dated June 11, 2004. In RAI 3.1.2.1-1, the staff requested additional information on the applicant's AMRs for managing cracking in low-alloy steel components that are exposed to an external air environment, particularly because aging management strategies for license renewal are somewhat dependent on the specific types of aging mechanisms that can induce age-related degradation, rather than on the general classification of the aging effect.

In response to RAI 3.1.2.1-1, the applicant stated that the low-alloy steel items that are susceptible to external cracking are limited to fasteners (e.g., RV closure studs) and the exterior attachments to vessels. Fasteners are not intentionally exposed to water or steam, but exposure may result from gasket leaks. If leakage is combined with contaminant species, such as sulfides or chlorides, an aggressive environment that can promote SCC may result. The applicant concluded that for the RCS components fabricated from low-alloy steel, including exterior attachments to vessels and fasteners, cracking at welded joints (i.e., initiation by fatigue and growth of preservice flaws at welded joints caused by service loadings) is considered an aging effect requiring management for the period of extended operation. The Inservice Inspection Program manages cracking. The TLAA for metal fatigue manages cracking of low-alloy steel RV components by fatigue. The staff finds the applicant's response acceptable and considers this issue closed.

In RAI 3.1.2.1-4, the staff requested a clarification on where Section 3.1 of the LRA or Table 3.1.2-1 considers the boric acid corrosion aging mechanism. The RAI noted that the clarification should include which component types, materials, environments, AERMs, and AMPs are associated with this aging mechanism.

In response to RAI 3.1.2.1-4, the applicant stated that in LRA Section 3.1 and Tables 3.1.2-1 and 3.1.2-3, boric acid corrosion is an applicable mechanism for loss of material for carbon steel and low-alloy steel components with an external air environment. Carbon and low-alloy steel components (including all bolting materials, piping and fittings, RCP driver mounts, and vessels and support skirts) of the RCS that are exposed to an external air environment are susceptible to loss of material by boric acid corrosion. The Boric Acid Corrosion Prevention Program, discussed in Section B.1.3 of the LRA, manages this aging effect. The staff finds the applicant's response acceptable and considers this issue closed.

Low-alloy steel clad with stainless steel and nickel-based alloy exposed to an internal environment of treated water is subject to loss of material, cracking, and cracking (fatigue). Low-alloy steel clad with stainless steel and nickel-based alloy exposed to an external environment of air is subject to loss of material. Low-alloy steel clad with stainless steel exposed to an internal environment of treated water is subject to loss of material, cracking, cracking (fatigue), and a reduction in fracture toughness. Low-alloy steel clad with stainless steel exposed to an external environment of air is subject to loss of material.

Aging Management of Nickel-Based Alloy Components in an Internal Borated Treated Water Environment. The applicant identified that nickel-based alloy components that are exposed to an internal environment of treated, borated water are subject to cracking, cracking (fatigue), and loss of material.

The applicant did not identify in Section 3.1 of the LRA, or in Table 3.1.2-1, which aging mechanisms could lead to loss of material in nickel-based alloy components. In RAI 3.1.2.1-2, the staff requested additional information on the applicant's AMRs for managing loss of material for nickel-based alloy components that are exposed to an internal environment of treated, borated water.

In response to RAI 3.1.2.1-2, the applicant stated that loss of material can be induced by crevice and pitting corrosion or by wear in nickel-based alloy components. If RCS fluid chemistry is not rigorously controlled, the concentration of system fluid contaminants could lead to loss of material from pitting or crevice corrosion of the nickel-based material. The applicant addresses this aging effect by maintaining rigorous control of RCS chemistry under the Water

Chemistry Control Program. Loss of material from wear has the potential to occur between the nickel-based alloy core-stabilizing lugs and the core barrel. While there has been no operating experience at ANO-2 showing that wear has occurred in this location, relative motion occurring from the handling of the vessel internals or thermal expansion during heatup and cooldown could lead to loss of material as a result of wear. The Inservice Inspection Program manages loss of material from wear. Finally, the nickel-based alloy SG U-tubes are subject to loss of material by sliding wear at tube support locations. Loss of material by sliding wear occurs when forces imposed on the tubes by the secondary fluid cause high-frequency vibration of the tubes and tube support structures. The Steam Generator Integrity Program manages loss of tube material from wear. The staff finds the applicant's response acceptable and considers this issue closed.

Aging Management of Stainless Steel Components. The applicant identified that stainless steel components that are exposed to an external air environment are subject to cracking (fatigue) and loss of mechanical closure. The applicant identified that stainless steel components that are exposed to an internal environment of treated, borated water are subject to cracking, cracking (fatigue), and loss of material.

The applicant did not identify in Section 3.1 of the LRA, or in Table 3.1.2-1, which aging mechanisms could lead to loss of material in stainless steel components. In RAI 3.1.2.1-3, the staff requested additional information on the applicant's AMRs for managing loss of material in stainless steel components that are exposed to an internal environment of treated, borated water.

In response to RAI 3.1.2.1-3, the applicant stated that loss of material can be induced by crevice and pitting corrosion of stainless steel in treated, borated water, if the RCS fluid chemistry is not rigorously controlled. The applicant addresses this aging effect by maintaining rigorous control of RCS chemistry under the Water Chemistry Control Program.

The applicant also stated that various stainless steel components at ANO-2 (e.g., the RV internals) are subject to flow-induced vibration during plant operation and differential thermal expansion and contraction movement during plant heatup, cooldown, and changes in power operating cycles. Flow -induced vibration and thermal expansion can cause repetitive relative movement between stainless steel interfacing and mating surfaces. This relative movement between the interfacing and mating surfaces may result in surface wear. The Inservice Inspection Program manages loss of material from the wear of these interfacing and mating surfaces. The staff finds the applicant's response acceptable and considers this issue closed.

On the basis of its review of the information provided in the LRA, and the additional information included in the applicant's response to its RAIs, the staff finds the aging effects of the above RV and CEDM pressure boundary component types are consistent with industry experience for these combinations of materials and environments. The staff did not identify any missing aging effects. Therefore, the staff finds that the applicant has identified the appropriate aging effects for the materials and environments associated with the above components in the RV and CEDM pressure boundary.

Aging Management Programs

After evaluating the applicant's identification of aging effects for each of the above components, the staff evaluated the AMPs to determine if they are appropriate for managing the identified aging effects. The staff also determined that the UFSAR Supplement contains an adequate description of the program. LRA Table 3.1.2-1 identifies the following AMPs for managing the aging effects described above for the RV and CEDM pressure boundary:

- Alloy 600 Aging Management Program
- Boric Acid Corrosion Prevention Program
- Reactor Vessel Head Penetration Program*
- Reactor Vessel Integrity Program
- Inservice Inspection Program*
- System Walkdown Program*
- Bolting and Torquing Activities Program
- Water Chemistry Control Program*

The NRC staff reviewed those AMPs identified with an asterisk (*) during an onsite audit. Sections 3.0.3.3.1, 3.0.3..2.1, 3.0.3.2.6, and 3.0.3.3.2 of this SER document the staff's review of remaining AMPs.

The applicant proposed to manage loss of material for the following stainless steel, nickel-based alloy, and low alloy steel clad with stainless steel and nickel-based alloy component types of the reactor vessel and CEDM pressure boundary system - core stop lugs, flow skirt, and surveillance capsule holders; penetrations for the CEDM motor housing, CEDM upper pressure housing, CEDM ball seal housing, CEDM upper pressure housing upper fitting, CEDM motor housing upper and lower end fittings, CEDM upper pressure housing lower fitting, CEDM nozzle, ICI nozzle tubes, ICI flange adapter/seal plate, reactor vessel vent pipe, and reactor vessel vent pipe flange; reactor vessel shell and nozzles for the bottom head (torus and dome), upper shell, closure head dome (torus and dome), intermediate shell, lower shell, and primary inlet/outlet nozzle safe ends - exposed internally to treated, borated water using the primary and secondary water chemistry control program (AMP B.1.30.3). The staff's evaluation of the primary and secondary water chemistry control program is documented in Section 3.0.3.1 of this SER. The staff concludes that the primary and secondary water chemistry control program credited by the applicant for this line item is adequate.

For each of these same component and material combinations in Table 3.1.2-1, the applicant is also managing cracking using the water chemistry control program (AMP B.1.14), inservice inspection - inservice inspection program (AMP B.1.14), and a plant-specific program such as Alloy 600 aging management program (AMP B.1.1). The staff's evaluation of the inservice inspection - inservice inspection - IWB, IWC, IWD, and IWF program is documented in Section 3.0.3.3.5 of this SER. The staff concludes that the inservice inspection - inservice inspection program credited by the applicant for this line item is adequate. The staff reviewed the Alloy 600 aging management program and its evaluation is documented in Section 3.0.3.3.1 of this SER. On the basis of the above discussion, the staff finds that the applicant manages cracking in a manner consistent with the GALL Report.

On the basis that management of cracking of stainless steel, nickel-based alloy and low alloy steel clad with stainless steel is being managed by the water chemistry control and inservice inspection programs, and the effects of pitting and crevice corrosion on stainless steel and nickel-based alloy components are not significant in chemically treated, borated water, the staff finds that management of loss of material using water chemistry control is adequate.

In the case of the stainless steel CEDM motor housing, upper-pressure housing and fitting, and ball seal housing as well as the CEDM nickel-alloy fittings, the staff asked the applicant to justify application of this position under the low-flow conditions that are expected. The staff reviewed a report (ML003748904) of maintenance activities that documented site-specific experience. This included a record of the visual inspection of materials in the same environment that had been operated under virtually identical conditions without observable loss of material, confirming the effectiveness of a water chemistry control program for management of this aging effect.

On the basis of industry and plant-specific operating experience, and the fact that the applicant manages the cracking aging effect of these same components, materials, and environment combinations using water chemistry control and inservice inspection programs, the staff finds that the use of a plant-specific water chemistry program to manage loss of material for stainless steel and nickel-based alloy components exposed to treated, borated water is acceptable.

The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the component intended functions will be maintained consistent with the CLB during the period of extended operation.

Conclusion

On the basis of its audit and review, the staff concludes that the applicant has adequately identified the aging effects, and the AMPs credited for managing the aging effects, for the RV and CEDM pressure boundary components so that the component intended functions can be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable UFSAR Supplement program summary descriptions and concludes that the UFSAR Supplement adequately describes the AMPs credited with managing aging in these components, as required by 10 CFR 54.21(d).

As stated in the staff's evaluation of the Reactor Vessel Integrity Program, Appendix H to 10 CFR Part 50 requires licensees to submit any proposed changes to their withdrawal schedules to the NRC for review and approval. As mentioned, Table 5.2-12 of the ANO-2 LRA contains a statement that says NRC approval is required, per Appendix H to 10 CFR Part 50, before changing removal intervals. To ensure that this requirement will carry forward after the ANO-2 operating license has been renewed, the staff will impose the following license condition in the renewed license for ANO-2 that requires Entergy to submit any further changes to the surveillance capsule withdrawal schedule for NRC review and approval:

> All capsules in the reactor vessel that are removed and tested must meet the test procedures and reporting requirements of ASTM E 185-82 to the extent practicable for the configuration of the specimens in the capsule. Any changes to the capsule withdrawal schedule, including spare capsules, must be approved by the NRC prior to implementation. All capsules placed in storage must be

maintained for future insertion. Any changes to storage requirements must be approved by the NRC.

3.1.2.3.2 Reactor Vessel Internals

Summary of Technical Information in the Application

In Section 3.1.2.1.2 of the LRA, the applicant identified the materials, environments, and AERMs. The applicant identified the following programs that manage the AERMs for the RV internals and associated pressure boundary components:

- Reactor Vessel Internals Cast Austenitic Stainless Steel (CASS) Components Programs
- Reactor Vessel Internals Stainless Steel Plates, Forgings, Welds, and Bolting Program
- Water Chemistry Control Program
- Inservice Inspection Program

Table 2.3.1-2 of the LRA lists individual system components within the scope of license renewal and subject to an AMR.

- control element assembly (CEA) instrument tube
- CEA shroud adapter
- CEA shroud support
- positioning plate
- CEA shroud extension shaft guides, cylinders, and bases
- CEA shroud base
- CEA shroud flow channel
- CEA shroud flow channel cap
- CEA shroud shaft retention pin
- CEA shroud retention block
- external spanner nut
- internal spanner nut
- CEA shroud fasteners
- CEA shroud flow channel extension
- CEA shroud tubes
- core shroud plates
- plates
- ribs[2]
- intermediate plates
- core shroud guide lugs
- core support barrel (CSB) alignment keys
- CSB assembly dowel pin

---

2 Note: The core shroud assembly ribs are the vertical members located along the outer surface (away from the core) of the core shroud assembly. The ribs provide structural stiffness and support to the core shroud assembly, and are welded in place to provide the appropriate intended function of the core shroud assembly.

- CSB lifting bolt insert
- CSB lower flange
- CSB lug
- CSB nozzle
- CSB cylinder
- CSB upper flange
- CSB cylinder
- CSB upper flange (continued)
- guide tubes
- in-core instrumentation thimble support plate assembly
- in-core instrumentation support plate, grid, lifting support, lifting plate, column, plates, funnel
- pad, ring, nipple, hex bolt, spacer
- threaded rod, hex jam nut, thimble support nut, cap screws
- bottom plate
- bottom plate manhole cover
- cylinder
- core support column
- core support plate
- insert pins
- support beam
- support beam flange
- fuel assembly alignment plate (FAP)
- FAP guide lug inserts
- holddown ring
- upper guide structure (UGS) support plate
- UGS cylinder
- UGS grid plate
- UGS flange
- UGS sleeve
- UGS lifting bolt insert
- UGS alignment keys
- UGS dowel pins

In Table 3.1.2-2 of the LRA, the applicant provided a summary of AMRs for the RV internals and associated pressure boundary components and identified which AMRs it considered to be consistent with the GALL Report.

Staff Evaluation

The staff reviewed Table 3.1.2-2 of the LRA, which summarized the results of AMR evaluations in the SRP-LR for the RV internals component groups.

The staff reviewed the AMR of the RV internals component-material-environment-AERM combinations that are not addressed in the GALL Report or required additional staff review. These combinations are identified by notes F through J, or plant-specific notes, in LRA Table 3.1.2-2. The NRC staff reviewed those portions of the RV internals that are covered by the GALL Report (specified by notes A through E in Table 3.1.2-2) during an onsite audit. The staff also reviewed the applicable UFSAR Supplements for the AMPs to ensure that the program descriptions are adequate.

Aging Effects

Aging Management of RV Internals Components Fabricated from Stainless Steel Materials, Including Cast Austenitic Stainless Steel (CASS). The applicant identified that stainless steel RV internal components (including CASS) that are exposed to an internal environment of treated, borated water are subject to loss of material, reduction in fracture toughness, cracking, cracking (fatigue), and changes in dimension. The applicant identified that loss of mechanical closure integrity is an additional aging effect requiring management for fastened stainless steel RV internals components.

The applicant did not identify in Section 3.1 of the LRA, or in Table 3.1.2-1, which aging mechanisms could lead to loss of material and cracking in CASS RV internals components. In RAI 3.1.2.2-1, the staff requested additional information on the applicant's AMRs for managing loss of material and cracking in CASS components that are exposed to an internal environment of treated, borated water.

In response to RAI 3.1.2.2-1, the applicant stated that if the RCS fluid chemistry is not rigorously controlled, the concentration of system fluid contaminants could lead to loss of material from pitting and crevice corrosion of CASS material.

The applicant concluded that CASS material may be susceptible to SCC or to IGA, if exposed to high concentrations of contaminants in the treated, borated water. In addition, IASCC is a degradation mechanism for CASS reactor internals items where materials become more susceptible to SCC with increasing exposure to neutron irradiation. The relatively benign environment of the RCS fluid, which incorporates hydrogen overpressure to reduce oxygen levels, reduces the potential for IASCC degradation of the RV internal components made from CASS materials. Loss of material from pitting or crevice corrosion is also a potential aging mechanism for CASS reactor internal components in the treated, borated water environment.

The only CASS item in the RV internals is the CEA shroud tube. The applicant credited the Inservice Inspection Program and the Water Chemistry Control Program with the management of loss of material and cracking in the CEA shroud tube. The applicant also credited the Reactor Vessel Internals Cast Austenitic Stainless Steel Components Program with the management of cracking, as well as loss of fracture toughness from thermal aging, in the CASS CEA shroud tube. These programs are consistent with industry wide programs for managing loss of material and cracking for CASS RV internal components and are therefore acceptable programs to credit for aging management. The staff considers this issue closed. Sections 3.0.3.3.4 and 3.0.3.2.3 of this SER document the staff's evaluation of the ability of the Inservice Inspection Program and the Water Chemistry Control Program to manage loss of material and cracking in the CASS CEA shroud tube. The staff evaluates the ability of the Reactor Vessel Internals Cast Austenitic Stainless Steel Components Program (which is discussed in LRA Section B.1.22) to manage loss of fracture toughness and cracking in the CASS CEA shroud tube later in this section of the SER.

On the basis of its review of the information provided in the LRA, the staff finds that the aging effects for the above RV internals component types are consistent with industry experience for these combinations of materials and environments. The staff did not identify any omitted aging effects. Therefore, the staff finds that the applicant has identified the appropriate aging effects for the materials and environments associated with the above components in the RV internals.

Aging Management Programs

After evaluating the applicant's identification of aging effects for each of the above components, the staff evaluated the AMPs to determine if they are appropriate for managing the identified aging effects. The staff also determined that the UFSAR Supplement contains an adequate description of the program.

LRA Table 3.1.2-2 identifies the following AMPs for managing the aging effects described above for the RV internals:

- Inservice Inspection Program
- Water Chemistry Control Program*
- Reactor Vessel Internals Cast Austenitic Stainless Steel Components Program*
- Reactor Vessel Internals Stainless Steel Plates, Forgings, Welds, and Bolting Program*

The NRC staff reviewed those AMPs identified by an asterisk (*) during an onsite audit. Section 3.0.3.3.4 of this SER present the review of the Inservice Inspection Program.

The applicant proposed to use the Primary and Secondary Water Chemistry Control Program (AMP B.1.30.3) to manage loss of material for the following stainless steel component types of the RV internals system exposed internally to treated, borated water—CEA shroud assembly components, such as CEA instrument tube, CEA shroud adapter, CEA shroud support, positioning plate, CEA shroud flow channel extension, and core shroud tube; core shroud assembly components, such as core shroud plates, plates, ribs, intermediate plates, and core shroud guide lugs; and in-core instrumentation components, such as guide tubes, in-core instrumentation thimble support plate assembly, in-core instrumentation support plate, grid, lifting support, lifting plate, columns, plates, funnel, pad, ring, nipple, hex bolt, spacer, threaded rod, hex jam nut, thimble support nut, and cap screws. Section 3.0.3.1 of this SER documents the staff's evaluation of the Primary and Secondary Water Chemistry Control Program. The staff concludes that the Primary and Secondary Water Chemistry Control Program credited by the applicant for this line item is adequate.

For each of these same component and material combinations in LRA Table 3.1.2-2, the applicant is also managing cracking using the Water Chemistry Control Program, the Inservice Inspection—Inservice Inspection Program (AMP B.1.14), and a plant-specific program, such as the Reactor Internals Stainless Steel Program. Section 3.0.3.3.5 of this SER documents the staff's evaluation of the Inservice Inspection—Inservice Inspection Program (ASME Code Subsections IWB, IWC, IWD, and IWF). The staff concludes that the Primary and Secondary Water Chemistry Control Program credited by the applicant for this line item is adequate. Section 3.0.3.1 of this SER documents the staff's review of the Reactor Vessel Internals Stainless Steel Plates, Forgings, Welds, and Bolting Program (AMP B.1.23). On the basis of the above discussion, the staff finds that the applicant manages cracking in a manner consistent with the GALL Report.

Because the applicant is managing cracking of stainless steel by the Water Chemistry Control and the Inservice Inspection Programs, and the effects of pitting and crevice corrosion on stainless steel components are not significant in chemically treated, borated water, the staff finds that management of loss of material using water chemistry control is adequate.

The GALL Report recommends a loose parts monitoring program to manage loss of mechanical closure integrity for CEA shroud extension shaft guides, cylinders, and bases; shroud base; shroud flow channel; shroud flow channel cap; shroud shaft retention pin; shroud retention block; spanner nuts; shroud fasteners; guide tubes; in-core instrumentation thimble support plate assembly; in-core instrumentation support plate, grid, lifting support, lifting plate, column, plates, and funnel; pad, ring, nipple, hex bolt, spacer; threaded rod, hex jam nut, thimble support nut, cap screws, and RV internals.

The applicant proposed to manage this aging effect using the Reactor Vessel Internals Stainless Steel Plates, Forgings, Welds, and Bolting Program (AMP B.1.23) and the Inservice Inspection—Inservice Inspection Program (AMP B.1.14). Sections 3.0.3.1 and 3.0.3.3.5 of this SER, respectively, document the staff's review of these programs. The staff concludes that the Reactor Vessel Internals Stainless Steel Plates, Forgings, Welds, and Bolting Program and the Inservice Inspection—Inservice Inspection Program credited by the applicant for this line item are adequate.

On the basis that the Reactor Vessel Internals Programs detect aging effects before the loss of mechanical integrity of these components, the staff finds that their use, in lieu of a loose parts monitoring program, is acceptable. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the component intended functions will be maintained consistent with the CLB during the period of extended operation.

Conclusion

On the basis of its audit and review, the staff concludes that the applicant has adequately identified the aging effects, and the AMPs credited for managing the aging effects, for the reactor vessel internal components so that the component intended functions can be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable UFSAR Supplement program descriptions and concludes that the UFSAR Supplement adequately describes the AMPs credited with managing aging in these components, as required by 10 CFR 54.21(d).

3.1.2.3.3 Class 1 Piping, Valves, and Reactor Coolant Pumps

Summary of Technical Information in the Application

In Section 3.1.2.1.3 of the LRA, the applicant identified the materials, environments, and aging effects requiring management. The applicant identified the following programs that manage the AERMs for the Class 1 piping, valves, and RCP and the associated pressure boundary components:

- Water Chemistry Control

- Inservice Inspection
- Cast Austenitic Stainless Steel
- Boric Acid Corrosion Prevention
- Alloy 600 Aging Management
- Bolting and Torquing Activities

Table 2.3.1-3 of the LRA lists the following individual system components within the scope of license renewal and subject to an AMR:

- charging inlet nozzle
- safety injection nozzle
- surge line nozzle
- charging inlet nozzle safe end
- drain nozzle safe end
- letdown nozzle safe ends
- pressure measurement nozzle safe end
- sampling nozzle safe end
- charging inlet nozzle thermal sleeve
- safety injection nozzle thermal sleeve
- surge line thermal sleeve
- ASME Code Class 1 boundary orifices
- ASME Code Class 1 pipe and fittings NPS less than 4 inches
- ASME Code Class 1 pipe NPS greater than or equal to 4 inches
- ASME Code Class 1 fittings
- cold-leg piping and elbows
- hot-leg pipe and elbows
- drain nozzles
- letdown nozzles
- shutdown cooling outlet nozzle
- spray nozzle
- pressure measurement nozzle
- replacement pressure nozzle
- sampling nozzle
- RCP safe ends
- resistance temperature device (RTD) nozzles
- safety injection nozzle safe end
- shutdown cooling outlet nozzle safe end
- surge nozzle safe end
- stainless steel bolting
- surge line pipe and elbows
- surge line piping: RTD and sampling nozzles
- carbon/alloy steel bolting
- valve bodies and bonnets
- ASME Code Class 2 and 3 closure bolting
- ASME Code Class 2 and 3 fittings
- ASME Code Class 2 and 3 pipe
- ASME Code Class 2 and 3 valve bodies and bonnets
- tubing
- RCP casing

- RCP cover
- RCP cover studs
- RCP cover nuts
- RCP driver mount assembly
- RCP thermal barrier heat exchanger inner coil
- RCP thermal barrier heat exchanger outer coil
- RCP thermal barrier bored hole heat exchanger

In Table 3.1.2-3 of the LRA, the applicant provided a summary of the AMRs for the Class 1 piping, valves, and RCP and the associated pressure boundary components and identified which AMRs it considered to be consistent with the GALL Report.

Staff Evaluation

The staff reviewed Table 3.1.2-3 of the LRA, which summarizes the results of the AMR evaluations in the SRP-LR for the Class 1 piping, valves, and RCP component groups. The staff finds that the programs proposed for management of the aging effects for the component types in this system are consistent with the GALL Report.

The NRC staff reviewed the AMR of the ASME Code Class 1 piping, valves, and RCP component-material-environment-AERM combinations that are not addressed in the GALL Report, or required additional staff review. Table 3.1.2-3 identifies these combinations by notes F through J, or plant-specific notes. The NRC staff reviewed those portions of the ASME Class 1 piping, valves, and RCPs that are covered by the GALL Report (specified by notes A through E in Table 3.1.2-3) during an onsite audit. The staff also reviewed the applicable UFSAR Supplements for the AMPs to ensure that the program descriptions are adequate.

Aging Effects

Aging Management of ASME Code Class 1 Piping, Valve, Pump and Fitting Components Fabricated from Carbon Steel and Low-Alloy Steel Materials. The surfaces of carbon steel components that are clad internally with stainless steel and are exposed to an internal environment of treated, borated water are subject to the aging effects of loss of material, cracking, and cracking (fatigue). The surfaces of carbon steel components, including carbon steel components with internal stainless steel cladding, that are exposed to an external air environment are subject to the aging effects of loss of material and cracking (fatigue).

Low-alloy steel components exposed to an external environment of air are subject to the aging effects of loss of material, cracking, cracking (fatigue), and, for low-alloy steel bolting components, loss of mechanical closure integrity.

Aging Management of ASME Code Class 1 Piping, Valve, Pump and Fitting Components Fabricated from Nickel-Based Alloy and Stainless Steel Materials, Including CASS. The applicant identified that nickel-based alloy components that are exposed to an internal environment of treated, borated water are subject to the aging effects of loss of material, cracking, and cracking (fatigue).

The applicant identified that stainless steel components that are exposed to an internal environment of treated, borated water are subject to the aging effects of loss of material, cracking, and cracking (fatigue). The applicant identified that stainless steel exposed to an external environment of air is subject to the aging effects of cracking, cracking (fatigue), reduction in fracture toughness (17-4PH [precipitation-hardened] material only), and loss of mechanical closure integrity. The applicant identified that stainless steel components exposed to an external environment of treated water are subject to the aging effects of loss of material, cracking, and cracking (fatigue).

The applicant identified that CASS components that are exposed to an internal environment of treated, borated water or a treated water external environment are subject to the aging effects of loss of material, cracking, cracking (fatigue), and reduction in fracture toughness.

In LRA Table 3.1.2-3, page 3.1-79, the applicant identified treated water as the external environment for the RCP thermal barrier heat exchanger inner coil. In addition, on page 3.1-80, the applicant identified treated water as the internal environment for the RCP thermal barrier heat exchanger outer coil and bored-hole heat exchanger. The aging effects of loss of material, cracking, and fatigue require aging management.

The AMPs identified to manage these aging effects are the Inservice Inspection Program and the Time-Limited Aging Analysis (TLAA)—Metal Fatigue. The applicant's Auxiliary Systems Water Chemistry Control Program, described in Section B.1.30.1, identifies its purpose as managing loss of material, cracking, and fouling of components exposed to treated water systems. The applicant has identified similar components of the same material which are exposed to the same environment as being managed by a water chemistry AMP and referenced concurrence with the GALL Report, Section VII.C2.2-a. In RAI 3.1.2-3.1, the staff requested that the applicant provide justification for excluding an AMP to manage the water chemistry of the treated water environment, as applicable to these components.

In response to RAI 3.1.2-3.1, the applicant stated that the treated water identified in the ANO-2 LRA which supplies cooling to the RCP thermal barrier heat exchangers is part of the ANO-2 component cooling water (CCW) system. The chemistry controls for this system are not sufficiently rigorous to control the contaminants which could potentially lead to loss of material and cracking in the RCP thermal barriers. Therefore, the Component Cooling Water Chemistry Control Program is not credited as managing these aging effects. The applicant concluded that the Inservice Inspection Program will manage these aging effects such that corrective action may be taken before a loss of the component intended function. The staff finds the applicant's response acceptable and considers this issue closed.

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 the aging effects for the ASME Code Class 1 piping, valves, and RCPs are consistent with industry experience for these combinations of materials and environments. The staff did not identify any omitted aging effects. Therefore, the staff finds that the applicant has identified the appropriate aging effects for the materials and environments associated with the above components in the ASME Code Class 1 piping, valves, and RCPs.

Aging Management Programs

After evaluating the applicant's identification of aging effects for each of the above components, the staff evaluated the AMPs to determine if they are appropriate for managing the identified aging effects. The staff also determined that the UFSAR Supplement contains an adequate description of the program.

LRA Table 3.1.2-3 identifies the following AMPs for managing the aging effects described above for the ASME Code Class 1 piping, valves, and RCPs:

- Inservice Inspection Program
- Water Chemistry Control Program*
- Alloy 600 Aging Management Program
- Boric Acid Corrosion Prevention Program
- System Walkdown Program*
- Cast Austenitic Stainless Steel (CASS) Evaluation Program*
- Bolting and Torquing Activities Program

The NRC staff reviewed those AMPs identified by an asterisk (*) during an onsite audit. Sections 3.0.3.3.4, 3.0.3.3.1, 3.0.3.2.1, and 3.0.3.3.2 of this SER document the staff's evaluation of remaining AMPs.

On the basis of its review of the information provided in the LRA, the staff finds that the applicant has identified appropriate AMPs for managing the aging effects of the Class 1 piping, valves, and RCP component types. In addition, the staff finds the program descriptions in the UFSAR Supplement acceptable.

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 them for the ASME Code Class 1 piping, valves, and RCPs so that there is assurance 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 UFSAR Supplement program descriptions and concludes that the UFSAR Supplement adequately describes the AMPs credited with managing aging in these components, as required by 10 CFR 54.21(d).

3.1.2.3.4 Pressurizer

Summary of Technical Information in the Application

In Section 3.1.2.1.4 of the LRA, the applicant identified the materials, environments, and aging effects requiring management. The applicant identified the following programs that manage the AERMs for the pressurizer and associated pressure boundary components:

- Water Chemistry Control Program
- Pressurizer Examinations Program
- Inservice Inspection Program
- Boric Acid Corrosion Prevention Program
- Alloy 600 Aging Management Program
- Bolting and Torquing Activities Program

- Cast Austenitic Stainless Steel (CASS) Evaluation Program

Table 2.3.1-4 of the LRA lists the following individual system components within the scope of license renewal and subject to an AMR:

- heater end plug
- heater sheaths
- heater sleeves
- heater support channel
- heater support plates
- heater support plate brackets
- heater support plate bracket bolts
- lower head
- lower shell
- upper shell
- upper head
- lower level nozzle
- manway cover bolts/studs
- manway cover plate
- manway forging
- manway gasket retainer plate
- mechanical nozzle seal assembly (MNSA) bolting (studs, nuts, and washers)
- MNSA compression collar
- MNSA upper flanges
- pressure measurement nozzle
- upper-level nozzle
- vent nozzle
- temperature nozzle
- pressure measurement nozzle safe end
- upper/lower-level nozzle safe end
- vent nozzle safe end
- temperature nozzle safe end
- safety valve nozzle
- spray nozzle
- surge nozzle
- safety valve nozzle flange
- spray nozzle safe end
- spray nozzle thermal sleeve
- support skirt
- surge nozzle safe end

In Table 3.1.2-4 of the LRA, the applicant provided a summary of AMRs for the pressurizer and associated pressure boundary components and identified which AMRs it considered to be consistent with the GALL Report.

Staff Evaluation

The staff reviewed Table 3.1.2-4 of the LRA, which summarizes the results of AMR evaluations in the SRP-LR for the pressurizer component groups.

The technical staff reviewed the AMR of component-material-environment-AERM combinations for the pressurizer components that are not addressed in the GALL Report, or required additional staff reviews. These combinations are identified by notes F through J, or plant-specific notes, in LRA Table 3.1.2-4. The NRC staff reviewed those portions of the pressurizer that are covered by the GALL Report (specified by notes A through E in Table 3.1.2-4) during an onsite audit. The staff determined that the applicant identified all applicable AERMs and credited the appropriate AMPs for managing them. The staff also reviewed the applicable UFSAR Supplements for the AMPs to ensure that the program descriptions are adequate.

Aging Effects

Aging Management of Pressurizer Components Fabricated from Nickel-Based Alloy or Stainless Steel Materials, Including CASS. The applicant identified that nickel-based alloy components (including the cladding of low-alloy steel pressurizer components that are clad internally with nickel-based alloy materials) that are exposed to an internal environment of treated, borated water are subject to the aging effects of loss of material, cracking, and cracking (fatigue).

The applicant identified that stainless steel components (including CASS and the cladding of low-alloy steel pressurizer components that are clad internally with stainless steel materials) that are exposed to an internal environment of treated, borated water are subject to the aging effects of loss of material, cracking, and cracking (fatigue). The applicant identified that for CASS components that are exposed to an internal environment of treated, borated water, reduction in fracture toughness as a result of thermal aging is an additional aging effect requiring management. The applicant identified that stainless steel components that are exposed to an external environment of air are subject to the aging effects of cracking and cracking (fatigue).

The applicant did not identify in Section 3.1 of the LRA, or in Table 3.1.2-4, which aging mechanisms could lead to cracking in stainless steel components. In RAI 3.1.2.4-2, the staff requested that the applicant provide additional information on the AMRs for managing cracking in stainless steel components that are exposed to an external air environment. In response to RAI 3.1.2.4-2, the applicant stated that generally, stainless steel exposed to an external air environment is not susceptible to aging effects requiring management. Insulation material used for RCS components has low soluble chloride and other halide content to minimize the possibility of SCC of stainless steel components. However, stainless steel items, such as flange and valve bolting, in air are subject to cracking, as indicated in Table 3.1.2-3 on page 3.1-68 of the LRA. Stainless steel fasteners are not intentionally exposed to water or steam, but exposure may result from gasket leaks. If leakage is combined with contaminant species, such as sulfides or chlorides, an aggressive environment that can promote SCC may result. Therefore, the applicant concluded that cracking of stainless steel flange and valve bolting is considered an AERM for the period of extended operation. Even though cracking is not expected, the Inservice Inspection Program is credited to confirm the absence of cracking resulting from SCC. The staff finds the applicant's response acceptable and considers this issue closed.

The applicant also did not identify in Section 3.1 of the LRA, or in Table 3.1.2-4, which aging mechanisms could lead to loss of material and cracking in the cladding of low-alloy steel pressurizer components that are clad either with stainless steel or nickel-based alloy and are exposed to an internal environment of treated, borated water. In RAI 3.1.2.4-3, the staff requested that the applicant provide additional information on the AMRs for managing loss of material and cracking in the cladding materials that are exposed to an internal environment of treated, borated water.

In response to RAI 3.1.2.4-3, the applicant stated that the stainless steel cladding and nickel-based alloy cladding are susceptible to cracking by SCC and PWSCC, respectively. The applicant also stated that both the stainless steel cladding and nickel-based alloy cladding are susceptible to loss of material by crevice or pitting corrosion, which is consistent with the applicant's responses to RAIs 3.1.2.1-2 and 3.1.2.1-3 on corresponding materials in the ANO-2 RV.

In RAI 3.1.2.4-5, the staff inquired as to how the applicant was managing cracking, and specifically PWSCC, in the nickel-based penetration nozzles of the ANO-2 pressurizer and any associated nickel-based alloy weld materials. In response to RAI 3.1.2.4-5, the applicant stated that nickel-based alloy penetrations associated with the ANO-2 pressurizer include pressure measurement, vent, level, and temperature nozzles; heater penetration nozzles and plugs; and Alloy 82/182 welds. All of these nickel-based alloy items are exposed to treated, borated water and are susceptible to PWSCC. A combination of the Inservice Inspection Program, the Water Chemistry Control Program, and the Alloy 600 Aging Management Program manages this aging effect. Sections B.1.14, B.1.30, and B.1.1, respectively, of the ANO-2 LRA discuss the details of these programs, including scope, frequency, technique, acceptance criteria, and the technical basis for future examinations. These programs represent industry norms for managing PWSCC of nickel-based alloy base-metal and weld components and are acceptable programs to credit for management of PWSCC in the nickel-based alloy base-metal and weld components in the ANO-2 pressurizer system. The staff finds the applicant's response acceptable and considers this issue closed. Sections 3.0.3.3.4 and 3.0.3.2.8 of this SER, respectively, present the staff's evaluation of the Inservice Inspection Program and the Water Chemistry Control Program. Section 3.0.3.3.1 of this SER presents the staff's evaluation of the Alloy 600 Aging Management Program.

Aging Management in Carbon Steel and Low-Alloy Steel Pressurizer Components. The applicant identified that carbon steel components exposed to an external environment of air are subject to the aging effects of loss of material, cracking, and cracking (fatigue).

The applicant identified that low-alloy steel components exposed to an external environment of air are subject to the aging effects of loss of material, cracking, cracking (fatigue), and loss of mechanical closure integrity. The applicant also identified that unclad low-alloy steel (lower head only) exposed to an external environment of treated, borated water experiences the aging effect of loss of material.[3]

The applicant did not identify in Section 3.1 of the LRA, or in Table 3.1.2-4, which aging mechanisms could lead to cracking in carbon steel components. In RAI 3.1.2.4-1, the staff requested that the applicant provide additional information on the AMRs for managing cracking in carbon steel components that are exposed to an external air environment.

In response to RAI 3.1.2.4-1, the applicant referred to its response to RAI 3.1.2.1-1, which concluded that for the RCS components fabricated from low-alloy steel, including exterior attachments to vessels, cracking at welded joints (initiated by fatigue and growth of preservice flaws at welded joints caused by service loadings) is considered an aging effect requiring management for the period of extended operation. Thus, to respond to RAI 3.1.2.4-1, the applicant extended the applicability of the discussion in its response to RAI 3.1.2.1-1 (as it pertains to cracking of low-alloy steel RCS components) to the surfaces of carbon steel pressurizer components that are exposed to the external air environment and considers cracking to be an AERM for the carbon steel pressurizer components.

For the underlying ferritic steel in the pressurizer (i.e., the low-alloy steel heads and shells in the pressurizer), service loadings may result in the growth of preservice flaws or initiation and growth of service-induced flaws. Cracking at the welded low-alloy steel joints is considered an aging effect requiring management for the period of extended operation. The applicant concluded that growth of fabrication flaws caused by service loads is the bases for the ASME Code, Section XI, inspections, as documented in EPRI NP-1406-SR, "Nondestructive Examination Acceptance Standards." The applicant credited the Inservice Inspection Program to manage this particular aging effect. Because the applicant is managing this aging effect through application of the recommendations of the EPRI standard, as implemented through the Inservice Inspection Program, the staff concludes that the applicant's response is acceptable and considers this issue closed.

The applicant credits the Inservice Inspection Program to manage cracking of the carbon steel and low-alloy steel pressurizer components in general. The applicant also credits the TLAA on metal fatigue of ASME Code Class 1 components to manage cracking that is induced by thermal fatigue of these components. These programs are consistent with industry norms for managing cracking in these components. The staff finds the applicant's response acceptable and considers this issue closed.

Table 3.1.2-4, page 3.1-84, identifies the pressurizer lower head, lower shell, upper shell, and upper head as component types. The applicant identified the aging effect of loss of material, and specified that it is applicable to the unclad low-alloy steel of the lower head only. In RAI 3.1.2.4-4, the staff requested the applicant to justify limiting the aging effect to only the lower head, since many components of the pressurizer are susceptible to boric acid corrosion in a

[3] The environment discussed in this sentence refers to the environmental condition that results either from installation of a mechanical nozzle seal assembly repair method or half-nozzle replacement design. These repair/replacement methods leave the underlying ferritic (low-alloy steel) materials adjoined to the repaired pressurizer nozzle exposed to the reactor coolant (i.e., treated, borated water environment). The applicant considers this to be an external environment.

treated, borated water environment and would require the aging effect of loss of material to be managed.

In response to RAI 3.1.2.4-4, the applicant stated that Table 3.1.2-4, page 3.1-84, identifies loss of material as an aging effect requiring management for unclad lower vessel head low-alloy steel exposed to treated, borated water. The applicable locations for this table entry are heater nozzle penetrations that have been repaired. An Alloy 600 nozzle may contain a through-wall flaw that exposes the underlying ferritic steel to treated, borated water. These locations are susceptible to loss of material caused by exposure to treated, borated water. In addition, LRA Table 3.1.2-4 identifies loss of material for low-alloy steel pressurizer items exposed to air with the potential for leaking borated water. Table 3.1.2-4, page 3.1-83, of the LRA, identifies the ANO-2 pressurizer upper head, upper shell, lower head, and lower shell identified as susceptible to loss of material caused by boric acid corrosion in an external air environment. The staff finds the applicant's response acceptable and considers this issue closed.

In Table 3.1.2-4 of the ANO-2 LRA, the applicant identified pressurizer component types, the aging effects requiring management, and the AMPs that will manage these aging effects. Recent operational experience at both domestic and foreign facilities (i.e., Palo Verde, Units 2 and 3; Millstone, Unit 2; Waterford, Unit 3; and Tsuruga, Unit 2 in Japan) has shown that leakage of pressurizer penetrations from PWSCC is an aging effect that requires management. In light of the recent industry experience, and the limited scope of the Pressurizer Examinations Program, the staff requested, in RAI 3.1.2.4-5, that the applicant discuss how it will manage the aging effect of PWSCC for the pressurizer penetrations during the period of extended operation.

With regard to the installation of MNSAs as alternative repair methods, the NRC staff believes that, should an applicant decide to keep an MNSA in service beyond the period for which temporary approval has already been granted, the applicant must provide a justification which supports the approval of the MNSA, either as a temporary repair for the facility or as a permanent repair for the facility. The applicant's justification should be submitted against the alternative ISI provisions of 10 CFR 50.55a(a)(3), and should include an analysis of the pressure boundary component to which the MNSA is attached, an assessment of all age-related mechanisms that may be applicable to the MNSA design and to all ferritic and nickel-based alloy components to which the MNSA installation is applicable, and a proposed alternative ISI program for the MNSA, which is to be maintained for the NRC-approved period (i.e., for the period of approval if the MNSA is approved as a temporary repair, or throughout the licensed life of the facility if the MNSA is approved as a permanent repair for the facility). The applicant should submit its justification to the NRC for review and approval no later than 1 year before the expiration of its existing temporary repair approval period.

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 of the pressurizer component types are consistent with industry experience for these combinations of materials and environments. The staff did not identify any omitted aging effects. Therefore, the staff finds that the applicant has identified the appropriate aging effects for the materials and environments associated with the components in the pressurizer.

Aging Management Programs

After evaluating the applicant's identification of aging effects for each of the above components, the staff evaluated the AMPs to determine if they are appropriate for managing the identified aging effects. The staff also determined that the UFSAR Supplement contains an adequate description of the program.

LRA Table 3.1.2-4 identifies the following AMPs for managing the aging effects described above for the pressurizer:

- Inservice Inspection Program
- Water Chemistry Control Program
- Pressurizer Examinations Program*
- Alloy 600 Aging Management Program
- Boric Acid Corrosion Prevention Program
- System Walkdown Program*
- Cast Austenitic Stainless Steel (CASS) Evaluation Program*
- Bolting and Torquing Activities Program

The NRC staff reviewed those AMPs identified with an asterisk (*) during an onsite audit. Sections 3.0.3.3.4, 3.0.3.2.8, 3.0.3.3.1, 3.0.3.2.1, and 3.0.3.3.2 of this SER document the staff's review of remaining AMPs.

During the review, the staff noted that the applicant had not credited the Inservice Inspection Program (AMP B.1.14) for managing the cracking of pressurizer safe ends. The staff requested the applicant to correct this discrepancy.

By letter dated March 24, 2004, the applicant committed to using the Inservice Inspection Program to manage cracking of the pressurizer safe ends. This is now consistent with the GALL Report and acceptable to the staff.

For loss of material from the nickel-alloy pressurizer heater support plates and support brackets exposed to treated, borated water, the applicant credited the Water Chemistry Control Program. Section 3.0.3.1 of this SER documents the staff's evaluation of this AMP. The staff concludes that the Water Chemistry Control Program credited by the applicant for this line item is adequate.

On the basis of industry operating experience with this material and use of a water chemistry control program consistent with the GALL Report, the staff found this acceptable.

On the basis of its review of the information provided in the LRA, the staff finds that the applicant has identified appropriate the AMPs for managing the aging effects of the pressurizer component types.

Conclusion

On the basis of its audit and review, the staff concludes that the applicant has adequately identified the aging effects, and the AMPs credited for managing the aging effects, for the pressurizer components so that the component intended functions can be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable UFSAR Supplement program descriptions and concludes that the UFSAR Supplement adequately describes the AMPs credited with managing aging in these components, as required by 10 CFR 54.21(d).

3.1.2.3.5 Steam Generators

<u>Summary of Technical Information in the Application</u>

In LRA Section 3.1.2.1.5, the applicant identified the following materials, environments, aging effects, and associated AMPs related to the SG components that are within the scope of the LRA. LRA Table 3.1.2-5 lists the SG components that require an AMR, which are discussed below.

Steam generator components are constructed of the following materials:

- low-alloy steel clad with stainless steel
- low-alloy steel clad with nickel-based alloy
- low-alloy steel
- carbon steel
- stainless steel
- nickel-based alloy

Steam generator components are exposed to the following environments:

- air
- treated, borated water on the primary side of the steam generators
- treated water on the secondary side of the steam generators, which includes steam

Steam generator components may experience the following aging effects:

- cracking
- loss of material
- fouling
- loss of preload/mechanical closure integrity

The above aging effects will be managed by the following AMPs:

- Water Chemistry Control Program
- Inservice Inspection Program
- Boric Acid Corrosion Prevention Program
- Alloy 600 Aging Management Program
- Bolting and Torquing Activities Program
- Steam Generator Integrity Program
- Flow-Accelerated Corrosion Program

In Table 3.1.2-5 of the LRA, the applicant provided a summary of AMRs for the SGs and associated pressure boundary components and identified which AMRs it considered to be consistent with the GALL Report.

Staff Evaluation

The staff reviewed Table 3.1.2-5 of the LRA, which summarizes the results of AMR evaluations in the SRP-LR for the SG component groups.

Aging Effects

The staff finds that the materials, environments, and aging effects associated with the SG components detailed in LRA Section 3.1.2.1.5 are acceptable because they are consistent with the SRP-LR and the GALL Report. In addition, they are consistent with the operating experience of these components. Various sections of this SER discuss the staff's review of the above AMPs related to the SG components.

The applicant replaced the two original steam generators with Westinghouse Delta 109s steam generators in the fall of 2000. Several corrosion mechanisms have been identified in operating SGs in the industry that can result in unacceptable tube degradation. The ANO-2 replacement SG design addresses these degradation mechanisms and provides a design that is resistant to tube corrosion. Given that appropriate water chemistry is maintained, the SGs are designed for a cumulative operating service of 40 years.

The tube material, tubing fabrication methods, and installation techniques minimize corrosion in the tubes. The replacement SGs contain thermally treated nickel-chromium-iron Alloy 690 tubes that are 11/16 inch in diameter with a 0.040-in. wall thickness. The tubes undergo a laboratory-derived thermal treatment process following tube-forming operations. The thermal treatment subjects the tubes to elevated temperatures for a prescribed period of time to improve the grain structure of the material. Laboratory tests and operating experience in nuclear power plants have shown thermally treated Alloy 690 to be resistant to PWSCC and ODSCC.

Industry corrosion tests subjected the SG tubing material to simulated SG water chemistry. These tests indicated that the loss from general corrosion over the 40-year operating design objective is small compared to the tube wall thickness. Testing to investigate the susceptibility of heat exchanger construction materials to stress corrosion in caustic and chloride aqueous solutions (more aggressive than reactor water conditions) indicate that the Alloy 690 material provides as good or better corrosion resistance as either Alloy 600 or nickel-iron-chromium Alloy 800.

The replacement SG design features minimize the potential for concentration of chemical species in crevices or contact areas between tubes and tubesheet or other internals that can be detrimental to high nickel-alloy tubing material. All tubes are initially tack expanded on the tube end, welded to the tubesheet cladding, then expanded into the tubesheet for the full depth of the tubesheet bore by the hydraulic expansion process. This process has the advantages of expanding the tube into essentially metal-to-metal contact with the tubesheet bore, without excessively cold working the tube wall. In addition, the full-depth expansion joint minimizes crevices between the tube and tubesheet.

The tube support plates are constructed of stainless steel and are a broached trefoil-hole design. The tube support plates are sized to provide sufficient strength to ensure that the tubes maintain structural integrity during a seismic event. The clearance between the tube and tube support, and the spacing between the supports, is sized to minimize the potential for excessive vibration of the tubes. The tube support plates are made of corrosion resistant Type 405 ferritic stainless steel. Use of this material minimizes the potential for corrosion of the tube support plates, thus minimizing tube denting. The tube support design reduces the tube-to-tube support plate crevice area, while providing for maximum steam and water flow in the open areas adjacent to the tube.

The upper bundle supports consists of five sets of staggered stainless steel antivibration bars. Antivibration bars installed in the U-bend portion of the tube bundle minimize the potential for excessive tube vibration. The antivibration bars are fabricated from Type 405 stainless steel.

The SG shell is constructed of low-alloy steel. Manways and handhold openings in the shell provide access to the SG internal structures. Manways on the inlet and outlet side of the channel head permit access to the tubesheet for inspection and tube plugging, if required.

Reactor coolant enters the primary side of the SGs through the 42-in. inside diameter inlet nozzle, flows through tubes, and leaves through two, 30-in. inside diameter outlet nozzles. A divider plate in the channel head separates the inlet and outlet plenums. The channel head is a low-alloy steel forging with low-cobalt stainless steel cladding. The tubesheet is low-alloy steel with the reactor coolant side of the tubesheet clad with nickel-chromium-iron Alloy 690.

Feedwater enters the secondary side of the SGs through the feedwater nozzle where it is distributed via an elevated feedwater distribution ring which directs the flow into the downcomer. The downcomer is the annular passage formed by the inner surface of the SG shell and the cylindrical wrapper that encloses the tubes. The feedwater distribution ring is welded to the feedwater nozzle to minimize the potential for draining the ring. The connection between the nozzle and the feedwater ring is a thermal sleeve that minimizes the effect of cold feedwater addition transients on the feedwater nozzle. The feedwater ring is located above the elevation of the feedwater nozzle to minimize the time required to fill the feedwater nozzle during a cold water addition transient. The feedwater is discharged through inverted J-nozzles installed on the top of the ring. These features reduce the thermal fatigue loading on the feedwater nozzle, eliminate steady-state thermal stratification in the feedwater nozzle and feedwater piping elbow at the feedwater nozzle entrance, and minimize the potential for bubble collapse water hammer generated in the feedwater distribution ring.

<u>Steam Generator Components in LRA Table 3.1.1 Requiring Further Evaluation</u>

LRA Table 3.1.1 summarizes the AMPs for the RCS, including SG components. The staff reviewed SG-related items in LRA Table 3.1.1 to determine their acceptability in the AMR. The following items in LRA Table 3.1.1 need further evaluation or clarification.

For Item 3.1.1-2, the applicant identified the Inservice Inspection Program to manage loss of material from pitting and crevice corrosion in the SG shell assembly. IN 90-04 states that the ASME Code, Section XI, inservice inspection method may not be sufficient to detect general and pitting corrosion in the shell/transition cone welds. The applicant stated that the concerns of IN 90-04 are not applicable to SGs because they were replaced in 2000, and pitting corrosion of the SG shell is not currently known to exist. However, the staff believes that the current operating experience does not provide assurance that pitting will not occur at the shell assembly in the future. In the absence of corrosion tests to demonstrate that the shell and transition cone would not develop pitting corrosion at the end of the extended period of operation, the applicant should assume pitting and general corrosion and implement inspection methods to detect such corrosion. In RAI 3.1.1-1, the staff asked the applicant to clarify whether it will implement any procedures, in addition to the ASME Code, to inspect the shell assembly, including transition cone, in the ANO-2 SGs for pitting and general corrosion.

By letter dated July 1, 2004, the applicant responded that the rules of Section XI of the ASME Code require a volumetric examination of one upper shell-to-transition cone weld during each 10-year inspection interval. However, IN 90-04 states that if general corrosion pitting of the SG shell is known to exist, the requirements of Section XI of the ASME Code may not be sufficient to differentiate isolated cracks from inherent geometric conditions. IN 90-04 indicates that the degradation probably results from corrosion-assisted thermal fatigue caused by relatively cold water impinging upon the weld region during reactor trips from full-power and certain transient operations.

The applicant further stated that localized corrosion is heavily dependent on contaminants for initiation and propagation. The ANO-2 Water Chemistry Control Program limits these contaminants, which precludes localized corrosion. The program relies on monitoring and control of water chemistry based on the guidelines in TR-102134 for secondary water chemistry. In addition, the shell-to-transition cone welds in the replacement SGs have low cyclic stress (thermal fatigue) levels with a cumulative usage factor of 0.15. The applicant installed the replacement SGs in 2000, with a design life extending to 2040, which is beyond the period of extended operation ending in 2038. The applicant believes that the corrosion mechanisms described in IN 90-04 are not applicable to the replacement SGs because of the control of water chemistry. Therefore, the applicant believes that no additional inspections are required for the shell-to-transition cone weld for the period of extended operation.

The staff finds the applicant's response acceptable because the shell-to-transition cone welds in the replacement SGs have an acceptable cumulative usage factor (0.15), as compared to the ASME Code allowable cumulative usage factor of 1.0. This indicates that the cyclic stresses are low, which will minimize cracking, and the Water Chemistry Control Program is based on guidelines in TR-102134, which will minimize localized corrosion at the shell-to-transition cone welds.

For Items 3.1.1-19 and 3.1.1-20, the applicant stated that the SGs do not have carbon steel tube support plates and carbon steel tube support lattice bars, respectively. By letter dated July 1, 2004, in its response to RAI 3.1.1-2, the applicant clarified that the SG tubes are supported by tube support plates maintained in place with a system of stayrods and spacer pipes. The support plates are fabricated from stainless steel; the stayrods and spacer pipes are fabricated from carbon steel. The U-bend portions of the tubes are supported by a system of antivibration bars fabricated from stainless steel. These items are all subject to an AMR and are included in LRA Table 3.1.2-5. The staff finds the applicant's response acceptable because the applicant has clarified the tube support system.

For Item 3.1.1-21, the applicant stated that the feedwater ring discussed in the GALL Report (e.g., Section IV.D1.3-a) is applicable to CE System 80 steam generators and is not applicable to the Westinghouse steam generators at ANO-2. In RAI 3.1.1-3, the staff asked the applicant to justify the exclusion of the Westinghouse feedwater ring from the LRA. By letter dated July 22, 2004, the applicant responded that the internal feedwater distribution rings are within the scope of license renewal, but are not subject to an AMR because they do not support any intended function of the steam generators. There are no design-bases or regulated events at ANO-2 that rely on the SG feedwater ring to demonstrate successful mitigation and recovery from the event. However, the applicant stated that it performs a visual inspection of the feedwater distribution ring and J-nozzles at least once every 5 years as part of the Steam Generator Integrity Program.

Although the applicant has not performed an AMR of the feedwater distribution ring and J-nozzles, the staff finds the applicant's response acceptable because the applicant's periodic inspection will detect aging effects of the feedwater distribution ring and J-nozzles. In addition, the feedwater distribution ring in the replacement SGs is designed to minimize potential thermal fatigue which may cause cracking.

For Item 3.1.1-39, the applicant stated that loss of material from erosion affecting SG secondary manways and handholds is applicable to once-through SGs and is not applicable to the Westinghouse steam generators at ANO-2. However, the ANO-2 steam generators do have manways and handholds which may be degraded from erosion. In RAI 3.1.1-4, the staff asked the applicant to justify why loss of material from erosion is not an applicable aging mechanism for these components in the ANO-2 steam generators.

By letter dated July 1, 2004, the applicant responded that Item 3.1.1-39 of Table 3.1.1 represents GALL Report Item IV.D2.1.10 (i.e., erosion of carbon steel manway covers). Because Section IV.D2 of the GALL Report is specific to once-through SGs and ANO-2 has recirculating SGs, this GALL Report line item is not applicable to ANO-2. The GALL Report does not identify loss of material from erosion as an aging effect requiring management for recirculating steam generators. This is consistent with the results of the operating experience review which did not identify erosion as an applicable aging mechanism for manway and inspection port covers of recirculating steam generators. However, as identified in LRA Table 3.1.2-5, page 3.1-98, loss of material is an AERM for the secondary manway and inspection port covers (6 inch and 8 inch) exposed to internal treated water. Loss of mechanical closure integrity is an AERM for secondary bolted closures, as indicated on page 3.1-104 of LRA Table 3.1.2-5. Localized leakage at bolted closures may cause loss of material by erosion at ferritic seating surfaces, which is managed by bolting and torquing activities and the Inservice Inspection Program.

The staff finds the applicant's response acceptable because LRA Table 3.1.2-5 does include the aging management of the 3-in. and 6-in. inspection ports and the 8-in. handholds. Further, the applicant has appropriate AMPs to manage the aging effect of these components.

Steam Generator Components in LRA Table 3.1.2-5 Requiring Further Evaluation

LRA Table 3.1.2-5 summarizes the AMR of SG components. Each SG component is identified with associated intended function, material, environment, aging effect, and AMP. The staff reviewed LRA Table 3.1.2-5 to determine whether the applicant has demonstrated that the effects of aging of the SG components will be adequately managed during the period of extended operation, as required by 10 CFR 54.21(a)(3). The following SG components in

Table 3.1.2-5 need further evaluation or clarification.

In Table 3.1.2-5, the applicant identified the Steam Generator Integrity Program, described in LRA Section B.1.25, to manage cracking in the antivibration bar end caps, peripheral retaining rings, U-bend, and U-shaped retainer bars (see LRA, page 3.1-100), as well as stay rods, stay-rod hex nuts, spacer pipes, peripheral backup bars, wrapper, and wrapper jacking screws (see LRA page 3.1-106). In RAI 3.1.2.5-1, the staff asked the applicant to (1) discuss how it inspects these components and the frequency of inspection under the Steam Generator Integrity Program, and (2) clarify whether the U-bend referred to on LRA page 3.1-100 is applicable to the U-bend region of the tube or to the U-bend tube supports (e.g., peripheral retaining rings and retainer bars).

By letter dated July 1, 2004, the applicant responded that the Steam Generator Integrity Program includes visual inspection of the SG lower internals (tube support structures and tube bundle, including the U-bend). This inspection is completed at least once every 5 years. This inspection verifies loose parts and corrosion and other damage in this region. The SG upper internals (moisture separators) require a thorough visual inspection once every 5 years. This inspection looks for mechanical damage, corrosion, or other unusual conditions. The U-bend referred to in LRA Table 3.1.2-5 on page 3.1-100 has a typographical error because the reference is to the peripheral retaining rings and not to the tubes. The components on that page should include the U-bend peripheral retaining ring and the U-shaped retainer bars. The staff finds that the inspection of the secondary-side components is acceptable because the applicant performs periodic visual inspections of the above components for potential degradation.

The applicant identified LRA Section B.1.28, "System Walkdown Program," to manage loss of material in an air environment for many of the SG components listed in LRA Table 3.1.2-5. In RAI 3.1.2.5-3, the staff asked the applicant to (1) clarify how it documents the SG components in the System Walkdown Program because the staff could not determine whether the SG components are included in LRA Section B.1.28, and (2) discuss how it will inspect those SG components that are not accessible for the inspection during system walkdown.

By letter dated July 1, 2004, the applicant responded that the primary program to manage loss of material in an air environment in Table 3.1.2-5 is the Boric Acid Corrosion Prevention Program. This is consistent with the GALL Report, which does not indicate the need for a program to manage loss of material from general corrosion from external surfaces in an air environment for systems that operate at temperatures above 100 °C (212 °F). Because SG components operate at temperatures above 100 °C (212 °F), general corrosion in air is not an applicable aging mechanism. For these components, loss of material resulting from corrosion in air can be caused only by leakage. During system walkdowns, leakage can be detected from both accessible and inaccessible components. For RCS components, the System Walkdown Program is redundant with the Boric Acid Corrosion Prevention Program since both programs rely on visual inspections to detect evidence of leakage. The staff finds the applicant's response acceptable because the System Walkdown Program is a redundant and secondary program to monitor the loss of material in steam generators in an air environment. The primary program is the Boric Acid Corrosion Prevention Program, which also provides inspection of the outer surface of steam generators.

The applicant identified several aging mechanisms in the secondary side of the steam generators that contribute to tube degradation. In RAI 3.1.2.5-4, the staff asked the applicant to discuss the aging management of the loose parts in the steam generators. By letter dated July 1, 2004, the applicant responded that it performed the first inservice inspection for the replacement steam generators during the spring 2002 refueling outage. This inspection identified one loose part in the secondary side of the steam generators, which was retrieved during that outage. Measures are in place to monitor for loose parts within the steam generators and to prevent the introduction of foreign objects into the steam generators. The applicant removes loose parts whenever possible as part of the foreign object search and retrieval activity. In the unlikely event an object cannot be readily removed, it remains in the steam generator only if an evaluation is performed to determine that the object will not cause unacceptable tube degradation. The applicant performs sludge lancing of the steam generators at least once every 5 years. The applicant completes the secondary-side inspections in accordance with operating procedures for the Steam Generator Integrity Program.

The staff finds the applicant's response acceptable because the applicant has procedures to monitor and inspect the loose parts in the secondary side of the steam generators.

LRA Table 3.1.2-5, page 3.1-96, discusses the aging management of SG tube plugs. In RAI 3.1.2.5-5, the staff asked the applicant to discuss (1) the types and materials of tube plugs that it has installed in the SG tubes, and (2) whether NRC Bulletin 89-01, and associated supplements 1 and 2, IN 89-33, IN 89-65, and IN 94-87 are applicable to the tube plugs installed in the steam generators. By letter dated July 1, 2004, the applicant responded that there are two welded plugs (one at each end of the same tube) in steam generator B. These Alloy-690 plugs were welded in place at the factory before shipment of the steam generator. Steam generator A has no plugs. The NRC generic communications listed above describe failures of certain installed SG tube plugs fabricated of Alloy-600 material from PWSCC. Because the only plugs currently installed in the SG tubes are fabricated of Alloy-690 material (which is highly resistant to PWSCC), the generic communications described in the RAI above are not applicable to ANO-2. The staff agrees with the applicant that the previous NRC generic communications regarding tube plugs do not apply to tube plugs in the steam generators.

On LRA page 3.1-96, the applicant identified the Water Chemistry Control Program as an AMP to manage loss of material and cracking in the SG tubes. In RAI 3.1.2.5-6, the staff questioned the industry guidelines used in the Water Chemistry Control Program. By letter dated July 1, 2004, the applicant responded that it based the Water Chemistry Control Program on the EPRI guidelines in TR-105714, Revision 4, for primary water chemistry, and TR-102134, Revision 5, for secondary water chemistry. The staff is satisfied that the applicant is using the latest version of EPRI water chemistry reports. This demonstrates that the applicant has a procedure to adopt the latest revision of the EPRI guidelines that it will use during the period of extended operation.

Industry experience has shown that denting of tubes from corrosion of tube support plates is an aging effect. The applicant did not identify tube denting as an aging effect. In RAI 3.1.2.5-7, the staff asked the applicant to justify why it excluded denting as an aging effect for the SG tubes. By letter dated July 1, 2004, the applicant responded that the steam generators have stainless steel tube support plates which are inherently resistant to the type of corrosion (magnetite) leading to tube denting. Therefore, the SG tubes are not susceptible to denting. The staff finds that the applicant's response is acceptable because industry experience for the stainless steel tube support plates has not shown extensive tube denting that would cause a concern.

On LRA page 3.1-98, the applicant identified internal treated water as an environment for the 6-in. and 8-in. inspection port covers, but not for the 3-in. inspection port cover. Additionally, the applicant identified the diaphragms in the 3-in. inspection port as a component for aging management; however, it did not identify the diaphragm for the 6-in. or 8-in. inspection ports. In RAI 3.1.2.5-8, the staff asked the applicant to clarify this discrepancy. By letter dated July 1, 2004, the applicant responded that the steam generator 3-in. inspection ports have Alloy 690 diaphragms which prevent the treated water from contacting the underside of the low-alloy steel inspection port covers. The SG design does not include similar diaphragms for the 6-in. and 8-in. inspection ports. The staff finds that the applicant's clarification is acceptable and that it properly manages the inspection port covers.

On LRA page 3.1-99, the applicant identified the Inservice Inspection Program to manage cracking in the antivibration bars and tube support plates. In RAI 3.1.2.5-9, the staff questioned the applicability of the Inservice Inspection Program to manage the aging effects of these components. The staff asked the applicant to discuss the details of how these two components will be inspected under the Steam Generator Integrity Program, including inspection scope, frequency, and method.

By letter dated July 1, 2004, the applicant responded that it had inadvertently identified the Inservice Inspection Program to manage cracking for the antivibration bars and tube support plates. LRA Table 3.1.2-5, page 3.1-99, should identify only the Steam Generator Integrity and Water Chemistry Control Programs as applicable aging management programs for these items.

The Steam Generator Integrity Program requires visual inspection of the SG lower internals, including tube support structures and tube bundle. The applicant completes this inspection at least once every 5 years. This inspection checks for loose parts and corrosion and other damage in this region. The applicant performs an integrity assessment after each SG inspection which addresses all known degradation mechanisms in the steam generator being evaluated. The integrity assessment is performed in two parts, a condition monitoring assessment and an operational assessment. The condition monitoring assessment ensures that structural integrity was maintained during the previous operating cycle, while the operational assessment ensures that structural integrity will continue to be maintained during the upcoming operating interval. Each operational assessment addresses past operating experience, current degradation mechanisms and locations, and other insights from previous condition monitoring assessments. The staff finds that the applicant's clarification is acceptable and that the appropriate AMPs manage the antivibration bars and tube support plates.

On LRA page 3.1-102, the applicant discussed the aging management for the feedwater inlet nozzles. In RAI 3.1.2.5-11, the staff asked the applicant to discuss whether a flexitallic gasket is used in the feedwater system because there have been cases where the pieces of broken flexitallic gasket have fallen into the secondary side of the steam generators and caused tube degradation. By letter dated July 1, 2004, the applicant responded that the SG feedwater inlet nozzle is welded to the SG shell. As such, no flexitallic gasket is used at the feedwater inlet nozzle to the steam generator. The staff finds that potential loose parts resulting from a failure of the flexitallic gasket in the feedwater system is not of a concern at ANO-2.

On LRA pages 3.1-102 and 3.1-103, the applicant identified the Inservice Inspection Program to manage cracking in feedwater inlet nozzles, feedwater thermal sleeves, and flow-limiting insert (integral flow restrictors). In RAI 3.1.2.5-12, the staff asked the applicant to discuss the inspection method and frequency for these components. By letter dated July 1, 2004, the applicant responded that it inspects the feedwater inlet nozzles in accordance with ASME Code, Section XI, Examination Category C-B. However, the applicant inadvertently identified the Inservice Inspection Program as managing the aging effect of cracking for the feedwater thermal sleeves and flow-limiting inserts (integral flow restrictors) on the steam generators. Because these items are internal to the SG feedwater and steam nozzles, they are not accessible for performance of inservice inspection. For the nickel-based alloy feedwater thermal sleeves and flow-limiting inserts, the applicant uses the Water Chemistry Control Program alone to manage cracking and loss of material. The Water Chemistry Control Program maintains the environment in the steam generators by controlling contaminants that could lead to loss of material and cracking. A review of operating experience identified no failures caused by inadequate chemistry control. The feedwater thermal sleeves and flow-limiting inserts are internal to SG feedwater and steam nozzles and, as such, do not have a pressure boundary function. The Water Chemistry Control Program alone is sufficient to manage the aging effect of cracking for the SG feedwater nozzle thermal sleeves and flow-limiting inserts.

The staff finds that the applicant's response is acceptable because the applicant identified the appropriate AMPs for the feedwater inlet nozzle, thermal sleeve, and flow-limiting inserts. The applicant will inspect the feedwater inlet nozzle in accordance with ASME Code, Section XI. The thermal sleeve and flow limiting inserts are inaccessible for inspection; however, the Water Chemistry Control Program will manage the aging effects of these components.

On LRA page 3.1-104, the applicant identified the Steam Generator Integrity Program to manage cracking in key bracket and snubber lugs. In RAI 3.1.2.5-13, the staff questioned the applicability of the Steam Generator Integrity Program to manage cracking in these components. By letter dated July 1, 2004, the applicant responded that it had inadvertently identified the Steam Generator Integrity Program to manage cracking in these two components. These components are located on the outer surface of the SG shell and interface with the SG lateral support system. The Inservice Inspection Program manages cracking of these components for the period of extended operation. The staff finds the applicant's clarification acceptable because the applicant typically uses the Inservice Inspection Program, rather than the Steam Generator Integrity Program, to monitor the key bracket and snubber lugs.

In RAI 3.1.2.5-14, the staff questioned why the applicant did not identify wall thinning or FAC as an aging effect for the steam outlet nozzle, as shown on LRA page 3.1-105, because this aging effect is specified for the steam outlet nozzle in GALL IV D1.1-d. By letter dated July 1, 2004, the applicant responded that the nozzle in GALL Item IV.D1.1-d is carbon steel, whereas the integral flow restrictors in the steam outlet nozzles at ANO-2 are fabricated with nickel-based alloy. LRA page 3.1-103 identifies these flow restrictors, The applicant stated that nickel-based alloy material (Alloy-690) is not susceptible to FAC. Because of the integral flow restrictors, the low-alloy steel of the steam outlet nozzles is not exposed to the high-velocity fluid that causes FAC. The staff finds that the applicant's response is acceptable because the steam outlet restrictor/nozzle is fabricated with Alloy 690 material which is not susceptible to wall thinning or FAC.

On the basis of industry operating experience with this material and use of a water chemistry control program consistent with the GALL Report, the staff finds the applicant's approach to managing the aging effects for the SG components to be acceptable.

Aging Management Programs

For loss of material from the nickel-alloy SG tube plugs, U-tubes, divider plate, and tube plate exposed to treated, borated water, the applicant credited the Primary and Secondary Water Chemistry Control Program (AMP B.1.30.3). Section 3.0.3.1 of this SER documents the staff's evaluation of this AMP. The staff concludes that the Primary and Secondary Water Chemistry Control Program credited by the applicant for this line item is adequate.

During its review of Table 3.1.2-5 of the LRA, the staff identified that the SG inspection port diaphragms had been associated with the wrong item from tables in the GALL Report. By letter dated March 24, 2004, the applicant revised the associated note for this component type.

The staff finds that management of cracking in nickel-based alloy exposed to treated water using the Water Chemistry Control Program, as determined by inservice inspection, is acceptable.

Conclusion

On the basis of its audit and review, the staff concludes that the applicant has adequately identified the aging effects, and the AMPs credited for managing the aging effects, for the steam generator components so that the component intended functions can be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable UFSAR Supplement program descriptions and concludes that the UFSAR Supplement adequately describes the AMPs credited with managing aging in these components, as required by 10 CFR 54.21(d).

3.1.3 Conclusion

The staff concluded that the applicant provided sufficient information to demonstrate that the effects of aging for the RV, internals, RCS, pressurizer, and SG components and component types that are within the scope of license renewal and subject to an AMR will be adequately managed so 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 FSAR Supplement program summaries and concludes that the FSAR Supplement adequately describes the AMPs credited for managing aging of the RV, internals, RCS, pressurizer, and steam generator systems, as required by 10 CFR 54.21(d).

3.2 Engineered Safety Features Systems

This section of the SER documents the staff's review of the applicant's AMR results for the engineered safety features system components and component groups associated with the following systems:

- emergency core cooling system (ECCS)
- containment spray system
- containment cooling system
- containment penetrations system
- hydrogen control system

3.2.1 Summary of Technical Information in the Application

In Section 3.2 of the LRA, the applicant provided the AMR results for the ESF system components and component types listed in LRA Tables 2.3.2-1 through 2.3.2-5. The applicant also listed the materials, environments, aging effects requiring management, and AMPs associated with each system.

In Table 3.2.1, "Summary of the Aging Management Programs for Engineered Safety Features Evaluated in Chapter V of NUREG-1801," of the LRA, the applicant provided a summary comparison of its AMRs with the AMRs evaluated in the GALL Report for the engineered safety features system components and component types. In Section 3.2.2.2 of the LRA, the applicant provided information concerning Table 3.2.1 components for which further evaluation is recommended by the GALL Report.

3.2.2 Staff Evaluation

The staff reviewed LRA Section 3.2 to determine if the applicant provided sufficient information to demonstrate that the effects of aging for the ESF system components that are within the scope of license renewal and subject to an AMR will be adequately managed so that the 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 performed an audit and review to confirm the applicant's claim that certain identified AMRs are consistent with the staff-approved AMRs in the GALL Report. The staff did not repeat its review of the matters described in the GALL Report. However, the staff did determine that the material presented in the LRA was applicable and that the applicant had identified the appropriate GALL AMRs. The ANO-2 ANO-2 Audit and Review Report documents the staff's onsite audit and review findings, which are summarized in Section 3.2.2.1 of this SER.

The staff also audited and reviewed those AMRs that are consistent with the GALL Report and for which further evaluation is recommended. The staff determined that the applicant's further evaluations were consistent with the acceptance criteria in Section 3.2.3.2 of the SRP-LR. Section 3.2.2.2 of this SER summarizes the staff's audit and review findings.

The staff conducted a technical review of the remaining AMRs that were not consistent with the GALL Report. The review included evaluating whether the applicant had identified all plausible aging effects, and that the aging effects listed were appropriate for the combination of materials and environments specified. Section 3.2.2.3 of this SER documents the staff's review findings.

Finally, the staff reviewed the AMP summary descriptions in the FSAR Supplement to ensure that they provide an adequate description of the programs credited with managing or monitoring aging for the ESF systems components and component groups.

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 Engineered Safety Features System Components in the GALL Report

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Piping, fittings, and valves in emergency cooling system (Item Number 3.2.1-1)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c))	TLAA - Metal Fatigue	Consistent with GALL, which recommends further evaluation (See Section 3.2.2.2.1)
Components in containment spray (PWR only), standby gas treatment (BWR only), containment isolation, and emergency core cooling systems (Item Number 3.2.1-3)	Loss of material due to general corrosion	Plant specific	Containment Leak Rate (B.1.6), Water Chemistry Control (B.1.30)	Consistent with GALL, which recommends further evaluation (See Section 3.2.2.2.2)
Components in containment spray (PWR only), standby gas treatment (BWR only), containment isolation, and emergency core cooling systems (Item Number 3.2.1-5)	Loss of material due to pitting and crevice corrosion	Plant specific	Containment Leak Rate (B.1.6), Water Chemistry Control (B.1.30)	Consistent with GALL, which recommends further evaluation (See Section 3.2.2.2.3)
Containment isolation valves and associated piping (Item Number 3.2.1-6)	Loss of material due to microbiologically influenced corrosion (MIC)	Plant specific	Containment Leak Rate (B.1.6), Water Chemistry Control (B.1.30)	Consistent with GALL, which recommends further evaluation (See Section 3.2.2.2.4)

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
High pressure safety injection (charging) pump miniflow orifice (Item Number 3.2.1-8)	Loss of material due to erosion	Plant specific	Not Applicable to ANO-2	Consistent with GALL, which recommends further evaluation (See Section 3.2.2.2.6)
External surface of carbon steel components (Item Number 3.2.1-10)	Loss of material due to general corrosion	Plant specific	Containment Leak Rate (B.1.6), Boric Acid Corrosion Prevention (B.1.3)	Consistent with GALL, which recommends further evaluation (See Section 3.2.2.2.2)
Piping and fittings of CASS in emergency core cooling system (Item Number 3.2.1-11)	Loss of fracture toughness due to thermal aging embrittlement	Thermal aging embrittlement of CASS	Not Applicable to ANO-2	Consistent with GALL, which recommends no further evaluation (See Section 3.2.2.1)
Components serviced by open-cycle cooling system (Item Number 3.2.1-12)	Loss of material due to general, pitting and crevice corrosion, MIC, and biofouling; buildup of deposit due to biofouling	Open-cycle cooling water system	Service Water Integrity (B.1.24), Water Chemistry Control (B.1.30), Heat Exchanger Monitoring (B.1.12), Periodic Surveillance and Preventive Maintenance (B.1.18)	Consistent with GALL, which recommends no further evaluation (See Section 3.2.2.1)
Components serviced by closed-cycle cooling system (Item Number 3.2.1-13)	Loss of material due to general, pitting and crevice corrosion	Closed-cycle cooling water system	Not Applicable to ANO-2	Consistent with GALL, which recommends no further evaluation (See Section 3.2.2.1)
Pumps, valves, piping, and fittings, and tanks in containment spray and emergency core cooling systems (Item Number 3.2.1-15)	Crack initiation and growth due to SCC	Water chemistry	Water Chemistry Control (B.1.30)	Consistent with GALL, which recommends no further evaluation (See Section 3.2.2.1)
Carbon steel components (Item Number 3.2.1-17)	Loss of material due to boric acid corrosion	Boric acid corrosion	Boric Acid Corrosion Prevention (B.1.3)	Consistent with GALL, which recommends no further evaluation (See Section 3.2.2.1)

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Closure bolting in high pressure or high temperature systems (Item Number 3.2.1-18)	Loss of material due to general corrosion; crack initiation and growth due to cyclic loading and/or SCC	Bolting integrity	Bolting/Torquing Activities (B.1.2), Boric Acid (B.1.3), System Walkdown (B.1.28)	Consistent with GALL, which recommends no further evaluation (See Section 3.2.2.1)

The staff's review of the ANO-2 ESF system and associated components followed one of several approaches. One approach, documented in Section 3.2.2.1 of this SER, involves the staff's review of the AMR results for components in the ESF system that the applicant indicated are consistent with the GALL Report and do not require further evaluation. Another approach, documented in Section 3.2.2.2 of this SER, involves the staff's review of the AMR results for components in the ESF system that the applicant indicated are consistent with the GALL Report and for which further evaluation is recommended. A third approach, documented in Section 3.2.2.3 of this SER, involves the staff's technical review of the AMR results for components in the ESF system that the applicant indicated are not consistent with the GALL Report, or are not addressed in the GALL Report. Section 3.0.3 of this SER documents the staff's review of the AMPs that are credited to manage or monitor aging effects of the ESF system components.

3.2.2.1 AMR Results That Are Consistent with the GALL Report

In Sections 3.2.2.1.1 through 3.2.2.1.5 of the LRA, the applicant identified the materials, environments, and AERMs. The applicant identified the following programs that manage the aging effects related to the ESF system components:

- Boric Acid Corrosion Prevention Program
- Periodic Surveillance and Preventive Maintenance Program
- Water Chemistry Control Program
- System Walkdown Program
- Service Water Integrity Program
- Heat Exchanger Monitoring Program
- Bolting and Torquing Activities Program
- Containment Leak Rate Program
- Flow-Accelerated Corrosion Program

In Tables 3.2.2-1 through 3.2.2-5 of the LRA, the applicant provided a summary of the AMRs for the ESF systems and identified which AMRs it considered to be consistent with the GALL Report.

Staff Evaluation

In Tables 3.2.2-1 through 3.2.2-5 of the LRA, the applicant provided a summary of the AMRs for the ESF systems and identified which AMRs it considered to be consistent with the GALL Report.

For component groups evaluated in the GALL Report for which the applicant claimed consistency, and for which the GALL Report does not recommend further evaluation, the staff performed an audit and review to determine whether the plant-specific components contained in these GALL Report component groups were bounded by the GALL Report evaluation.

The applicant provided a note for each AMR line item. The notes describe how the information in the tables align with the information in the GALL Report. The staff audited those AMRs with notes A through E, which indicate that the AMR is consistent with the GALL Report.

Note A indicates that the AMR line item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP is consistent with the AMP identified in the GALL Report. The staff audited these line items to determine consistency with the GALL Report and the validity of the AMR for the site-specific conditions.

Note B indicates that the AMR line item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The staff audited these line items to determine consistency with the GALL Report. The staff determined that the identified exceptions to the GALL AMPs had been reviewed and accepted by the staff. The staff also determined whether the AMP identified by the applicant was consistent with the AMP identified in the GALL Report, and whether the AMR was valid for the site-specific conditions.

Note C indicates that the component for the AMR line item differs from, but is consistent with, the GALL Report for material, environment, and aging effect. In addition, the AMP is consistent with the AMP identified by the GALL Report. This note indicates that the applicant was unable to find a listing of some system components in the GALL Report. However, the applicant identified a different component in the GALL Report that had the same material, environment, aging effect, and AMP as the component that was under review. The staff audited these line items to determine consistency with the GALL Report. The staff also determined whether the AMR line item of the different component was applicable to the component under review, and whether the AMR was valid for the site-specific conditions.

Note D indicates that the component for the AMR line item differs from, but is consistent with, the GALL Report for material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The staff audited these line items to determine consistency with the GALL Report. The staff determined whether the AMR line item of the different component was applicable to the component under review. The staff determined whether the identified exceptions to the GALL AMPs had been reviewed and accepted by the staff. The staff also determined whether the AMP identified by the applicant was consistent with the AMP identified in the GALL Report, and whether the AMR was valid for the site-specific conditions.

Note E indicates that the AMR line item is consistent with the GALL Report for material, environment, and aging effect, but credits a different AMP. The staff audited these line items to determine consistency with the GALL Report. The staff also determined whether the identified AMP would manage the aging effect consistent with the AMP identified by the GALL Report, and whether the AMR was valid for the site-specific conditions.

The staff conducted an audit and review of the information provided in the LRA and program bases documents, which are available at the applicant's engineering office. On the basis of its audit and review, the staff finds that the AMR results which the applicant claimed to be consistent with the GALL Report are in fact consistent with the AMRs in the GALL Report. Therefore, the staff finds that the applicant identified the applicable aging effects which are appropriate for the combination of materials and environments listed.

On the basis of its audit and review, the staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so 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).

Conclusion

The staff has evaluated the applicant's claim of consistency with the GALL Report. The staff reviewed information pertaining to the applicant's consideration of recent operating experience and proposals for managing associated aging effects. On the basis of its review, the staff finds that the applicant has demonstrated that the effects of aging for these components can be adequately managed so that their intended functions can be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.2 AMR Results That Are Consistent with the GALL Report, for Which Further Evaluation is Recommended

Summary of Technical Information in the Application

In Section 3.2.2.2 of the LRA, the applicant provided further evaluation of aging management, as recommended by the GALL Report, for ESF systems. The applicant provided information concerning how it will manage the following aging effects:

- cumulative fatigue damage
- loss of material due to general corrosion
- local loss of material due to pitting and crevice corrosion
- local loss of material due to microbiologically influenced corrosion (MIC)
- changes in material properties due to elastomer degradation
- local loss of material due to erosion
- buildup of deposits due to corrosion
- quality assurance for aging management of nonsafety-related components

Staff Evaluation

For those component groups evaluated in the GALL Report, for which the applicant has claimed consistency with GALL, and for which the GALL Report recommends further evaluation, the staff reviewed the applicant's evaluation to determine whether it adequately addressed the issues that were further evaluated. In addition, the staff audited the applicant's further evaluations against the criteria contained in Section 3.2.2.2 of the SRP-LR. The ANO-2 ANO-2 Audit and Review Report documents the details of the staff's onsite audit and review.

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

As stated in the SRP-LR, 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). Section 4.3 of this SER documents the staff's review of the applicant's evaluation of this TLAA. In performing this review, the staff followed the guidance in Section 4.3 of the SRP-LR.

3.2.2.2.2 Loss of Material due to General Corrosion

In Section 3.2.2.2.2 of the LRA, the applicant addressed loss of material due to general corrosion that could occur in the containment spray, containment isolation valves and associated piping, and the external surfaces of carbon steel components.

Section 3.2.2.2.2 of the SRP-LR states that loss of material due to general corrosion could occur in the containment spray, containment isolation valves and associated piping, and the external surfaces of carbon steel components. The GALL Report recommends further evaluation on a plant-specific basis to ensure that this aging effect is adequately managed.

The applicant stated that the Containment Leak Rate Program (AMP B.1.6) and the Water Chemistry Control Program (AMP B.1.30.3) are credited with managing the aging effect of loss of material due to general corrosion on external surfaces of carbon steel components in the containment penetrations system. The applicant also stated that there are no carbon steel components in the containment spray system and the ECCS.

Sections 3.0.3.1 and 3.0.3.3.4 of this SER, respectively, document the staff's evaluation of the Primary and Secondary Water Chemistry Control Program and the Containment Leak Rate Program. The staff concludes that the Primary and Secondary Water Chemistry Control Program and the Containment Leak Rate Program credited by the applicant for this line item are adequate.

In Table 3.2.1, Item 3.2.1-10 of the LRA, the applicant also stated that the System Walkdown Program (AMP B.1.28), the Boric Acid Corrosion Prevention Program (AMP B.1.3), and the Containment Leak Rate Program (AMP B.1.6) manage loss of material due to general corrosion on external surfaces of carbon steel components.

The staff reviewed the System Walkdown Program, the Boric Acid Corrosion Prevention Program, and the Containment Leak Rate Program. Sections 3.0,3,3,9, 3.0.3.2.1, and 3.0.3.1 of this SER, respectively, document the staff's evaluation of these programs. The staff concludes that the System Walkdown Program, the Boric Acid Corrosion Prevention Program, and the Containment Leak Rate Program credited by the applicant for this line item are adequate.

On the basis of its review of the Water Chemistry Control Program, the System Walkdown Program, the Boric Acid Corrosion Prevention Program, and the Containment Leak Rate Program, the staff finds that the applicant has appropriately evaluated the AMR results involving management of the loss of material due to general corrosion, as recommended in the GALL Report.

3.2.2.2.3 Local Loss of Material due to Pitting and Crevice Corrosion

In Section 3.2.2.2.3 of the LRA, the applicant addressed local loss of material due to pitting and crevice corrosion that could occur in the containment spray components, containment isolation valves and associated piping, and the buried portion of the refueling water tank external surface.

Section 3.2.2.2.3 of the SRP-LR states that local loss of material due to pitting and crevice corrosion could occur in the containment spray components, containment isolation valves and associated piping, and the buried portion of the refueling water tank external surface. The GALL Report recommends further evaluation to ensure that this aging effect is adequately managed.

The applicant stated that the refueling water storage tank is not buried, so it is not subject to this aging mechanism. The applicant credited the Containment Leak Rate Program (AMP B.1.13) and Water Chemistry Control Program (AMP B.1.30.3) with managing the aging effect of loss of material due to pitting and crevice corrosion for the other components. The staff evaluated and accepted the Primary and Secondary Water Chemistry Control Program and the Containment Leak Rate Program. Section 3.0.3.1 and 3.0.3.3.4 of this SER, respectively, document the staff's evaluation of these programs.

Subsection 3.2.2.2.3.2 of the SRP-LR recommends verification of the programs' effectiveness and identifies one-time inspections as an acceptable method. Both programs include periodic (rather than one-time) inspection of components, however, it does not appear that the parameters monitored or locations inspected will allow the applicant to determine the presence or extent of pitting and crevice corrosion.

By letter dated June 24, 2004, the staff asked the applicant, in RAI 3.2-11, to describe how the presence or extent of pitting and crevice corrosion will be detected for ESF systems components subject to this aging effect, and to provide the basis for assurance that periodic inspections will provide an adequate sampling. In further discussions with the applicant, the staff asked the applicant to confirm that planned activities will provide an appropriate sample for each material and environment combination, or to provide for a review to confirm that each material and environment combination subject to this aging effect has been adequately sampled before the period of extended operation.

In its response, the applicant provided details of ESF systems' material and environment groups that credit water chemistry control programs for local loss of material due to pitting and crevice corrosion. The applicant provided information on the following material and environment combinations:

- carbon steel exposed to treated water greater than 132 °C (270 °F)
- carbon steel exposed to treated water
- Inconel exposed to treated, borated water
- stainless steel exposed to treated, borated water greater than 132 °C (270 °F)
- stainless steel exposed to treated, borated water

Based on its review, the staff finds the applicant's response to RAI 3.2-11 acceptable because the applicant demonstrated that the AMR results involving management of the loss of material due to pitting and crevice corrosion have been appropriately evaluated, as recommended in the GALL Report. Therefore, the staff considers in RAI 3.2-11 resolved.

3.2.2.2.4 Local Loss of Material due to Microbiologically Influenced Corrosion

In Section 3.2.2.2.4 of the LRA, the applicant addressed local loss of material due to MIC.

Section 3.2.2.2.4 of the SRP-LR states that local loss of material due to MIC could occur in 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 this aging effect is adequately managed.

The applicant stated that the Containment Leak Rate Program (AMP B.1.6) and the water chemistry control programs are credited with managing the aging effect of loss of material due to MIC. Both programs include periodic (rather than one-time) inspection of components, however, it does not appear that the parameters monitored will detect the presence or extent of MIC.

By letter dated June 24, 2004, the staff asked the applicant, in RAI 3.2-12, to describe how it will detect the presence or extent of MIC for piping and valve component types in the containment penetrations system (see LRA Table 3.2.2-4).

In its response to RAI 3.2-12, the applicant stated that the majority of the containment penetrations system component types in listed in LRA Table 3.2.2-4 are exposed to a treated water environment, where sulfates are low (less than 150 parts per billion (ppb)). MIC is unlikely to occur in treated water systems with low sulfates. The applicant credits the Water Chemistry Control Program to minimize the potential for MIC by maintaining the system free of contaminants. The Containment Leak Rate Program provides additional assurance that loss of material due to MIC will be managed such that the containment penetrations system components will continue to perform their intended functions.

In its response to RAI 3.2-12, the applicant further identified some stainless steel containment penetrations system component types that are exposed to an untreated, borated water environment such as part of the quench tank, the reactor drain tank vent and drainlines, and the containment sump drainline. The applicant has confirmed the absence of MIC in the containment sump by means of containment sump close-out inspections, which it performs every refueling outage. Because these stainless steel component types in LRA Table 3.2.2-4 drain to the containment sump, the absence of MIC in the containment sump during inspections provides evidence that these stainless steel components in LRA Table 3.2.2-4 do not have MIC. Based on its review, the staff finds the applicant's response to RAI 3.2-12 acceptable because the applicant demonstrated that the AMR results involving management of the loss of material due to MIC have been appropriately evaluated, as recommended in the GALL Report. Therefore, the staff considers RAI 3.2-12 resolved.

3.2.2.2.5 Changes in Material Properties due to Elastomer Degradation

The applicant stated that this issue applies to boiling-water reactors (BWRs) only; therefore, it is not applicable to ANO-2. The staff concurs with the applicant's position.

3.2.2.2.6 Local Loss of Material due to Erosion

In Section 3.2.2.2.6 of the LRA, the applicant addressed local loss of material due to erosion that could occur in the HPSI miniflow orifice.

Section 3.2.2.2.6 of the SRP-LR states that local loss of material due to erosion could occur in the HPSI pump miniflow orifice. This aging mechanism and its effect will apply only to pumps that are normally used as charging pumps in the CVCS. The GALL Report recommends further evaluation to ensure that this aging effect is adequately managed.

The applicant stated that the chemical and volume control charging pumps are used for the RCS makeup at ANO-2, not the HPSI pumps. There are no orifices downstream of the chemical and volume control charging pumps.

The staff finds that ANO-2 components are not subject to this aging effect.

On the basis that there are no orifices downstream of the chemical and volume control charging pumps used for RCS makeup, the staff finds that this aging effect is not applicable to ANO-2.

3.2.2.2.7 Buildup of Deposits due to Corrosion

The applicant stated that this issue applies to BWRs only; therefore, it is not applicable to ANO-2. The staff concurs with the applicant's position.

3.2.2.2.8 Quality Assurance for Aging Management of Nonsafety-Related Components

Section 3.0.4 of this SER provides a separate evaluation of the applicant's Quality Assurance Program.

Conclusion

On the basis of its audit and review, the staff finds that the applicant's further evaluations conducted in accordance with the GALL Report are consistent with the acceptance criteria in Section 3.2.2.2 of the SRP-LR. Since the applicant's AMR results are otherwise consistent with the GALL report, the staff finds that the applicant has demonstrated that the effects of aging can be adequately managed so that the intended function(s) can be maintained consistent with the current licensing basis for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.3 AMR Results That Are NOT Consistent with the GALL Report

3.2.2.3.1 Emergency Core Cooling System

Summary of Technical Information in the Application

In Section 3.2.2.1.1 of the LRA, the applicant identified the materials, environments, and aging effects requiring management. The applicant identified the following programs that manage the aging effects requiring management for the ECCS components:

- Boric Acid Corrosion Prevention Program
- Periodic Surveillance and Preventive Maintenance Program
- Water Chemistry Control Program
- System Walkdown Program
- Service Water Integrity Program

In Table 3.2.2-1 of the LRA, the applicant provided a summary of the AMRs for the ECCS components and identified which AMRs it considered to be consistent with the GALL Report.

Staff Evaluation

The NRC staff reviewed the AMR of the ECCS component-material-environment-AERM combinations that are not addressed in the GALL Report. These combinations are identified by notes F through J in LRA Table 3.2.2-1, except for those which have past precedents. The staff also reviewed those combinations in Table 3.2.2-1, with notes A through E, for which issues were identified. The staff determined that the applicant identified all applicable AERMs and credited appropriate AMPs for managing the them. The staff also reviewed the applicable UFSAR Supplements for the AMPs to ensure that the program descriptions are adequate.

Aging Effects

Table 2.3.2-1 of the LRA lists individual system components within the scope of license renewal and subject to an AMR. The component types that do not rely on the GALL Report for AMR include bearing housing, bolting, heat exchanger (shell), heat exchanger (tubes), nozzle, orifice, piping, pump casing, tank, thermowell, tubing, and valve.

For these component types, the applicant identified the materials, environments, and AERMS, as specified below:

- Cast iron components exposed to a fresh raw water (internal) environment are subject to the aging effects of fouling and loss of material.

- Cast iron components in air (external) environments are subject to loss of material.

- Carbon steel components (bolting) in air (external) environments are subject to loss of material and loss of mechanical closure integrity.

- Stainless steel components in fresh raw water (internal) environments are subject to loss of material.

- Stainless steel components in fresh raw water (external), treated, borated water (internal), and treated, borated water greater than 132 °C (270 °F) (internal) environments are subject to fouling, cracking and loss of material, and for fresh raw water (internal), loss of material wear, as well.

- Inconel components in treated, borated water (internal) are subject to loss of material.

- Carbon steel with stainless steel cladding in air (external) and treated, borated water (internal) environments is subject to loss of material.

- Stainless steel components exposed to air (external) and nitrogen (internal) environments experience no aging effects.

- Inconel components exposed to air (external) environments experience no aging effects.

During its review, the staff determined that it needed additional information to complete its review.

In LRA Table 3.2.1, Item 3.2.2-18, the applicant stated that this AMR item was not considered to match the ANO-2 AMR results. The applicant stated that for closure bolting, the AERM is loss of mechanical closure integrity, which includes a broader range of aging mechanisms than those included in this line item (i.e., loss of material due to general corrosion; crack initiation and growth due to cyclic loading and/or SCC). In RAI 3.2-1(1), (2), and (3), the staff requested the applicant to (1) explain the extent to which AMR Item 3.2.1-18 does not match the ANO-2 results, (2) clarify whether the aging effect of loss of mechanical closure integrity includes loss of material and cracking, and, specifically, what other aging effects/mechanisms are included in the "broader range," and (3) discuss how it will manage each of the identified aging effects and why the approach for managing these aging effects is adequate.

By letter dated April 6, 2004, the applicant stated that LRA Table 3.2-1, Item 3.2.1-18, addresses closure bolting in high-pressure or high-temperature systems. Within the ESF systems, the HPSI portion of the ECCS is a high-pressure system, but not a high-temperature system. The only bolting in a high-temperature system is the bolting on components in the SG blowdown and sampling penetrations in the containment penetrations system. In addition to loss of material, loss of mechanical closure integrity is considered an AERM. Cracking is not considered an AERM in the ESF systems because, at ANO-2, the potential for SCC of bolting in non-Class 1 systems is minimized by using lower yield strength carbon steel bolting material and limiting contaminants such as chlorides and sulfur in lubricants and sealant compounds. The staff found that the applicant adequately addressed the question of why AMR Item 3.2.1-18 does not match the ANO-2 results by clarifying that the ESF closure bolting, which is in a high-temperature environment, is susceptible to loss of mechanical closure integrity due to loss of preload, instead of crack initiation and growth due to cyclic loading and/or SCC. RAI 3.2.1(1) is, therefore, closed.

The applicant stated that the words "broad range" refer to the fact that loss of mechanical closure integrity is identified as an aging effect requiring management for bolting in two cases. First, bolting in high-temperature systems and in applications subject to significant vibration is subject to loss of mechanical closure integrity due to loss of preload, which is managed by the Bolting and Torquing Activities Program. The same bolted closures may be subject to loss of material, if they are carbon steel or wetted stainless steel. If so, the loss of material is managed by the System Walkdown Program or the Boric Acid Corrosion Prevention Program. Second, in the case of exposure to borated water leakage, loss of material may progress to such an extent that it will affect the mechanical closure integrity. Thus, both the loss of material and the loss of mechanical closure integrity are conservatively considered AERMs. In this case, both the loss of material and the loss of mechanical closure integrity are managed by the Boric Acid Corrosion Prevention and the System Walkdown Programs. Based on its review, the staff found that the applicant adequately delineated the aging effects included under loss of mechanical closure integrity, with a justifiable basis, and identified the associated AMPs to manage these aging effects. RAI 3.2-1(2) and (3), therefore, are closed.

In Tables 3.2.2-1 and 3.2.2-2 of the LRA, for ECCS and containment spray systems, the applicant identified loss of mechanical closure integrity as one of the aging effects (in addition to loss of material) requiring management for carbon steel bolting in air (external) environments. The Boric Acid Corrosion Prevention and the System Walkdown Programs are credited for managing the aging effect. In RAI 3.2-2, the staff requested that the applicant explain why it did not identify the Bolting and Torquing Activities Program as a required AMP. By letter dated April 6, 2004, the applicant stated that both the ECCS and containment spray system are exposed to air indoors with the potential for leaking borated water. Because of the highly corrosive nature of boric acid on carbon steel, borated water leakage could cause significant loss of material from components of bolted closures. In this case, loss of mechanical closure integrity is an aging effect from excessive loss of material resulting from borated water leakage, instead of from loss of preload. As a result, the Boric Acid Corrosion Prevention Program and the System Walkdown Program, instead of the Bolting and Torquing Activities Program, manage loss of material, and hence, loss of mechanical closure integrity. Based on the above information and the fact that the bolted closures in the ECCS and the containment spray system are not exposed to high-temperature environments, the staff determined that the applicant adequately explained why it did not identify the Bolted and Torquing Activities Program as a required AMP. RAI 3.2-2 is, therefore, closed.

In Table 3.2.2-1 of the LRA, the applicant stated that the Water Chemistry Control Program is used to manage cracking and loss of material for stainless steel components in a treated, borated water greater than 132 °C (270 °F) (internal) environment. This AMP is also used to manage loss of material for stainless steel components in a treated, borated water (internal) environment. In RAI 3.2-5, the staff requested that the applicant explain why a supplemental inspection program is not needed to assess the effectiveness of the Water Chemistry Control Program, as recommended by the GALL Report. By letter dated April 6, 2004, the applicant stated that for the ESF systems, the GALL Report does not identify stainless steel components among those certain cases requiring augmentation of the water chemistry program. The applicant further stated the following:

> NUREG-1801 does not include loss of material for stainless steel in any PWR borated water environment, consistent with the minor significance of the aging effect on this material. Operating history has demonstrated that the effect is minor, even in stagnant water conditions. The response to a question from the ANO-1 LRA review documents the results of inspections of the ANO-1 control rod drive mechanisms (CRDMs) which are also exposed to treated borated water. The response (ANO correspondence 1CAN090002, item 3.3.2.8.2.2-2) states, in part: "Loss of material by corrosion and pitting, and SCC of CRDM pressure boundary items have not been observed at ANO-1 in visual inspections of drives during routine and corrective maintenance activities. In addition, inspections at other B&W operating plants have found no indications in the motor tube extensions." Thus, loss of material is not a significant aging effect for stainless steel components in a typical PWR treated borated water (primary) environment. This is not an unexpected result since the materials chosen for primary systems were selected for their ability to withstand the borated water environment. Although the loss of material is minor, the effect is possible. ANO-2 has conservatively identified loss of material as an aging effect requiring management for stainless steel in treated borated water. Since industry experience has shown that primary water chemistry programs are effective in

preventing (managing) loss of material, this program alone is sufficient to manage the effect.

Based on the above, the staff finds the use of the chemistry program alone to be acceptable for managing loss of material in stainless steel components, and the GALL recommendations of augmenting the water chemistry program with a verification inspection are satisfied for the ESF components. RAI 3.2-5 is, therefore, closed.

In Tables 3.2.2-1, 3.2.2-2, 3.2.2-3, and 3.2.2-5 of the LRA, the applicant stated that for stainless steel bolting in air (external) environments, there is no applicable AERM. This presents a different AMR result from the stainless steel bolting in Table 3.2.2-4 of the LRA for the containment penetrations system, where loss of mechanical closure integrity is identified as an aging effect under a similar environment. In RAI 3.2-9, the staff requested that the applicant explain the apparent inconsistency in the above AMR results. By letter dated April 6, 2004, the applicant stated that some of the bolting in the containment penetrations system (blowdown and SG sampling) is exposed to high temperatures that could result in loss of preload and a loss of mechanical closure integrity. The portions of the ECCS, containment spray, containment cooling, and hydrogen control systems that are subject to AMR, on the other hand, are at low temperatures and would not experience a loss of mechanical closure integrity. The staff considered that the applicant has adequately explained why the stainless steel bolting is susceptible to loss of mechanical closure integrity in the containment penetrations system, but not in the other ESF systems. RAI 3.2-9 is, therefore, closed.

On the basis of its review of the information provided in the LRA and the additional information included in the applicant's responses to the above RAIs, the staff finds that the aging effects of the ECCS component types not addressed by the GALL Report are consistent with industry experience for these combinations of materials and environments. The staff did not identify any omitted aging effects. Therefore, the staff finds that the applicant has identified the appropriate aging effects for the materials and environments associated with the components in the ECCS.

Aging Management Programs

After evaluating the applicant's identification of aging effects for each of the above components, the staff evaluated the AMPs to determine if they are appropriate for managing the identified aging effects. The staff also determined that the UFSAR Supplement contains an adequate description of the program.

LRA Table 3.2.2-1 identifies the following AMPs for managing the aging effects described above for the ECCS.

- Boric Acid Corrosion Prevention Program (B.1.3)
- Periodic Surveillance and Preventive Maintenance Program (B.1.18)
- Service Water Integrity Program (B.1.24)
- System Walkdown Program (B.1.28)
- Water Chemistry Control Program (B.1.30)

Sections 3.0.3.2.1, 3.0.3.3.7, 3.0.3.2.7, 3.0.3.3.9, and 3.0.3.1 of this SER, respectively, present the staff's detailed review of these AMPs.

During its review, the staff determined that it needed additional information to complete its review.

In LRA Table 3.2-1, Item 3.2.1-18, the applicant stated that the Bolting and Torquing Activities, Boric Acid Corrosion Prevention, and System Walkdown Programs will manage loss of mechanical closure integrity. In RAI 3.2-1(4), the staff requested the applicant to demonstrate that, with the combination of these AMPs, the aging effects associated with closure bolting will be adequately managed, or managed in a manner equivalent to that described in GALL AMP XI.M18, "Bolting Integrity." By letter dated April 6, 2004, the applicant stated that, while the Containment Leak Rate, Boric Corrosion Prevention, and System Walkdown Programs will be used to manage loss of material, the Bolting and Torquing Activities, Boric Acid Corrosion Prevention, and System Walkdown Programs will be used to manage loss of mechanical closure integrity. The applicant stated that visual inspections of bolting for loss of material and loss of mechanical closure integrity, embodied in the Boric Acid Corrosion Prevention and System Walkdown Programs, are adequate to assure that the closure bolting can perform its intended function. Loss of material (and ultimately loss of mechanical closure integrity) for external surfaces, such as a bolted closure, is a long-term aging effect that would be observed well before aging progressed to the point of loss of intended function. In addition, the Containment Leak Rate Program verifies that leak rates of the penetrations are acceptable, which proves that the closure bolting remains capable of performing its intended function. The Bolting and Torquing Activities Program assures that proper torque values are applied to bolted closures such that loss of mechanical closure integrity, as a result of loss of preload from high temperatures, does not occur. The Bolting and Torquing Activities and the System Walkdown Programs are plant-specific programs and are not intended to be comparable to GALL AMP XI.M18, which stipulates the ISI requirements of the ASME Code, Section XI. The ANO-2 Inservice Inspection Program for Class 1, 2, and 3 bolted closures includes these ISI requirements. However, these inspection requirements are focused on identifying the aging effect of cracking. Because cracking is not an AERM for non-Class 1 bolted closures, the applicant stated that it did not include the Inservice Inspection Program as an AMP for ESF systems. Because the bolted closures under these systems include only ASME Code Class 2 and 3 closure bolting, the staff found that the applicant's response adequately addresses the staff's concern regarding the adequacy and sufficiency of the Bolting and Torquing Activities and the System Walkdown Programs for the ANO-2 bolted closures. The applicant's response also clarified, for closure bolting, the difference between these AMPs and the ANO-2 Inservice Inspection Program, which primarily focuses on identifying the aging effect of cracking. Based on the above, RAI 3.2-1(4) is closed.

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 identified appropriate AMPs for managing the aging effects of the ECCS component types not addressed by the GALL Report. In addition, the staff finds the program descriptions in the UFSAR Supplement acceptable.

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 ECCS components that are not addressed by the GALL Report, so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by

10 CFR 54.21(a)(3).

The staff also reviewed the applicable FSAR Supplement program summaries and concludes that they adequately describe the AMPs credited for managing aging in these components, as required by 10 CFR 54.21(d).

3.2.2.3.2 Containment Spray System

Summary of Technical Information in the Application

In Section 3.2.2.1.2 of the LRA, the applicant identified the materials, environments, and aging effects requiring management. The applicant identified the following programs that manage the AERMs for the containment spray system components:

- Boric Acid Corrosion Prevention Program
- Heat Exchanger Monitoring Program
- Periodic Surveillance and Preventive Maintenance Program
- Service Water Integrity Program
- System Walkdown Program
- Water Chemistry Control Program

In Table 3.2.2-2 of the LRA, the applicant provided a summary of AMRs for the containment spray system components and identified which AMRs it considered to be consistent with the GALL Report.

Staff Evaluation

The technical staff reviewed the AMR of the containment spray system component-material-environment-AERM combinations that are not addressed in the GALL Report. These combinations are identified by notes F through J in LRA Table 3.2.2-2, except for those with past precedents. The staff also reviewed those combinations in Table 3.2.2-2 identified by notes A through E for which there were issues identified. The staff determined that the applicant identified all applicable AERMs and has credited appropriate AMPs for managing them. The staff also reviewed the applicable UFSAR Supplements for the AMPs to ensure that the program descriptions are adequate.

Aging Effects

Table 2.3.2-2 of the LRA lists individual system components within the scope of license renewal and subject to an AMR. The component types that do not rely on the GALL Report for AMR include bolting, filter housing, heat exchanger (shell), heat exchanger (tubes), heat exchanger (tubesheet), heater housing, nozzle, orifice, piping, pump casing, tank, thermowell, tubing, valve, and vortex breaker.

For these component types, the applicant identified the materials, environments, and AERMS, as specified below:

- Carbon steel components (bolting) in air (external) and outdoor air (external) environments are subject to loss of material and loss of mechanical closure integrity.

- Carbon steel components in air (external) and fresh raw water (internal) are subject to loss of material.

- Stainless steel components in fresh raw water (external) and treated, borated water (internal) environments are subject to fouling and loss of material.

- Stainless steel components in fresh raw water (external) are subject to loss of material-wear.

- Stainless steel components in treated, borated water greater than 132 °C (270 °F) (internal) environments are subject to cracking and loss of material.

- Stainless steel components in untreated borated water (internal and external) are subject to loss of material.

- Ferritic stainless steel in fresh raw water (external) and treated borated water greater than 132 °C (270 °F) (internal) environments are subject to fouling and loss of material-wear in fresh raw water (external).

- Carbon steel components with stainless cladding in fresh raw water (external) are subject to cracking, loss of material, and loss of material-wear.

- Cast stainless steel components in treated, borated water (internal) are subject to loss of material.

- Stainless steel components exposed to air (external) and outdoor air (external) environments, as well as cast stainless steel components exposed to air (external) environments, experience no aging effects.

During its review, the staff determined that it needed additional information to complete its review. RAI 3.2-1(1), (2), and (3) requested the applicant to (1) explain the extent to which AMR Item 3.2.1-18 does not match the ANO-2 results, (2) clarify whether the aging effect of loss of mechanical closure integrity includes loss of material and cracking, and, specifically, what other aging effects/mechanisms are included in the "broader range," and (3) discuss how it will manage each of the identified aging effects and why the approach for managing the aging effects is adequate. Section 3.2.2.4.1 of this SER provides the staff's discussion of this RAI and its resolution by the applicant.

RAI 3.2-2 requested that the applicant explain why it did not credit the Bolting and Torquing Activities Program as a required AMP for the aging effect of loss of mechanical closure integrity. The staff also requested the applicant to provide a detailed description of the potential aging effects included under loss of mechanical closure integrity, and to discuss how they will be managed by the stated AMPs. Section 3.2.2.4.1 of this SER provides the staff's discussion of this RAI and its resolution by the applicant.

In Table 3.2.2-2 of the LRA, the applicant stated it credits the Water Chemistry Control Program to manage cracking and loss of material for stainless steel components in a treated, borated water greater than 132 °C (270 °F) (internal) environments, and to manage loss of material for stainless steel and cast stainless steel components in a treated, borated water (internal) environment. In RAI 3.2-6, the staff requested that the applicant explain why it does not need a supplemental inspection program to assess the effectiveness of the Water Chemistry Control Program. The staff's discussion of this RAI and its resolution by the applicant are similar to those for RAI 3.2-5, which are provided in Section 3.2.2.4.1 of this SER.

RAI 3.2-9 requested that the applicant explain the differences in the AMR results for the stainless steel bolting in air (external) environments, as provided in LRA Table 3.2.2-2 and Table 3.2.2-4. Table 3.2.2-2 does not identify an AERM for stainless steel bolting in air (external) environments, whereas Table 3.2.2-4 identifies, for containment penetrations system, loss of mechanical closure integrity as an aging effect for the same bolting under a similar environment. Section 3.2.2.4.1 of this SER provides the staff's discussion of this RAI and its resolution by the applicant.

On the basis of its review of the information provided in the LRA and the additional information included in the applicant's responses to the above RAIs, the staff finds that the aging effects of the containment spray system component types not addressed by the GALL Report are consistent with industry experience for these combinations of materials and environments. The staff did not identify any omitted aging effects. Therefore, the staff finds that the applicant has identified the appropriate aging effects for the materials and environments associated with the components in the containment spray system.

Aging Management Programs

After evaluating the applicant's identification of aging effects for each of the above components, the staff evaluated the AMPs to determine if they are appropriate for managing the identified aging effects. The staff also determined that the UFSAR Supplement contains an adequate description of the program.

LRA Table 3.2.2-2 identifies the following AMPs for managing the aging effects described above for the containment spray system:

- Boric Acid Corrosion Prevention Program (B.1.3)
- Heat Exchanger Monitoring Program (B.1.12)
- Periodic Surveillance and Preventive Maintenance Program (B.1.18)
- Service Water Integrity Program(B.1.24)
- System Walkdown Program (B.1.28)
- Water Chemistry Control Program (B.1.30)

Sections 3.0.3.2.1, 3.0.3.3.3, 3.0.3.3.7, 3.0.3.2.7, 3.0.3.3.9, and 3.0.3.1 of this SER, respectively, provide the staff's detailed review of these AMPs.

During its review, the staff determined that it needed additional information to complete its review.

RAI 3.2-1(4) requested that the applicant explain why it did not identify the Bolting and Torquing Activities Program as a required AMP for the containment spray system, and demonstrate that the Boric Acid Corrosion Prevention, Bolting and Torquing Activities, and System Walkdown Programs will adequately manage the aging effects associated with closure bolting, or will manage these effects in a manner equivalent to that described in GALL AMP XI.M18. Section

3.2.2.4.1 of this SER provides the staff's discussion of this RAI and its resolution by the applicant.

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 has identified the appropriate AMPs for managing the aging effects of the containment spray system component types not addressed by the GALL Report. In addition, the staff finds the program descriptions in the UFSAR Supplement acceptable.

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 spray system components that are not addressed by the GALL Report, so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable FSAR Supplement program summaries and concludes that they adequately describe the AMPs credited for managing aging in these components, as required by 10 CFR 54.21(d).

3.2.2.3.3 Containment Cooling System

Summary of Technical Information in the Application

In Section 3.2.2.1.3 of the LRA, the applicant identified the materials, environments, and aging effects requiring management. The applicant identified the following programs that manage the AERMs for the containment cooling system components:

- System Walkdown Program
- Periodic Surveillance and Preventive Maintenance Program
- Service Water Integrity Program

In Table 3.2.2-3 of the LRA, the applicant provided a summary of AMRs for the containment cooling system components and identified which AMRs it considered to be consistent with the GALL Report.

Staff Evaluation

The NRC staff reviewed the AMR of the containment cooling system component-material-environment-AERM combinations that are not addressed in the GALL Report. These combinations are identified by notes F through J in LRA Table 3.2.2-3, except for those with past precedents. The staff also reviewed those combinations in Table 3.2.2-3, identified by notes A through E, for which there were issues identified. The staff determined that the applicant identified all applicable AERMs and credited appropriate AMPs for managing them. The staff also reviewed the applicable UFSAR Supplements for the AMPs to ensure that the program descriptions are adequate.

Aging Effects

Table 2.3.2-3 of the LRA lists individual system components within the scope of license renewal and subject to an AMR. The component types that do not rely on the GALL Report for AMR include blower housing, bolting, cooling coil assembly, cooling coil housing, damper housing, ductwork, piping and valve.

For these component types, the applicant identified the materials, environments, and AERMS, as specified below:

- Carbon steel components in air (external and internal), condensation (external and internal), and fresh raw water (internal) environments are subject to loss of material.
- Stainless steel components in condensation (external and internal) and fresh raw water (internal) environments are subject to loss of material.
- Copper alloy components in condensation (external) and fresh raw water (internal) environments are subject to fouling and loss of material, and for condensation (external) environments, loss of material-wear, as well.
- Stainless steel components in air (external and internal) environments experience no aging effects.

During its review, the staff determined that it needed additional information to complete its review.

RAI 3.2-1(1), (2), and (3) requested the applicant to (1) explain the extent to which AMR Item 3.2.1-18 does not match the ANO-2 results, (2) clarify whether the aging effect of loss of mechanical closure integrity includes loss of material and cracking, and, specifically, what other aging effects/mechanisms are included in the "broader range," and (3) discuss how it will manage each of the identified aging effects and why the approach for managing the aging effects is adequate. Section 3.2.2.4.1 of this SER provides the staff's discussion of this RAI and its resolution by the applicant.

In Table 3.2.2-3 of the LRA, the applicant stated that loss of material is identified as the AERM for carbon steel bolting in air (external) and condensation (external) environments, and stainless steel bolting in condensation (external) environments. In RAI 3.2-3, the staff requested that the applicant explain why it did not identify loss of mechanical closure integrity as an AERM for the bolting, and how it would be managed if identified. By letter dated April 6, 2004, the applicant stated that it did identify loss of mechanical closure integrity as an AERM for bolting in two cases. First, bolting in high-temperature systems and in applications subject to significant vibration is also subject to loss of mechanical closure integrity caused by loss of preload, which is managed by the Bolting and Torquing Activities Program. The same bolted closures may be subject to loss of material if they are carbon steel or wetted stainless steel, and are managed by the System Walkdown or the Boric Acid Corrosion Prevention Programs. Second, in case of exposure to borated water leakage, loss of material may progress to such an extent that it will affect the mechanical closure integrity. In this case, the applicant conservatively considers both the loss of material and the loss of mechanical closure integrity as AERMs, which are managed by the Boric Acid Corrosion Prevention and the System

Walkdown Programs.

Based on the above, the applicant did not identify the loss of mechanical closure integrity as an AERM for bolting in the containment cooling system because the containment cooling system is not a high-temperature system, it is not subject to significant vibration, and it does not contain borated water. The staff found that the applicant adequately delineated the aging effects covered under loss of mechanical closure integrity, and explained why it did not identify them as AERMs for the bolting in the containment cooling system. RAI 3.2-3 is, therefore, closed.

RAI 3.2-9 requested that the applicant explain the differences in the AMR results for the stainless steel bolting in air (external) environments, as provided in LRA Table 3.2.2-3 and Table 3.2.2-4. Table 3.2.2-3 does not identify an AERM for stainless steel bolting in air (external) environments, whereas Table 3.2.2-4 identifies, for containment penetrations system, loss of mechanical closure integrity as an aging effect for the same bolting under a similar environment. Section 3.2.2.4.1 of this SER provides the staff's discussion of this RAI and its resolution by the applicant.

On the basis of its review of the information provided in the LRA and the additional information included in the applicant's responses to the above RAIs, the staff finds that the aging effects of the containment cooling system component types not addressed by the GALL Report are consistent with industry experience for these combinations of materials and environments. The staff did not identify any omitted aging effects. Therefore, the staff finds that the applicant has identified the appropriate aging effects for the materials and environments associated with the components in the containment cooling system.

Aging Management Programs

After evaluating the applicant's identification of aging effects for each of the above components, the staff evaluated the AMPs to determine if they are appropriate for managing the identified aging effects. The staff also confirmed that the UFSAR Supplement contains an adequate description of the program.

LRA Table 3.2.2-3 identifies the following AMPs for managing the aging effects described above for the containment cooling system:

- Periodic Surveillance and Preventive Maintenance Program (B.1.18)
- Service Water Integrity Program (B.1.24)
- System Walkdown Program (B.1.28)

Sections 3.0.3.3.7, 3.0.3.2.7, and 3.0.3.3.9 of this SER, respectively, present the staff's detailed review of these AMPs.

On the basis of its review of the information provided in the LRA, the staff finds that the applicant has identified appropriate AMPs for managing the aging effects of the containment cooling system component types not addressed by the GALL Report. In addition, the staff finds the program descriptions in the UFSAR Supplement acceptable.

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 cooling system components that are not addressed by the GALL Report, so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable FSAR Supplement program summaries and concludes that they adequately describe the AMPs credited for managing aging in these components, as required by 10 CFR 54.21(d).

3.2.2.3.4 Containment Penetration System

Summary of Technical Information in the Application

In Section 3.2.2.1.4 of the LRA, the applicant identified the materials, environments, and aging effects requiring management. The applicant identified the following programs that manage the AERMs for the containment penetrations system components:

- Boric Acid Corrosion Prevention Program
- Bolting and Torquing Activities Program
- Containment Leak Rate Program
- Flow-Accelerated Corrosion Program
- Periodic Surveillance and Preventive Maintenance Program
- Water Chemistry Control Program

In Table 3.2.2-4 of the LRA, the applicant provided a summary of AMRs for the containment penetrations system components and identified which AMRs it considered to be consistent with the GALL Report.

Staff Evaluation

The NRC staff reviewed the AMR of the containment penetrations system component-material-environment-AERM combinations that are not addressed in the GALL Report. These combinations are identified by notes F through J in LRA Table 3.2.2-4, except for those with past precedents. The staff also reviewed those combinations in Table 3.2.2-4, identified by notes A through E, for which issues were identified. The staff determined that the applicant identified all applicable AERMs and credited appropriate AMPs for managing the AERMs. The staff also reviewed the applicable UFSAR Supplements for the AMPs to ensure that the program descriptions adequately describe the AMPs.

Aging Effects

Table 2.3.2-4 of the LRA lists individual system components within the scope of license renewal and subject to an AMR. The component types that do not rely on the GALL Report for AMR include bolting, flex hose, piping, tubing, and valve.

For these component types, the applicant identifies the materials, environments, and AERMS, as specified below:

- Carbon steel bolting in air (external), condensation (external), and untreated borated water (external) environments is subject to loss of material, and for air (external) environments, loss of mechanical closure integrity, as well.

- Carbon steel components are subject to loss of material when exposed to air (external and internal), condensation (external), treated water (internal), and treated water greater than 132 °C> (270 °F) (internal) environments.

- Stainless steel bolting in air (external) environment is subject to loss of mechanical closure integrity.

- Stainless steel components in untreated, borated water (internal) and treated water greater than 132 °C (270 °F) (internal) environments are subject to cracking and loss of material.

- Elastomer components in air (external) and nitrogen (internal) environments are subject to cracking and change in material properties.

- Carbon steel components in nitrogen environments experience no aging effects.

- Stainless steel components in air (external and internal), concrete, and nitrogen environments experience no aging effects.

- Copper alloy components in air (external) and nitrogen (internal) environments experience no aging effects.

During its review, the staff determined that it needed additional information.

RAI 3.2-1(1), (2), and (3) requested the applicant to (1) explain the extent to which AMR Item 3.2.1-18 does not match the ANO-2 results, (2) clarify whether the aging effect of loss of mechanical closure integrity includes loss of material and cracking, and, specifically, what other aging effects/mechanisms are included in the "broader range," and (3) discuss how it will manage each of the identified aging effects and why the approach for managing the aging effects is adequate. Section 3.2.2.4.1 of this SER provides the staff's discussion of this RAI and its resolution by the applicant.

In Table 3.2.2-4 of the LRA, the applicant stated that it identified loss of mechanical closure integrity as the AERM for carbon steel and stainless steel bolting, all in air (external) environments. The applicant credits the Bolting and Torquing Activities Program as an AMP. In view of the discussion provided in AMR Item 3.2.1-18, the staff requested, in RAI 3.2-4, that the applicant explain why it did not also credit the System Walkdown Program as an AMP. By letter dated April 6, 2004, the applicant stated that loss of mechanical closure integrity is an AERM for bolting that can experience a loss of preload caused by exposure to high temperatures, significant vibration, or significant loss of material from borated water leakage. For the containment penetrations system, the Bolting and Torquing Activities Program manages loss of mechanical closure integrity because the bolting in question is exposed to high temperatures. This program manages aging through the application of proper torque values to the bolting. The applicant uses the Containment Leak Rate Program, on the other hand, to manage the aging effect of loss of material for carbon steel bolting without reliance upon system walkdowns. The staff found the applicant's response to be adequate in providing the basis of how it will manage the aging effects of loss of material and/or loss of mechanical closure integrity. RAI 3.2-4 is, therefore, closed.

In Table 3.2.2-4 of the LRA, the applicant stated that it credits the Water Chemistry Control Program to manage cracking and loss of material for the stainless steel valve in a treated, borated water greater than 132 °C (270 °F) (internal) environments. In RAI 3.2-7, the staff requested that the applicant explain why it does not need a supplemental inspection program to assess the effectiveness of the Water Chemistry Control Program. The staff's discussion of this RAI and its resolution by the applicant is similar to that for RAI 3.2-5, which is provided in Section 3.2.2.4.1 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 responses to the above RAIs, the staff finds that the aging effects of the containment penetrations system component types not addressed by the GALL Report are consistent with industry experience for these combinations of materials and environments. The staff did not identify any omitted aging effects. Therefore, the staff finds that the applicant has identified the appropriate aging effects for the materials and environments associated with the components in the containment penetrations system.

Aging Management Programs

After evaluating the applicant's identification of aging effects for each of the above components, the staff evaluated the AMPs to determine if they are appropriate for managing the identified aging effects. The staff also confirmed that the UFSAR Supplement contains an adequate description of the program.

LRA Table 3.2.2-4 identifies the following AMPs for managing the aging effects described above for the containment penetrations system.

- Bolting and Torquing Activities Program (B.1.2)
- Boric Acid Corrosion Prevention Program (B.1.3)
- Containment Leak Rate Program (B.1.6)
- Flow-Accelerated Corrosion Program (B.1.11)
- Periodic Surveillance and Preventive Maintenance Program (B.1.18)
- Water Chemistry Control Program (B.1.30)

Sections 3.0.3.3.2, 3.0.3.2.1, 3.0.3.1,3.0.3.1, 3.0.3.3.7, and 3.0.3.1 of this SER, respectively, provide the staff's detailed review of these AMPs.

During its review, the staff determined that it needed additional information to complete its review.

RAI 3.2-1(4) requested the applicant to demonstrate that the Boric Acid Corrosion Prevention, Bolting and Torquing Activities, and System Walkdown Programs will adequately manage the aging effects associated with closure bolting, or will manage them in a manner equivalent to that described in GALL AMP XI.M18. Section 3.2.2.4.1 of this SER provides the staff's discussion of this RAI and its resolution by the applicant.

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 has identified appropriate AMPs for managing the aging effects of the containment penetrations system component types not addressed by the GALL Report. In addition, the staff finds the program descriptions in the UFSAR supplement acceptable.

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 penetration system components that are not addressed by the GALL Report, so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable FSAR Supplement program summaries and concludes that they adequately describe the AMPs credited for managing aging in these components, as required by 10 CFR 54.21(d).

3.2.2.3.5 Hydrogen Control System

Summary of Technical Information in the Application

In Section 3.2.2.1.5 of the LRA, the applicant identified the materials, environments, and aging effects requiring management. The applicant identified the following programs that manage the AERMs for the hydrogen control system components:

- System Walkdown Program
- Service Water Integrity Program

In Table 3.2.2-5 of the LRA, the applicant provided a summary of AMRs for the hydrogen control system components and identified which AMRs it considered to be consistent with the GALL Report.

Staff Evaluation

The NRC staff reviewed the AMR of the hydrogen control system component-material-environment-AERM combinations that are not addressed in the GALL Report. These combinations are identified by notes F through J in LRA Table 3.2.2-5, except for those with past precedents. The staff also reviewed those combinations in Table 3.2.2-5, identified by notes A through E, for which issues were identified. The staff confirmed that the applicant has identified all applicable AERMs and has credited appropriate AMPs for managing the AERMs. The staff also reviewed the applicable UFSAR supplements for the AMPs to ensure that the program descriptions are adequate.

Aging Effects

Table 2.3.2-5 of the LRA lists individual system components within the scope of license renewal and subject to an AMR. The component types that do not rely on the GALL Report for AMR include bolting, filter housing, heat exchanger (shell and tubes), orifice, piping, pump casing, tubing, and valve.

For these component types, the applicant identified the materials, environments, and AERMs, as specified below:

- Carbon steel components in air (external) environments are subject to loss of material.
- Stainless steel components in condensation (external) and fresh raw water (internal) are subject to loss of material.
- Stainless steel components in fresh raw water (external) are subject to fouling, loss of material, and loss of material-wear.
- Stainless steel components in air (external and internal) and condensation (internal) environments experience no aging effects.

During its review, the staff determined that it needed additional information.

RAI 3.2-1(1), (2), and (3) requested the applicant to (1) explain the extent to which AMR Item 3.2.1-18 does not match the ANO-2 results (2) clarify whether the aging effect of loss of mechanical closure integrity includes loss of material and cracking, and, specifically, what other aging effects/mechanisms are included in the "broader range," and (3) discuss how it will manage each of the identified aging effects and why the approach for managing the aging effects is adequate. Section 3.2.2.4.1 presents the staff's discussion of this RAI and its resolution by the applicant.

In Table 3.2.2-5 of the LRA, the applicant stated that it identified loss of material as an AERM for the carbon steel bolting in air (external) environments. In RAI 3.2-8, the staff requested that the applicant explain why it did not specify loss of mechanical closure integrity and its associated AMPs for the bolting. By letter dated April 6, 2004, the applicant stated that the hydrogen control system internal environment is air, and not borated water, as in the other systems. As a result, there is very little potential for any carbon steel bolting in the system to be exposed to borated water leakage that would result in loss of mechanical closure integrity. In addition, the system is not subject to elevated temperatures or significant vibration. The staff considered the applicant's response to be adequate in explaining why it did not identify loss of mechanical closure integrity as an AERM for the bolting in this system. RAI 3.2-8 is, therefore, closed.

RAI 3.2-9 requested that the applicant explain the differences in the AMR results for the stainless steel bolting in air (external) environments, as provided in LRA Tables 3.2.2-5 and 3.2.2-4. Table 3.2.2-5 does not identify an AERM for stainless steel bolting in air (external) environments, whereas Table 3.2.2-4 identifies, for containment penetrations system, loss of mechanical closure integrity as an aging effect for the same bolting under a similar environment. Section 3.2.2.4.1 of this SER presents the staff's discussion of this RAI and its resolution by the applicant.

In Table 3.2.2-5 of the LRA, the applicant stated it did not identify any aging effects for the stainless steel heat exchanger (tubes) in a condensation (internal) environment. Because industry experience indicates that stainless steel may be susceptible to the aging effect of loss of material when exposed to condensation with alternating wetting and drying, the staff requested, in RAI 3.2-10, that the applicant explain why it did not identify an aging effect for the component. By letter dated April 6, 2004, the applicant stated that for ANO-2, it identified loss of material as an aging effect for stainless steel, with condensation as an environment, when there is a potential for concentrating chemical species through repeated alternating wet and dry conditions. Conservatively, the applicant identified condensation as an internal environment in the hydrogen control system sample coolers, even though the coolers are only operated intermittently for short periods of time. The hydrogen control system normally has no flow through it, and, as a result, would not contain significant amounts of aggressive chemicals. Thus, there is minimal possibility of concentrating chemicals, and loss of material is not an aging effect requiring management. The staff considered the applicant's response to be adequate in explaining why it did not identify any aging effects for the stainless steel components in the specific condensation (internal) environment. RAI 3.2-10 is, therefore, closed.

On the basis of its review of the information provided in the LRA and the additional information included in the applicant's responses to the above RAIs, the staff finds that the aging effects of the hydrogen control system component types not addressed by the GALL Report are consistent with industry experience for these combinations of materials and environments. The staff did not identify any omitted aging effects. Therefore, the staff finds that the applicant has identified the appropriate aging effects for the materials and environments associated with the components in the hydrogen control system.

Aging Management Programs

After evaluating the applicant's identification of aging effects for each of the above components, the staff evaluated the AMPs to determine if they are appropriate for managing the identified aging effects. The staff also confirmed that the UFSAR Supplement contains an adequate description of the program.

LRA Table 3.2.2-5 identifies the following AMPs for managing the aging effects described above for the hydrogen control system.

- Service Water Integrity Program (B.1.24)
- System Walkdown Program (B.1.28)

Sections 3.0.3.2.7 and 3.0.3.3.9 of this SER, respectively, present the staff's detailed review of these AMPs.

On the basis of its review of the information provided in the LRA, the staff finds that the applicant has identified the appropriate AMPs for managing the aging effects of the hydrogen control system component types not addressed by the GALL Report. In addition, the staff finds the program descriptions in the UFSAR Supplement acceptable.

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 hydrogen control system components that are not addressed by the GALL Report, so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable FSAR Supplement program summaries and concludes that they adequately describe the AMPs credited for managing aging in these components, as required by 10 CFR 54.21(d).

3.2.3 Conclusion

On the basis of its audit and review, the staff concludes that the applicant has demonstrated that the aging effects associated with the engineered safety feature systems components will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable FSAR Supplement program summaries and concludes that the FSAR Supplement adequately describes the AMPs credited for managing aging of the engineered safety feature systems, as required by 10 CFR 54.21(d).

3.3 Auxiliary Systems

This section of the SER documents the staff's review of the applicant's AMR results for the auxiliary system components and component groups associated with the following systems:

- spent fuel pool system
- water suppression fire protection system
- emergency diesel generator system
- alternate ac diesel generator system
- chemical and volume control system
- Halon fire protection and reactor coolant pump motor oil leakage collection system
- fuel oil system
- service water system
- auxiliary building ventilation system
- control room ventilation system
- miscellaneous systems in scope of 10 CFR 54.4(a)(2)

3.3.1 Summary of Technical Information in the Application

In Section 3.3 of the LRA, the applicant provided the results of the AMR of the auxiliary systems components and component types listed in Tables 2.3.3-1 through 2.3.3-11 of the LRA. The applicant also listed the materials, environments, aging effects requiring management, and aging management programs associated with each system.

In Table 3.3.1, "Summary of the Aging Management Programs for the Auxiliary Systems Evaluated in Chapter VII of NUREG-1801," of the LRA, the applicant provided a summary comparison of its AMRs with the AMRs evaluated in the GALL Report for the auxiliary systems components and component types. In Section 3.3.2.2 of the LRA, the applicant provided information concerning Table 3.3.1 components for which the GALL Report recommends further evaluation.

3.3.2 Staff Evaluation

The staff reviewed LRA Section 3.3 to determine if the applicant provided sufficient information to demonstrate that the effects of aging for the reactor system components that are within the scope of license renewal and subject to an AMR will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff performed an audit to confirm the applicant's claim that certain identified AMRs were consistent with the GALL Report. The staff did not repeat its review of the matters described in the GALL Report. However, the staff did determine that the material presented in the LRA was applicable and that the applicant had identified the appropriate GALL AMPs. Section 3.0.3 of this SER documents the staff's evaluations of the AMPs. The audit report issued on August 19, 2004, and summarized in Section 3.3.2.1 of this SER, documents the staff's audit findings.

The staff also performed an audit of those AMRs that were consistent with the GALL Report and for which further evaluation is recommended. During the audit, the staff determined that the applicant's additional evaluations were consistent with the acceptance criteria in Section 3.3.2.2 of the SRP-LR. The staff's audit findings are documented in the audit report and summarized in Section 3.3.2.2 of this SER.

The staff conducted a technical review of the remaining AMRs that were not consistent with the GALL Report. The review included evaluating whether the applicant had identified all plausible aging effects and whether the aging effects listed were appropriate for the combination of materials and environments specified. Section 3.3.2.3 of this SER documents the staff's review findings.

Finally, the staff reviewed the AMP summary descriptions in the UFSAR Supplement to ensure that they adequately describe the programs credited with managing or monitoring aging for the reactor system components.

Table 3.3-1 below summarizes the staff's evaluation of the components, aging effects/mechanisms, and AMPs listed in LRA Section 3.3 that are addressed in the GALL Report.

Table 3.3-1 Staff Evaluation for Auxiliary System Components in the GALL Report

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Components in spent fuel pool cooling and cleanup (Item Number 3.3.1-1)	Loss of material due to general, pitting, and crevice corrosion	Water chemistry and one-time inspection	Water Chemistry Control (B.1.30)	Consistent with GALL, which recommends further evaluation (See Section 3.3.2.2.1)
Linings in spent fuel pool cooling and cleanup system; seals and collars in ventilation systems (Item Number 3.3.1-2)	Hardening, cracking and loss of strength due to elastomer degradation; loss of material due to wear	Plant specific	Periodic Surveillance and Preventive Maintenance (B.1.18)	Consistent with GALL, which recommends further evaluation (See Section 3.3.2.2.2)
Components in load handling, chemical and volume control system (PWR), and reactor water cleanup and shutdown cooling systems (older BWR) (Item Number 3.3.1-3)	Cumulative fatigue damage	TLAA, evaluated in accordances with 10 CFR 54.21(c)		Consistent with GALL, which recommends further evaluation (See Section 3.3.2.2.3)

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Heat exchangers in reactor water cleanup system (BWR); high pressure pumps in chemical and volume control system (PWR) (Item Number 3.3.1-4)	Crack initiation and growth due to SCC or cracking	Plant specific	Water Chemistry Control (B.1.30)	Consistent with GALL, which recommends further evaluation (See Section 3.3.2.2.4)
Components in ventilation systems, diesel fuel oil system, and emergency diesel generator systems; external surfaces of carbon steel components (Item Number 3.3.1-5)	Loss of material due to general, pitting, and crevice corrosion, and MIC	Plant specific	Fire Protection (B.1.10), System Walkdown (B.1.28), Wall Thinning Monitoring (B.1.29), and Periodic Surveillance and Preventive Maintenance (B.1.18)	Consistent with GALL, which recommends further evaluation (See Section 3.3.2.2.5)
Components in reactor coolant pump oil collect system of fire protection (Item Number 3.3.1-6)	Loss of material due to galvanic, general, pitting, and crevice corrosion	One-time inspection	Periodic Surveillance and Preventive Maintenance (B.1.18)	Consistent with GALL, which recommends further evaluation (See Section 3.3.2.2.6)
Diesel fuel oil tanks in diesel fuel oil system and emergency diesel generator system (Item Number 3.3.1-7)	Loss of material due to general, pitting, and crevice corrosion, MIC, and biofouling	Fuel oil chemistry and one-time inspection	Diesel Fuel Monitoring (B.1.7), Periodic Surveillance and Preventive Maintenance (B.1.18), and Service Water Integrity (B.1.24)	Consistent with GALL, which recommends further evaluation (See Section 3.3.2.2.7)
Heat exchangers in chemical and volume control system (Item Number 3.3.1-9)	Crack initiation and growth due to SCC and cyclic loading	Water chemistry and a plant-specific verification program	Water Chemistry Control (B.1.30)	Consistent with GALL, which recommends further evaluation (See Section 3.3.2.2.9)
Neutron absorbing sheets in spent fuel storage racks (Item Number 3.3.1-10)	Reduction of neutron absorbing capacity and loss of material due to general corrosion (Boral, boron steel)	Plant specific	Not Applicable to ANO-2	Consistent with GALL, which recommends further evaluation (See Section 3.3.2.2.10)

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
New fuel rack assembly (Item Number 3.3.1-11)	Loss of material due to general, pitting, and crevice corrosion	Structures monitoring	Structures Monitoring - Structures (B.1.27)	Consistent with GALL, which recommends no further evaluation (See Section 3.3.2.1)
Neutron absorbing sheets in spent fuel storage racks (Item Number 3.3.1-12)	Reduction of neutron absorbing capacity due to Boraflex degradation	Boraflex monitoring	Not Applicable to ANO-2	Consistent with GALL, which recommends no further evaluation (See Section 3.3.2.1)
Spent fuel storage racks and valves in spent fuel pool cooling and cleanup (Item Number 3.3.1-13)	Crack initiation and growth due to stress corrosion cracking	Water chemistry	Water Chemistry Control (B.1.30)	Consistent with GALL, which recommends no further evaluation (See Section 3.3.2.1)
Closure bolting and external surfaces of carbon steel and low-alloy steel components (Item Number 3.3.1-14)	Loss of material due to boric acid corrosion	Boric acid corrosion	Boron Acid Corrosion Prevention (B.1.3)	Consistent with GALL, which recommends no further evaluation (See Section 3.3.2.1)
Components in or serviced by closed-cycle cooling water system (Item Number 3.3.1-15)	Loss of material due to general, pitting, and crevice corrosion, and MIC	Closed-cycle cooling water system	Water Chemistry Control (B.1.30)	Consistent with GALL, which recommends no further evaluation (See Section 3.3.2.1)
Cranes including bridge and trolleys and rail system in load handling system (Item Number 3.3.1-16)	Loss of material due to general corrosion and wear	Overhead heavy load and light load handling system	Structures Monitoring - Structures Monitoring (B.1.27)	Consistent with GALL, which recommends no further evaluation (See Section 3.3.2.1)
Components in or serviced by open-cycles cooling water systems (Item Number 3.3.1-17)	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	Water Chemistry Control (B.1.30)	Consistent with GALL, which recommends no further evaluation (See Section 3.3.2.1)

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Buried piping and fittings (Item Number 3.3.1-18)	Loss of material due to general, pitting, and crevice corrosion, and MIC	Buried piping and tanks surveillance or Buried piping and tanks inspection	Buried Piping Inspection (B.1.4)	Consistent with GALL, which recommends no further evaluation (See Section 3.3.2.1) Consistent with GALL, which recommends further evaluation (3.3.2.2.11)
Components in compressed air system (Item Number 3.3.1-19)	*Loss of material due to general and pitting corrosion*	*Compressed air monitoring*		Consistent with GALL, which recommends no further evaluation (See Section 3.3.2.1)
Components (doors and barrier penetration seals) and concrete structures in fire protection (Item Number 3.3.1-20)	Loss of material due to wear; hardening and shrinkage due to weathering	Fire protection	Fire Protection (B.1.10)	Consistent with GALL, which recommends no further evaluation (See Section 3.3.2.1)
Components in water-based fire protection (Item Number 3.3.1-21)	Loss of material due to general, pitting, crevice, and galvanic corrosion, MIC, and biofouling	Fire water system	Fire Protection (B.1.10)	Consistent with GALL, which recommends no further evaluation (See Section 3.3.2.1)
Components in diesel fire system (Item Number 3.3.1-22)	Loss of material due to galvanic, general, pitting, and crevice corrosion	Fire protection and fuel oil chemistry	Diesel Fuel Monitoring (B.1.7) and Fire Protection (B.1.10)	Consistent with GALL, which recommends no further evaluation (See Section 3.3.2.1)
Tanks in diesel fuel oil system (Item Number 3.3.1-23)	Loss of material due to general, pitting, and crevice corrosion	Aboveground carbon steel tanks	System Walkdown (B.1.28)	Consistent with GALL, which recommends no further evaluation (See Section 3.3.2.1)
Closure bolting (Item Number 3.3.1-24)	Loss of material due to general corrosion; crack initiation and growth due to cyclic loading and SCC	Bolting integrity	Bolting and Torquing Activities (B.1.2)	Consistent with GALL, which recommends no further evaluation (See Section 3.3.2.1)

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Components (aluminum bronze, crass, cast iron, cast steel) in open-cycle and closed-cycle cooling water systems, and ultimate heat sink (Item Number 3.3.1-29)	Loss of material due to selective leaching	Selective leaching of materials	Service Water Integrity (B.1.24), Periodic and Preventive Surveillance (B.1.18), Water Chemistry Control (B.1.30)	Consistent with GALL, which recommends no further evaluation (See Section 3.3.2.1)
Fire barriers, walls, ceilings, and floors in fire protection (Item Number 3.3.1-30)	Concrete cracking and spalling due to freeze-thaw, aggressive chemical attack, and reaction with aggregates; loss of material due to corrosion embedded steel	Fire protection and structures monitoring	Fire Protection (B.1.10)	Consistent with GALL, which recommends no further evaluation (See Section 3.3.2.1)

The staff's review of the ANO-2 auxiliary system and associated components followed one of several approaches. One approach, documented in Section 3.3.2.1 of this SER, involves the staff's audit and review of the AMR results for components in the auxiliary system that the applicant indicated are consistent with the GALL Report and do not require further evaluation. Another approach, documented in Section 3.3.2.2 of this SER, involves the staff's audit and review of the AMR results for components in the auxiliary system that the applicant indicated are consistent with the GALL Report and for which further evaluation is recommended. A third approach, documented in Section 3.2.2.3 of this SER, involves the staff's technical review of the AMR results for components in the auxiliary system that the applicant indicated are not consistent with the GALL Report, or are not addressed in the GALL Report. Section 3.0.3 of this SER documents the staff's review of the AMPs that are credited to manage or monitor aging effects of the auxiliary system components.

3.3.2.1 AMR Results That Are Consistent with the GALL Report

<u>Summary of Technical Information in the Application</u>

In Sections 3.3.2.1.1 through 3.3.2.1.11 of the LRA, the applicant identified the materials, environments, and aging effects requiring management. The applicant identified the following programs that manage the aging effects related to the auxiliary system components:

- Boric Acid Corrosion Prevention Program
- System Walkdown Program
- Water Chemistry Control Program
- Bolting and Torquing Activities Program
- Buried Piping Inspection Program
- Fire Protection Program
- Oil Analysis Program

- Wall Thinning Monitoring Program
- Heat Exchanger Monitoring Program
- Periodic Surveillance and Preventive Maintenance Program
- Diesel Fuel Monitoring Program
- Service Water Integrity Program
- Flow-Accelerated Corrosion Program

Staff Evaluation

In Tables 3.3.2-1 through 3.3.2-11 of the LRA, the applicant summarized the AMRs for the auxiliary systems and identified which AMRs it considered to be consistent with the GALL Report.

The staff conducted an audit of the information provided in the LRA and program bases documents, which are available at the applicant's engineering office. On the basis of its audit, the staff finds that the AMR results, which the applicant claimed to be consistent with the GALL Report, are consistent with the AMRs in the GALL Report. Therefore, the staff finds that the applicant identified the applicable aging effects and they are appropriate for the combination of materials and environments listed.

For component groups evaluated in the GALL Report for which the applicant has claimed consistency with the GALL Report, and for which the GALL Report does not recommend further evaluation, the staff performed an audit and review to determine whether the GALL Report evaluation bounded the plant-specific components contained in these GALL Report component groups.

The applicant provided a note for each AMR line item. The notes describe how the information in the tables aligns with the information in the GALL Report. The staff audited those AMRs with Notes A through E, which indicate the AMR is consistent with the GALL Report.

Note A indicates that the AMR line item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP is consistent with the AMP identified in the GALL Report. The staff audited these line items to determine consistency with the GALL Report and the validity of the AMR for the site-specific conditions.

Note B indicates that the AMR line item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The staff audited these line items to determine consistency with the GALL Report. The staff determined that it had reviewed and accepted the identified exceptions to the GALL AMPs. The staff also determined whether the AMP identified by the applicant is consistent with the AMP identified in the GALL Report and whether the AMR is valid for the site-specific conditions.

Note C indicates that the component for the AMR line item is different but consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP is consistent with the AMP identified by the GALL Report. This note indicates that the applicant could not find a listing of some system components in the GALL Report. However, the applicant identified a different component in the GALL Report that has the same material, environment, aging effect, and AMP as the component that was under review. The staff audited these line items to determine consistency with the GALL Report. The staff also determined whether the AMR line item of the different component applies to the component under review and whether the AMR is valid for the site-specific conditions.

Note D indicates that the component for the AMR line item is different but consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The staff audited these line items to determine consistency with the GALL Report. The staff determined that the AMR line item of the different component applies to the component under review. The staff determined that it had reviewed and accepted the identified exceptions to the GALL AMPs. The staff also determined whether the AMP identified by the applicant is consistent with the AMP identified in the GALL Report and whether the AMR is valid for the site-specific conditions.

Note E indicates that the AMR line item is consistent with the GALL Report for material, environment, and aging effect, but a different AMP is credited. The staff audited these line items to determine consistency with the GALL Report. The staff also determined whether the identified AMP would manage the aging effect consistent with the AMP identified by the GALL Report and whether the AMR is valid for the site-specific conditions.

The staff conducted an audit and review to confirm the applicant's claim that certain identified AMRs are consistent with the staff-approved AMRs in the GALL Report. The staff reviewed the information provided in the LRA and program bases documents, which were available at the applicant's engineering office. The staff did not repeat its review of the matters described in the GALL Report. However, the staff did determine that the material presented in the LRA was applicable and that the applicant had identified the appropriate GALL AMRs. The staff evaluation is discussed below.

3.3.2.1.1 Loss of Material Due to General, Pitting, Crevice, and Microbiologically Influenced Corrosion

The staff reviewed Table 3.3.1, Item Number 3.3.1-15, and associated AMRs consistent with the GALL Report.

The applicant stated that it uses the plant-specific periodic surveillance and preventive maintenance (PSPM) program (AMP B.1.18) to manage loss of material for heat exchanger (bonnet and shell) components exposed to treated water of the emergency diesel generator system. The staff's evaluation of the PSPM program is documented in Section 3.0.3.3.7 of this SER. The staff found that the use of the PSPM program in lieu of the auxiliary systems water chemistry control program (AMP B.1.30.1) is not adequate for the carbon steel components of the emergency diesel generator and alternate AC diesel generator systems that are exposed internally to treated water. The PSPM program's emergency diesel generator maintenance inspections detect aging effects but do not sample or control water chemistry to manage aging effects. The auxiliary systems water chemistry control program, evaluated in Section 3.0.3.3.11 of this SER, controls and monitors water chemistry in addition to performing sampling and analyses on the emergency diesel generator cooling water system.

By letter dated March 24, 2004, the applicant stated that the auxiliary systems water chemistry control program applies to the emergency diesel generator heat exchanger bonnet and shell in treated water (page 3.3-51 of the LRA) rather than the PSPM program. Subsequently, by letter dated May 19, 2004, the applicant committed, in response to Question B.1.30.1-6, to update the UFSAR supplement LRA Section A.2.1.31 to reflect industry guidance used for auxiliary systems water chemistry control program (AMP B.1.30.1). This is now consistent with the GALL Report, and on that basis the staff finds it acceptable.

3.3.2.1.2 Loss of Material Due to General, Pitting, Crevice, and Microbiologically Influenced Corrosion and Biofouling; Buildup of Deposit Due to Biofouling

The staff reviewed Table 3.3.1, Item Number 3.3.1-17, the AMP descriptions in the LRA, and the associated AMRs consistent with the GALL Report.

The applicant stated that it uses the plant-specific, periodic surveillance and preventive maintenance program (AMP B.1.18) to manage this aging effect. The staff's evaluation of the PSPM program is documented in Section 3.0.3.3.7 of this SER. The staff found that the use of the PSPM program in lieu of the service water integrity program (AMP B.1.24) is not acceptable for managing the loss of material aging effect for emergency diesel generator heat exchanger bonnets in a fresh, raw water environment.

By letter dated March 24, 2004, the applicant stated that the PSPM program manages loss of material for the emergency diesel generator heat exchanger bonnet in fresh raw water (page 3.3-51 of the LRA) in Table 3.3.2-3 through periodic internal inspections during emergency diesel generator overhauls. The applicant further stated that, in addition to the periodic surveillance and preventive maintenance program, the service water integrity program is conservatively included as an AMP since it provides additional aging management of this component. The evaluation of this program is discussed in Section 3.0.3.2.7 of this SER. On the basis of the review of the service water integrity program and the applicant's response, the staff finds this acceptable.

On the basis of its audit and review, the staff determined that for all other AMRs not requiring further evaluation, as identified in the Table 3.3.1 (Table 1), the applicant's references to the GALL Report are acceptable and no further staff review is required.

Conclusion

The staff has evaluated the applicant's claim of consistency with GALL Report. The staff also has reviewed information pertaining to the applicant's consideration of recent operating experience and proposals for managing associated aging effects. On the basis of its review, the staff finds that the AMR results, which the applicant claimed to be consistent with the GALL Report, are consistent with the AMRs in the GALL Report. Therefore, the staff finds that the applicant has demonstrated that the effects of aging for these components can be adequately managed so that their intended function(s) can be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

On the basis of its audit and review, the staff concludes that the applicant has demonstrated that the effects of aging can be adequately managed so that the intended function(s) can be maintained consistent with the CLB for the period of extended operation, as required by

10 CFR 54.21(a)(3).

3.3.2.2 AMR Results That Are Consistent with the GALL Report, for Which Further Evaluation Is Recommended

Summary of Technical Information in the Application

In Section 3.3.2.2 of the LRA, the applicant provided further evaluation of aging management as recommended by the GALL Report for auxiliary systems. The applicant provided information concerning how it will manage the following aging effects:

- loss of material due to general, pitting, and crevice corrosion
- hardening and cracking or loss of strength due to elastomer degradation or loss of material due to wear
- cumulative fatigue damage
- crack initiation and growth due to cracking or stress-corrosion cracking
- loss of material due to general, microbiologically influenced, pitting, and crevice corrosion
- loss of material due to general, galvanic, pitting, and crevice corrosion
- loss of material due to general, pitting, crevice, and microbiologically influenced corrosion and biofouling
- quality assurance for aging management of nonsafety-related components
- crack initiation and growth due to stress-corrosion cracking and cyclic loading
- reduction of neutron-absorbing capacity and loss of material due to general corrosion
- loss of material due to general, pitting, crevice, and microbiologically influenced corrosion

Staff Evaluation

For component groups evaluated in the GALL Report for which the applicant has claimed consistency with the GALL Report, and for which the GALL Report recommends further evaluation, the staff reviewed the applicant's evaluation to determine whether it adequately addressed the issues in need of further evaluation. In addition, the staff audited the applicant's additional evaluations against the criteria contained in Section 3.3.2.2 of the Standard Review Plan for License Renewal. The audit report issued August 19, 2004, documents the details of the staff's audit.

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

In Section 3.3.2.2.1 of the LRA, the applicant addressed loss of material in components of the spent fuel pool system.

Section 3.3.2.2.1 of the SRP-LR states that 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 and cleanup. The Water Chemistry Program relies on monitoring and control of reactor water chemistry based on the EPRI guidelines of TR-105714 for primary water chemistry and TR-102134 for secondary water chemistry to manage the effects of loss of material due to 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, the applicant should assess the effectiveness of the Chemistry Control Program to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to manage loss of material due to general, pitting, and crevice corrosion to assess the effectiveness of the Water Chemistry Program. A one-time inspection of selected components at susceptible locations is an acceptable method for ensuring that corrosion is not occurring and that the components' intended function will be maintained during the period of extended operation. No loss of material aging effects are observed for stainless steel components exposed to air.

Further, Section 3.3.2.2.1 of the SRP-LR states that 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 and cleanup system. The Water Chemistry Program relies on monitoring and control of reactor water chemistry based on the EPRI guidelines of TR-105714 for primary water chemistry and TR-102134 for secondary water chemistry to manage the effects of loss of material due to pitting or crevice corrosion. However, high concentrations of impurities at crevices and locations of stagnant flow conditions could cause pitting or crevice corrosion. Therefore, the applicant should evaluate the effectiveness of the Chemistry Control Program to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to manage loss of material due to pitting and crevice corrosion to evaluate the effectiveness of the Water Chemistry Program. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

The applicant stated that the portion of the spent fuel pool system that supplies emergency makeup is subject to an AMR, and the applicant credited the Primary and Secondary Water Chemistry Control Program (AMP B.1.30.3) with managing loss of material. The staff reviewed the Primary and Secondary Water Chemistry Control Program and documented its evaluation in Section 3.0.3.1 of this SER. The Water Chemistry Control Program, in conjunction with anticipated future maintenance activities, provides for the inspection of systems when they are opened for maintenance, which addresses the verification program recommendation in the GALL Report. The Water Chemistry Control Program is credited with managing loss of material for stainless steel components in this portion of the spent fuel pool system that are exposed to borated treated water. This is consistent with the GALL Report and acceptable to the staff.

3.3.2.2.2 Hardening and Cracking or Loss of Strength due to Elastomer Degradation or Loss of Material due to Wear

In Section 3.3.2.2.2 of the LRA, the applicant addressed the potential for degradation of elastomers in collars and seals in spent fuel cooling systems and ventilation systems.

Section 3.3.2.2.2 of the SRP-LR states that hardening and cracking due to elastomer degradation could occur in elastomer linings of the filter, valve, and ion exchangers in spent fuel pool cooling and cleanup systems. Hardening and loss of strength due to elastomer degradation could occur in the collars and seals of the duct and in the elastomer seals of the filters in the control room area, auxiliary and radwaste area, and primary containment heating ventilation systems and in the collars and seals of the duct in the diesel generator building ventilation system. Loss of material due to wear could occur in the collars and seals of the duct in the ventilation systems. The GALL Report recommends further evaluation to ensure adequate management of these aging effects.

The applicant stated that the portion of the spent fuel pool system that is subject to an AMR contains no elastomers. The applicant stated that for the ventilation systems, it uses the plant-specific Periodic Surveillance and Preventive Maintenance Program (AMP B.1.18) to manage degradation of elastomers. The staff reviewed this program and concludes that it is acceptable. Section 3.0.3.3.7 of this SER documents this evaluation.

The applicant further stated that for other systems, the PSPM Program, supplemented by the Fire Protection Program (AMP B1.10), manages elastomer degradation. The staff reviewed the Fire Protection Program, as documented in Section 3.0.3.2.5 of this SER.

The staff finds that the PSPM Program is an acceptable program for managing cracking and change in material properties for elastomer expansion joints and flex hose in the alternate ac diesel generator system and the fuel oil system exposed to outdoor air and air expansion joints associated with control room and auxiliary building heating, ventilation, and air conditioning (HVAC) systems. However, Section 3.3.2.2.2 of the LRA states, "Elastomers are used in other [other than spent fuel pool and ventilation systems] systems. For these systems, management of elastomer degradation is provided by the PSPM program supplemented by the fire protection program." Based on this statement, the staff finds that the PSPM Program should be supplemented by the Fire Protection Program for elastomers in the alternate ac diesel generator and water suppression fire protection systems.

By letter dated March 24, 2004, the applicant stated that for these systems, the PSPM Program, supplemented by the Fire Protection Program, manages elastomer degradation. The words "supplemented by" mean that for fire protection elastomers, the Fire Protection Program is used instead of the PSPM Program. The staff finds assignment of these AMRs to the Fire Protection Program to be acceptable.

3.3.2.2.3 Cumulative Fatigue Damage

As stated in the SRP-LR, fatigue is a TLAA as defined in 10 CFR 54.3. The TLAAs must be evaluated in accordance with 10 CFR 54.21(c)(1). Section 4.3 of this SER documents the staff's review of the applicant's evaluation of this TLAA. In performing this review, the staff followed the guidance in Section 4.3 of the SRP-LR.

3.3.2.2.4 Crack Initiation and Growth due to Cracking or Stress-Corrosion Cracking

In Section 3.3.2.2.4 of the LRA, the applicant addressed the potential for cracking in the high-pressure pumps of the CVCS.

Section 3.3.2.2.4 of the SRP-LR addresses crack initiation and growth due to cracking in the high-pressure pump in the CVCS. The GALL Report recommends further evaluation to ensure that these aging effects are adequately managed.

In the ESF section of the GALL Report, Volume 2, Item V.D.1.1-a, the management of stainless steel components performing a pressure boundary function is addressed by using the Water Chemistry Program. The applicant stated that it uses the Primary and Secondary Water Chemistry Control Program (AMP B.1.30.3) to manage cracking and SCC of these stainless steel components. Section 3.0.3.1 of this SER documents the staff's review of the Primary and Secondary Water Chemistry Control Program. The program is consistent with the GALL Report and therefore acceptable to the staff.

3.3.2.2.5 Loss of Material due to General, Microbiologically Influenced, Pitting, and Crevice Corrosion

In Section 3.3.2.2.5 of the LRA, the applicant addressed the loss of material due to corrosion that could occur on internal and external surfaces of components exposed to air and the associated range of atmospheric conditions.

Section 3.3.2.2.5 of the SRP-LR states that loss of material due to general, pitting, and crevice corrosion could occur in the piping and filter housing and supports in the control room area, in the auxiliary and radwaste area, in the primary containment heating and ventilation systems, in the piping of the diesel generator building ventilation system, in the aboveground piping and fittings, valves, and pumps in the diesel fuel oil system, and in the diesel engine starting air, combustion air intake, and combustion air exhaust subsystems in the emergency diesel generator system. Loss of material due to general, pitting, crevice, and MIC could occur in the duct fittings, access doors, and closure bolts, equipment frames and housing of the duct. Loss of material due to pitting and crevice corrosion could occur in the heating/cooling coils of the air handler heating/cooling, and loss of material due to general corrosion could occur on the external surfaces of all carbon steel SCs, including bolting exposed to operating temperatures less than 212 °F in the ventilation systems. The GALL Report recommends further evaluation to ensure adequate management of these aging effects.

The applicant credited the System Walkdown Program (AMP B.1.28) for managing loss of material of carbon steel components in the spent fuel pool, emergency diesel generator, alternate ac diesel generator, fuel oil, water suppression fire protection, service water, and the control room and auxiliary building HVAC systems for external and internal surfaces exposed to air and outdoor air. The staff reviewed the System Walkdown Program and concludes that it is acceptable. Section 3.0.3.3.9 of this SER documents its evaluation.

The applicant stated that it uses the plant-specific PSPM Program (AMP B.1.18) to manage loss of material for the external surfaces of emergency diesel generator and alternate Ac diesel generator system carbon steel components with internal exposure to exhaust gas, treated and untreated air, outdoor air, and the control room and auxiliary building HVAC systems. The

PSPM Program is also used for managing loss of material of carbon steel components in an external environment of air in the Halon fire protection and reactor coolant pump motor oil leakage collection system. The staff reviewed the PSPM Program and concludes that it is acceptable. Section 3.0.3.3.7 of this SER documents the staff's evaluation.

The applicant credited the Wall Thinning Monitoring Program (AMP B.1.29) for managing loss of material from the internal surfaces of the emergency diesel generator and alternate AC diesel generator system carbon steel piping, silencer, and tank with internal exposure to exhaust gas and untreated air. The staff reviewed the Wall Thinning Monitoring Program and concludes that it is acceptable. Section 3.0.3.3.10 of this SER documents this evaluation.

3.3.2.2.6 Loss of Material due to General, Galvanic, Pitting, and Crevice Corrosion

In Section 3.3.2.2.6 of the LRA, the applicant addressed further evaluation of programs to manage loss of material in the reactor coolant pump oil collection system to evaluate the effectiveness of the Fire Protection Program.

Section 3.3.2.2.6 of the SRP-LR states that loss of material due to general, galvanic, pitting, and crevice corrosion could occur in tanks, piping, valve bodies, and tubing in the RCP oil collection system in fire protection. The 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 Branch Technical Position 9.5-1 to manage loss of material due to corrosion. However, corrosion may occur at locations where water from washdowns may accumulate. Therefore, the applicant should assess the effectiveness of the program to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to manage loss of material due to general, galvanic, pitting, and crevice corrosion to determine that the effectiveness of the program. A one-time inspection of the bottom half of the interior surface of the tank of the RCP oil collection system 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 applicant stated that it uses the plant-specific Periodic Surveillance and Preventive Maintenance Program (AMP B.1.18) to manage loss of material in lieu of the one-time inspection. Carbon steel components in this system are included in the visual inspection for loss of material and will be monitored for degradation. The staff reviewed the PSPM Program and finds that the program will adequately manage the effects of aging so that the intended functions will be maintained. Section 3.0.3.3.7 of this SER documents its evaluation.

3.3.2.2.7 Loss of Material due to General, Pitting, Crevice, and Microbiologically Influenced Corrosion and Biofouling

In Section 3.3.2.2.7 of the LRA, the applicant addressed further evaluation of programs to manage loss of material in the diesel fuel oil system to determine the effectiveness of the diesel fuel monitoring program.

Section 3.3.2.2.7 of the SRP-LR states that loss of material due to general, pitting, and crevice corrosion, MIC, and biofouling could occur in the internal surface of tanks in the diesel fuel oil system and due to general, pitting, and crevice corrosion and MIC in the tanks of the diesel fuel oil system in the EDG system. The existing AMP relies on the fuel oil chemistry program for 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 chemistry control program should be performed to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to manage corrosion/biofouling to determine the effectiveness of the program. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

The applicant stated that it uses the diesel fuel monitoring program (AMP B.1.7) to manage loss of material for the diesel fuel oil system. This program also provides for the periodic inspection of the fuel oil tanks, which addresses the one-time inspection recommendation in the GALL Report.

The staff reviewed the diesel fuel monitoring program and finds that the program will adequately manage the effects of aging so that the intended functions will be maintained. Its evaluation is documented in Section 3.0.3.1 of this SER.

3.3.2.2.8 Quality Assurance for Aging Management of Nonsafety-Related Components

Section 3.0.4 of this SER provides a separate evaluation of the applicant's Quality Assurance Program.

3.3.2.2.9 Crack Initiation and Growth due to Stress-Corrosion Cracking and Cyclic Loading

In Section 3.3.2.2.9 of the LRA, the applicant addressed further evaluation of programs to manage cracking in the CVCS to determine the effectiveness of the Water Chemistry Control Program.

Section 3.3.2.2.9 of the SRP-LR states that 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 CVCS. The Water 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 applicant should determine the effectiveness of the Chemistry Control Program to ensure that crack initiation and growth are not occurring. The GALL Report recommends further evaluation to manage crack initiation and growth due to SCC and cyclic loading for these systems to determine the effectiveness of the Water Chemistry Program. A one-time inspection of selected components and susceptible locations is an acceptable method to ensure that crack initiation and growth are not occurring and that the component's intended function will be maintained during the period of extended operation.

The GALL Report recommends that the Water Chemistry Program be augmented by determining the absence of cracking due to SCC and cyclic loading, or loss of material due to pitting and crevice corrosion. The GALL Report states that an acceptable verification program should include temperature and radioactivity monitoring of the shell-side water and eddy-current testing of tubes.

The applicant credited the Primary and Secondary Water Chemistry Control Program (AMP B.1.30.3) with minimizing cracking in the heat exchangers and providing for the inspection of systems when they are opened for maintenance. This inspection of opened systems is used to address the verification program recommendation in the GALL Report. The staff reviewed the Primary and Secondary Water Chemistry Control Program and concludes that it is acceptable. Section 3.0.3.1 of this SER documents its evaluation.

Because the GALL Report recommends the Water Chemistry Control Program for managing SCC and cyclic loading, supplemented by a plant-specific program, the staff finds the use of the Primary and Secondary Water Chemistry Control Program acceptable. The inspection of these heat exchangers whenever they are opened for maintenance is an acceptable substitute for the one-time inspection of susceptible locations.

3.3.2.2.10 Reduction of Neutron-Absorbing Capacity and Loss of Material due to General Corrosion

In Section 3.3.2.2.10 of the LRA, the applicant addressed reduction of neutron-absorbing capacity and loss of material due to general corrosion, which could occur in the neutron-absorbing sheets of the spent fuel storage rack in the spent fuel storage.

Section 3.3.2.2.10 of the SRP-LR states that 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 in the spent fuel storage. The GALL Report recommends further evaluation to ensure that these aging effects are adequately managed.

The applicant stated that it does not credit the sheets of neutron-absorbing materials affixed to the spent fuel racks with neutron absorption and stated that ANO-2 components are not subject to this aging effect. Because the sheets of the neutron-absorption materials affixed to the spent fuel racks are not credited with neutron absorption, the staff finds that this aging effect is not applicable to ANO-2.

3.3.2.2.11 Loss of Material due to General, Pitting, Crevice, and Microbiologically Influenced Corrosion

In Section 3.3.2.2.11 of the LRA, the applicant addressed the potential for loss of material in buried piping of the service water and diesel fuel oil systems.

Section 3.3.2.2.11 of the SRP-LR states that 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 (SW system) and in the diesel fuel oil system. The Buried Piping and Tanks Inspection Program relies on industry practice, frequency of pipe excavation, and operating experience to manage the effects of loss of material due to general, pitting, and crevice corrosion and MIC. The effectiveness of the Buried Piping and Tanks Inspection Program should be reviewed to evaluate an applicant's inspection frequency and operating experience with buried components, thus ensuring that loss of material is not occurring.

The applicant credited the Buried Piping Inspection Program (AMP B.1.4) with managing loss of material for buried components of the service water and diesel fuel oil systems. This is consistent with GALL AMP XI.M34, "Buried Piping Inspection." The staff reviewed the applicant's operating history and found that the frequency of pipe excavation was sufficient to manage the effects of loss of material. The staff reviewed the Buried Piping Inspection Program and concludes that it is acceptable. Section 3.0.3.2.2 of this SER documents its evaluation.

Conclusion

On the basis of its review, for component groups evaluated in the GALL Report for which the applicant has claimed consistency with the GALL Report, and for which the GALL Report recommends further evaluation, the staff determined that the applicant has adequately addressed the issues that it further evaluated. In addition, the staff reviewed the applicant's additional evaluations against the criteria contained in Section 3.3.2.2 of the SRP-LR. The staff finds that the applicant has demonstrated that it can adequately manage the effects of aging so that the intended functions can be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3 AMR Results That Are Not Consistent with the GALL Report

Summary of Technical Information in the Application

In Tables 3.3.2-1 through 3.3.2-11 of the LRA, the applicant gave additional details of the results of the AMRs for material, environment, aging effects requiring management, and AMP combinations that are not consistent with the GALL Report.

In Tables 3.3.2-1 through 3.3.2-11, the applicant indicated, via Notes F through J, that neither the identified component nor the material and environment combination is evaluated in the GALL Report and provided information concerning how it will manage the aging effects requiring management.

Note F indicates that the material is not in the GALL Report for the identified component.

Note G indicates that the environment is not in the GALL Report for the identified component and material.

Note H indicates that the aging effect is not in the GALL Report for the component, material, and environment combination.

Note I indicates that the aging effect in the GALL Report for the identified component, material, and environment combination is not applicable.

Note J indicates that neither the identified component nor the material and environment combination is evaluated in the GALL Report.

For component type, material, and environment combination that are not evaluated in the GALL Report, the staff reviewed the applicant's evaluation to determine whether the applicant had demonstrated that the effects of aging will be adequately managed so that the intended function will be maintained consistent with the CLB during the period of extended operation.

Staff Evaluation

3.3.2.3.0 General RAIs on AMR Issues

By letter dated May 5, 2004, the staff requested the applicant to provide additional information on the issues described in the following general RAIs. By letters 2CAN060402 and 2CAN060404 dated June 21, 2004, the applicant responded to these RAIs. These RAIs, the applicant's responses and the staff's evaluation of the responses are described below.

Cracking Fatigue (RAI 3.3-1)

LRA Tables 3.3.2-5 and 3.3.2-11 identify cracking-fatigue as an aging effect requiring aging management, but LRA Section 4.3.2 states that, "Engineering evaluations identified no non-class 1 pressure vessels, heat exchangers, storage tanks or pumps requiring evaluation for thermal fatigue." The applicant credits the periodic surveillance and preventive maintenance program for managing this aging effect in the CVCS pump casing and the system walkdown aging management program for various components in miscellaneous systems in scope for 10CFR54.4(a)(2). The applicant was requested to clarify the type of fatigue managed by these inspections, the basis for these inspections in lieu of a TLAA and explain how the inspections are effective in detecting internal cracks prior to loss of the intended function, including operating experience.

By letter dated June 21, 2004, the applicant responded by providing the following information:

Type of Fatigue (Part 1)

The applicant stated that, for the CVCS pump casing (charging pumps), as identified in LRA Table 3.3.2-5, cracking due to high-cycle fatigue (as a result of deflection of the plunger cap during a pump cycle) is the aging effect identified. For the components in miscellaneous systems in scope for 10CFR54.4(a)(2), as identified in LRA Table 3.3.2-11, the aging effect managed is cracking due to thermal fatigue.

Basis for Inspections in Lieu of a TLAA (Part 2)

In reference to Table 3.3.2-5, the applicant stated that cracking of the charging pump plunger cap (pump casing) was discovered during plant operation and documented in the Corrective Action Program. Neither an analysis involving time-limited assumptions defined by the current operating term nor a requirement for such an analysis was found for this condition during the identification of TLAAs for license renewal. Components in LRA Table 3.3.2-11 are generally nonsafety-related components designed in accordance with American Society of Mechanical Engineers B.31.1 with an implicit analysis limit of 7000 thermal cycles. Cracking due to thermal fatigue was conservatively identified as an aging effect requiring management although it is not expected to occur. If cracking due to thermal fatigue were to occur, the System Walkdown Program would manage this aging effect as described in part 3 of this response.

Effectiveness of Inspections (Part 3)

The applicant stated that, for the charging pump plunger cap, a preventive maintenance task exists to disassemble and inspect the charging pumps and plungers. Operating experience has shown this inspection to be effective in identifying the effects of aging prior to loss of system function. For components in LRA Table 3.3.2-11, system walkdowns detect leakage and spray from liquid-filled systems. Industry operating experience has shown that age-related failures of nonsafety-related structures, systems, and components, (SSCs) containing steam or liquid that could prevent safety-related components from accomplishing their safety function have only occurred as a result of loss of material due to flow-accelerated corrosion (FAC), which is managed by the FAC Program. Leakage from causes other than FAC has been limited in extent such that it has been identified and corrected through normal operational activities or system walkdowns prior to loss of system functions. For further information on how the System Walkdown Program is effective in managing this aging effect see response to RAI 3.3.2.4.11-1.

Staff Evaluation of the Applicant's Response

The staff reviewed the applicant's response to RAI 3.3-1 and determined that the applicant's response does not completely resolve the staff's concerns. However, in general, the staff found the applicant's response adequate and acceptable because the applicant has identified the type of fatigue, the basis for inspections rather than a TLAA and information to support the effectiveness of the inspections.

The staff found that the high-cycle fatigue identified by the applicant as applicable to the charging pumps due to deflection of the plunger cap during a pump cycle to be appropriate for a reciprocating type pump. The staff also found that thermal fatigue identified by the applicant for miscellaneous systems in scope of 10CFR54.4(a)(2) to be appropriate on the basis that thermal fatigue is addressed in the ASME codes for systems that experience thermal cycles.

In regard to the basis for inspections rather than a TLAA for these components, the staff found the applicant response adequate and acceptable in that a requirement does not exist in the ASME codes of record for the charging pump casing or ASME B31.1 piping. Therefore, periodic inspections are considered to be appropriate in lieu of a TLAA to manage fatigue-cracking in these components.

The staff found that the information submitted to support the effectiveness of the charging pump inspections to be adequate and acceptable. The staff considers the identified maintenance tasks to disassemble and inspect the charging pumps and plungers to be appropriate for managing fatigue-cracking. However, the operating experience submitted by the applicant response to support the effectiveness of the Walkdown Program to manage fatigue-cracking in miscellaneous systems in scope for 10CFR54.4(a)(2) by visual inspections for leakage is not sufficient and requires additional basis for acceptability. This concern is addressed under RAI 3.3.2.4.11-1

The staff was also concerned that the Periodic Surveillance and Preventive Maintenance Program (PSPM) and AMR Table 3.3.2-5 do not address fatigue cracking in the charging pump bolting and the PSPM does not address fatigue-cracking in the casing. The staff identified this as potential open item and requested the applicant to clarify how the PSPM or other aging management program manages fatigue cracking in the charging pump casing and bolting.

By letter dated September 10, 2004, the applicant identified that, although cracking due to fatigue of the charging pump block was not identified as a likely failure mechanism, the pump block will be periodically inspected for indications of cracking. The applicant clarified that during maintenance inspections, plunger caps and blocks are visually inspected for indications of cracking and indications of cracking results in additional non-destructive examination (such as dye penetrant tests) and replacement of the affected component if cracking is confirmed. In this letter the applicant also explained that cracking of bolting due to high cycle fatigue is not a concern for license renewal since it would be discovered during the current license period in most cases where systems are frequently operated. The applicant response also stated that there have been no instances of pump casing bolting requiring replacement due to cracking or other defects. The applicant further identified that during regular pump maintenance (each pump has historically been repacked two to three times a year), bolting is inspected for defects. The applicant clarified that evidence of cracking would be detected during these inspections.

The applicant's response is adequate and acceptable to resolve the staff's concern because the applicant has clarified that maintenance inspections of the charging pump will detect fatigue-cracking in the pump block and, although most cases of high cycle fatigue would be detected during the current license period, evidence of fatigue-cracking in bolting would be detected by bolting inspections during regular pump maintenance. All issues related to RAI 3.3-1 are resolved.

<u>Chemistry Control Programs and Verification Inspections (RAI 3.3-2)</u>

The LRA aging management evaluation credits the water chemistry control program for managing aging effects for various components in the auxiliary systems, but it is not clear which specific subprogram is used to manage each component. The applicant was requested to clarify which subprogram manages each auxiliary system component. The applicant was also requested to identify any additional inspection programs such as one-time inspections, to determine the effectiveness of the chemistry control program. The applicant was further requested to provide a description of the elements of the inspection program as defined in Appendix A.1 of the SRP-LR including details such as inspection methods, how susceptible locations are determined, basis for inspection population and sample size, timing, acceptance criteria including codes and standards, and operating experience. LRA Table B-1 identifies that one-time inspections are not applicable. If periodic inspections are planned rather than one-time inspections, the applicant was requested to identify the frequency. If opportunistic inspections are planned rather than one-time inspections, the applicant was requested to explain how the program assures that the inspections will be completed prior to end of the existing operating license. The applicant was also requested to identify any specific operating experience (i.e.; inspection results) relevant to inspections to determine effective chemistry control in auxiliary systems that demonstrate the effectiveness of the inspection program.

By letter dated June 21, 2004, the applicant responded by providing the following information:
<u>Water Chemistry Control Programs to Manage Aging Effects for Various Components in the Auxiliary Systems (Part a)</u>

Components in Table 3.3.2-1, Spent Fuel Pool System, and Table 3.3.2-5, Chemical and Volume Control System, that list water chemistry control as the program are included in the Primary and Secondary Water Chemistry Control Program.

Components in Table 3.3.2-3, Emergency Diesel Generator (EDG) System, and Table 3.3.2-4, Alternate AC (AAC) Diesel Generator System, that list water chemistry control as the program are included in the Auxiliary Systems Cooling Water Chemistry Control Program.

Components in Table 3.3.2-11, Miscellaneous Systems in Scope for 10CFR54.4(a)(2), that list water chemistry control as the program are included in the program that applies to the system in which the component resides. Since all of the water chemistry control subprograms provide assurance that the aging effect loss of material will be managed such that the applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation, the particular subprogram for a specific component is beyond the level of detail necessary in the table.

Effectiveness of the Water Chemistry Programs (Part b)

The applicant stated that the effectiveness of the water chemistry programs at ANO-2 has been confirmed through routine component inspections that are performed by chemistry, maintenance and engineering personnel. This includes the Primary and Secondary, Closed Cooling, and Auxiliary Systems Water Chemistry Programs. These inspections were performed when primary and secondary systems were opened for maintenance, when an adverse chemistry trend existed, or when requested by the chemistry or engineering departments. The areas inspected have included areas that are susceptible to the aging effects identified in the license renewal application. In addition, for many reactor coolant system components included in the Primary and Secondary Water Chemistry Control Program, inspection activities within other aging management programs provide additional confirmation of chemistry program effectiveness. These other programs include the Inservice Inspection, Alloy 600 Aging Management, Cast Austenitic Stainless Steel Evaluation, Pressurizer Examinations, Reactor Vessel Internals Inspection, and Steam Generator Integrity Programs. Some components, such as heat exchangers, have been inspected periodically providing repetitive evidence that the water chemistry programs are adequately managing aging effects. If, during these inspections significant abnormal conditions were noted, including those that were the result of aging effects such as loss of material and cracking, these conditions would have been documented under the Corrective Action Program. Actions to determine the cause of the condition and corrective actions to prevent recurrence would have then been taken. The Generic Aging Lessons Learned (GALL) One Time Inspection Program XI.M32 focuses on the most susceptible material and environment combinations in the most susceptible locations. Items such as heat exchangers, piping and valves normally in standby, and system low points or stagnant areas are representative of these susceptible locations. At ANO-2, inspections have been performed in systems such as emergency feedwater (EFW) and EDGs which are normally in standby, steam generators, condensate storage tanks, feedwater heaters, moisture separator reheaters, chillers, main steam safety valves, and blowdown heat exchangers. All of these components are made of susceptible materials (stainless and carbon steel) and are exposed to environments (treated water and steam) that would be conducive to aging effects managed by the water chemistry programs.

Many components in the steam generators are inspected under other aging management programs that provide additional assurance that significant degradation is not occurring and that the Primary and Secondary Water Chemistry Control Program is effective. These inspection activities include those contained in the Inservice Inspection and Steam Generator Integrity Programs. The inspection results of steam generator components are also applicable to the main steam, main feedwater and EFW components with the same material and environment combinations.

As additional confirmation of the effectiveness of water chemistry programs, the ANO-2 review of operating experience included a review of condition reports (CRs), CR trending data, and interviews with site personnel regarding water chemistry program operating experience. The operating experience review did not identify component failures or significant adverse conditions that were the result of an ineffective water chemistry program. Also, the CR trending data did not identify recurrent component degradation occurring in the systems covered under this aging management program. The review of CRs, CR trending data, and personnel interviews provided additional confirmation of chemistry program effectiveness.

The combination of inspections under the Inservice Inspection Program, the Steam Generator Integrity Program, and maintenance and routine chemistry inspections as a whole, constitute a more thorough confirmation of water chemistry aging management program effectiveness than could be obtained from one-time inspections of a sample of items.

Staff Evaluation of the Applicant's Response

The staff reviewed the applicant's response to RAI 3.3-2 and determined that the response does not entirely resolve the issues concerning chemistry programs applied to components in miscellaneous systems in part a) of the response and chemistry verification inspections addressed in part b) of the response. The staff identified a potential open item and requested the applicant to clarify whether auxiliary system inspections are limited to opportunistic inspections and explain how the ANO-2 chemistry program verification inspections provide an appropriate sample size required by the GALL one-time inspection program. The applicant was also requested to clarify how the chemistry verification inspections will be completed prior to the period of extended operation. Alternatively, the LRA may identify the application of planned maintenance inspections for auxiliary systems such as the periodic surveillance and preventive maintenance program or the use of future one-time inspections consistent with GALL.

By letter dated August 18, 2004, the applicant clarified that while many auxiliary system inspections are opportunistic, some are performed periodically. The applicant identified specific auxiliary system material and environmental groups crediting the water chemistry control programs and stated that inspections have confirmed the effectiveness of water chemistry control programs in managing the effects of aging on auxiliary system components.

The staff was concerned that the limited sample of auxiliary system components inspected may not have been sufficient to conclude that the effectiveness of the water chemistry programs has been confirmed and additional inspections may be required. The applicant was requested to provide technical justification that an adequate sample size has been or will be selected prior to the period of extended operation on the basis of industry criteria/operating experience.

By letter dated September 10, 2004 the applicant responded that the sample of components is sufficient to conclude that the effectiveness of the water chemistry programs has been confirmed and additional inspections are not required. The applicant stated that a review of maintenance data for the past five years indicates that the number of inspections completed for each group exceeds the minimum number of random samples necessary to obtain a 90% confidence level that aging effects would have been identified, if present. The applicant further stated, "Therefore, the sample of components inspected is sufficient to conclude that the effectiveness of the water chemistry programs has been confirmed and additional inspections are not required."

The staff was concerned that, if no future one-time or periodic inspections are performed, detection of potential aging effects in the future may not be adequately detected or corrected. GALL AMP XI.M32 specifically identifies that the inspection not be scheduled too early in the current operating term, which could raise questions regarding continued absence of aging effects prior to and near the extended period of operation. The applicant was requested to clarify that future chemistry, ISI and maintenance inspections combined with past inspections constitute an adequate sample size to determine chemistry control or provide justification for not performing future inspections close to the end of the current operating license.

By letter dated September 23, 2004, the applicant clarified that maintenance activities are not expected to decline and it is proper to assume that maintenance history is representative of future numbers and diverse locations of anticipated maintenance inspections. The applicant concludes that past chemistry, maintenance and inservice inspections combined with future anticipated inspections constitute an adequate sample size to determine that the water chemistry programs are managing aging effects so that intended functions will be maintained during the period of extended operation.

The staff found the applicant's response to issues concerning chemistry control verifications for auxiliary systems to be adequate and acceptable because the applicant has identified that a combination of past chemistry, maintenance and inservice inspections combined with future anticipated inspections constitute an adequate sample size to determine that the water chemistry programs are managing aging effects so that intended functions will be maintained during the period of extended operation. All issues pertaining to RAI 3.3-2 are resolved.

Inspection Criteria for Flex Hose (RAI 3.3-3)

LRA Tables 3.3.2-3 and 3.2.3-7 state that flex hose exposed to an internal treated water and untreated air environments, and fuel oil environment, respectively, are managed by the periodic surveillance and preventive maintenance program. The description of the periodic surveillance and preventive maintenance program in LRA Section B.1.18 does not identify inspection criteria for the flex hose. The applicant was requested to identify the method of maintenance inspections applied to the flex hose, the frequency of inspections and the technical basis for the inspections. If inspection is limited to the external surfaces, the applicant was requested to justify the basis considering manufacturer's recommendations, industry practices and operating experience. The applicant was also requested to clarify if elastomer hoses used in auxiliary systems are to be replaced at specified intervals according to manufacturer's recommendations and standard industry practice.

By letter dated June 21, 2004, the applicant responded by providing the following information:

> The details on inspection criteria and frequency for the flex hoses that are included in the Periodic Surveillance and Preventive Maintenance Program will be determined prior to entering the period of extended operation. It is expected that a visual inspection of the internal and external surfaces will be performed. However, it may be determined that periodic replacement of the hoses is preferable and inspections will not be performed. None of these hoses are replaced on a specified interval since no replacement frequency was specified by the original manufacturer. If replaced at specific intervals, flex hoses would be considered short-lived and not subject to aging management review.

In their letter dated June 21, 2004 the applicant identified a specific commitment that the details of the inspection criteria and frequency of the flex hoses that are included in the Periodic Surveillance and Preventive Maintenance Program will be determined prior to the period of extended operation. It is expected that a visual inspection of the internal and external surfaces will be performed. However, it may be determined that periodic replacement of the hoses is preferable and inspections will not be performed.

Staff Evaluation of the Applicant's Response

The staff reviewed the applicant's response to RAI 3.3-3 and determined that the response does not entirely resolve the issues concerning inspection criteria for flexible hoses. In a meeting with the applicant on July 20, 2004, the staff requested the applicant to identify criteria for inspection of flexible hoses managed by the periodic surveillance and preventive maintenance program and to identify a commitment to have plant procedures updated prior to the period of extended operation. By letter dated August 18, 2004 the applicant provided the following response:

> As stated in the response to RAI 3.3-3, the PSPM Program will manage the effects of aging on flexible hoses through visual examination of external and internal surfaces. The visual examination looks for evidence of cracking and changes in material properties such as loss of flexibility and embrittlement. The flexibility of the hoses will be verified through manual manipulation of the hose concurrent with visual inspection. If evidence of degradation is detected, the hoses will be replaced. These hoses will be inspected at least once every 10 years. The hoses that credit the PSPM program are in the emergency diesel generator, fuel oil, alternate AC, and nitrogen systems. Procedures and preventive maintenance tasks for the inspection of flex hoses in these systems using the above criteria will be implemented prior to the period of extended operation. Alternatively, periodic replacement of the hose may be implemented in lieu of periodic inspection.

This response is adequate and acceptable because specific inspection criteria and a commitment for implementation were identified to demonstrate that the flexible hoses will be inspected both externally and internally at specified frequencies to provide assurance that the aging effects will be detected and corrected prior to the intended loss of function of the components. All issues related to RAI 3.3-3 are resolved.

Moisture Control in Compressed Air for Diesel Generator Systems (RAI 3.3-4)

LRA Tables 3.3.2-3 and 3.3.2.4 for the emergency diesel generator system and the alternate AC diesel generator system identify treated air and untreated air as an environment for various components in these systems. It is understood that the portions of these systems with treated and untreated air are the starting air subsystems normally containing compressed air. Compressed air systems are susceptible to loss of material due to internal condensation, unless effective measures are provided to remove moisture. Identify any specific operating practices used to remove moisture such as the continuous use of air driers or manually draining air receivers. Also provide justification that the loss of material in the starting air subsystems containing either treated air or untreated air is effectively managed. For example, identify specific operating experience including internal inspection results at susceptible locations.

By letter dated June 21, 2004, the applicant responded by providing the following information:

> The starting air for the AAC diesel in table 3.3.2-4 is specified as treated air since the system contains air dryers. In Table 3.3.2-3 for the EDG, the air is identified as untreated air since there are no air dryers on the system. However, the starting air tanks on the EDGs are drained every month. Loss of material in the starting air system for the AAC diesel will be managed thru the use of periodic maintenance that ensures the proper operation of the air dryers such that significant moisture will not be entrained in the portion of the system that is subject to aging management review. In the starting air system for the EDGs, loss of material will be managed through periodic inspections of the internals of components of the starting air system. As indicated in Table 3.3.2-3, the air receiver tanks for the EDGs are included in the Wall Thinning Monitoring Program. The tanks are the most susceptible locations for loss of material caused by moisture in the system. The operating experience review performed as part of the aging management review did not identify instances of significant corrosion or degradation of components in the starting air systems for the AAC diesel and EDGs.

In their letter dated June 21, the applicant identified a specific commitment that loss of material in the starting air system for the AAC diesel will be managed thru the use of periodic maintenance that ensures the proper operation of the dryers such that significant moisture will not be entrained in the portion of the system that is subject to aging management. In the same letter, the applicant also identified a specific commitment that in the starting air system for the EDGs, loss of material will be managed through periodic inspections of the internals of components of the starting air system.

Staff Evaluation of the Applicant's Response

The staff reviewed the applicant's response to RAI 3.3-4. The staff found the applicant's response to issues concerning moisture control in compressed air for the diesel generator systems to be adequate and acceptable because the applicant has identified specific commitments to manage loss of material in the AAC diesel and EDGs by providing for periodic maintenance of the AAC air dryers and periodic inspections of the internals of the EDG starting air system. The applicant has also performed an operating experience review to confirm that significant corrosion or degradation was not occurring in the starting air systems.

Bolting Integrity in Auxiliary Systems (RAI 3.3-6)

LRA Tables 3.3.2-3, 3.3.2-4 and 3.3.2-7 identify carbon steel bolting in auxiliary systems as subject to loss of mechanical closure integrity and the bolting and torquing activities AMP is credited with managing this aging effect. Note E is applicable to these components and this note states that this is consistent with NUREG-1801material, environment, and aging effect but a different aging management program is credited. LRA AMP B.1.2, bolting and torquing activities, indicates that this program relies on industry recommendations for comprehensive bolting maintenance based on EPRI TR-104213. EPRI report TR-104213 is also referenced in the GALL XI.M18 bolting integrity AMP. For those auxiliary systems with carbon steel bolting associated with Note E, the applicant was requested to clarify if the credited bolting and torquing activities combined with other inspections required by the system walkdown are consistent with the GALL AMP XI.M18 bolting integrity, including periodic inspection of closure bolting for indication of loss of preload with subsequent loss of mechanical closure integrity. If not consistent, the applicant was requested to identify specific exceptions to the GALL AMP and the technical justification for the exceptions.

By letter dated June 21, 2004, the applicant stated that the program described in NUREG-1801, Section XI.M18 covers all bolting within the scope of license renewal including safety-related bolting, bolting for nuclear steam supply system component supports, bolting for other pressure retaining components, and structural bolting. It includes periodic inspection of closure bolting for many aging effects, including loss of preload, cracking, and loss of material. Cracking of non-Class 1 stainless steel bolting is not an aging effect requiring management and loss of material is managed by other programs listed in the LRA. Thus, the plant specific Bolting and Torquing Activities Program, used only to manage loss of mechanical closure integrity, is not comparable to the aging management program XI.M18 of NUREG-1801. In Appendix B of the LRA, the ten attributes of the program were provided to allow for its assessment independent of NUREG-1801 Section XI.M18.

The applicant stated that the System Walkdown Program adequately manages loss of material for closure bolting as described in LRA Section B.1.28. The Bolting and Torquing Activities Program and System Walkdown Program also manage loss of mechanical closure integrity for closure bolting as described in LRA Sections B.1.2 and B.1.28. Visual inspections of bolting for loss of material and loss of mechanical closure integrity in the System Walkdown Program are adequate to assure that the closure bolting can perform its intended function since loss of material (and ultimately loss of mechanical closure integrity) for external surfaces is a long term aging effect that would be observed well before aging progressed to the point of loss of intended function. The Bolting and Torquing Activities Program assures that proper torque values are applied to bolted closures such that loss of mechanical closure integrity as a result of loss of preload due to high temperatures or significant vibration does not occur.

Staff Evaluation of the Applicant's Response

The staff reviewed the applicant's response to RAI 3.3-6. The staff found the applicant's response to issues concerning bolting integrity for auxiliary systems to be adequate and acceptable because the applicant credits more than one program to manage aging effects pertaining to bolting integrity. The System Walkdown Program manages loss of material. The Bolting and Torqing Activities Program manages loss of mechanical closure integrity, including loss of preload. The applicant identified that cracking of non-Class 1 stainless steel bolting is not an aging effect requiring management. This position is consistent with industry experience on the basis of bolting and torquing programs developed in accordance with EPRI guidance. Although the applicant indicated that their Bolting and Torqing Activites Program is not comparable to the aging management program XI.M18 of NUREG-1801, a combination of the Bolting and Torqing Activites Program and the System Walkdown Program manage appropriate aging effects concerning bolting integrity. In addition, NUREG-1801 Appendix XI.M18, states that the bolting integrity programs developed and implemented in accordance with commitments made in response to NRC communications on bolting events have provided an effective means of ensuring bolting reliability.

3.3.2.3.1 Spent Fuel Pool System

Summary of Technical Information in the Application

In Section 3.3.2.1.1 of the LRA, the applicant identified the materials, environments, and aging effects requiring management. The applicant identified the following programs that manage the aging effects requiring management for the spent fuel pool system components:

- Boric Acid Corrosion Prevention Program
- System Walkdown Program
- Water Chemistry Control Program

In Table 3.3.2-1 of the LRA, the applicant summarized the AMRs for the spent fuel pool system components and identified which AMRs it considered to be consistent with the GALL Report.

Staff Evaluation

The staff reviewed Table 3.3.2-1 of the LRA, which summarized the results of AMR evaluations in the SRP-LR for the spent fuel pool system component groups.

The staff reviewed the AMR of the spent fuel pool system component/material/environment/AERM combinations that are not addressed in the GALL report and specific combinations addressed in the GALL report within the scope of technical review. Component AERM combinations not addressed in the GALL report use note F through J in LRA Table 3.3.2-1. The staff confirmed that the applicant has identified all applicable AERMs and has credited appropriate AMPs for managing the AERMs. The staff also reviewed the applicable UFSAR supplements for the AMPs to ensure that the program descriptions adequately describe the AMPs.

Aging Effects

Table 2.3.3-1 of the LRA lists individual system components within the scope of license renewal and subject to aging management review. The component types that do not rely on the GALL report for AMR include bolting, fuel transfer tube, piping, spent fuel racks, and valves.

For these component types, the applicant identifies the following materials, environments, and AERMs:

- Stainless steel components subjected to treated borated water (internal and external) environments are subject to the aging effects of loss of material.

- Stainless steel components exposed to inside air (internal and external) environments experience no aging effect.

- Carbon steel bolting exposed to air and managed by the Boric Acid Corrosion Prevention Program is subject to loss of material.

The staff reviewed the information in Section 2.3.3.1, Table 2.3.3-1, Section 3.3.2.1.1, and Table 3.3.2-1 in the LRA. During its review, the staff determined that additional information was needed to complete its review. The Requests for Additional Information (RAIs) were organized in two groups, general RAIs and system specific RAIs. General RAIs that are applicable to this system include RAI 3.3-2.

By letter dated May 5, 2004, the staff requested the applicant to provide additional information on the issues described in RAI 3.3-2. By letter dated June 21, 2004, the applicant responded to the RAI. The RAI, applicant responses and the staff's evaluation of the responses are described in Section 3.3.2.3.0 of this SER.

By the same letter dated May 5, 2004, the staff requested the applicant to provide additional information on the issues described in the system-specific RAI 3.3.2.4.1-1. By letter dated June 21, 2004, the applicant responded to the RAI. RAI 3.3.2.4.1-1, the responses to this RAI, and the staff's evaluation of the responses are described below:

RAI 3.3.2.4.1-1

LRA Table 3.3.2-1 identifies that, for stainless steel spent fuel racks in a treated borated water environment, cracking is an applicable aging effect requiring aging management. The operating temperature for these environments is not identified. The applicant was requested to clarify why cracking is not a similarly applicable aging effect requiring aging management for the stainless steel fuel transfer tubes in a treated borated water environment.

In its response, by letter dated June 21, 2004, the applicant stated that cracking is not an aging effect requiring management for the stainless steel fuel transfer tube because the treated borated water temperature is maintained less than the 140°F threshold for cracking from stress corrosion and intergranular attack. The applicant clarified that, since spent fuel pool temperature at the spent fuel racks may exceed this threshold, cracking is applicable for the spent fuel racks.

The staff reviewed the applicant's response and found the response to be adequate and adequate because the applicant indicated that for the stainless steel fuel transfer tube the treated borated water temperature is maintained less than the 140°F threshold for cracking from stress corrosion and intergranular attack for stainless steel components.

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 the aging effects of the above spent fuel pool cooling and cleanup system component types that are not addressed in the GALL report and the specific component types that are within the scope of the technical review are consistent with industry experience for these combinations of materials and environments. The staff did not identify any omitted aging effects. Therefore, the staff finds that the applicant has identified the appropriate aging effects for the materials and environments associated with the above components in the spent fuel pool system.

Aging Management Programs

After evaluating the applicant's identification of aging effects for each of the above components, the staff evaluated the AMPs to determine if they are appropriate for managing the identified aging effects. The staff also determined that the UFSAR Supplement adequately describes the program.

LRA Table 3.3.2-1 identifies the following AMPs for managing the aging effects described above for the spent fuel pool system component types:

- Boric Acid Corrosion Prevention Program (Appendix B.1.3)
- System Walkdown Program (Appendix B.1.28)
- Water Chemistry Control Program (Appendix B.1.30)

The staff's detailed review of these AMPs appears in Sections 3.0.3.2.1, 3.0.3.3.9, and 3.0.3.3.11 of this SER, respectively.

The Water Chemistry Control Program is credited for managing loss of material aging effect on the stainless steel components exposed to treated borated water. During its review, the staff determined that additional information was needed to complete its review. The request for additional information is described in RAI 3.3-2. RAI 3.3-2, the applicant's response to this RAI and the staff's evaluation of the responses are described in Section 3.3.2.3.0 of this SER.

The applicant proposed to manage loss of material for stainless steel and nickel-based alloy components exposed to treated, borated water by using only the Primary and Secondary Water Chemistry Control Program (AMP B.1.30.3). The applicant stated that stainless steel components to be managed this way include heat exchanger tubes, orifices, piping, pump casings, thermowells, tubing, and valves. The Water Chemistry Control Program will also manage nozzles made of nickel-based alloy components and the stainless steel cladding of a tank made of carbon steel. The staff reviewed the Primary and Secondary Water Chemistry Control Program and concludes that it is acceptable. Section 3.0.3.1 of this SER documents its evaluation.

The staff reviewed stainless steel and nickel-based alloy components exposed to treated, borated water. The staff concludes that since the effects of pitting and crevice corrosion on stainless steel and nickel-based alloy components are not significant in chemically treated borated water, inspection of selected components to determine the absence of loss of material is not required. Because the Primary and Secondary Water Chemistry Control Program is consistent with the GALL Report, the staff finds this acceptable.

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 the applicant has identified appropriate AMPs for managing the aging effects of the spent fuel pool system component types that are not addressed by the GALL Report and those specific component types addressed in the GALL Report that are within the scope of the technical review. In addition, the staff finds the program descriptions in the UFSAR Supplement acceptable.

Conclusion

On the basis of its review, the staff concludes that the applicant has adequately identified the aging effects and the AMPs credited with managing the aging effects for the spent fuel pool components that are not addressed by the GALL Report and those specific component types within the scope of the technical review, so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable UFSAR Supplement program descriptions and concludes that the UFSAR Supplement adequately describes the AMPs credited with managing aging in these components, as required by 10 CFR 54.21(d).

3.3.2.3.2 Water Suppression Fire Protection System

Summary of Technical Information in the Application

Section 2.3.3.2 of this SER describes the water suppression fire protection system. Tables 3.3.1 and 2.3.3-2 identify the passive, long-lived components of this system that are subject to an AMR. Table 3.3.2-2 provides a summary of the components, aging effects, and AMPs.

Aging Effects

Table 2.3.3-2 of the LRA lists the fire protection components that are within the scope of license renewal and subject to an AMR. These components include air dryer housing, blower housing, bolting, ductwork, expansion joint, filter, filter housing, flex hose, gear housing, governor housing, heat exchanger (housing), heat exchanger (shell), heat exchanger (tubes), heater housing, nozzle, orifice, pipe/fittings, piping, pump casing, tubing, and valve.

In Section 3.3.2.1.2 and Table 3.3.2-2 of the LRA, the applicant identified the materials, environments, and aging effects requiring management. The materials identified are aluminum, carbon steel, cast iron, cast iron with enameline, copper, copper alloys, elastomers, and stainless steel.

The applicant identified the environment to which these materials could be exposed as air, exhaust gas, lube oil, fresh raw water, soil, and treated water.

The applicant identified changes in material properties, cracking, fatigue cracking, fouling, loss of material, wear, and loss of mechanical closure integrity as the aging effects associated with the fire protection system components.

Aging Management Programs

The LRA identifies the following programs that manage the aging effects related to the fire protection system:

- Bolting and Torquing Activities Program (Appendix B.1.2)
- Buried Piping Inspection Program (Appendix B.1.4)
- Fire Protection Program (Appendix B.1.10)
- Oil Analysis Program (Appendix B.1.17)
- System Walkdown Program (B.1.28)

Appendix B to the LRA describes these AMPs. The applicant indicated that these AMPs will adequately manage the effects of aging associated with the components of the fire protection system during the period of extended operation.

Staff Evaluation

The staff reviewed Table 3.3.2-2 of the LRA, which summarized the results of AMR evaluations in the SRP-LR for the water suppression fire protection system component groups.

Aging Effects

The staff reviewed the LRA to determine whether the applicant had demonstrated that the effects of aging for the fire protection system will be adequately managed during the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff reviewed Section 3.3.2.1.2 and Tables 3.3.1 and 3.3.2-2 of the LRA for completeness, consistency with the GALL Report, and industry experience.

For these component types, the applicant identifies the following materials, environments, and AERMs:

- Stainless steel components subjected to air (external) and fresh raw water (internal) environments are subject to the aging effects of loss of material.

- Stainless steel components exposed to inside air (external) environments are subject to the aging effects of loss of mechanical closure integrity.

- Stainless steel components subjected to fresh raw water (external) environments are subject to the aging effects of loss of material

- Carbon steel bolting exposed to air and managed by the Boric Acid Corrosion Prevention Program is subject to loss of mechanical closure integrity.

- Carbon steel components exposed to air (internal and external) and exhaust gas (internal) environments are subject to loss of material.

- Carbon steel components exposed to air (internal and external) and exhaust gas (internal) environments are subject to loss of material.

- Carbon steel components exposed to soil (external) environments are subject to loss of material.

- Carbon steel components exposed to treated water (internal) environments are subject to loss of material.

- Carbon steel components exposed to lube oil (internal) environments are subject to loss of material.

- Cast iron components exposed to treated water (internal) and air (external) environments are subject to loss of material.

- Elastomer components exposed to air (external) and exhaust gas (internal) environments are subject to change in material properties and cracking.

- Copper alloy components exposed to fresh raw water (internal) environments are subject to loss of material.

- Copper alloy components exposed to treated water (internal) environments are subject to fouling.

LRA Table 3.3.1, Item 3.3.1-30, addresses fire barriers and references Section 3.5.

On the basis of its review of the information provided in the LRA, the staff finds that the aging effects resulting from contact of the fire protection system components with the environments described in Table 3.3.2-2 of the LRA are consistent with the GALL Report and industry experience for these combinations of materials and environments. Therefore, the staff finds that the applicant identified the applicable aging effects and associated AMPs that are appropriate for the combination of materials and environments listed.

<u>Aging Management Programs</u>

The applicant credits the following AMPs with managing the aging effects in the fire protection system:

- Bolting and Torquing Activities Program (Appendix B.1.2)
- Buried Piping Inspection Program (Appendix B.1.4)
- Fire Protection Program (Appendix B.1.10)
- Oil Analysis Program (Appendix B.1.17)
- System Walkdown Program (Appendix B.1.28)

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 acceptable for managing the aging effects identified for this system. These AMPs are evaluated in sections 3.0.3.3.2, 3.0.3.2.2, 3.0.3.2.5, 3.0.3.3.6, and 3.0.3.3.9, respectively, of this SER.

During the onsite audit, the staff asked the applicant to provide the technical basis for treating cast iron components (i.e., filter housing, heat exchanger housing, diesel engine cooling water subsystem components, and valves) in a manner similar to carbon steel components. The applicant's position is that the aging effects are the same in this environment for carbon steel and cast iron that is not gray cast iron. a The staff finds that using an AMP considered acceptable to manage the aging effects of carbon steel components is appropriate for cast iron components.

Additionally, the applicant stated that the aging effects for carbon steel and gray cast iron are the same, except gray cast iron is susceptible to selective leaching. By letter dated March 24, 2004, the applicant stated that where selective leaching is possible, an additional program is credited unless the one specified program will manage selective leaching (such as the Diesel Fuel Monitoring and Oil Analysis Programs). Selective leaching does not normally occur in air, lube oil, or fuel oil because the environment is not aqueous. In LRA Table 3.3.1, Item Number 3.3.1-29, the applicant stated that gray cast iron components exposed to an environment conducive to selective leaching are managed by the Periodic Surveillance and Preventive Maintenance Program, Service Water Integrity Program, or Fire Protection Program that includes the management of loss of material due to selective leaching. Because these programs manage the aging effects of selective leaching for gray cast iron components, the staff finds this acceptable.

The applicant's reference to the GALL Report, Volume 2, Item VII.H2.1-a, for copper-alloy valve components in treated water did not match the material, aging effect, and program cited. By letter dated March 24, 2004, the applicant stated that reference to GALL Item VII.H2.1-a is not appropriate for "valve," and the correct note is 301 rather than "E" in Table 3.3.2-2 of the LRA (page 3.3-43 of the LRA).

The staff reviewed the applicant's response and finds that the applicant has demonstrated that it will adequately manage the effects of aging so that the intended functions will be maintained consistent with the CLB during the period of extended operation.

In Table 3.3.2-2 of the LRA (page 3.3-43), the applicant proposed to manage loss of material of copper-alloy valves exposed to lube oil using the Oil Analysis Program (AMP B.1.17). Loss of material because of pitting corrosion is an applicable aging effect for copper-alloy materials in a lubricating oil environment at locations containing oxygenated water with contaminants such as halide ions, particularly chloride ions. In addition, loss of material due to galvanic corrosion in a lubricating oil environment can occur only when materials with different electrochemical potentials are in contact in the presence of water. Loss of material due to crevice corrosion can also occur in brass, bronze, and copper materials in a lubricating oil environment at locations containing oxygenated water. Oxygen is required for the initiation of crevice corrosion. Lube oil that is not contaminated with water does not contain oxygen in sufficient quantities for crevice corrosion to occur.

Water contamination of lubricating oil can occur and is required for the introduction of oxygen. However, only high-quality (water- and contaminant-free) lubricating oil is received, and periodic sampling is performed to ensure the quality is maintained.

Loss of material due to microbiologically influenced corrosion (MIC) is an applicable aging effect for brass and copper materials exposed to lubricating oil. The applicant treated the lubricating oil with biocides to limit the presence of microbiological organisms and, therefore, MIC has not been a concern for those portions of the water suppression fire protection system that are within the scope of license renewal and the associated materials exposed to lubricating oil.

On the basis of its review of the information provided by the applicant, the staff concludes that the applicant has credited the appropriate AMP with managing the aging effects from the materials and environments associated with the fire protection system and that the AMPs identified above will effectively manage these aging effects.

Conclusion

On the basis of its review, the staff concludes that the applicant has adequately identified the aging effects and the AMPs credited with managing the aging effects for the water suppression fire protection components that are not addressed by the GALL Report and those specific component types within the scope of the technical review, so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable UFSAR Supplement program descriptions and concludes that the UFSAR Supplement adequately describes the AMPs credited with managing aging in these components, as required by 10 CFR 54.21(d).

3.3.2.3.3 Emergency Diesel Generator System

Summary of Technical Information in the Application

In Section 3.3.2.1.3 of the LRA, the applicant identified the materials, environments, and aging effects requiring management. The applicant identified the following programs that manage the aging effects requiring management for the emergency diesel generator components:

- Bolting and Torquing Activities Program
- Wall Thinning Monitoring Program
- Heat Exchanger Monitoring Program
- Oil Analysis Program
- System Walkdown Program
- Periodic Surveillance and Preventive Maintenance Program
- Service Water Integrity Program
- Water Chemistry Control Program

In Table 3.3.2-3 of the LRA, the applicant provided a summary of AMRs for the emergency diesel generator system components and identified which AMRs it considered to be consistent with the GALL Report.

Staff Evaluation

The staff reviewed Table 3.3.2-3 of the LRA, which summarized the results of AMR evaluations in the SRP-LR for the Emergency diesel generator system component groups.

The staff reviewed the AMR of the emergency diesel generator component/material/ *environment/AERM combinations that are not addressed in the GALL report and specific* combinations addressed in the GALL report within the scope of the technical review. Component AERM combinations not addressed in the GALL report use note F through J in LRA Table 3.3.2-3. Material and environment combinations addressed in GALL without a comparable component use note 301. The staff determined that the applicant has identified all applicable AERMs and has credited appropriate AMPs for managing the AERMs. The staff also reviewed the applicable UFSAR supplements for the AMPs to ensure that the program descriptions adequately describe the AMPs.

Aging Effects

Table 2.3.3-3 of the LRA lists individual system components within the scope of license renewal and subject to AMR. The components that do not rely on the GALL Report for AMR include blower housing, bolting, booster housing, ejector, expansion joint, filter, filter housing, flex hose, governor house, heat exchanger shell, heat exchanger tubes, heat exchanger tubesheet, heater housing, piping, pump casing, silencer, tank, thermowell, tubing, unloader, and valve.

For these component types, the applicant identifies the following materials, environments, and

AERMs:

- Elastomer components exposed to inside and outdoor air, untreated air, or a treated water environment are subject to the aging effects of change in material properties and cracking.

- Carbon steel, cast iron, copper alloy, and stainless steel components exposed to the lube oil environment are subject to the loss of material aging effect.

- Stainless steel and copper alloy components exposed to air or outdoor air experience no aging effects.

- Carbon steel components exposed to exhaust gas are subject to loss of material and cracking-fatigue aging effect.

- Carbon steel components exposed to outdoor air and untreated air are subject to cracking-fatigue aging effects.

- Stainless steel components exposed to exhaust gas are subject to loss of material, cracking, and cracking-fatigue.

- Copper alloy and stainless steel components exposed to untreated air are subject to the aging effects of loss of material and cracking-fatigue.

- Stainless steel components exposed to treated water are subject to loss of material and cracking.

- Carbon steel, cast iron, and copper alloy components exposed to treated water are subject to the aging effect of loss of material.

- Copper alloy heat exchanger tubes, tubesheets, copper with aluminum fin exposed to fresh raw water, lube oil, or outdoor air are subject to loss of heat transfer function due to fouling.

- Carbon steel bolting exposed to air and managed by the Bolting and Torquing Activities AMP is subject to loss of mechanical closure integrity.

The staff reviewed the information in Section 2.3.3.3, Table 2.3.3-3, Section 3.3.2.1.3, and Table 3.3.2-3 in the LRA. During its review, the staff determined that it needed additional information. The RAIs were organized in two groups, general RAIs and system specific RAIs. General RAIs that are applicable to this system include RAIs 3.3-2, 3.3-3, 3.3-4 and 3.3-6.

By letter dated May 5, 2004, the staff asked the applicant for additional information on the issues described in RAIs 3.3-2, 3.3-3, and 3.3-4. By letter dated May 25, 2004, the staff requested additional information on the issues described in RAI 3.3-6. By letter dated June 21, 2004, the applicant responded to these RAIs. Section 3.3.2.3.0 of this SER describes the RAIs, the applicant's responses, and the staff's evaluation of the responses.

By the same letter dated May 5, 2004, the staff asked the applicant to provide additional information on the issues described in the system-specific RAIs 3.3.2.4.3-1 and 3.3.2.4.3-2. By letter dated June 21, 2004, the applicant responded to these RAIs. The following sections describe RAIs 3.3.2.4.3-1 and 3.3.2.4.3-2, the responses to these RAIs, and the staff's evaluation of the responses.

RAI 3.3.2.4.3-1

Loss of material due to wear is an applicable aging effect on expansion joints and flex hose. However, in Table 3.3.2-3 of the LRA, the applicant did not identify this aging effect/aging mechanism for the expansion joints and flex hose made of elastomer material or stainless steel. The staff asked the applicant to justify why it did not identify this aging effect/mechanism as an applicable aging effect on the elastomer or stainless steel expansion joints.

In its response, by letter dated June 21, 2004, the applicant stated that there is no relative motion between these components and another surface. The applicant also stated that these components are exposed to environments which do not contain abrasive particles. The applicant concluded that, as a result, loss of material due to wear is not an aging effect requiring management for these components.

The staff reviewed the applicant's response and found the response to be acceptable and adequate because expansion joints will not be subjected to conditions that would result in wear.

On the basis of its review of the information provided in the LRA, the staff finds that the aging effects of the emergency diesel generator component types that are not addressed by the GALL Report and specific component types within the scope of the technical review are consistent with industry experience for these combinations of materials and environments. The staff did not identify any omitted aging effects. Therefore, the staff finds that the applicant has identified the appropriate aging effects for the materials and environments associated with the above components in the emergency diesel generator.

Aging Management Programs

After evaluating the applicant's identification of aging effects for each of the above components, the staff evaluated the AMPs to determine if they are appropriate for managing the identified aging effects. The staff also determined that the UFSAR Supplement contains an adequate description of the program.

Table 3.3.2-3 of the LRA identifies the following AMPs for managing the aging effects described above for the emergency diesel generator:

- Heat Exchanger Monitoring Program (Appendix B.1.12)
- Oil Analysis Program (Appendix B.1.17)
- Periodic Surveillance and Preventive Maintenance Program (Appendix B.1.18)
- Service Water Integrity Program (Appendix B.1.24)
- Water Chemistry Control Program (Appendix B.1.30)
- Bolting and Torquing Activities Program (Appendix B.1.2)
- TLAA—Metal Fatigue Program (4.3)

The staff's detailed review of these AMPs appears in Sections 3.0.3.3.3, 3.0.3.3.6, 3.0.3.3.7, 3.0.3.2.7, 3.0.3.2.8, and 3.0.3.3.2 of this SER, respectively. Section 4.3 of this SER contains the staff's evaluation of the TLAA—Metal Fatigue Program.

The Water Chemistry Control Program is credited for managing aging effects on the stainless steel and copper components exposed to treated water. During its review, the staff determined that additional information was needed to complete its review. The request for additional information is described in RAI 3.3-2. RAI 3.3-2, the applicant's response to this RAI and the staff's evaluation of the responses are described in Section 3.3.2.3.0 of this SER.

The PSPM is credited with managing flex hose exposed to an internal treated water and untreated air. During its review, the staff determined that additional information was needed to complete its review. The request for additional information is described in RAI 3.3-3. RAI 3.3-3, the applicant's response to this RAI and the staff's evaluation of the response is described in Section 3.3.2.3.0 of this SER.

The PSPM is credited with managing various components exposed to untreated air. During its review, the staff determined that additional information was needed to complete its review. The request for additional information is described in RAI 3.3-4. RAI 3.3-4, the applicant's response to this RAI and the staff's evaluation of the response is described in Section 3.3.2.3.0 of this SER.

RAI 3.3.2.4.3-2

LRA Table 3.3.2-3 states that carbon and stainless steel expansion joints exposed to an internal exhaust gas environment is managed by the TLAA-Metal Fatigue Program and the Periodic Surveillance and Preventive Maintenance Program. The applicant was requested to explain why the Wall Thinning Program was not applied to the carbon and stainless steel expansion joints. The applicant was also requested to identify and justify the frequency of inspection and clarify if inspections will include internal inspections for cracking and loss of material as recommended in industry standards.

In its response by letter dated June 21, 2004, the applicant stated that expansion joints will be inspected every 18 months in accordance with vendor recommendations. The applicant also confirmed that internal inspections and NDE capable of detecting both loss of material and cracking will be performed. The applicant identified a specific commitment that the wall thinning program will include the exhaust expansion joints.

The staff reviewed the applicant response and found the response to be acceptable and adequate because the expansion joints will be inspected every 18 months in accordance with vendor recommendations and the wall thinning program will use NDE to detect loss of material and cracking.

During the audit, the staff asked the applicant to justify, for emergency diesel generator heat exchanger shell component types in LRA Table 3.3.2-3 that are consistent with the GALL Report, that the aging management program applied to carbon steel remains applicable to cast iron with a similar environment.

By letter dated March 24, 2004, the applicant stated that where selective leaching is possible, an additional program is credited unless the one specified program will manage selective leaching such as the diesel fuel monitoring and oil analysis programs. Selective leaching does not normally occur in air, lube oil, or fuel oil due to the lack of an aqueous environment. In its response, the applicant further stated that if cast iron components are gray cast iron and are exposed to an environment conducive to selective leaching, then they are managed by a periodic surveillance and preventive maintenance program, service water integrity program, or fire protection program that includes the management of loss of material due to selective leaching. On the basis that these programs manage the aging effects of selective leaching for gray cast iron components, the staff finds this acceptable.

The applicant credited the PSPM (AMP B.1.18) and not the service water integrity program (AMP B.1.24) for managing loss of material for components exposed to a raw water environment. The applicant agreed to add the service water integrity program for these components. By letter dated March 24, 2004, the applicant stated that the PSPM program manages loss of material for the emergency diesel generator heat exchanger bonnet in fresh raw water (page 3.3-51of the LRA) through periodic internal inspections during emergency diesel generator overhauls. In addition to the PSPM program, the service water integrity program is conservatively included as a program since it provides additional aging management of this component. On the basis that these programs manage the aging effects of loss of material for components exposed to a raw water environment, the staff finds this acceptable.

The applicant credited the PSPM (AMP B.1.18) and not the auxiliary systems water chemistry control program (AMP B.1.30.1) for managing loss of material for components internally exposed to a treated-water environment. The applicant agreed that the auxiliary water chemistry control program should have been credited for bonnet and shell components internally exposed to a treated water environment, which is acceptable to the staff. By letter dated March 24, 2004, the applicant stated that the auxiliary systems water chemistry control program applies to the emergency diesel generator heat exchanger bonnet and shell in treated water (page 3.3-51 of the LRA) rather than the PSPM program. On the basis that this program manages the aging effects of loss of material for components internally exposed to a treated water environment, the staff finds this acceptable.

The applicant credited the auxiliary systems water chemistry control program (AMP B.1.30.1) to manage loss of material of carbon steel heater housing and orifice, carbon and stainless steel piping, emergency diesel generator pump casing and tank, tubing, and valves in an internally treated water environment. This is consistent with Item VII.H2.1-a of the GALL Report with a different AMP credited than the GALL AMP XI.M21, closed-cycle cooling water system. If this is the case, LRA Note D should be changed to LRA Note E. By letter dated March 24, 2004, the applicant stated that reference to LRA Note D is not appropriate for the emergency diesel generator heater housing and orifice (page 3.3-54 of the LRA), the carbon and stainless steel piping (page 3.3-56 of the LRA), the emergency diesel generator pump casing and tank (page 3.3-57 of the LRA), tubing (page 3.3-59 of the LRA), and valve (page 3.3-61 of the LRA) in treated water. The correct note is LRA Note E. The staff finds the applicant's response acceptable and consistent with the LRA Notes.

In the case of a copper-alloy lubricator housing exposed to air, the applicant identified no aging effect. On the basis of the staff's evaluation that copper-alloy components exposed to air have no aging effects, the staff concludes that this is acceptable.

On the basis of its review of the information provided in the LRA, the staff finds that the applicant has identified appropriate AMPs for managing the aging effects of the emergency diesel generator component types that are not addressed by the GALL Report and those specific component types addressed by the GALL Report that are within the scope of the technical review. In addition, the staff finds the program descriptions in the UFSAR Supplement acceptable.

Conclusion

On the basis of its review, the staff concludes that the applicant has adequately identified the aging effects and the AMPs credited with managing the aging effects for the emergency diesel generator components that are not addressed by the GALL Report and those specific component types within the scope of the technical review, so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable UFSAR Supplement program descriptions and concludes that the UFSAR Supplement adequately describes the AMPs credited with managing aging in these components, as required by 10 CFR 54.21(d).

3.3.2.3.4 Alternate AC Diesel Generator System

Summary of Technical Information in the Application

In Section 3.3.2.1.4 of the LRA, the applicant identified the materials, environments, and aging effects requiring management. The applicant identified the following programs that manage the aging effects requiring management for the alternate ac diesel generator system components:

- Bolting and Torquing Activities Program
- Wall Thinning Monitoring Program
- Oil Analysis Program
- System Walkdown Program
- Periodic Surveillance and Preventive Maintenance Program
- Water Chemistry Control Program

In Table 3.3.2-4 of the LRA, the applicant summarized the AMRs for the alternate ac diesel generator system components and identified which AMRs it considered to be consistent with the GALL Report.

Staff Evaluation

The staff reviewed Table 3.3.2-4 of the LRA, which summarized the results of AMR evaluations in the SRP-LR for the alternate ac diesel generator system component groups.

The staff also reviewed the AMR of the alternate AC diesel generator system component/material/environment/AERM combinations that are not addressed in the GALL report and specific combinations that are addressed in the GALL report within the scope of the technical review. Component AERM combinations not addressed in the GALL report use note F through J in LRA Table 3.3.2-4. Material and environment combinations addressed in GALL without a comparable component use note 301. The staff confirmed that the applicant has identified all applicable AERMs and has credited appropriate AMPs for managing the AERMs. The staff also reviewed the applicable UFSAR supplements for the AMPs to ensure that the program descriptions adequately describe the AMPs. During the staff evaluation of the LRA, the applicant's response to RAI 2.3.3.3.4-1 identified thermal insulation around the exhaust piping was added to the scope of components subject to an AMR.

Aging Effects

Table 2.3.3-4 of the LRA lists individual system components within the scope of license renewal and subject to AMR. The component types that do not rely on the GALL Report for AMR include blower housing, bolting, expansion joint, filter, filter housing, flex hose, governor housing, heat exchanger (shell), heat exchanger (tubes), heater housing, indicator housing, lubricator housing, orifice, piping, pump casing, silencer, thermowell, tubing, and valves.

For these component types, the applicant identified the following materials, environments, and AERMs:

- Stainless steel components in an exhaust gas environment are subject to loss of material. In the same environment, carbon steel and stainless steel components experience cracking-fatigue, and stainless steel components are subject to the additional aging effect of cracking.

- In a lube oil environment, carbon steel, carbon steel with aluminum fins, copper alloy, and stainless steel components are subject to loss of material. Fouling is an applicable aging effect for carbon steel with aluminum fins and copper alloy components in lube oil. Cracking is an applicable aging effect in a lube oil environment for elastomer and stainless steel. Elastomer components in a lube oil environment are subject to the additional aging effect of change of material properties.

- Carbon steel, copper alloy, and stainless steel components are subject to loss of material in a treated air environment, and stainless steel components in the same environment may experience the additional aging effect of cracking.

- In a treated water environment, carbon steel, copper alloy, and stainless steel components are subject to loss of material. In the same environment, carbon steel with aluminum fins and copper alloy components experience fouling. Also in a treated water environment, elastomer components are subject to cracking and change in material properties. Cracking is also applicable to stainless steel components in the treated water environment.

- In outdoor air, carbon steel with aluminum fins experiences fouling, and copper alloy components suffer from fouling, as well as loss of materials through wear. In an air environment, aluminum, copper alloy, glass, and stainless steel components experience no applicable aging effects. Carbon steel blower housings exposed to outdoor air are subject to cracking-fatigue. Carbon steel bolting managed by the Bolting and Torquing Activities Program is subject to loss of mechanical closure integrity.

- Neither glass components in treated water nor stainless steel components in outdoor air experience aging effects.

The staff reviewed the information in Section 2.3.3.4, Table 2.3.3-4, Section 3.3.2.1.4, and Table 3.3.2-4 in the LRA. During its review, the staff determined that it needed additional information. The RAIs were organized in two groups, general RAIs and system specific RAIs. General RAIs that are applicable to this system include RAIs 3.3-2, 3.3-3, 3.3-4 and 3.3-6.

By letter dated May 5, 2004, the staff requested the applicant to provide additional information on the issues described in RAIs 3.3-2, 3.3-3, 3.3-4 and 3.3-6. By letter dated May 25, 2004, the staff requested the applicant to provide additional information on the issues described in RAIs 3.3-6. By letters dated June 21, 2004, the applicant responded to these RAIs. The RAIs, the applicant's responses and the staff's review of the responses are described in Section 3.3.2.3.0 of this SER.

By a letter dated May 5, 2004, the staff asked the applicant to provide additional information on the issues described in the system-specific RAI 3.3.2.4.1-1. By letter dated June 21, 2004, the applicant responded to that RAI. The following section describes RAI 3.3.2.4.1-1, the applicant's response, and the staff's evaluation of the response.

RAI 3.3.2.4.1-1

Table 3.3.2-4 of the LRA credits the Periodic Surveillance and Preventive Maintenance Program with managing fouling in heat exchanger tubes. A periodic diesel generator test alone may not be adequate verification that the required heat transfer is maintained under all applicable design conditions. The staff asked the applicant to clarify how the inspections and testing are performed to ensure that fouling does not adversely affect heat transfer by using proven practices such as periodic heat balances to specific industry standards.

In its response, the applicant stated that the alternate ac diesel is operated on a quarterly basis for at least 2 hours at near full-rated load, and full-rated load significantly exceeds the required design loading of the diesel. The applicant also stated that during this testing, engine parameters such as inlet and outlet temperatures on heat exchangers are monitored and trended to assure that the heat exchangers are capable of removing heat loads. The applicant further stated that adverse trends or alarms noted during performance of the surveillance tests would be identified in accordance with the Corrective Action Program. The applicant concluded that appropriate actions to determine the cause and correct the condition would be taken long before the intended function of the system is affected.

The staff reviewed the applicant's response and found the response to be acceptable and adequate because the applicant indicated that (1) the alternate ac diesel is tested on a quarterly basis for at least 2 hours at near full-rated load which significantly exceeds the required design loading of the diesel, (2) during this testing, engine parameters such as inlet and outlet temperatures on heat exchangers are monitored and trended, and (3) any adverse trends or alarms noted would lead to appropriate actions being taken to determine the cause and to correct the condition long before the intended function of the system is affected.

As a result of the resolution of an unresolved issue related to RAI 2.3.3.4-1 during the scoping and screening review, the thermal insulation for the exhaust piping for the EDG was placed in the scope to license renewal and subject to an aging management review. The staff requested that the applicant identify the type of thermal insulation used on the exhaust piping and to review the applicability of NRC Information Notice 88-28 regarding the type of insulation.

By letter dated September 24, 2004, the applicant clarified that two types of insulation material cover the alternate AC generator exhaust piping in the generator building. The applicant identified that the majority of the insulation is calcium silicate with metal jacketing and a small portion is fiberglass blanket material encased in a covering. The applicant stated that no aging effects requiring management have been identified for the exhaust piping insulation in its dry, indoor environment. By e-mail from the PM dated September 23, 2004, additional information was forwarded by the applicant. The applicant clarified that a walkdown of the insulation did not detect any foil covering on the blanket insulation similar to that reported in NRC IN 88-28.

The staff reviewed the applicant's responses and found the responses to be acceptable and adequate because the type of insulation used in this application is not subjected to environmental conditions that would result in degradation of thermal properties during the period of extended operation.

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 the aging effects of the above alternate ac diesel generator system component types that are not addressed by the GALL Report and specific component types that are addressed by the GALL Report and are within the scope of technical review are consistent with industry experience for these combinations of materials and environments. The staff did not identify any omitted aging effects. Therefore, the staff finds that the applicant has identified the appropriate aging effects for the materials and environments associated with the above components in the alternate ac diesel generator system.

Aging Management Programs

After evaluating the applicant's identification of aging effects for each of the above components, the staff evaluated the AMPs to determine if they are appropriate for managing the identified aging effects. The staff also determined that the UFSAR Supplement contains an adequate description of the program.

Table 3.3.2-5 of the LRA identifies the following AMPs for managing the aging effects described above for the alternate ac diesel generator system:

- Wall Thinning Monitoring Program (Appendix B.1.29)
- Oil Analysis Program (Appendix B.1.17)
- Periodic Surveillance and Preventive Maintenance Program (Appendix B.1.18)
- System Walkdown Program (Appendix B.1.28)
- Water Chemistry Control Program (Appendix B.1.30)
- Bolting and Torquing Activities Program (Appendix B.1.2)
- TLAA—Metal Fatigue Program (4.3)

The staff's detailed review of these AMPs appears in Sections 3.0.3.3.10, 3.0.3.3.6, 3.0.3.3.7, 3.0.3.3.9, 3.0.3.3.11, and 3.0.3.3.2 of this SER, respectively. Section 4.3 of this SER contains the staff's evaluation of the TLAA—Metal Fatigue Program.

The applicant credits the Water Chemistry Control Program with managing the loss of material aging effects on the copper alloy, carbon steel and stainless steel components exposed to treated water. During its review, the staff determined that it needed additional information and issued RAI 3.3-2. Section 3.3.2.3.0 of this SER describes RAI 3.3-2, the applicant's response, and the staff's evaluation of the response.

The applicant credits the PSPM Program with managing flex hose exposed to an internal treated water, lube oil and treated air. During its review, the staff determined that it needed additional information and issued RAI 3.3-3. Section 3.3.2.3.0 of this SER describes RAI 3.3-3, the applicant's response, and the staff's evaluation of the response.

The applicant credits the PSPM Program with managing various components exposed to treated air. During its review, the staff determined that additional information was needed to complete its review. The request for additional information is described in RAI 3.3-4. RAI 3.3-4, the applicant's response to this RAI and the staff's evaluation of the response is described in Section 3.3.2.3.0 of this SER.

By letter dated May 5, 2004, the staff requested the applicant to provide additional information on the issues described in the system-specific RAI 3.3.2.4.1-1. By letter dated June 21, 2004, the applicant responded to the RAI. RAI 3.3.2.4.1-1, the responses to this RAI, and the staff's evaluation of the responses are described below:

RAI 3.3.2.4.4-1

LRA Table 3.3.2-4 credits the Periodic Surveillance and Preventive Maintenance Program for managing fouling in heat exchanger tubes. A periodic diesel generator test alone may not be adequate verification that the required heat transfer is maintained under all applicable design conditions. The applicant was requested to clarify how the inspections and testing are performed to ensure that fouling does not adversely affect heat transfer by using proven practices such as periodic heat balances to specific industry standards.

In its response, by letter dated June 21, 2004, the applicant stated that the AAC diesel is operated on a quarterly basis for at least two hours at near full-rated load and full-rated load significantly exceeds the required design loading of the diesel. The applicant also stated that during this testing, engine parameters such as inlet and outlet temperatures on heat exchangers are monitored and trended to assure the heat exchangers are capable of removing heat loads. The applicant further stated that adverse trends or alarms noted during performance of the surveillance tests would be identified in accordance with the Corrective Action Program. The applicant concluded that appropriate actions to determine the cause and correct the condition would be taken long before the intended function of the system is affected.

The staff reviewed the applicant's response and found the response to be adequate because the applicant indicated that a) the AAC diesel is tested on a quarterly basis for at least two hours at near full-rated load which significantly exceeds the required design loading of the diesel, b) during this testing, engine parameters such as inlet and outlet temperatures on heat exchangers are monitored and trended, and that c) any adverse trends or alarms noted would lead to appropriate actions being taken to determine the cause and to correct the condition long before the intended function of the system is affected.

During the audit, the staff asked the applicant to provide a technical basis for treating cast iron components in the diesel engine cooling water subsystem in a manner similar to carbon steel components. The applicant's position is that carbon steel and cast iron experience the same aging effects in this environment. The staff agrees that use of an AMP considered acceptable for carbon steel is appropriate for these components.

The staff identified a discrepancy in the classification of AMRs involving Water Chemistry Control Programs. The applicant assigned Notes B and D of the LRA in cases where LRA Note E is more appropriate. By letter dated March 24, 2004, the applicant stated that reference to "water chemistry control" for the alternate ac diesel generator stainless steel expansion joint in treated water (page 3.3-67 of the LRA) in Table 3.3.2-4 means the Auxiliary Systems Water Chemistry Control Program. In addition, wherever LRA Note B or D appears in Tables 3.3.2-3 and 3.3.2-4 with the Auxiliary Systems Water Chemistry Control Program as an AMP, LRA Note E should have been used since the Auxiliary Systems Water Chemistry Control Program is the water chemistry control program for treated water, and it is a plant-specific program. Based on its review of the applicant's response, the staff finds that these corrections are consistent with the LRA note classifications and are acceptable.

The staff reviewed the alternate ac diesel generator system stainless steel components exposed to an air environment. The staff has observed that stainless steel components exposed to air/gas, containment air, indoor air (not air-conditioned), and outdoor environments show no aging effect. The GALL Report does not identify an air/gas environment for these components and materials. The staff finds that no aging effects are applicable, and thus, the absence of an AMP for stainless steel components exposed to air is acceptable.

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 applicant has identified appropriate AMPs for managing the aging effects of the alternate ac diesel generator system component types that are not addressed by the GALL Report and specific component types that are addressed in the GALL Report and are within the scope of the technical review. In addition, the staff finds the program descriptions in the UFSAR Supplement acceptable.

Conclusion

On the basis of its review, the staff concludes that the applicant has adequately identified the aging effects and the AMPs credited with managing the aging effects for the alternate ac diesel generator system components that are not addressed by the GALL Report and those specific component types within the scope of the technical review, so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable UFSAR Supplement program descriptions and concludes that the UFSAR Supplement adequately describes the AMPs credited with managing aging in these components, as required by 10 CFR 54.21(d).

3.3.2.3.5 Chemical and Volume Control System

Summary of Technical Information in the Application

In Section 3.3.2.1.5 of the LRA, the applicant identified the materials, environments, and aging effects requiring management. The applicant identified the following programs that manage the aging effects requiring management for the CVCS components:

- Bolting and Torquing Activities Program
- Boric Acid Corrosion Prevention Program
- Oil Analysis Program
- System Walkdown Program
- Periodic Surveillance and Preventive Maintenance Program
- Water Chemistry Control Program

In Table 3.3.2-5 of the LRA, the applicant summarized the AMRs for the CVCS components and identified which AMRs it considered to be consistent with the GALL Report.

Staff Evaluation

The staff reviewed Table 3.3.2-5 of the LRA, which summarized the results of AMR evaluations in the SRP-LR for the CVCS component groups.

The staff reviewed the AMR of the chemical and volume control system component/material/environment/AERM combinations that are not addressed in the GALL report and specific combinations that are addressed in the GALL report within the scope of the technical review. Component AERM combinations not addressed in the GALL report use note F through J in LRA Table 3.3.2-5. Material and environment combinations addressed in GALL without a comparable component use note 301. The staff determined that the applicant has identified all applicable AERMs and has credited appropriate AMPs for managing the AERMs. The staff also reviewed the applicable UFSAR supplements for the AMPs to ensure that the program descriptions adequately describe the AMPs.

Aging Effects

Table 2.3.3-5 of the LRA lists individual system components within the scope of license renewal and subject to AMR. The component types that do not rely on the GALL Report for AMR include bolting, gear housing, heat exchanger (shell, including the heat exchanger channel head/bonnet), piping, pump casing, sight glass, sight glass housing, tank, thermowell, tubing, and valves. Carbon steel bolting managed by the Boric Acid Corrosion Prevention Program and stainless steel bolting managed by the Bolting and Torquing Activities Program are within the scope of the technical review.

For these component types, the applicant identified the following materials, environments, and AERMs:

- In a treated borated water environment, stainless steel components are subject to loss of material.

- In a lube oil environment, stainless steel components are subject to cracking and loss of material. In the same lube oil environment, carbon steel components are subject to loss of material only, and glass components experience no aging effect.

- Stainless steel and glass components exposed to an air environment experience no aging effects.

- Stainless steel components in a nitrogen environment also experience no aging effects.

- Carbon steel and stainless steel bolting exposed to air is subject to loss of mechanical closure integrity.

- Stainless steel heat exchanger shells, piping, themowells, tubing, and valves exposed to treated borated water above 132 °C (270 °F) are subject to cracking-fatigue. Stainless steel pump casings exposed to treated borated water are also subject to cracking-fatigue.

The staff reviewed the information in Section 2.3.3.5, Table 2.3.3-5, Section 3.3.2.1.5, and Table 3.3.2-5 in the LRA. During its review, the staff determined that it needed additional information. The RAIs were organized into two groups, general RAIs and system-specific RAIs. General RAIs applicable to this system include RAIs 3.3-1 and 3.3-2.

By letter dated May 5, 2004, the staff asked the applicant for additional information on the issues described in RAIs 3.3-1 and 3.3-2. By letter dated June 21, 2004, the applicant responded to these RAIs. Section 3.3.2.3.0 of this SER describes the RAIs, the applicant's responses, and the staff's evaluation of the responses.

By the same letter dated May 5, 2004, the staff asked for additional information on the issues described in the system-specific RAI 3.3.2.5.1-1. By letter dated June 21, 2004, the applicant responded to the RAI. The following section describes RAI 3.3.2.5.1-1, the responses to this RAI, and the staff's evaluation of the responses.

RAI 3.3.2.4.5-1

For stainless steel components in a treated borated water environment, the staff asked the applicant to clarify whether loss of fracture toughness/thermal aging embrittlement is an applicable aging effect. The staff also asked the applicant to provide the technical basis if this aging effect is not applicable or otherwise specify the applicable AMP.

In its response by letter dated June 21, 2004, the applicant stated that loss of fracture toughness can occur in cast stainless steel materials exposed to temperatures greater than 250 °C (482 °F). The applicant clarified that components on the tube-side inlet and shell-side outlet of the regenerative heat exchanger are exposed to temperatures above the threshold, but none are constructed of cast austenitic stainless steel. The applicant concluded that fracture toughness is not an aging effect requiring management for CVCS components.

The staff reviewed the applicant's response and found it to be adequate and acceptable because the applicant indicated that the stainless steel used in the CVCS at temperatures above 250 °C (482 °F) is not cast austenitic and is therefore not susceptible to loss of fracture toughness.

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 of the CVCS component types that are not addressed by the GALL Report and the specific component types that are addressed in the GALL Report and are within the scope of technical review are consistent with industry experience for these combinations of materials and environments. The staff did not identify any omitted aging effects. Therefore, the staff finds that the applicant has identified the appropriate aging effects for the materials and environments associated with the above components in the CVCS.

Aging Management Programs

After evaluating the applicant's identification of aging effects for each of the above components, the staff evaluated the AMPs to determine if they are appropriate for managing the identified aging effects. The staff also determined that the UFSAR Supplement contains an adequate description of the program.

Table 3.3.2-5 of the LRA identifies the following AMPs for managing the aging effects described above for managing the aging effects described above for the CVCS:

- Water Chemistry Control Program (Appendix B.1.30)
- Oil Analysis Program (Appendix B.1.17)
- Periodic Surveillance and Preventive Maintenance Program (Appendix B.1.18)
- Bolting and Torquing Activities Program (Appendix B.1.2)
- Boric Acid Corrosion Prevention Program (Appendix B.1.3)
- TLAA—Metal Fatigue Program (4.3)

The staff's detailed review of these AMPs appears in Sections 3.0.3.1, 3.0.3.3.6, 3.0.3.3.7, 3.0.3.3.2, and 3.0.3.2.1 of this SER, respectively. Section 4.3 of this SER contains the staff's evaluation of the TLAA—Metal Fatigue Program.

The applicant credits the Water Chemistry Control Program with managing the loss of material aging effect on the stainless steel components exposed to treated borated water. During its review, the staff determined that it needed additional information and issued RAI 3.3-2. Section 3.3.2.3.0 of this SER describes RAI 3.3-2, the applicant's response to this RAI, and the staff's evaluation of the response.

For the CVCS pump casing, the applicant identified cracking-fatigue as an aging effect managed with the Periodic Surveillance and Preventive Maintenance Program (AMP B.1.18). This aging effect is not included in the detection of aging effects program element description in Appendix B, Section B.1.18, to the LRA. By letter dated March 24, 2004, the applicant stated that cracking-fatigue is identified as an aging effect for the CVCS pump casing (page 3.3-84 of the LRA) in Table 3.3.2-5 with the PSPM Program as an AMP. Cracking-fatigue should be included as an aging effect for the CVCS charging pumps in the "detection of aging effects" program element of Appendix B, Section B.1.18, to the LRA. Based on its review of the applicant's response, the staff finds the correction to the "detection of aging effects" program element for the PSPM AMP acceptable.

The staff reviewed the CVCS stainless steel components exposed to an air environment. The staff has observed that stainless steel components exposed to air/gas, containment air, indoor air (not air-conditioned), and outdoor environments show no aging effect. The GALL Report does not identify an air/gas environment for these components and materials. The staff finds that no aging effects are applicable, and thus, the absence of an AMP for stainless steel components exposed to air is acceptable.

For the management of cracking in the stainless steel regenerative heat exchanger exposed internally to treated borated water greater than 132 °C (270 °F) (page 3.3-83 of the LRA), the applicant credited the Water Chemistry Control Program.

The GALL Report, Volume 2, Item VII.E1.7-c, calls for augmentation of water chemistry control by verification that cracking is absent using temperature and radioactivity monitoring of the shell-side water and eddy-current testing of tubes. The applicant responded that the heat exchanger tubes are not required to satisfy the pressure boundary function of the regenerative heat exchanger. On this basis, the staff finds the response acceptable.
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 applicant has identified appropriate AMPs for managing the aging effects of the CVCS component types that are not addressed by the GALL Report and those specific component types addressed in the GALL Report that are within the scope of the technical review. In addition, the staff finds the program descriptions in the UFSAR Supplement acceptable.

Conclusion

On the basis of its review, the staff concludes that the applicant has adequately identified the aging effects and the AMPs credited with managing the aging effects for the chemical and volume control system components that are not addressed by the GALL Report and those specific component types within the scope of the technical review, so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable UFSAR Supplement program descriptions and concludes that the UFSAR Supplement adequately describes the AMPs credited with managing aging in these components, as required by 10 CFR 54.21(d).

3.3.2.3.6 Halon Fire Protection and Reactor Coolant Pump Motor Oil Leakage Collection System

Summary of Technical Information in the Application

Section 2.3.3.6 of this SER describes the Halon fire protection system and the RCP Motor Oil Leakage Collection system. Table 2.3.3-6 of the LRA identifies the passive, long-lived components of this system that are subject to an AMR. Tables 3.3.1 and 3.3.2-6 summarize the components, aging effects, and AMPs.

Aging Effects

Table 2.3.3.6 of the LRA lists the fire protection components that are within the scope of license renewal and subject to an AMR. These components include bolting, flex hose, indicator housing, nozzle, pan, piping, tank, tubing, and valve.

In Section 3.3.2.1.6 and Table 3.3.2-6 of the LRA, the applicant identified the materials, environments, and aging effects requiring management. The materials identified are aluminum, brass, carbon steel, cast bronze, glass, stainless steel, and stainless steel braid with Teflon liner.

The applicant identified the environments to which these materials could be exposed as air, Halon 1301, lube oil, nitrogen, and untreated borated water.

The applicant identified loss of material and loss of mechanical closure integrity as the aging effects associated with the fire protection system components.

Aging Management Programs

The LRA identifies the following programs that manage the aging effects related to the fire protection system.

- Boric Acid Corrosion Prevention (Appendix B.1.3)
- Periodic Surveillance and Preventive Maintenance (Appendix B.1.18)

Appendix B to the LRA describes these AMPs. The applicant indicated that these AMPs will adequately manage the effects of aging associated with the components of the fire protection system during the period of extended operation.

Staff Evaluation

The staff reviewed Table 3.3.2-6 of the LRA, which summarized the results of AMR evaluations in the SRP-LR for the Halon fire protection and RCP motor oil leakage collection system component groups.

The staff reviewed the LRA to determine whether the applicant demonstrated that it would adequately manage the effects of aging for the fire protection system during the extended period of operation, as required by 10 CFR 54.21(a)(3). The staff reviewed Section 3.3.2.1.6 and Tables 3.3.1 and 3.3.2-6 of the LRA for completeness, consistency with the GALL Report, and industry experience.

For these component types, the applicant identifies the following materials, environments, and AERMs:

- Stainless steel components subjected to untreated borated water (external) and lube oil (internal) environments are subject to the aging effects of loss of material.

- Carbon steel components exposed to inside air (external) and untreated borated water (external) environments are subject to the aging effects of loss of material.

- Carbon steel components subjected to air (external) and lube oil (internal) environments are subject to the aging effects of loss of material

- Carbon steel bolting exposed to untreated borated water environment is subject to loss of mechanical closure integrity.

- Carbon steel components exposed to untreated borated water (internal) environments are subject to loss of material.

Table 3.3.1 includes the RCP oil collection system under Item 3.3.1-6 and references Section 3.3.2.2.6.

On the basis of its review of the information provided in the LRA, the staff finds that the aging effects resulting from contact of the Halon fire protection system components and RCP motor oil collection system components with the environments described in Table 3.3.2-6 of the LRA are consistent with the GALL Report and industry experience for these combinations of materials and environments. Therefore, the staff finds that the applicant identified the applicable aging effects and associated AMPs, and they are appropriate for the combination of materials and environments listed.

Aging Management Programs

The applicant credits the following AMPs with managing the aging effects in the Halon fire protection and RCP motor oil leakage collection system:

- Boric Acid Corrosion Prevention Program (Appendix B.1.3)
- Periodic Surveillance and Preventive Maintenance Program (Appendix B.1.18)

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 acceptable for managing the aging effects identified for this system. These AMPs are evaluated in sections 3.0.3.2.1 and 3.0.3.3.7 of this SER.

During the onsite audit, the staff reviewed the stainless steel components of the Halon fire protection and RCP motor oil leakage collection system that are exposed to an air environment. The staff has observed that stainless steel components exposed to air/gas, containment air, indoor air (not air-conditioned), and outdoor environments show no aging effects. The GALL Report does not identify an air/gas environment for these components and materials. The staff finds that no aging effects requiring management are applicable, and thus, the absence of an AMP for stainless steel components exposed to air is acceptable.

On the basis of its review of the information provided by the applicant, the staff concludes that the applicant has credited the appropriate AMPs with managing the aging effects from the materials and environments associated with the Halon fire protection system and RCP motor oil collection system, and that the AMPs identified above will effectively manage these aging effects.

Conclusion

On the basis of its review, the staff concludes that the applicant has adequately identified the aging effects and the AMPs credited with managing the aging effects for the spent fuel pool components that are not addressed by the GALL Report and those specific component types within the scope of the technical review, so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable UFSAR Supplement program descriptions and concludes that the UFSAR Supplement adequately describes the AMPs credited with managing aging in these components, as required by 10 CFR 54.21(d).

3.3.2.3.7 Fuel Oil System

Summary of Technical Information in the Application

In Section 3.3.2.1.7 of the LRA, the applicant identified the materials, environments, and aging effects requiring management. The applicant identified the following programs that manage the aging effects requiring management for the fuel oil system components:

- Bolting and Torquing Activities Program (Appendix B.1.2)
- Buried Piping Inspection Program (Appendix B.1.4)
- Oil Analysis Program (Appendix B.1.17)
- System Walkdown Program (Appendix B.1.28)
- Periodic Surveillance and Preventive Maintenance Program (Appendix B.1.18)
- Diesel Fuel Monitoring Program (Appendix B.1.7)

In Table 3.3.2-7 of the LRA, the applicant summarized the AMRs for the fuel oil system components and identified which AMRs it considered to be consistent with the GALL Report.

Staff Evaluation

The staff reviewed Table 3.3.2-7 of the LRA, which summarized the results of AMR evaluations in the SRP-LR for the fuel oil system component groups.

The technical staff reviewed the AMR of the fuel oil system component/material/ environment/AERM combinations that are not addressed in the GALL report and specific combinations addressed in the GALL report within the scope of the technical review. Component AERM combinations not addressed in GALL use note F through J in LRA Table 3.3.2-7. Material and environment combinations addressed in GALL without a comparable component use note 301. The staff determined that the applicant has identified all applicable AERMs and has credited appropriate AMPs for managing the AERMs. The staff also reviewed the applicable UFSAR supplements for the AMPs to ensure that the program descriptions adequately describe the AMPs.

The technical staff reviewed the AMR of the fuel oil system component/material/environment/ AERM combinations that are not addressed in the GALL Report and specific combinations addressed in the GALL Report that are within the scope of the technical review. Component AERM combinations not addressed in the GALL Report use Notes F through J in LRA Table 3.3.2-7. Material and environment combinations addressed in the GALL Report without a comparable component use Note 301. The staff determined that the applicant identified all applicable AERMs and credited appropriate AMPs with managing the AERMs. The staff also reviewed the applicable UFSAR Supplements for the AMPs to ensure that the program descriptions are adequate.

Aging Effects

Table 2.3.3-7 of the LRA lists individual system components within the scope of license renewal and subject to AMR. The component types that do not rely on the GALL Report for AMR include bolting, filter, filter housing, flame arrestor, flex hose, heat exchanger (tubes), indicator housing, injector housing, orifice, piping, tank, thermowell, tubing, and valves.

For these component types, the applicant identified the following materials, environments, and AERMs:

- Carbon steel, copper alloys, elastomer, and stainless steel components exposed to fuel oil environment are subject to the aging effects of loss of material. In the same fuel oil environment, stainless steel and elastomer components are subject to the additional aging effects of cracking and change of material properties.

- Carbon steel components in air, lube oil, outdoor air, and sand and concrete environments are subject to loss of material.

- In an outdoor environment, loss of material is an applicable aging effect for carbon steel with aluminum fin and copper alloy components.

- Copper alloy components in an air environment and aluminum and stainless steel components exposed to an outdoor air environment experience no applicable aging effects.

- Carbon steel and stainless steel bolting exposed to air and managed by the Bolting and Torquing Activities Program is subject to loss of mechanical closure integrity.

The staff reviewed the information in Section 2.3.3.7, Table 2.3.3-7, Section 3.3.2.1.7, and Table 3.3.2-7 in the LRA. During its review, the staff determined that it needed additional information. The RAIs were organized in two groups, general RAIs and system-specific RAIs. A general RAI applicable to this system is RAI 3.3-3.

By letter dated May 5, 2004, the staff asked the applicant for additional information on the issues described in RAI 3.3-3. By letter dated May 25, 2004, the staff requested additional information on the issues described in RAI 3.3-6. By letter dated June 21, 2004, the applicant responded to the RAIs. Section 3.3.2.3.0 of this SER describes the RAI, the applicant's responses, and the staff's evaluation of the responses.

By the same letter dated May 5, 2004, the staff requested the applicant to provide additional information on the issues described in the system-specific RAI 3.3.2.4.7-1. By letter dated June 21, 2004, the applicant responded to this RAI. The following section describes RAI 3.3.2.4.7-1, the responses to this RAI, and the staff's evaluation of the responses.

RAI 3.3.2.4.7-1

The LRA identifies cracking as an applicable aging effect for some stainless steel components in a fuel oil environment (such as filter and thermowell) but not others in the same environment (such as indicator housing and orifice). The staff asked the applicant to clarify the environments, including temperatures, applicable to stainless steel components in the fuel oil system to justify the difference in the identified aging effects.

In its response, by letter dated June 21, 2004, the applicant stated that cracking is identified as an aging effect requiring management for stainless steel components in fuel oil when the fluid temperature can exceed 60 °C (140 °F) and there is a potential for water in the oil. The applicant clarified that portions of the fuel oil system for the alternate ac diesel, emergency diesel generator, and fire pump diesel can exceed 60 °C (140 °F) during engine operation. The applicant further stated that for these portions of the fuel oil system, it identified cracking as an aging effect for stainless steel components. Finally the applicant stated that stainless steel components in the remainder of the fuel oil system are not exposed to temperatures in excess of 60 °C (140 °F).

The staff reviewed the applicant's response and found it to be acceptable and adequate because the applicant indicated that portions of the fuel oil system can exceed 60 °C (140 °F) during engine operation and for these portions of the fuel oil system, cracking was identified as an aging effect for stainless steel components, while stainless steel components in the remainder of the fuel oil system are not exposed to temperatures in excess of 60 °C (140 °F).

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 of the fuel oil system component types that are not addressed by the GALL Report and those specific component types addressed in the GALL Report that are within the scope of the technical review are consistent with industry experience for these combinations of materials and environments. The staff did not identify any omitted aging effects. Therefore, the staff finds that the applicant has identified the appropriate aging effects for the materials and environments associated with the above components of the fuel oil system.

Aging Management Programs

After evaluating the applicant's identification of aging effects for each of the above components, the staff evaluated the AMPs to determine if they are appropriate for managing the identified aging effects. The staff also determined that the UFSAR Supplement contains an adequate description of the program.

Table 3.3.2-7 of the LRA identifies the following AMPs for managing the aging effects described above for the fuel oil system:

- Diesel Fuel Monitoring Program (Appendix B.1.7)
- System Walkdown Program (Appendix B.1.28)
- Oil Analysis Program (Appendix B.1.17)
- Periodic Surveillance and Preventive Maintenance Program (Appendix B.1.18)
- Bolting and Torquing Activities Program (Appendix B.1.2)

The staff's detailed review of these AMPs appears in Sections 3.0.3.2.3, 3.0.3.3.9, 3.0.3.3.6, 3.0.3.3.7 and 3.0.3.3.2 of this SER, respectively.

The applicant credits the Periodic Surveillance and Preventive Maintenance Program with managing flex hose exposed to an internal fuel oil environment. During its review, the staff determined that it needed additional information and issued RAI 3.3-3. Section 3.3.2.3.0 of this SER describes RAI 3.3-3, the applicant's response to this RAI, and the staff's evaluation of the response.

The staff asked the applicant to provide a technical basis for treating cast iron components in the fuel oil system in a manner similar to carbon steel components. The applicant's position is that the aging effects for carbon steel and cast iron in this environment are the same. The staff agrees that use of an AMP considered acceptable for carbon steel is appropriate for these components.

The applicant credited the System Walkdown Program (AMP B.1.28) with managing the aging effects of loss of material of heat exchangers (tubes) made of carbon steel with aluminum fins in external air. In Note 302 of the table, the applicant states that the aging effect applies only to the carbon steel portion of the component. The staff finds that aluminum is corrosion resistant in a dry air environment and that there are no applicable aging effects requiring aging management. On that basis, the staff finds the applicant's position acceptable.

The staff reviewed the fuel oil system stainless steel components exposed to an air environment. The staff has observed that stainless steel components exposed to air/gas, containment air, indoor air (not air-conditioned), and outdoor environments show no aging effects. The GALL Report does not identify an air/gas environment for these components and materials. The staff finds that no aging effects are applicable, and thus, the absence of an AMP for stainless steel components exposed to air is acceptable.

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 has identified appropriate AMPs for managing the aging effects of the fuel oil system component types that are not addressed by the GALL Report and those specific component types addressed in the GALL Report that are within the scope of the technical review. In addition, the staff finds the program descriptions in the UFSAR Supplement acceptable.

Conclusion

On the basis of its review, the staff concludes that the applicant has adequately identified the aging effects and the AMPs credited with managing the aging effects for the fuel oil system components that are not addressed by the GALL Report and those specific component types within the scope of the technical review, so that the intended functions can be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable UFSAR Supplement program descriptions and concludes that the UFSAR Supplement adequately describes the AMPs credited with managing aging in these components, as required by 10 CFR 54.21(d).

3.3.2.3.8 Service Water System

Summary of Technical Information in the Application

In Section 3.3.2.1.8 of the LRA, the applicant identified the materials, environments, and aging effects requiring management. The applicant identified the following programs that manage the aging effects requiring management for the service water system components:

- Buried Piping Inspection Program (Appendix B.1.4)
- System Walkdown Program (Appendix B.1.28)
- Periodic Surveillance and Preventive Maintenance Program (Appendix B.1.18)
- Service Water Integrity Program (Appendix B.1.24)

In Table 3.3.2-8 of the LRA, the applicant summarized the AMRs for the service water system components and identified which AMRs it considered to be consistent with the GALL Report.

Staff Evaluation

The staff reviewed Table 3.3.2-8 of the LRA, which summarized the results of AMR evaluations in the SRP-LR for the service water system component groups.

The staff reviewed the AMR of the service water system component/material/environment/ AERM combinations that are not addressed in the GALL report and specific combinations addressed in the GALL report within the scope of the technical review. Component AERM combinations not addressed in the GALL report use note F through J in LRA Table 3.3.2-8. Material and environment combinations addressed in GALL without a comparable component use note 301. The staff determined that the applicant has identified all applicable AERMs and has credited appropriate AMPs for managing the AERMs. The staff also reviewed the applicable UFSAR supplements for the AMPs to ensure that the program descriptions adequately describe the AMPs.

Aging Effects

Table 2.3.3-8 of the LRA lists individual system components within the scope of license renewal and subject to AMR. The component types that do not rely on the GALL Report for AMR include bolting, expansion joint, filter housing, flow straightener, orifice, piping, thermowell, tubing, and valves.

For these component types, the applicant identifies the following materials, environments, and AERMs:

- Stainless steel components exposed to a condensation environment experience loss of material.

- In a fresh raw water environment, stainless steel components are subject to the aging effect of cracking.

- Carbon steel and stainless steel bolting in a fresh raw water environment or condensation are subject to loss of material.

The staff reviewed the information in Section 2.3.3.8, Table 2.3.3-8, Section 3.3.2.1.8, and Table 3.3.2-8 in the LRA. During its review, the staff determined that it needed additional information.

The RAIs are organized in two groups, general RAIs and system-specific RAIs. There are no general RAIs applicable to this system.

By letter dated May 5, 2004, the staff asked the applicant for additional information on the issues described in the system-specific RAI 3.3.2.4.8-1 and RAI 3.3.2.4.8-2. By letter dated June 21, 2004, the applicant responded to the RAIs. The following section describes RAI 3.3.2.4.8-1 and RAI 3.3.2.4.8-2, the applicant's responses to these RAIs, and the staff's evaluation of the responses.

RAI 3.3.2.4.8-1

The LRA does not identify biofouling as an aging effect/mechanism in the service water system. The GALL Report identifies biofouling as an aging effect/mechanism for service water systems. The staff asked the applicant to clarify what aging effect due to biofouling and/or silting is applicable to service water components. If this applicable aging effect is not loss of material, the applicant should clarify which specific AMP is applicable to manage biofouling in service water components.

In its response, by letter dated June 21, 2004, the applicant stated that biofouling and silting can create conditions that are conducive to the aging mechanisms of pitting, crevice corrosion, and microbiologically influenced corrosion. The applicant concluded that loss of material is the applicable aging effect resulting from the mechanisms of pitting, crevice corrosion, and microbiologically influenced corrosion for the service water system.

The staff reviewed the applicant's response and found it to be acceptable and adequate because the applicant clarified that biofouling and silting can create conditions that are conducive to the aging mechanisms of pitting, crevice corrosion, and microbiologically influenced corrosion, and that loss of material is the applicable aging effect.

RAI 3.3.2.4.8-2

Table 3.3.2-8 of the LRA identifies loss of material as an aging effect requiring aging management for the stainless steel expansion joints, but cracking is not addressed. Industry documents such as EPRI Report 1008035, "Expansion Joint Maintenance Guide," Revision 1, dated May 2003, indicate that stainless steel expansion joints are susceptible to cracking when exposed to contaminants. The staff asked the applicant to identify if cracking is considered an aging effect for these expansion joints and to explain how the credited AMPs effectively manage cracking, if applicable.

In its response, by letter dated June 21, 2004, the applicant stated that stainless steel is susceptible to cracking when exposed to contaminants and temperatures above 60 °C (140 °F). The applicant clarified that the service water system stainless steel expansion joints subject to AMR are located in the service water pump discharge lines, and these expansion joints are exposed to temperatures well below the 60 °C (140 °F) threshold for cracking. The applicant also stated that these expansion joints are constructed of nickel-based alloy which is more resistant to SCC than 300-series stainless steels. The applicant concluded that cracking is not an aging effect requiring management for the stainless steel expansion joints in the service water system.

The staff reviewed the applicant's response and found it to be acceptable and adequate because the applicant clarified that the service water system stainless steel expansion joints subject to AMR are exposed to temperatures well below the 60 °C (140 °F) threshold for cracking, and that these expansion joints are constructed of nickel-based alloy which is more resistant to SCC than 300-series stainless steels.

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 of the service water system component types that are not addressed by the GALL Report are consistent with industry experience for these combinations of materials and environments. The staff did not identify any omitted aging effects. Therefore, the staff finds that the applicant has identified the appropriate aging effects for the materials and environments associated with the above components in the service water system.

Aging Management Programs

After evaluating the applicant's identification of aging effects for each of the above components, the staff evaluated the AMPs to determine if they are appropriate for managing the identified aging effects. The staff also determined that the UFSAR Supplement contains an adequate description of the program.

Table 3.3.2-8 of the LRA identifies the following AMPs for managing the aging effects described above for the service water system:

- System Walkdown Program (Appendix B.1.28)
- Service Water Integrity Program (Appendix B.1.24)
- Periodic Surveillance and Preventive Maintenance Program (Appendix B.1.18)
- Bolting and Torquing Activities Program (Appendix B.1.2)

The staff's detailed review of these AMPs appears in Sections 3.0.3.3.9, 3.0.3.2.7, 3.0.3.3.7, and 3.0.3.3.2 of this SER, respectively.

During the audit, the staff asked the applicant to justify, for service water system component types in LRA Table 3.3.2-8 that are consistent with the GALL Report (LRA Note A), that the AMP applied to carbon steel remains applicable to cast iron in a similar environment.

By letter dated March 24, 2004, the applicant stated that where selective leaching is possible, it credits an additional program unless the one specified program will manage selective leaching (such as the Diesel Fuel Monitoring and Oil Analysis Programs). Selective leaching does not normally occur in air, lube oil, or fuel oil because the environment is not aqueous. In its response, the applicant further stated that if cast iron components are gray cast iron and are exposed to an environment conducive to selective leaching, then they are managed by the Periodic Surveillance and Preventive Maintenance Program, Service Water Integrity Program, or Fire Protection Program that includes the management of loss of material due to selective leaching. Because these programs manage the aging effects of selective leaching for gray cast iron components, the staff finds this approach acceptable.

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 applicant has identified appropriate AMPs for managing the aging effects of the service water system component types that are not addressed by the GALL Report. In addition, the staff finds the program descriptions in the UFSAR Supplement acceptable.

Conclusion

On the basis of its review, the staff concludes that the applicant has adequately identified the aging effects and the AMPs credited with managing the aging effects for the service water system components that are not addressed by the GALL Report and those specific component types within the scope of the technical review, so that the intended functions can be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable UFSAR Supplement program descriptions and concludes that the UFSAR Supplement adequately describes the AMPs credited with managing aging in these components, as required by 10 CFR 54.21(d).

3.3.2.3.9 Auxiliary Building Ventilation System

Summary of Technical Information in the Application

In Section 3.3.2.1.9 of the LRA, the applicant identified the materials, environments, and aging effects requiring management. The applicant identified the following programs that manage the aging effects requiring management for the auxiliary building ventilation system components:

- Periodic Surveillance and Preventive Maintenance Program (Appendix B.1.18)
- Service Water Integrity Program (Appendix B.1.24)

In Table 3.3.2-9 of the LRA, the applicant summarized the AMRs for the auxiliary building ventilation system components and identified which AMRs it considered to be consistent with the GALL Report.

Staff Evaluation

The staff reviewed Table 3.3.2-9 of the LRA, which summarized the results of AMR evaluations in the SRP-LR for the auxiliary building ventilation system component groups.

The staff reviewed the AMR of the auxiliary building ventilation system component/material/environment/AERM combinations that are not addressed in the GALL Report. Component AERM combinations not addressed in the GALL Report use Notes F through J in LRA Table 3.3.2-9. The staff determined that the applicant had identified all applicable AERMs and had credited appropriate AMPs for managing the AERMs. The staff also reviewed the applicable UFSAR Supplements for the AMPs to ensure that the program descriptions are adequate.

Aging Effects

Table 2.3.3-9 of the LRA lists individual system components within the scope of license renewal and subject to AMR. The components that do not rely on the GALL Report for AMR include heat exchanger (tubes) and tubing.

For these component types, the applicant identifies the following materials, environments, and AERMs:

- Copper alloy components exposed to condensation are subject to the aging effects of fouling and loss of material—wear.

- In a fresh raw water environment, the same components are subject only to fouling.

- In both air and Freon environments, copper alloy components experience no aging effects requiring management.

The staff reviewed the information in Section 2.3.3.9, Table 2.3.3-9, Section 3.3.2.1.9, and Table 3.3.2-9 in the LRA. There are no RAIs related to aging effects for this system.

On the basis of its review of the information provided in the LRA, the staff finds that the aging effects of the auxiliary building ventilation system component types that are not addressed by the GALL Report are consistent with industry experience for these combinations of materials and environments. The staff did not identify any omitted aging effects. Therefore, the staff finds that the applicant has identified the appropriate aging effects for the materials and environments associated with the above components in the auxiliary building ventilation system.

Aging Management Programs

After evaluating the applicant's identification of aging effects for each of the above components, the staff evaluated the AMPs to determine if they are appropriate for managing the identified aging effects. The staff also determined that the UFSAR Supplement contains an adequate description of the program.

Table 3.3.2-9 of the LRA identifies the following AMPs for managing the aging effects described above for the auxiliary and radwaste area ventilation system:

- Periodic Surveillance and Preventive Maintenance Program (Appendix B.1.18)
- Service Water Integrity Program (Appendix B.1.24)

The staff's detailed review of these AMPs appears in Sections 3.0.3.3.7 and 3.0.3.2.7 of this SER, respectively.

The staff reviewed the auxiliary building ventilation system component groups exposed to an air environment. The staff has observed that stainless steel components exposed to air/gas, containment air, indoor air (not air-conditioned), and outdoor environments show no aging effect. The GALL Report does not identify an air/gas environment for these components and materials. The staff finds that no aging effects are applicable, and thus, the absence of an AMP for stainless steel components exposed to air is acceptable.

On the basis of its review of the information provided in the LRA, the staff finds that the applicant has identified appropriate AMPs for managing the aging effects of the auxiliary building ventilation system component types that are not addressed by the GALL Report. In addition, the staff finds the program descriptions in the UFSAR Supplement acceptable.

Conclusion

On the basis of its review, the staff concludes that the applicant has adequately identified the aging effects and the AMPs credited with managing the aging effects for the auxiliary building ventilation system components that are not addressed by the GALL Report and those specific component types within the scope of the technical review, so that the intended functions can be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable UFSAR Supplement program descriptions and concludes that the UFSAR Supplement adequately describes the AMPs credited with managing aging in these components, as required by 10 CFR 54.21(d).

3.3.2.3.10 Control Room Ventilation System

Summary of Technical Information in the Application

In Section 3.3.2.1.10 of the LRA, the applicant identified the materials, environments, and aging effects requiring management. The applicant identified the following programs that manage the aging effects requiring management for the control ventilation system components:

- System Walkdown Program
- Periodic Surveillance and Preventive Maintenance Program
- Service Water Integrity Program

In Table 3.3.2-10 of the LRA, the applicant summarized the AMRs for the control ventilation system components and identified which AMRs it considered to be consistent with the GALL Report.

Staff Evaluation

The staff reviewed Table 3.3.2-10 of the LRA, which summarizes the results of AMR evaluations in the SRP-LR for the control room ventilation system component groups.

The staff reviewed the AMR of the control room ventilation system component/material/environment/AERM combinations that are not addressed in the GALL Report and specific combinations addressed in the GALL Report that are within the scope of the technical review. These combinations use Notes F through J in LRA Table 3.3.2-10. Material and environment combinations addressed in the GALL Report without a comparable component use Note 301. The staff determined that the applicant has identified all applicable AERMs and has credited appropriate AMPs for managing the AERMs. The staff also reviewed the applicable UFSAR Supplements for the AMPs to ensure that the program descriptions are adequate.

Aging Effects

Table 2.3.3-10 of the LRA lists individual system components within the scope of license renewal and subject to AMR. The components that do not rely on the GALL Report for AMR include bolting, compressor casing, damper housing, filter housing, heat exchanger (shell), heat exchanger (tubes), indicator housing, sight glass, sight glass housing, tubing, and valves.

For these component types, the applicant identifies the following materials, environments, and AERMs:

- Copper alloy components exposed to condensation and lube oil environments are subject to the aging effect of loss of material. In a fresh raw water environment, these components experience fouling.
- Carbon steel components in a lube oil environment are also subject to loss of material.
- Aluminum, glass, and stainless steel components in air do not experience aging effects.
- There is no aging effect for carbon steel components in a carbon dioxide environment.
- In a Freon environment, both carbon steel and copper alloy components experience no applicable aging degradation.
- Neither glass nor stainless steel components in a condensation environment experience aging effects.
- In an air environment, copper alloy components, in general, do not experience aging degradation. However, copper alloy heat transfer tube components in an air environment are subject to fouling.

The staff reviewed the information in Section 2.3.3.10, Table 2.3.3-10, Section 3.3.2.1.10, and Table 3.3.2-10 in the LRA. During its review, the staff determined that it needed additional information. The RAIs were organized in two groups, general RAIs and system-specific RAIs. There are no general RAIs applicable to the control room ventilation system.

By letter dated May 5, 2004, the staff requested the applicant to provide additional information on the issues described in the system-specific RAI 3.3.2.4.10-1. By letter dated June 21, 2004, the applicant responded to the RAI. The following section describes RAI 3.3.2.4.10-1, the applicant's responses to the RAI, and the staff's evaluation of the responses.

RAI 3.3.2.4.10-1

The LRA states that all components in a carbon dioxide environment are not subject to any aging effect. Dry carbon dioxide is not a degrading environment for carbon steel, brass, or bronze components, but carbon steel components may be susceptible to corrosion in the presence of moisture in the carbon dioxide environment. The staff asked the applicant to clarify the degree of dryness of the carbon dioxide environment and to identify the activities in place to establish and maintain the degree of dryness of the carbon dioxide environment necessary to minimize aging degradation of carbon steel components during the period of extended operation, including the effects resulting from operations to replenish or refill the carbon dioxide.

In response, by letter dated June 21, 2004, the applicant stated that carbon dioxide is an environment only for the control room ventilation system. The applicant clarified that carbon steel bottles contain anhydrous (dry) carbon dioxide with a low level of impurities that minimizes the effects of aging on components. The applicant further stated that the carbon dioxide bottles are normally isolated from the system. The applicant concluded that, since the bottles are pressurized, moisture cannot be introduced into them. The applicant confirmed that refilling is done by a vendor according to vendor recommendations and that periodic monitoring of bottle pressure detects the occurrence of leaks and identifies the need for refilling.

The staff reviewed the applicant's response and found the response to be acceptable and adequate because the applicant indicated (1) that the carbon dioxide bottles containing anhydrous (dry) carbon dioxide with a low level of impurities are normally isolated from the system, and since they are pressurized, moisture cannot be introduced into the bottles, and (2) periodic monitoring of bottle pressure detects the occurrence of leaks and identifies the need for refilling.

On the basis of its review of the information provided in the LRA, the staff finds that the aging effects of the control room ventilation system component types that are not addressed by the GALL Report are consistent with industry experience for these combinations of materials and environments. The staff did not identify any omitted aging effects for the combinations in LRA Table 3.3.2-10 using Notes F through J. Therefore, the staff finds that the applicant has identified the appropriate aging effects for the materials and environments associated with the above components in the control room ventilation system.

Aging Management Programs

After evaluating the applicant's identification of aging effects for each of the above components, the staff evaluated the AMPs to determine if they are appropriate for managing the identified aging effects. The staff also determined that the UFSAR Supplement contains an adequate description of the program.

Table 3.3.2-9 of the LRA identifies the following AMPs for managing the aging effects described above for the control room ventilation system:

- System Walkdown Program (Appendix B.1.28)
- Periodic Surveillance and Preventive Maintenance Program (Appendix B.1.18)
- Service Water Integrity Program (Appendix B.1.24)

The staff's detailed review of these AMPs appears in Sections 3.0.3.3.9, 3.0.3.3.7, and 3.0.3.2.7 of this SER, respectively.

The staff reviewed the control room ventilation system stainless steel components exposed to an air environment. The staff observed that stainless steel components exposed to air/gas, containment air, indoor air (not air-conditioned), and outdoor environments show no aging effects. The GALL Report does not identify an air/gas environment for these components and materials. The staff finds that no aging effects are applicable, and thus, the absence of an

AMP for stainless steel components exposed to air is acceptable.

On the basis of its review of the information provided in the LRA, the staff finds that the applicant has identified appropriate AMPs for managing the aging effects of the control room ventilation system component types that are not addressed by the GALL Report. In addition, the staff finds the program descriptions in the UFSAR Supplement acceptable.

Conclusion

On the basis of its review, the staff concludes that the applicant has adequately identified the aging effects and the AMPs credited with managing the aging effects for the control room ventilation system components that are not addressed by the GALL Report and those specific component types within the scope of the technical review, so that the intended functions can be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable UFSAR Supplement program descriptions and concludes that the UFSAR Supplement adequately describes the AMPs credited with managing aging in these components, as required by 10 CFR 54.21(d).

3.3.2.3.11 Miscellaneous Systems in Scope for 10 CFR 54.4(a)(2)

Summary of Technical Information in the Application

In Section 3.3.2.1.11 of the LRA, the applicant identified the materials, environments, and aging effects requiring management. The applicant identified the following programs that manage the aging effects requiring management for the miscellaneous systems in scope for 10 CFR 54.4(a)(2) components:

- Bolting and Torquing Activities Program
- Boric Acid Corrosion Prevention Program
- Flow-Accelerated Corrosion Program
- System Walkdown Program
- Water Chemistry Control Program

In Table 3.3.2-11 of the LRA, the applicant summarized the AMRs for the miscellaneous systems in scope for 10 CFR 54.4(a)(2) components and identified which AMRs it considered to be consistent with the GALL Report.

Staff Evaluation

The staff reviewed Table 3.3.2-11 of the LRA, which summarized the results of AMR evaluations in the SRP-LR for the miscellaneous systems in scope for 10 CFR 54.4(a)(2) component groups.

The staff reviewed the AMR of the miscellaneous systems in scope for 10 CFR 54.4(a)(2) component/material/environment/AERM combinations in various systems that, in general, are not addressed in the GALL Report. These combinations use Note 304 in LRA Table 3.3.2-11. The staff determined that the applicant had identified all applicable AERMs and had credited appropriate AMPs for managing the AERMs. The staff also reviewed the applicable UFSAR Supplements for the AMPs to ensure that the program descriptions are adequate.

Aging Effects

Table 2.3.3-11 of the LRA lists individual system components within the scope of license renewal and subject to AMR. The components that do not rely on the GALL Report for AMR include bolting, filter housing, heat exchanger (shell, channel head), heat exchanger (heating or cooling coil when not enclosed in a housing), level glass gauge, orifice, piping, pump casing, tank, thermowell, tubing, valve, and ventilation unit housing.

For these component types, the applicant identified the following materials, environments, and AERMs:

- In an air environment, aluminum, carbon steel, and carbon steel (coated) components are subject to loss of material. In the same environment, copper alloy, glass and stainless steel components experience no aging effect.
- In both condensation and treated water environments, aluminum, carbon steel copper alloy, and stainless steel components experience the aging effect of loss of material.
- In a hydrazine/ammonia environment, stainless steel components are subject to loss of material and cracking. Carbon steel, copper alloy, and stainless steel components experience loss of material, but glass components in the same environment experience no aging effects.
- In steam or treated water greater than 104 °C (220 °F), carbon steel components are subject to cracking-fatigue, loss of material, and erosion.
- Stainless steel components experience loss of material and cracking in sodium hydroxide, treated borated water greater than 60 °C (140 °F), treated borated water greater than 132 °C (270 °F), and untreated water greater than 60 °C (140 °F).
- Stainless steel components experience cracking-fatigue in treated borated water greater than 132 °C (270 °F).
- In an untreated water environment, carbon steel, carbon steel (coated) copper alloy, and stainless steel components are subject to loss of material.
- Stainless steel components in an untreated borated water environment experience loss of material.
- Carbon steel bolting exposed to air and condensation is subject to loss of material and loss of mechanical closure integrity.

The staff reviewed the information in Section 2.3.3.11, Table 2.3.3-11, Section 3.3.2.1.11, and Table 3.3.2-11 in the LRA. During its review, the staff determined that it needed additional information. The RAIs were organized in two groups, general RAIs and system-specific RAIs. General RAIs applicable to this system include RAIs 3.3-1 and 3.3-2.

By letter dated May 5, 2004, the staff asked the applicant to provide additional information on the issues described in RAIs 3.3-1 and 3.3-2. By letter dated June 21, 2004, the applicant responded to the RAIs. Section 3.3.2.3.0 of this SER describes the general RAIs, applicant's responses, and the staff's evaluation of the responses.

On the basis of its review of the information provided in the LRA, the staff finds that the aging effects of the above miscellaneous systems in scope for 10 CFR 54.4(a)(2) component types that are not addressed by the GALL Report are consistent with industry experience for these combinations of materials and environments. The staff did not identify any omitted aging effects for the combinations in LRA Table 3.3.2-11 using Notes F through J. Therefore, the staff finds that the applicant has identified the appropriate aging effects for the materials and environments associated with the above components in the miscellaneous systems in scope for 10 CFR 54.4(a)(2).

<u>Aging Management Programs</u>

After evaluating the applicant's identification of aging effects for each of the above components, the staff evaluated the AMPs to determine if they are appropriate for managing the identified aging effects. The staff also determined that the UFSAR Supplement contains an adequate description of the program.

Table 3.3.2-9 of the LRA identifies the following AMPs for managing the aging effects described above for the miscellaneous systems in scope for 10 CFR 54.4(a)(2):

- System Walkdown Program (Appendix B.1.28)
- Flow-Accelerated Corrosion Program (Appendix B.1.11)
- Water Chemistry Control Program (Appendix B.1.30)
- Bolting and Torquing Activities Program (Appendix B.1.2)
- Boric Acid Corrosion Prevention Program (Appendix B.1.3)

The staff's detailed review of these AMPs appears in Sections 3.0.3.3.9, 3.0.3.1, 3.0.3.3.11, 3.0.3.3.2, and 3.0.3.2.1 of this SER, respectively.

The applicant credits the Water Chemistry Control Program with managing aging effects in the stainless steel, carbon steel, copper alloy, and aluminum components exposed to treated borated water or treated water. During its review, the staff determined that it needed additional information and issued RAI 3.3-2. Section 3.3.2.3.0 of this RAI describes RAI 3.3-2, the applicant's response to this RAI, and the staff's evaluation of the response.

By letter dated May 5, 2004, the staff asked the applicant for additional information on the issues described in the system-specific RAI 3.3.2.4.11-1. By letter dated June 21, 2004, the applicant responded to the RAI. The following section describes RAI 3.3.2.4.11-1, the applicant's responses to this RAI, and the staff's evaluation of the responses.

RAI 3.3.2.4.11-1

Table 3.3.2-11 of the LRA identifies various components exposed internally to treated water and other environments with a pressure boundary function. The applicant credited the System

Walkdown and Water Chemistry Control Programs with managing the loss of material and cracking of the internal surfaces of these components. The system walkdown is a visual inspection of external surfaces. The staff asked the applicant to clarify how a visual inspection of external surfaces assures that internal surfaces are effectively managed when the internal and external environments are different. If evidence of leakage is necessary to determine if an aging effect has occurred, the staff asked the applicant to provide technical justification that a failure of the pressure boundary is acceptable.

In its response, by letter dated June 21, 2004, the applicant cited five programs credited with managing aging effects for equipment that meets the 10 CFR 54.4(a)(2) criteria. Although three of the programs do not require leakage detection, the applicant explained that the System Walkdown Program manages the effects of aging by detecting leakage through visual inspections. The applicant addressed long-term and short-term exposure effects resulting from the leakage which would be detected by walkdowns and other normal plant operational activities. The applicant concluded that the operating experience and routine operator rounds/system walkdowns, in conjunction with a Flow-Accelerated Corrosion Program, Water Chemistry Program, Bolting and Torquing Activities Program, and Boric Acid Corrosion Prevention Program, provide assurance that leaks from nonsafety-related SSCs will not preclude the satisfactory accomplishment of required safety functions.

Staff Evaluation of the Applicant's Response

The staff reviewed the applicant's response to RAI 3.3.2.4.11-1 and does not concur that the external visual inspections for leakage are appropriate for managing internal aging effects for (a)(2) system components using the System Walkdown Program alone. For all components within license renewal scope, the staff requires AMPs to prevent fluid leaks rather than only detecting and mitigating the consequences of the leak. An NRC letter to NEI dated March 15, 2002, clarified that the applicant has two options when performing its scoping evaluation for nonsafety-related SSCs. If the applicant cannot demonstrate that the mitigative features (e.g., spray and drip shields, seismic supports, flood barriers, etc.) are adequate to protect safety-related SSCs from the consequences of failures of nonsafety-related SCCs, then the applicant should use the preventive option by including the nonsafety-related SCCs within scope. Since the ANO-2 nonsafety-related SSCs are within scope, the preventive action is applicable with appropriate preventive rather than mitigative AMPs. Leak detection is considered a mitigative program, and internal inspections are considered a preventive program. The staff explained this concern to the applicant in a phone call on June 22, 2004, and the applicant agreed to supply additional information regarding aging management of system components that rely only on the plant walkdown program. On July 2, 2004, the applicant provided additional information to support the aging management of (a)(2) components. This response states that, for the nine pressurized systems containing raw or untreated water, operating experience and maintenance inspections have not identified any abnormal corrosion in 25 years of operation.

The staff was concerned that the use of external visual inspections alone is not appropriate to manage internal aging effects. By letter dated September 10, 2004, the applicant stated that ANO-2 will implement a one-time inspection program for the components subject to aging management review that were included for 10CFR54.4(a)(2) in the following systems:

- Auxiliary building heating and ventilation
- Auxiliary building sump

- Drain collection header
- Liquid radwaste management
- Post accident sampling
- Resin Transfer
- Regenerative waste
- Spent Resin

The applicant response further stated that the one-time inspection program will be consistent with NUREG-1801 Vol.2, XI.M32, one-time inspection and a new SAR Section A.2.1.34 was included.

The staff was concerned that one-time inspections may not be appropriate for systems containing raw or untreated water unless there is sufficient data to conclude that degradation is not occurring or is occurring very slowly. The staff was also concerned that the one-time inspection program does not apply to the floor drains in the turbine building sump system. GALL AMP XI.M32 states that one-time inspections or any other action or program are to be reviewed by the staff on a plant-specific basis. The applicant was requested to submit for review their Appendix B program for one-time inspections. The applicant was requested to justify that one-time inspections are appropriate rather than periodic inspections. For example, the applicant was requested to clarify that, for these systems, there is sufficient data to conclude that degradation is not expected to occur or is expected to progress very slowly and that follow-up examinations would be performed to monitor the progression of any aging degradation. The applicant was also requested to justify why one-time inspections are not required for the in scope floor drains in the turbine building sump system.

By letter dated September 23, 2004, the applicant clarified that the one-time inspection will be performed near the end of the current operating term and aging of these components, if any, should progress slowly. The applicant indicated that, if loss of material due to corrosion is found, an evaluation will be performed to determine the rate of corrosion and appropriate corrective action taken. The applicant also stated that the turbine building sump system will be included with the eight systems managed by the one-time inspection program.

This response is adequate and acceptable to resolve the staff's concern regarding one-time inspections for 10CFR54.4(a)(2) components because the applicant has identified that the aging effects should progress very slowly in these components and the turbine building sump system will also be managed by the one-time inspection program. All issues related to RAI 3.3.2.4.11-1 are 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 the applicant has identified appropriate AMPs for managing the aging effects of the miscellaneous systems in scope for 10CFR54.4(a)(2) component types that are not addressed by the GALL report. In addition, the staff finds the program descriptions in the UFSAR supplement acceptable.

3.3.2.4.12 Miscellaneous Components

During the site inspection that was conducted by the staff on November 15 through 19, 2004, a walk-down of various systems was conducted. The staff noted that several component types that were brought into the scope of license renewal as a result of RAI 2.1-4 were included in the scope of license renewal. The applicant stated that the material and environment combinations of these components had been previously reviewed by the NRC staff. In a letter dated February 28, the applicant submitted the a table describing the additional components. The staff reviewed the table and determined that the aging effects could be adequately managed by the AMP's credited for the components. The inspection item associated with this issue is closed.

Conclusion

On the basis of its review, the staff concludes that the applicant has adequately identified the aging effects and the AMPs credited with managing the aging effects for the miscellaneous system components that are not addressed by the GALL Report and those specific component types within the scope of the technical review, so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable UFSAR Supplement program descriptions and concludes that the UFSAR Supplement adequately describes the AMPs credited with managing aging in these components, as required by 10 CFR 54.21(d).

3.3.3 Conclusion

On the basis of its audit and review, the staff concludes that the applicant has demonstrated that the aging effects associated with the auxiliary systems components will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable FSAR Supplement program summaries and concludes that the FSAR Supplement adequately describes the AMPs credited for managing aging of the auxiliary systems, as required by 10 CFR 54.21(d).

3.4 Steam and Power Conversion Systems

This section of the SER documents the staff's review of the applicant's AMR results for the steam and power conversion system components and component groups associated with the following systems:

- main steam system
- main feedwater system
- emergency feedwater system

3.4.1 Summary of Technical Information in the Application

In Section 3.4 of the LRA, the applicant provided the results of the AMRs of the main steam, main feedwater, and emergency feedwater system components and component types listed in Tables 2.3.4-1 through 2.3.4-3 of the LRA. The applicant also listed the materials, environments, aging effects requiring management, and AMPs associated with each system.

In Table 3.4.1, "Summary of the Aging Management Programs for the Steam and Power Conversion System Evaluated in Chapter VIII of NUREG-1801," of the LRA, the applicant provided a summary comparison of its AMRs with the AMRs evaluated in the GALL Report for the main steam, main feedwater, and emergency feedwater system components and component types. In Section 3.4.2.2 of the LRA, the applicant provided information concerning Table 3.4.1 components for which the GALL Report recommends further evaluation.

3.4.2 Staff Evaluation

The staff reviewed LRA Section 3.4 to determine if the applicant provided sufficient information to demonstrate that the effects of aging for the steam and power conversion system components that are within the scope of license renewal and subject to an AMR will be adequately managed so that the intended 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 performed an audit and review to confirm the applicant's claim that certain identified AMRs were consistent with the GALL Report. The staff did not repeat its review of the matters described in the GALL Report. However, the staff did determine that the material presented in the LRA was applicable and that the applicant had identified the appropriate GALL AMPs. Section 3.0.3 of this SER documents the staff's evaluations of the AMPs. The staff's audit and review findings are documented in the audit report issued on August 19, 2004 and summarized in Section 3.4.2.1 of this SER.

The staff also performed an audit of those AMRs that were consistent with the GALL Report and for which further evaluation is recommended. During the audit, the staff determined that the applicant's further evaluations were consistent with the acceptance criteria in Section 3.4.2.2 of the SRP-LR. The staff's audit findings are documented in the audit report and summarized in Section 3.4.2.2 of this SER.

The staff conducted a technical review of the remaining AMRs that were not consistent with the GALL Report. The review included evaluating whether the applicant had identified all plausible aging effects and whether the aging effects listed were appropriate for the combination of materials and environments specified. Section 3.4.2.3 of this SER documents the staff's review findings.

Finally, the staff reviewed the AMP summary descriptions in the FSAR Supplement to ensure that they adequately describe the programs credited with managing or monitoring aging for the reactor system components.

Table 3.4-1 below summarizes the staff's evaluation of components, aging effects/mechanisms, and AMPs listed in LRA Section 3.4 that are addressed in the GALL Report.

Table 3.4-1 Staff Evaluation for Steam and Power Conversion System Components in the GALL Report

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Piping and fittings in main feedwater line, steam line, and auxiliary feedwater (AFW) piping (PWR only) (Item 3.4.1-1)	Cumulative fatigue damage	TLAA in accordance with 10 CFR 54.21(c))	TLAA—Metal Fatigue	Consistent with GALL, which recommends further evaluation
Piping and fittings, valve bodies and bonnets, pump casings, tanks, tubes, tubesheets, channel head, and shell (except main steam system) (Item 3.4.1-2)	Loss of material due to general (carbon steel only), pitting, and crevice corrosion	Water Chemistry and One-Time Inspection	Water Chemistry Control (B.1.30), Periodic Surveillance and Preventive Maintenance (B.1.18)	Consistent with GALL, which recommends further evaluation
AFW piping (Item 3.4.1-3)	Loss of material due to general, pitting, and crevice corrosion, MIC, and biofouling	Plant specific	Water Chemistry Control (B.1.30), PSPM (B.1.18), Service Water Integrity (B.1.24)	Consistent with GALL, which recommends further evaluation
Oil coolers in AFW system (lubricating oil side possibly contaminated with water) (Item 3.4.1-4)	Loss of material due to general (carbon steel only), pitting, and crevice corrosion, and MIC	Plant specific	Oil Analysis (B.1.17)	Consistent with GALL, which recommends further evaluation
External surface of carbon steel components (Item 3.4.1-5)	Loss of material due to general corrosion	Plant specific	System Walkdown (B.1.28)	Consistent with GALL, which recommends further evaluation
Carbon steel piping and valve bodies (Item 3.4.1-6)	Wall thinning due to flow-accelerated corrosion	Flow-Accelerated Corrosion	Flow-Accelerated Corrosion (B.1.11)	Consistent with GALL, which recommends no further evaluation

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Carbon steel piping and valve bodies in main steam system (Item 3.4.1-7)	Loss of material due to pitting and crevice corrosion	Water Chemistry	Water Chemistry Control (b.1.30)	Consistent with GALL, which recommends no further evaluation
Closure bolting in high-pressure or high-temperature systems (Item 3.4.1-8)	Loss of material due to general corrosion; crack initiation and growth due to cyclic loading and/or SCC	Bolting Integrity	System Walkdown (B.1.28), Bolting and Torquing Activities (B.1.2)	Consistent with GALL, which recommends no further evaluation
Heat exchangers and coolers/ condensers serviced by open-cycle cooling water (Item 3.4.1-9)	Loss of material due to general (carbon steel only), pitting, and crevice corrosion, MIC, and biofouling; buildup of deposits due to biofouling	Open-Cycle Cooling Water System	Not Applicable to ANO-2	Consistent with GALL, which recommends no further evaluation
Heat exchangers and coolers/ condensers serviced by closed-cycle cooling water (Item 3.4.1-10)	Loss of material due to general (carbon steel only), pitting, and crevice corrosion	Closed-Cycle Cooling Water System	Not Applicable to ANO-2	Consistent with GALL, which recommends no further evaluation
External surface of aboveground condensate storage tank (Item 3.4.1-11)	Loss of material due to general (carbon steel only), pitting, and crevice corrosion	Aboveground Carbon Steel Tanks	Not Applicable to ANO-2	Consistent with GALL, which recommends no further evaluation
External surface of buried condensate storage tank and AFW piping (Item 3.4.1-12)	Loss of material due to general, pitting, and crevice corrosion, MIC	Buried Piping and Tanks Surveillance or Buried Piping and Tanks Inspection	Not Applicable to ANO-2	Consistent with GALL, which recommends no further evaluation Consistent with GALL, which recommends further evaluation
External surface of carbon steel components (Item 3.4.1-13)	Loss of material due to boric acid corrosion	Boric Acid Corrosion Prevention	Not Applicable to ANO-2	Consistent with GALL, which recommends no further evaluation

The staff's review of the ANO-2 steam and power conversion system and associated components followed one of several approaches. One approach, documented in Section 3.4.2.1, involves the staff's audit and review of the AMR results for components in the steam and power conversion system that the applicant indicated are consistent with the GALL Report and do not require further evaluation. Another approach, documented in Section 3.4.2.2, involves the staff's audit and review of the AMR results for components in the steam and power conversion system that the applicant indicated are consistent with the GALL Report and for which further evaluation is recommended. A third approach, documented in Section 3.4.2.3, involves the staff's technical review of the AMR results for components in the steam and power conversion system that the applicant indicated are not consistent with the GALL Report or are not addressed in the GALL Report. Section 3.0.3 of this SER documents the staff's review of AMPs that are credited with managing or monitoring the aging effects of the steam and power conversion system components.

3.4.2.1 AMR Results That Are Consistent with the GALL Report

In Sections 3.4.2.1.1 through 3.4.2.1.3 of the LRA, the applicant identified the materials, environments, and aging effects requiring management. The applicant identified the following programs that manage the aging effects related to the power and conversion system components:

- Bolting and Torquing Activities Program
- Flow-Accelerated Corrosion Program
- System Walkdown Program
- Water Chemistry Control Program
- Oil Analysis Program
- Periodic Surveillance and Preventive Maintenance Program

In Tables 3.4.2-1 through 3.4.2-3 of the LRA, the applicant summarized the AMRs for the steam and power conversion systems and identified which AMRs it considered to be consistent with the GALL Report.

The staff conducted an audit of the information provided in the LRA and program bases documents, which are available at the applicant's engineering office. On the basis of its audit, the staff finds that the AMR results, which the applicant claimed to be consistent with the GALL Report, are consistent with the AMRs in the GALL Report. Therefore, the staff finds that the applicable aging effects were identified and are appropriate for the combination of materials and environments listed.

The applicant provided a note for each AMR line item. The notes describe how the information in the tables aligns with the information in the GALL Report. The staff audited those AMRs with Notes A through E, which indicated the AMR is consistent with the GALL Report.

Note A indicates that the AMR line item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP is consistent with the AMP identified in the GALL Report. The staff audited these line items to determine consistency with the GALL Report and the validity of the AMR for the site-specific conditions.

Note B indicates that the AMR line item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The staff audited these line items to determine consistency with the GALL Report. The staff determined that it had reviewed and accepted the identified exceptions to the GALL Report. The staff also determined whether the AMP identified by the applicant is consistent with the AMP identified in the GALL Report and whether the AMR is valid for the site-specific conditions.

Note C indicates that the component for the AMR line item is different, but consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP is consistent with the AMP identified by the GALL Report. This note indicates that the applicant could not find a listing of some system components in the GALL Report. However, the applicant identified a different component in the GALL Report that has the same material, environment, aging effect, and AMP as the component under review. The staff audited these line items to determine consistency with the GALL Report. The staff also determined whether the AMR line item of the different component applies to the component under review and whether the AMR is valid for the site-specific conditions.

Note D indicates that the component for the AMR line item is different, but consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The staff audited these line items to determine consistency with the GALL Report. The staff determined that the AMR line item of the different component applies to the component under review. The staff determined that it had reviewed and accepted the identified exceptions to the GALL AMPs. The staff also determined whether the AMP identified by the applicant is consistent with the AMP identified in the GALL Report and whether the AMR is valid for the site-specific conditions.

Note E indicates that the AMR line item is consistent with the GALL Report for material, environment, and aging effect, but a different AMP is credited. The staff audited these line items to determine consistency with the GALL Report. The staff also determined whether the identified AMP would manage the aging effect consistent with the AMP identified by the GALL Report and whether the AMR is valid for the site-specific conditions.

The staff conducted an audit and review of the information provided in the LRA and program bases documents, which are available at the applicant's engineering office. On the basis of its audit and review, the staff confirms that the AMR results, which the applicant claimed to be consistent with the GALL Report, are consistent with the AMRs in the GALL Report. Therefore, the staff finds that the applicant identified the applicable aging effects, and they are appropriate for the combination of materials and environments listed.

On the basis of its audit, the staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

Conclusion

The staff has determined the applicant's claim of consistency with the GALL Report. The staff reviewed information pertaining to the applicant's consideration of recent operating experience and proposals for managing associated aging effects. On the basis of its review, the staff finds that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable FSAR Supplement program summaries and concludes that they adequately describe the AMPs credited for managing aging in these components, as required by 10 CFR 54.21(d).

3.4.2.2 AMR Results That Are Consistent with the GALL Report, for Which Further Evaluation Is Recommended

Summary of Technical Information in the Application

In Section 3.4.2.2 of the LRA, the applicant provides further evaluation of aging management as recommended by the GALL Report for steam and power conversion systems. The applicant provided information concerning how it will manage the following aging effects:

- cumulative fatigue damage
- loss of material due to general, pitting, and crevice corrosion
- loss of material due to general, pitting, and crevice corrosion, microbiologically influenced corrosion, and biofouling
- general corrosion
- loss of material due to general, pitting, crevice, and microbiologically influenced corrosion
- quality assurance for aging management for nonsafety-related components

Staff Evaluation

For component groups evaluated in the GALL Report for which the applicant has claimed consistency with the GALL Report, and for which the GALL Report recommends further evaluation, the staff reviewed the applicant's evaluation to determine whether it adequately addressed the issues in its additional evaluation. The staff also audited the applicant's further evaluations against the criteria contained in Section 3.4.2.2 of the SRP-LR. The audit report issued August 19, 2004, documents the details of the staff's audit.

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. In accordance with 10 CFR 54.21(c)(1), TLAAs must be evaluated in accordance with 10 CFR 54.21(c)(1). Section 4.3 of this SER documents the staff's review of the applicant's evaluation of this TLAA. In performing this review, the staff followed the guidance in Section 4.3 of the SRP-LR.

3.4.2.2.2 Loss of Material due to General, Pitting, and Crevice Corrosion

In Section 3.4.2.2.2 of the LRA, the applicant addressed the GALL Report recommendation for further evaluation to evaluate the effectiveness of the Water Chemistry Control Program in managing loss of material due to general, pitting, and crevice corrosion.

Section 3.4.2.2.2 of the SRP-LR states that the management of loss of material due to general, pitting, and crevice corrosion should be evaluated further for 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. It also recommends further evaluation of loss of material due to pitting and crevice corrosion for stainless steel tanks and heat exchanger/cooler tubes. The Water Chemistry Program relies on monitoring and control of water chemistry based on the EPRI guidelines of TR-102134 for secondary water chemistry to manage the effects of loss of material due to general, pitting, or crevice corrosion. However, corrosion may occur at locations of stagnant flow conditions. Therefore, the effectiveness of the Chemistry Control Program should be evaluated to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to manage loss of material due to general, pitting, and crevice corrosion to determine the effectiveness of the Water Chemistry Program. A one-time inspection of selected components and susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the components' intended function will be maintained during the period of extended operation.

For the components for which this evaluation is required, the applicant credited the Primary and Secondary Water Chemistry Control Program (AMP B.1.30.3) with managing loss of material. The Water Chemistry Control Program minimizes loss of material and provides for the inspection of systems when they are opened for maintenance, which addresses the verification program recommendation in the GALL Report. The applicant credited the Periodic Surveillance and Preventive Maintenance Program (AMP B.1.18) with supplementing the Water Chemistry Control Program for portions of the emergency feedwater system. The Water Chemistry Control Program provides for the inspection of systems when they are opened for maintenance, which addresses the one-time inspection recommendation in the GALL Report. The applicant's existing Primary and Secondary Water Chemistry Control Program relies on the EPRI guidelines of TR-102134 for secondary water chemistry to manage the effects of loss of material due to general, pitting, or crevice corrosion. The applicant does not have a one-time inspection program of selected components and susceptible locations, which is suggested in the GALL AMP XI.M32 as a means to determine the program's effectiveness. Rather, the applicant credited on-going routine maintenance and inspection activities with determining the effectiveness of the Primary and Secondary Water Chemistry Control Program.

The staff reviewed the effectiveness of the Primary and Secondary Water Chemistry Control Program by examining routine component inspections that are performed by chemistry, maintenance, and engineering staff when primary and secondary systems were opened for maintenance, when an adverse chemistry trend existed, or when requested by the chemistry or engineering departments. The components inspected have included areas that are susceptible to the aging effects identified in the LRA. The inspections performed include inspections in systems such as emergency feedwater and EDGs which are normally in standby, condensate storage tanks, feedwater heaters, moisture separator reheaters, chillers, main steam safety valves, and blowdown heat exchangers. All of these components have areas that are susceptible to the aging effects addressed in Section 3.4.2.2.2 of the LRA.

Seeking additional confirmation of the effectiveness of the Water Chemistry Programs, the staff reviewed operating experience documented in the applicant's engineering report, which included an audit of condition reports (CRs), CR trending data, and interviews with the applicant's technical staff regarding the Water Chemistry Program's operating experience. The operating experience review did not identify component failures or significant adverse conditions such as aging effects in the systems that were the result of an ineffective Water Chemistry Program. Also, the CR trending data did not identify recurrent component degradation occurring in the steam and power conversion systems. The audit of CRs, CR trending data, and personnel interviews provided additional confirmation of the effectiveness of the Primary and Secondary Water Chemistry Control Program.

The staff finds that the applicant has demonstrated that the effects of aging for loss of material will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation.

3.4.2.2.3 Loss of Material due to General, Pitting, and Crevice Corrosion, Microbiologically Influenced Corrosion, and Biofouling

In Section 3.4.2.2.3 of the LRA, the applicant addressed loss of material in carbon steel piping and fittings for untreated water from the backup water supply in the emergency feedwater system.

Section 3.4.2.2.3 of the SRP-LR states that loss of material due to general corrosion, pitting, and crevice corrosion, MIC, and biofouling could occur in carbon steel piping and fittings for untreated water from the backup water supply in the auxiliary feedwater system. The GALL Report recommends further evaluation to ensure that these aging effects are adequately managed.

The applicant stated that it addressed the portion of the lines from the service water system to the emergency feedwater system that are exposed to untreated water as part of the service water system (LRA Item 3.3.1-17 of Table 3.3.1). With exceptions, the Service Water Integrity Program (AMP B.1.24) is the equivalent of the Open-Cycle Cooling System Program described in the GALL AMP XI.M20, "Open-Cycle Cooling Water System." Section 3.0.3.2.7 of this SER evaluates the Service Water Integrity Program.

The Service Water Integrity Program is supplemented by the Primary and Secondary Water Chemistry Control Program (AMP B.1.30.3) and the Periodic Surveillance and Preventive Maintenance Program (AMP B.1.18) which manage loss of material and fouling. Although biofouling is not, in itself, an aging effect, these programs manage the effects that may result from biofouling in carbon steel piping and fittings for untreated water from the backup water supply in the emergency feedwater system. The staff reviewed the Primary and Secondary Water Chemistry Control Program and the PSPM Program. Sections 3.0.3.1 and 3.0.3.3.7 of this SER, respectively, document the staff's evaluation of these programs. The staff finds that the PSPM Program effectively manages the aging effects of loss of material.

3.4.2.2.4 General Corrosion

In Section 3.4.2.2.4 of the LRA, the applicant stated that loss of material due to general corrosion could occur on external surfaces of carbon steel SCs, including closure bolting. The applicant credited the System Walkdown Program (AMP B.1.28) with managing loss of material for the external surfaces of carbon steel SCs, including bolting indoors and outdoors.

Section 3.4.2.2.4 of the SRP-LR states that loss of material due to general corrosion could occur on the external surfaces of all carbon steel SCs, including closure boltings, exposed to operating temperatures less than 212 °F. The GALL Report recommends further evaluation to ensure adequate management of this aging effect.

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. Based on its review of the System Walkdown Program, the staff concludes that the program will adequately manage these aging effects. Section 3.0.3.3.9 of this SER documents the staff's evaluation of this program.

3.4.2.2.5 Loss of Material due to General, Pitting, Crevice, and Microbiologically Influenced Corrosion

In Section 3.4.2.2.5 of the LRA, the applicant addressed (1) loss of material due to general corrosion (carbon steel only), pitting and crevice corrosion, and microbiologically influenced corrosion in stainless steel and carbon steel components exposed to lubricating oil in the emergency feedwater system and (2) loss of material in underground piping and fittings and storage tanks for steam and power conversion systems.

Section 3.4.2.2.5 of the SRP-LR addresses loss of material due to general corrosion (carbon steel only), pitting and crevice corrosion, and MIC which could occur in stainless steel and carbon steel shells, tubes, and tubesheets within the bearing oil coolers (for steam turbine pumps) in the auxiliary feedwater system. The GALL Report recommends further evaluation to ensure adequate management of these aging effects.

Section 3.4.2.2.5 of the SRP-LR also addresses loss of material due to general corrosion, pitting and crevice corrosion, and MIC, which could occur in underground piping and fittings and the emergency condensate storage tank in the auxiliary feedwater system and the underground condensate storage tank in the condensate system. The Buried Piping and Tanks Inspection Program relies on industry practice, frequency of pipe excavation, and operating experience to manage the effects of loss of material due to general corrosion, pitting and crevice corrosion, and MIC. The effectiveness of the Buried Piping and Tanks Inspection Program should be reviewed to evaluate an applicant's inspection frequency and operating experience with buried components, thus ensuring that loss of material is not occurring.

The applicant stated that the Oil Analysis Program (AMP B.1.17) manages the loss of material aging effect for stainless steel and carbon steel components exposed to lubricating oil in the emergency feedwater system. The staff review found that the Oil Analysis Program adequately manages the effects of aging of loss of material for stainless and carbon steel components exposed to lubricating oil. Section 3.0.3.3.6 of this SER documents the staff's evaluation of this AMP.

3.4.2.2.6 Quality Assurance for Aging Management for Nonsafety-Related Components

Section 3.0.4 of this SER provides the staff's evaluation of the applicant's Quality Assurance Program.

Conclusion

On the basis of its audit and review, the staff finds that the applicant's further evaluations, conducted in accordance with the GALL Report, are consistent with the acceptance criteria in Section 3.4.2.2 of the SRP-LR. Since the applicant's AMR results are otherwise consistent with the GALL report, the staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the current licensing basis for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.3 AMR Results That Are Not Consistent with the GALL Report

Summary of Technical Information in the Application

In Tables 3.4.2-1 through 3.4.2-3 of the LRA, the applicant gave additional details of the results of the AMRs for material, environment, aging effects requiring management, and AMP combinations that are not evaluated in the GALL Report.

In Tables 3.4.2-1 through 3.4.2-3, the applicant indicated, via Notes F through J, that neither the identified component nor the material and environment combination is evaluated in the GALL Report and provided information concerning how the aging effect will be managed.

Note F indicates that the material is not in the GALL Report for the identified component.

Note G indicates that the environment is not in the GALL Report for the identified component and material.

Note H indicates that the aging effect is not in the GALL Report for component, material, and environment combination.

Note I indicates that the aging effect in the GALL Report for the identified component, material, and environment combination is not applicable.

Note J indicates that neither the identified component nor the material and environment combination is evaluated in the GALL Report.

For component type, material, and environment combination that are not evaluated in the GALL Report, the staff reviewed the applicant's evaluation to determine whether the applicant demonstrated that it will adequately manage the effects of aging so that the intended function will be maintained consistent with the CLB during the period of extended operation.

The staff evaluation is discussed below.

3.4.2.3.1 Main Steam System

Summary of Technical Information in the Application

In Section 3.4.2.1.1 of the LRA, the applicant identified the materials, environments, and aging effects requiring management. The applicant identified the following programs that manage the aging effects requiring management for the main steam system components:

- Bolting and Torquing Activities
- Flow-Accelerated Corrosion
- System Walkdown
- Water Chemistry Control

In Table 3.4.2-1 of the LRA, the applicant summarized the AMRs for the main steam system components and identified which AMRs it considered to be consistent with the GALL Report.

Staff Evaluation

The staff reviewed Table 3.4.2-1 of the LRA, which summarized the results of AMR evaluations in the SRP-LR for the main steam system component groups. The staff reviewed the AMR of the main steam system component/material/environment/AERM combinations that are not addressed in the GALL Report. These combinations use Notes F through J in LRA Table 3.4.2-1, except for those that had past precedents. The staff also reviewed those combinations in Table 3.4.2-1, with Notes A through E, which had associated emerging issues. The staff confirmed that the applicant had identified all applicable AERMs and had credited appropriate AMPs for managing the AERMs. The staff also reviewed the applicable UFSAR Supplements for the AMPs to ensure that the program descriptions were adequate.

The applicant identified no aging effects for stainless steel components exposed to air, including expansion joint, piping, thermowell, tubing, and valve component types. The GALL Report does not identify air as an environment for these components and materials.

On the basis of current industry research and operating experience, dry air on metal will not result in aging that will be of concern during the period of extended operation. The external environments referred to are typical of ambient air (e.g., under a shelter, indoors, or in an air-conditioned enclosure or room). Therefore, the staff concludes that there are no aging effects requiring management for stainless steels in an air environment.

Aging Effects

Table 2.3.4-1 of the LRA lists individual system components within the scope of license renewal and subject to AMR. The component types that do not rely on the GALL Report for AMR include bolting, expansion joint, orifice, piping, steam trap, thermowell, tubing, and valve.

For these component types, the applicant identified the following materials, environments, and AERMS:

- Carbon steel bolting in air (external) environments is subject to loss of material and loss of mechanical closure integrity.

- Carbon steel components in air (external), steam greater than 220 °F (internal), and treated water greater than 220 °F (internal) environments are subject to loss of material.

- Stainless steel bolting in air (external) environments is subject to loss of mechanical closure integrity.

- Stainless steel components in steam greater than 270 °F (internal) and treated water greater than 270 °F (internal) environments are subject to loss of material and cracking.

- Stainless steel components in air (external) environments experience no aging effects.

During its review, the staff determined that it needed additional information.

In LRA Table 3.4.1, Item 3.4.1-8, under "Discussion," the applicant stated that for closure bolting, the aging effect requiring management is loss of mechanical closure integrity, which includes a broader range of aging mechanisms than those included in this line item (i.e., loss of material due to general corrosion and crack initiation and growth due to cyclic loading and/or SCC). The applicant also stated that it uses the System Walkdown Program to supplement the Bolting and Torquing Activities Program to maintain bolting integrity. In RAI 3.2-1(1), (2), and (3), the staff asked the applicant to (1) explain the extent to which AMR Item 3.4.1-8 deviates from the ANO-2 AMR results; (2) clarify whether the aging effect of "loss of mechanical closure integrity" indeed includes loss of material and cracking, and, specifically, what other aging effects/mechanisms are included in the "broader range"; and (3) discuss how it will manage each of the identified aging effects and why the approach to managing the aging effects is adequate.

By letter dated April 6, 2004, the applicant stated that it does not consider LRA Table 3.4-1, Item 3.4.1-8, to match the ANO-2 AMR results because the aging effects and programs used to manage them do not match. The applicant stated that the differences in the ANO-2 aging effects are that loss of mechanical closure integrity is considered an aging effect requiring management for high-temperature bolting, and cracking is not considered an aging effect requiring management. At ANO-2, the potential for SCC of bolting in non-Class 1 systems is minimized by using lower yield strength carbon steel bolting material and limiting contaminants such as chlorides and sulfur in lubricants and sealant compounds. Consistent with the GALL Report, the ANO-2 AMR identifies loss of material as an aging effect requiring management. However, for carbon steel bolting in the steam and power conversion systems, the System Walkdown Program manages loss of material.

The staff found that the applicant's response adequately explains the differences between AMR Item 3.4.1-8 and the ANO-2 AMR results for the closure bolting in the steam and power conversion systems, including how the aging effect of loss of material will be managed. RAI 3.4-1(1) is therefore closed.

The applicant stated that the words "broad range" refer to the fact that loss of mechanical closure integrity is identified as an aging effect requiring management for bolting in two cases. First, bolting in high-temperature systems, and in applications subject to significant vibration, is subject to loss of mechanical closure integrity resulting from loss of pre-load, which is managed by the Bolting and Torquing Activities Program. The same bolted closures may be subject to loss of material, if they are carbon steel or wetted stainless steel. If so, another program, such as the System Walkdown Program, would manage the loss of material. Second, in a case where the carbon steel bolting is exposed to borated water leakage, loss of material may progress to such an extent that it will affect the mechanical closure integrity. Thus, the applicant conservatively considered both loss of material and loss of mechanical closure integrity to be aging effects requiring management. In general, however, loss of mechanical closure integrity does not cover the aging effects of loss of material or cracking. Based on this information, the staff determined that the applicant has adequately delineated the aging effects included under the "loss of mechanical closure integrity" and has identified the associated AMPs to manage these aging effects. RAIs 3.2-1(2) and (3) are therefore closed.

In LRA Table 3.4.2-1, the applicant stated that for the main steam system, a Water Chemistry Control Program manages cracking and loss of material for stainless steel components in steam greater than 270 °F (internal) and treated water greater than 270 °F (internal) environments. In RAI 3.4-3, the staff requested that the applicant explain why a supplemental inspection is not needed to determine the effectiveness of the Water Chemistry Control Program. By letter dated April 6, 2004, the applicant stated that for the steam and power conversion systems' stainless steel components, the GALL Report identifies only the condensate storage tank and heat exchanger tubes as requiring augmentation of the Water Chemistry Program. Other stainless steel components require no confirmation. However, the applicant provided the following information to confirm the effectiveness of the Water Chemistry Programs at ANO-2:

> The effectiveness of the Water Chemistry programs at ANO-2 has been confirmed through routine component inspections that are performed by chemistry, maintenance and engineering personnel. This includes the primary and secondary water chemistry programs. These inspections were performed when systems were opened for maintenance, when an adverse chemistry trend existed, or when requested by the chemistry or engineering departments. The areas inspected have included stagnant areas that are most susceptible to aging effects identified in the LRA. In addition, for many components covered by the Primary and Secondary Water Chemistry Control Program, such as those in the reactor coolant system and steam generators, inspection activities included in other aging management programs provide additional confirmation of chemistry program effectiveness. These other programs include the Inservice Inspection, Alloy 600 Aging Management, Cast Austenitic Stainless Steel Evaluation, Pressurizer Examinations, Reactor Vessel Internals Inspection, and Steam Generator Integrity Programs. Some components, such as heat exchangers and steam generators, have been inspected on a periodic basis providing further evidence that the water chemistry programs are adequately managing aging effects. If during these inspections significant abnormal conditions were noted, including those that were the result of aging effects such as loss of material and cracking, these conditions would have been documented under the corrective action program. Subsequently, actions to determine cause of the condition and corrective actions to correct and prevent recurrence would have been taken.

The GALL One Time Inspection Program XI.M32, focuses on the most susceptible material and environment combinations in the most susceptible locations. Items such as heat exchangers, piping and valves normally in standby, and system low points or stagnant areas are representative of these susceptible locations. At ANO-2, inspections have been performed in systems such as emergency feedwater and emergency diesel generators which are normally in standby, steam generators, condensate storage tanks, feedwater heaters, moisture separator reheaters, chillers, main steam safety valves, and blowdown heat exchangers. All of these components are made of susceptible materials (stainless and carbon steel) and are exposed to environments (treated water and steam) that would be conducive to aging effects managed by the chemistry programs.

Many components in the steam generators have inspection activities included in other aging management programs that provide additional assurance that significant degradation is not occurring and that the Water Chemistry Control Program is effective. These inspection activities include those contained in the Inservice Inspection and Steam Generator Integrity Programs. These inspection results of steam generator components are also applicable to the main steam, main feedwater and emergency feedwater components which possess the same material and environment combinations.

As additional confirmation of the effectiveness of the water chemistry programs, the ANO-2 review of operating experience included a review of condition reports (CRs), CR trending data, and interviews with site personnel regarding water chemistry program operating experience. The operating experience review did not identify component failures or significant adverse conditions that were the result of an ineffective water chemistry program. Also, the CR trending data did not identify recurrent component degradation occurring in the systems covered under this aging management program. The review of CRs, CR trending data, and personnel interviews provided additional confirmation of chemistry program effectiveness.

The combination of inspections under the Inservice Inspection Program, the Steam Generator integrity Program, and maintenance and routine chemistry inspections as a whole, constitute a more thorough confirmation of water chemistry aging management program effectiveness than would be obtained from one-time inspections of a sample of items.

The staff has confirmed that LRA Table 3.1.2-5 lists stainless steel components of steam generators in treated water (internal) environments, which are managed by the Water Chemistry Control Program and also inspected under the Inservice Inspection and Steam Generator Integrity Programs. These inspection results of steam generator components are also applicable to the main steam, main feedwater, and emergency feedwater components that have the same material and environment combinations. Based on the above, the staff found that the combination of inspections under the Inservice Inspection Program, the Steam Generator Integrity Program, and those inspection activities included in the other AMPs constitute an adequate confirmation of the effectiveness of the Water Chemistry Control Program. The staff therefore considers the GALL recommendations satisfied for these components, and RAI 3.4-3 is closed.

On the basis of its review of the information provided in the LRA and the additional information included in the applicant's responses to the above RAIs, the staff finds that the aging effects of the main steam system component types not addressed by the GALL Report are consistent with industry experience for these combinations of materials and environments. The staff did not identify any omitted aging effects. Therefore, the staff finds that the applicant has identified the appropriate aging effects for the materials and environments associated with the components in the main steam system.

Aging Management Programs

After evaluating the applicant's identification of aging effects for each of the above components, the staff evaluated the AMPs to determine if they are appropriate for managing the identified aging effects. The staff also confirmed that the UFSAR Supplement contains an adequate description of the programs.

Table 3.4.2-1 of the LRA identifies the following AMPs for managing the aging effects described above for the main steam system.

- Bolting and Torquing Activities (B.1.2)
- Flow-Accelerated Corrosion (B.1.11)
- System Walkdown (B.1.28)
- Water Chemistry Control (B.1.30)

The staff's detailed review of these AMPs appears in Sections 3.0.3.3.2, 3.0.3.1, 3.0.3.3.9, and 3.0.3.3.11 of this SER, respectively.

During its review, the staff determined that it needed additional information.

In LRA Table 3.4-1, Item 3.4.1-8, under "Discussion," the applicant stated that the System Walkdown Program supplements Bolting and Torquing Activities to maintain bolting integrity in the steam and power conversion systems. In RAI 3.4-1(4), the staff asked the applicant to demonstrate that with the combination of these AMPs, the aging effects associated with closure bolting will be adequately managed, or managed in a manner equivalent to that described in GALL AMP XI.M18, "Bolting Integrity." By letter dated April 6, 2004, the applicant stated that the System Walkdown Program manages loss of material for closure bolting and the Bolting and Torquing Activities Program manages loss of mechanical closure integrity for closure bolting. The applicant stated that visual inspections of bolting for loss of material in the System Walkdown Program are adequate to assure that the closure bolting can perform its intended function. This is because loss of material from external surfaces such as closure bolting is a long-term aging effect that would be observed well before aging progressed to the point of loss of intended function. The applicant stated that the Bolting and Torquing Activities Program assures that proper torque values are applied to bolted closures such that loss of mechanical closure integrity as a result of loss of pre-load because of high temperatures does not occur.

The Bolting and Torquing Activities and System Walkdown Programs are plant-specific programs and are not intended to be comparable to GALL AMP XI.M18, "Bolting Integrity," which stipulates the inservice inspection requirements of the ASME Code, Section XI. These

ISI requirements are included in the ANO-2 Inservice Inspection Program for Class 1, 2, and 3 bolted closures. However, these ISI requirements are focused on identifying the aging effect of cracking. Since cracking is not an aging effect requiring management for non-Class 1 bolted closures, the applicant did not include the Inservice Inspection Program as an AMP for the steam and power conversion systems.

Because the bolted closures under these systems include only ASME Class 2 and 3 closure bolting, the staff found that the applicant's response adequately addresses the staff's concern regarding the adequacy and sufficiency of the Bolting and Torquing Activities and System Walkdown Programs for the ANO-2 bolted closures. The applicant's response also clarified, for closure bolting, the difference between these AMPs and the ANO-2 Inservice Inspection Program, which primarily focuses on identifying the aging effect of cracking. Based on this information, the staff considers RAI 3.4-1(4) to be closed.

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 has identified appropriate AMPs for managing the aging effects of the main steam system component types not addressed by the GALL Report. In addition, the staff finds the program descriptions in the UFSAR Supplement acceptable.

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 main steam system components that are not addressed by the GALL Report, so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 51.21(a)(3).

The staff also reviewed the applicable FSAR Supplement program descriptions and concludes that the FSAR Supplement adequately describes the AMPs credited with managing aging in these components, as required by 10 CFR 54.21(d).

3.4.2.3.2 Main Feedwater System

Summary of Technical Information in the Application

In Section 3.4.2.1.2 of the LRA, the applicant identified the materials, environments, and aging effects requiring management. The applicant identified the following programs that manage the aging effects requiring management for the main feedwater system components:

- Bolting and Torquing Activities
- Flow-Accelerated Corrosion
- System Walkdown
- Water Chemistry Control

In Table 3.4.2-2 of the LRA, the applicant summarized the AMRs for the main feedwater system components and identified which AMRs it considered to be consistent with the GALL Report.

Staff Evaluation

The staff reviewed Table 3.4.2-2 of the LRA, which summarized the results of AMR evaluations in the SRP-LR for the main feedwater system component groups. The staff reviewed the AMR of the main feedwater system component/material/environment/AERM combinations that are not addressed in the GALL Report. These combinations use Notes F through J in LRA Table 3.4.2-2, except for those with past precedents. The staff also reviewed those combinations in Table 3.4.2-2, with Notes A through E, which had associated emerging issues. The staff confirmed that the applicant had identified all applicable AERMs and had credited appropriate AMPs for managing the AERMs. The staff also reviewed the applicable UFSAR Supplements for the AMPs to ensure that the program descriptions are adequate.

The applicant identified no aging effects for stainless steel components exposed to air, including bolting, tubing, and valve component types. The GALL Report does not identify air as an environment for these components and materials.

On the basis of current industry research and operating experience, dry air on metal will not result in aging that will be of concern during the period of extended operation. The external environments referred to are typical of ambient air (e.g., under a shelter, indoors, or in an air-conditioned enclosure or room). Therefore, the staff concludes that there are no aging effects requiring management for stainless steel in a dry air environment.

Aging Effects

Table 2.3.4-2 of the LRA lists individual system components within the scope of license renewal and subject to AMR. The component types that do not rely on the GALL Report for AMR include bolting, piping, tubing, and valve.

For these component types, the applicant identifies the following materials, environments, and AERMS:

- Carbon steel bolting in air (external) environments is subject to loss of material and loss of mechanical closure integrity.
- Carbon steel components in air (external) and treated water greater than 220 °F (internal) environments are subject to loss of material.
- Stainless steel bolting in air (external) environments is subject to loss of mechanical closure integrity.
- Stainless steel components in treated water greater than 270 °F (internal) environments are subject to loss of material and cracking.
- Stainless steel components in air (external) environments experience no aging effects.

During its review, the staff determined that it needed additional information.

In LRA Table 3.4.1, Item 3.4.1-8, under "Discussion," the applicant stated that for closure bolting, the aging effect requiring management is loss of mechanical closure integrity, which includes a broader range of aging mechanisms than those included in this AMR line item. The applicant also stated that it used programs other than the GALL Report's Bolting Integrity Program. In RAI 3.4-1(1), (2), and (3), the staff asked the applicant to (1) explain the extent to which AMR Item 3.4.1-8 deviates from the ANO-2 results; (2) clarify whether the aging effect of "loss of mechanical closure integrity" includes loss of material and cracking, and, specifically, what other aging effects/mechanisms are included in the "broader range"; and (3) discuss how it will manage each of the identified aging effects and why the approach for managing the aging effects is adequate. Section 3.4.2.4.1 of this SER provides the staff's discussion of this RAI and its resolution by the applicant.

In LRA Table 3.4.2-2, the applicant stated that for the main feedwater system, it uses a Water Chemistry Control Program to manage cracking and loss of material for stainless steel components in an environment of treated water greater than 270 °F (internal). In RAI 3.4-4, the staff asked the applicant to explain why a supplemental inspection program is not needed to determine the effectiveness of the Water Chemistry Control Program. The staff's discussion of this RAI and its resolution by the applicant is similar to RAI 3.4-3 and appears in Section 3.4.2.4.1 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 responses to the above RAIs, the staff finds that the aging effects of the main feedwater system component types not addressed by the GALL Report are consistent with industry experience for these combinations of materials and environments. The staff did not identify any omitted aging effects. Therefore, the staff finds that the applicant has identified the appropriate aging effects for the materials and environments associated with the components of the main feedwater system.

Aging Management Programs

After evaluating the applicant's identification of aging effects for each of the above components, the staff evaluated the AMPs to determine if they are appropriate for managing the identified aging effects. The staff also confirmed that the UFSAR Supplement adequately describes the program.

Table 3.4.2-2 of the LRA identifies the following AMPs for managing the aging effects described above for the main feedwater system:

- Bolting and Torquing Activities (B.1.2)
- Flow-Accelerated Corrosion (B.1.11)
- System Walkdown (B.1.28)
- Water Chemistry Control (B.1.30)

The staff's detailed review of these AMPs appears in Sections 3.0.3.3.2, 3.0.3.1, 3.0.3.3.9, and 3.0.3.2.8 of this SER, respectively.

During its review, the staff determined that it needed additional information.

In LRA Table 3.4-1, Item 3.4.1-8, under "Discussion," the applicant stated that the System Walkdown Program supplements Bolting and Torquing Activities to maintain bolting integrity in the steam and power conversion systems. In RAI 3.4-1(4), the staff asked the applicant to demonstrate that the combination of these AMPs will adequately manage the aging effects associated with closure bolting or will manage them in a manner equivalent to that described in GALL AMP XI.M18, "Bolting Integrity." Section 3.4.2.4.1 of this SER contains the staff's discussion of this RAI and its resolution by the applicant.

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 has identified appropriate AMPs for managing the aging effects of the main feedwater system component types not addressed by the GALL Report. In addition, the staff finds the program descriptions in the UFSAR Supplement acceptable.

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 main feedwater system components that are not addressed by the GALL Report, so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 51.21(a)(3).

The staff also reviewed the applicable FSAR Supplement program descriptions and concludes that the FSAR Supplement adequately describes the AMPs credited with managing aging in these components, as required by 10 CFR 54.21(d).

3.4.2.3.3 Emergency Feedwater System

Summary of Technical Information in the Application

In Section 3.4.2.1.3 of the LRA, the applicant identified the materials, environments, and aging effects requiring management. The applicant identified the following programs that manage the aging effects requiring management for the emergency feedwater system components:

- Bolting and Torquing Activities
- Flow-Accelerated Corrosion
- Oil Analysis
- Periodic Surveillance and Preventive Maintenance
- System Walkdown
- Water Chemistry Control

In Table 3.4.2-3 of the LRA, the applicant summarized the AMRs for the emergency feedwater system components and identified which AMRs it considered to be consistent with the GALL Report.

Staff Evaluation

The staff reviewed Table 3.4.2-3 of the LRA, which summarized the results of AMR evaluations in the SRP-LR for the emergency feedwater system component groups. The staff reviewed the AMR of the emergency feedwater system component/material/environment/AERM combinations that are not addressed in the GALL Report. These combinations use Notes F through J in LRA Table 3.4.2-3, except where there were past precedents. The staff also reviewed those combinations in Table 3.4.2-3, with Notes A through E, for which there were emerging issues. The staff confirmed that the applicant had identified all applicable AERMs and had credited appropriate AMPs with managing the AERMs. The staff also reviewed the applicable UFSAR Supplements for the AMPs to ensure that the program descriptions are adequate.

The applicant identified no aging effects for stainless steel components exposed to air, including bolting, orifice, piping, tank, thermowell, tubing, and valve component types. The GALL Report does not identify air as an environment for these components and materials.

On the basis of current industry research and operating experience, dry air on metal will not result in aging that will be of concern during the period of extended operation. The external environments referred to are typical of ambient air (e.g., under a shelter, indoors, or in an air-conditioned enclosure or room). Therefore, the staff concludes that there are no aging effects requiring management for stainless steel in a dry air environment.

In the case of a copper alloy heat exchanger tubesheet exposed to lube oil, the applicant proposed to manage loss of material using the Oil Analysis Program (AMP B.1.17). The staff reviewed and accepted the Oil Analysis Program. Section 3.0.3.3.6 of this SER documents the staff's evaluation of this program.

The staff notes that loss of material due to pitting corrosion is an applicable aging effect for brass, bronze, and copper materials in a lubricating oil environment at locations containing oxygenated water with contaminants such as halide ions, particularly chloride ions. In addition, loss of material due to galvanic corrosion in a lubricating oil environment can occur only when materials with different electrochemical potentials are in contact in the presence of water.

The staff also notes that loss of material due to crevice corrosion can also occur in brass, bronze, and copper materials in a lubricating oil environment at locations containing oxygenated water. Oxygen is required for the initiation of crevice corrosion. Lube oil that is not contaminated with water does not contain oxygen in sufficient quantities for crevice corrosion to occur. Water contamination of lubricating oil can occur and is required for the introduction of oxygen. Although only high-quality (water- and contaminant-free) lubricating oil is received, and periodic sampling is performed to ensure the quality is maintained, the potential contamination of lubricating oil makes the loss of material due to general corrosion, pitting, galvanic corrosion, and crevice corrosion an applicable aging effect for brass, bronze, and copper materials exposed to lubricating oil in the emergency feedwater system.

The staff further notes that loss of material due to microbiologically influenced corrosion is an applicable aging effect for brass and copper materials exposed to lubricating oil. The applicant treated the lubricating oil with biocides to limit the presence of microbiological organisms and, therefore, microbiologically influenced corrosion has not been a concern for those portions of the steam and power conversion systems that are within the scope of license renewal, and the associated materials exposed to lubricating oil. However, the potential for microbiological organisms to be found in lubricating oil makes microbiologically influenced corrosion an applicable aging effect for brass and copper materials exposed to lubricating oil in the steam and power conversion systems.

Because the Oil Analysis Program maintains oil systems free of contaminants (primarily water and particles), the staff finds that this program adequately manages loss of material for components exposed to lubricating oil.

Aging Effects

Table 2.3.4-3 of the LRA lists individual system components within the scope of license renewal and subject to AMR. The component types that do not rely on the GALL Report for AMR include bearing housing, bolting, equalizer pipe, filter housing, governor housing, heat exchanger (tubes), heat exchanger (tubesheet), heater housing, orifice, piping, pump casing, servo housing, sight glass, sight glass housing, steam trap, tank, thermowell, tubing, turbine casing, and valve.

For these component types, the applicant identified the following materials, environments, and AERMS:

- Carbon steel bolting in air (external) environments is subject to loss of material and loss of mechanical closure integrity. In an outdoor air (external) environment, it is also subject to loss of material.
- Carbon steel and cast iron components in air (external) and lube oil (internal) environments are subject to loss of material.
- Carbon steel components in steam greater than 220 °F (internal), treated water (internal), and treated water greater than 220 °F (internal) environments are subject to loss of material.
- Stainless steel bolting in air (external) environments is subject to loss of mechanical closure integrity.
- Stainless steel components in treated water (internal), lube oil (internal), and steam greater than 270 °F (internal) environments are subject to loss of material and cracking.
- Copper components in lube oil (internal) and treated water (internal) environments are subject to fouling and loss of material.
- Copper alloy components in lube oil (internal) are subject to loss of material.
- Stainless steel components in air (internal and external) and outdoor air (external) environments experience no aging effects.
- Glass components in air (external) and lube oil (internal) environments experience no aging effects.
- Copper alloy components in air (external) environments experience no aging effects.

During its review, the staff determined that it needed additional information.

In LRA Table 3.4.1, Item 3.4.1-8, under "Discussion," the applicant stated that for closure bolting, the aging effect requiring management is loss of mechanical closure integrity, which includes a broader range of aging mechanisms than those included in this AMR line item. The applicant also stated that it uses programs other than the GALL Bolting Integrity Program. In RAI 3.4-1(1), (2), and (3), the staff requested the applicant to (1) explain the extent to which AMR Item 3.4.1-8 deviates from the ANO-2 results; (2) clarify whether the aging effect of "loss of mechanical closure integrity" includes loss of material and cracking, and, specifically, what other aging effects/mechanisms are included in the "broader range"; and (3) discuss how it will manage each of the identified aging effects and why the approach to managing the aging effects is adequate. Section 3.4.2.4.1 of this SER contains the staff's discussion of this RAI and its resolution by the applicant.

In LRA Table 3.4.2-3, the applicant stated that for the emergency feedwater system, it uses a Water Chemistry Control Program to manage cracking and loss of material for stainless steel components in a steam greater than 270 °F (internal) environment. In RAI 3.4-5, the staff requested that the applicant explain why a supplemental inspection program is not needed to determine the effectiveness of the Water Chemistry Control Program. The staff's discussion of this RAI and of its resolution by the applicant is similar to that for RAI 3.4-3 and appears in Section 3.4.2.4.1 of this SER.

In LRA Table 3.4.2-3, the applicant stated that for the emergency feedwater system, it specifies a Water Chemistry Control Program as an AMP for loss of material for stainless steel components in treated water (internal and external) environments, and for carbon steel components in treated water (internal) and treated water greater than 220 °F (internal) environments. In RAI 3.4-6, the staff asked the applicant to explain why an augmented inspection program is not needed to determine the effectiveness of the Water Chemistry Control Program, as recommended by GALL (VIII.G.1-c, VIII.G.3-a, and VIII.G.4-b) for carbon steel piping and valves in treated water in the emergency feedwater system and the stainless steel condensate storage tank.

By letter dated April 6, 2004, the applicant stated that, as noted in its response to RAI 3.4-3, since the environment and material combinations in the steam generators are the same or more problematic than those in the emergency feedwater system, the results of steam generator component inspections to determine the effectiveness of the Water Chemistry Control Program are also applicable to the emergency feedwater carbon steel piping and valves and the condensate storage tank. These inspection activities include those that are part of the Inservice Inspection and Steam Generator Integrity Programs. Table 3.1.2-5 of the LRA lists carbon (low alloy) and stainless steel components inspected under these programs. Based on this information and the applicant's response to RAI 3.4-3, the staff determined that the inspection activities conducted for components in the steam generators are applicable to the components in the steam and power conversion systems, and the GALL recommendations of augmenting the Water Chemistry Control Program with an inspection to determine the effectiveness of the Water Chemistry Program are satisfied for the steam and power conversion components. RAI 3.4-6 is therefore closed.

In LRA Table 3.4.2-3, the applicant stated that, for the emergency feedwater system, it identified no aging effect for the glass component in lube oil (internal) environments. In RAI 3.4-7, the staff asked the applicant to provide the basis for such a conclusion. By letter dated April 6, 2004, the applicant stated that glass is an amorphous, inorganic oxide that is mostly silica and is cooled to a rigid condition without crystallization. It is highly resistant to corrosion but is susceptible to degradation in hydrofluoric acid, caustic, and high-temperature water. The applicant stated that lubricating oil does not contain hydrofluoric acid or caustic, and this glass is not exposed to high-temperature water. Therefore, there are no aging effects requiring management for the glass. The staff considered the applicant's response to adequately rule out possible aging effects for the glass based on the material and environmental consideration. RAI 3.4-7 is therefore closed.

On the basis of its review of the information provided in the LRA and the additional information included in the applicant's responses to the above RAIs, the staff finds that the aging effects of the emergency feedwater system component types not addressed by the GALL Report are consistent with industry experience for these combinations of materials and environments. The staff did not identify any omitted aging effects. Therefore, the staff finds that the applicant has identified the appropriate aging effects for the materials and environments associated with the components of the emergency feedwater system.

Aging Management Programs

After evaluating the applicant's identification of aging effects for each of the above components, the staff evaluated the AMPs to determine if they are appropriate for managing the identified aging effects. The staff also confirmed that the UFSAR Supplement contains an adequate description of the program.

Table 3.4.2-3 of the LRA identifies the following AMPs for managing the aging effects described above for the emergency feedwater system.

- Bolting and Torquing Activities (B.1.2)
- Flow-Accelerated Corrosion (B.1.11)
- Oil Analysis (B.1.17)
- Periodic Surveillance and Preventive Maintenance (B.1.18)
- System Walkdown (B.1.28)
- Water Chemistry Control (B.1.30)

The staff's detailed review of these AMPs appears in Sections 3.0.3.3.2, 3.0.3.1, 3.0.3.3.6, 3.0.3.3.7, 3.0.3.3.9, and 3.0.3.2.8 of this SER, respectively.

During its review, the staff determined that it needed additional information.

In LRA Table 3.4-1, Item 3.4.1-8, under "Discussion," the applicant stated that the System Walkdown Program supplements Bolting and Torquing Activities to maintain bolting integrity in the steam and power conversion systems. In RAI 3.4-1(4), the staff requested that the applicant demonstrate that with the combination of these AMPs, the aging effects associated with closure bolting will be adequately managed, or managed in a manner equivalent to that described in GALL AMP XI.M18, "Bolting Integrity." Section 3.4.2.4.1 of this SER provides the staff's discussion of this RAI and its resolution by the applicant.

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 has identified appropriate AMPs for managing the aging effects of the emergency feedwater system component types not addressed by the GALL Report. In addition, the staff finds the program descriptions in the UFSAR Supplement acceptable.

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 emergency feedwater system components that are not addressed by the GALL Report, so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 51.21(a)(3).

The staff also reviewed the applicable FSAR Supplement program descriptions and concludes that the FSAR Supplement adequately describes the AMPs credited with managing aging in these components, as required by 10 CFR 54.21(d).

3.4.3 Conclusion

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 system components will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable FSAR Supplement program summaries and concludes that the FSAR Supplement adequately describes the AMPs credited for managing aging in steam and power conversion system components, as required by 10 CFR 54.21(d).

3.5 Structures and Component Supports

This section of the SER documents the staff's review of the applicant's AMR results for the structures and component supports system components and component groups associated with the following systems:

- containment and containment internals
- auxiliary building, turbine building, and yard structures
- intake structure and emergency cooling pond
- bulk commodities

3.5.1 Summary of Technical Information in the Application

In Section 3.5 of the LRA, the applicant provided the results of the AMR of the structures and component supports components and component types listed in Tables 2.4-1 through 2.4-4 of the LRA. The applicant also listed the materials, environments, AERMs, and AMPs associated with each structure and component support type.

In Table 3.5.1 of the LRA, the applicant provided a summary comparison of its AMRs with the AMRs evaluated in the GALL Report for the structures and component supports. In Section 3.5.2.2 of the LRA, the applicant provided information concerning Table 3.5.1 components for which the GALL Report recommends further evaluation.

3.5.2 Staff Evaluation

The staff reviewed LRA Section 3.5 to determine if the applicant provided sufficient information to demonstrate that the effects of aging for the reactor system components that are within the scope of license renewal and subject to an AMR will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff performed an audit and review to confirm the applicant's claim that certain identified AMRs were consistent with the GALL Report. The staff did not repeat its review of the matters described in the GALL Report. However, the staff did determine that the material presented in the LRA was applicable and that the applicant had identified the appropriate GALL AMPs. Section 3.0.3 of this SER documents the staff's evaluations of the AMPs. The staff documented its audit findings in the audit report issued on August 19, 2004, and summarizes them in Section 3.5.2.1 of this SER.

The staff also performed an audit of those AMRs that are consistent with the GALL Report and for which further evaluation is recommended. During the audit, the staff determined that the applicant's further evaluations are consistent with the acceptance criteria in Section 3.5.2.2 of the SRP-LR. The staff documented its audit findings in the audit report and summarizes them in Section 3.5.2.2 of this SER.

The staff conducted a technical review of the remaining AMRs that are not consistent with the GALL Report. The review included evaluating whether the applicant identified all plausible aging effects and listed the appropriate aging effects for the combinations of materials and environments specified. Section 3.5.2.3 of this SER documents the staff's review findings.

Finally, the staff reviewed the AMP summary descriptions in the FSAR Supplement to ensure that they adequately describe the programs credited with managing or monitoring aging for the reactor system components.

Table 3.5-1 below provides a summary of the staff's evaluation of components, aging effects/mechanisms, and AMPs listed in LRA Section 3.3 that are addressed in the GALL Report.

Table 3.5-1 Staff Evaluation for Structures and Component Supports System Components in the GALL Report

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Penetration sleeves, penetration bellows, and dissimilar metal welds (Item Number 3.5.1-1)	Cumulative fatigue damage (CLB fatigue analysis exists)	TLAA evaluated in accordance with 10 CFR 54.21(c)		Consistent with GALL, which recommends further evaluation (See Section 3.5.2.2.1.6)
Penetration sleeves, bellows, and dissimilar metal welds (Item Number 3.5.1-2)	Cracking due to cyclic loading; crack initiation and growth due to SCC	Containment inservice inspection (ISI) and containment leak rate test	Containment Leak Rate (B.1.6), Containment Inservice Inspection (B.1.13)	Consistent with GALL, which recommends further evaluation (See Section 3.5.2.2.1.7)
Penetration sleeves, penetrations bellows, and dissimilar metal welds (Item Number 3.5.1-3)	Loss of material due to corrosion	Containment ISI and containment leak rate test	Containment Inservice Inspection (B.1.13), Containment Leak Rate (B.1.6)	Consistent with GALL, which recommends no further evaluation (See Section 3.5.2.1)
Personnel airlock and equipment hatch (Item Number 3.5.1-4)	Loss of material due to corrosion	Containment ISI and containment leak rate test	Containment Inservice Inspection (B.1.13), Containment Leak Rate (B.1.6)	Consistent with GALL, which recommends no further evaluation (See Section 3.5.2.1)
Personnel airlock and equipment hatch (Item Number 3.5.1-5)	Loss of leak tightness in closed position due to mechanical wear of locks, hinges, and closure mechanisms	Containment leak rate test and plant technical specifications		Consistent with GALL, which recommends no further evaluation (See Section 3.5.2.1)

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Seals, gaskets, and moisture barriers (Item Number 3.5.1-6)	Loss of sealant and leakage through containment due to deterioration of join seals, gaskets, and moisture barriers	Containment ISI and containment leak rate test	Containment Leak Rate (B.1.6)	Consistent with GALL, which recommends no further evaluation (See Section 3.5.2.1)
Concrete elements; foundation, dome, and wall (Item Number 3.5.1-7)	Aging of accessible and inaccessible concrete areas due to leaching of calcium hydroxide, aggressive chemical attack, and corrosion of embedded steel	Containment ISI	Inservice Inspection - Containment Inservice Inspection (B.1.13), Structures Monitoring - Structures Monitoring (B.1.27)	Consistent with GALL, which recommends further evaluation (See Section 3.5.2.2.1.1)
Concrete elements: foundation (Item Number 3.5.1-8)	Cracks, distortion, and increases in component stress level due to settlement	Structures monitoring	Structures Monitoring - Structures Monitoring (B.1.27)	Consistent with GALL, which recommends no further evaluation (See Section 3.5.2.2.1.2)
Concrete elements: foundation (Item Number 3.5.1-9)	Reduction in foundation strength due to erosion of porous concrete subfoundation	Structures monitoring	Inservice Inspection - Containment Inservice Inspection (B.1.13), Structures Monitoring - Structures Monitoring (B.1.27)	Consistent with GALL, which recommends no further evaluation (See Section 3.5.2.2.1.2)
Concrete elements: foundation, dome, and wall (Item Number 3.5.1-10)	Reduction in strength and modulus due to elevated temperature	Plant specific	Inservice Inspection - Containment Inservice Inspection (B.1.13), Structures Monitoring - Structures Monitoring (B.1.27)	Consistent with GALL, which recommends further evaluation (See Section 3.5.2.2.1.3)
Prestressed containment: tendons and anchorage component (Item Number 3.5.1-11)	Loss of prestress due to relaxation shrinkage, creep, and elevated temperature	TLAA evaluated in accordance with 10 CFR 54.21(c)		Consistent with GALL, which recommends further evaluation (See Section 3.5.2.2.1.5)
Steel elements: liner plate and containment shell (Item Number 3.5.1-12)	Loss of material due to corrosion in accessible and inaccessible areas	Containment ISI and containment leak rate test	Structures Monitoring - Structures Monitoring (B.1.27), Inservice Inspection - Containment Inservice Inspection (B.1.13)	Consistent with GALL, which recommends further evaluation (See Section 3.5.2.2.1.4)

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Steel elements: protected by coating (Item Number 3.5.1-14)	Loss of material due to corrosion in accessible areas only	Protective coating monitoring and maintenance	Not Applicable at ANO-2	Consistent with GALL, which recommends no further evaluation (See Section 3.5.2.1)
Prestressed containment: tendons and anchorage components (Item Number 3.5.1-15)	Loss of material due to corrosion of prestressing tendons and anchorage components	Containment ISI	Inservice Inspection - Containment Inservice Inspection (B.1.13)	Consistent with GALL, which recommends no further evaluation (See Section 3.5.2.1.1)
Concrete elements: foundation, dome, and wall (Item Number 3.5.1-16)	Scaling, cracking, and spalling due to freeze-thaw; expansion and cracking due to reactor with aggregate	Containment ISI	Structures Monitoring - Structures Monitoring (B.1.27), Inservice Inspection - Containment Inservice Inspection (B.1.13)	Consistent with GALL, which recommends no further evaluation (See Section 3.5.2.2.2.1)
All groups except Group 6: accessible interior/ exterior concrete and steel components (Item Number 3.5.1-20)	All types of aging effects	Structures monitoring	Structures Monitoring - Structures Monitoring (B.1.27)	Consistent with GALL, which recommends no further evaluation (See Section 3.5.2.1)
Group 1-3, 5, 7-9; inaccessible concrete components, such as exterior walls below grade and foundation (Item Number 3.5.1-21)	Aging of inaccessible concrete areas due to aggressive chemical attack, and corrosion of embedded steel	Plant specific	Structures Monitoring - Structures Monitoring (B.1.27)	Consistent with GALL, which recommends further evaluation (See Section 3.5.2.2.2.2)
Group 6: all accessible/ inaccessible concrete, steel, and earthen components (Item Number 3.5.1-22)	All types of aging effects, including loss of material due to abrasion, cavitation, and corrosion	Inspection of water-control structures or FERC/US Army Corp of Engineers dam inspection and maintenance	Structures Monitoring - Structures Monitoring (B.1.27)	Consistent with GALL, which recommends no further evaluation (See Section 3.5.2.1)
Group 5: liners (Item Number 3.5.1-23)	Crack initiation and growth due to SCC; loss of material due to crevice corrosion	Water chemistry and monitoring of spent fuel pool water level	Water Chemistry Control (B.1.30)	Consistent with GALL, which recommends no further evaluation

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Groups 1-3, 5, 6: all masonry block walls (Item Number 3.5.1-24)	Cracking due to restraint, shrinkage, creep, and aggressive environment	Masonry wall	Structures Monitoring - Masonry Wall (B.1.26)	Consistent with GALL, which recommends no further evaluation (See Section 3.5.2.1)
Groups 1-3, 5, 7-9: foundation (Item Number 3.5.1-25)	Cracks, distortion, and increases in component stress level due to settlement	Structures monitoring	Structures Monitoring - Structures Monitoring (B.1.27)	Consistent with GALL, which recommends no further evaluation (See Section 3.5.2.1)
Groups 1-3, 5-9: foundation (Item Number 3.5.1-26)	Reduction in foundation strength due to erosion of porous concrete subfoundation	Structures monitoring	Structures Monitoring - Structures Monitoring (B.1.27)	Consistent with GALL, which recommends no further evaluation (See Section 3.5.2.1)
Groups 1-5: concrete (Item Number 3.5.1-27)	Reduction of strength and modulus due to elevated temperature	Plant specific	Structures Monitoring - Structures Monitoring (B.1.27)	Consistent with GALL, which recommends further evaluation (See Section 3.5.2.2.1.3)
Groups 7,8: liners (Item Number 3.5.1-28)	Crack initiation and growth due to SCC; loss of material due to crevice corrosion	Plant specific	Not Applicable to ANO-2	Consistent with GALL, which recommends further evaluation (See Section 3.5.2.2.2.1(9))
All groups: support members: anchor bolts, concrete surrounding anchor bolts, welds, grout pad, bolted connections, etc. (Item Number 3.5.1-29)	Aging of component supports	Structures monitoring	Structures Monitoring - Structures Monitoring (B.1.27)	Consistent with GALL, which recommends no further evaluation (See Section 3.5.2.1)
Group B1.1, B1.2, and B1.3: support members: anchor bolts and welds (Item Number 3.5.1-30)	Cumulative fatigue damage (CLB fatigue analyses exists)	TLAA evaluated in accordance with 10 CFR 54.21(c)		Consistent with GALL, which recommends further evaluation (See Section 3.5.2.2.3.2)
All groups: support members: anchor bolts and welds (Item Number 3.5.1-31)	Loss of material due to boric acid corrosion	Boric acid corrosion	Boric Acid Corrosion Prevention (B.1.3)	Consistent with GALL, which recommends no further evaluation (See Section 3.5.2.1)

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Groups B1.1, B1.2, and B1.3: support members: anchor bolts, welds, spring hangers, guides, stops, and vibration isolators (Item Number 3.5.1-32)	Loss of material due to environmental corrosion; loss of mechanical function due to corrosion, distortion, dirt, overload, etc.	ISI	Inservice Inspection -Inservice Inspection (B.1.14)	Consistent with GALL, which recommends no further evaluation (See Section 3.5.2.1)
Group B1.1: high strength low-alloy bolts (Item Number 3.5.1-33)	Crack initiation and growth due to SCC	Bolting integrity	Inservice Inspection -Inservice Inspection (B.1.14), Boric Acid Corrosion Prevention (B.1.3)	Consistent with GALL, which recommends no further evaluation (See Section 3.5.2.1)

The staff's review of the ANO-2 structures and component supports system and associated components followed one of several approaches. One approach, documented in Section 3.5.2.1 of this SER, involves the staff's audit and review of the AMR results for components in the structures and component supports system that the applicant indicated are consistent with the GALL Report and do not require further evaluation. The second approach, documented in Section 3.5.2.2 of this SER, involves the staff's audit and review of the AMR results for components in the structures and component supports system that the applicant indicated are consistent with the GALL Report and for which further evaluation is recommended. A third approach, documented in Section 3.5.2.3 of this SER, involves the staff's technical review of the AMR results for components in the structures and component supports system that the applicant indicated are not consistent with the GALL Report or are not addressed in the GALL Report. Section 3.0.3 of this SER documents the staff's review of AMPs that are credited to manage or monitor aging effects of the structures and component supports system components.

3.5.2.1 AMR Results That Are Consistent with the GALL Report

Summary of Technical Information in the Application

In Section 3.5.2.1 of the LRA, the applicant identified the materials, environments, and AERMs. The applicant identified the following programs that manage the aging effects related to the structures and component supports components:

- Boric Acid Corrosion Prevention Program
- Containment Leak Rate Program
- Inservice Inspection—Containment Inservice Inspection (IWE and IWL) Program
- Inservice Inspection (IWF) Program
- Structures Monitoring Program
- Structures Monitoring—Masonry Wall Program
- Water Chemistry Control Program
- Service Water Integrity Program
- Periodic Surveillance and Preventive Maintenance Program

- Fire Protection Program

In Tables 3.5.2-1 through 3.5.2-4 of the LRA, the applicant provided a summary of AMRs for the structures and component supports systems and identified which AMRs it considered to be consistent with the GALL Report.

Staff Evaluation

In Tables 3.5.2-1 through 3.5.2-4 of the LRA, the applicant provided a summary of AMRs for the containment and containment internals, auxiliary building, turbine building, yard structures, intake structure, emergency cooling pond, and bulk commodities components and identified which AMRs it considered to be consistent with the GALL Report.

For component groups evaluated in the GALL Report for which the applicant has claimed consistency with the GALL Report, and for which the GALL Report does not recommend further evaluation, the staff performed an audit and review to determine whether the plant-specific components contained in these GALL Report component groups are bounded by the GALL Report evaluation.

The applicant provided a note for each AMR line item. The notes describe how the information in the tables aligns with the information in the GALL Report. The staff audited those AMRs with Notes A through E, which indicate that the AMR is consistent with the GALL Report.

Note A indicates that the AMR line item is consistent with the GALL Report for the component, material, environment, and aging effect. In addition, the AMP is consistent with the AMP identified in the GALL Report. The staff audited these line items to determine consistency with the GALL Report and the validity of the AMR for the site-specific conditions.

Note B indicates that the AMR line item is consistent with the GALL Report for the component, material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The staff audited these line items to determine consistency with the GALL Report. The staff confirmed that it has reviewed and accepted the identified exceptions to the GALL AMPs. The staff also determined whether the AMP identified by the applicant is consistent with the AMP identified in the GALL Report and whether the AMR is valid for the site-specific conditions.

Note C indicates that the component for the AMR line item is different, but consistent with the GALL Report for the material, environment, and aging effect. In addition, the AMP is consistent with the AMP identified by the GALL Report. This note indicates that the applicant could not find a listing of some system components in the GALL Report. However, the applicant identified a different component in the GALL Report that has the same material, environment, aging effect, and AMP as the component under review. The staff audited these line items to determine consistency with the GALL Report. The staff also determined whether the AMR line item of the different component applies to the component under review and whether the AMR is valid for the site-specific conditions.

Note D indicates that the component for the AMR line item is different, but consistent with the GALL Report for the material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The staff audited these line items to determine consistency with the GALL Report. The staff noted whether the AMR line item of the different component applies to the component under review. The staff confirmed that it reviewed and accepted the identified exceptions to the GALL AMPs. The staff also determined whether the AMP identified by the applicant is consistent with the AMP identified in the GALL Report and whether the AMR is valid for the site-specific conditions.

Note E indicates that the AMR line item is consistent with the GALL Report for the material, environment, and aging effect, but a different AMP is credited. The staff audited these line items to determine consistency with the GALL Report. The staff also determined whether the identified AMP would manage the aging effect consistent with the AMP identified by the GALL Report and whether the AMR is valid for the site-specific conditions.

The staff conducted an audit and review, discussed below, to confirm the applicant's claim that certain identified AMRs are consistent with the staff-approved AMRs in the GALL Report. The staff reviewed the information provided in the LRA and program basis documents, which are available at the applicant's engineering office. The staff did not repeat its review of the matters described in the GALL Report. However, the staff did determine that the material presented in the LRA is applicable and that the applicant has identified the appropriate GALL Report AMRs.

3.5.2.1.1 Structures and Components Supports, Containment, and Containment Internals

The staff reviewed Table 3.5.1, Item 3.5.1-3 of the LRA, and associated AMRs consistent with the GALL Report.

In Table 3.5.2-1 of the LRA, the applicant associated the incorrect Table 3.5.1, Item 3.5.1-3, for loss of material of carbon steel tendon anchorage and the tendon wires component type (page 3.5-27). The staff requested that the applicant revise the LRA Table 3.5.2-1 line entry with the correct Table 3.5.1 item number.

By letter dated March 24, 2004, the applicant submitted a clarification to reference the correct Table 3.5.1, Item 3.5.1-15, to anchorage and tendon wires. The applicant also submitted a clarification that Table 3.5.1, Item 3.5.1-15 (LRA page 3.5-17), should credit the Inservice Inspection (IWL) Program rather than the Inservice Inspection (IWE) Program in the discussion column.

The staff reviewed the Inservice Inspection—Containment Inservice Inspection Program (AMP B.1.13) and determined that the ASME Code, Section XI, Subsection IWL Program manages the containment anchorage and tendon wires. On the basis of its review, the staff concludes that this line item is acceptable.

3.5.2.1.2 Structures and Components Supports, Bulk Commodities

In Table 3.5.2-4 (page 3.5-38) of the LRA, the applicant associated component type "HVAC missile barrier" with the GALL Report, Volume 2, Chapter III.A2.2-a. The staff requested that the applicant revise the LRA Table 3.5.2-4 line entry with the correct GALL Report, Volume 2, item number.

By letter dated March 24, 2004, the applicant submitted a clarification to reference the correct GALL Report, Volume 2, Item III.A3.2-a. The staff reviewed the GALL Report, Volume 2, Item

III.A3.2-a, and determined that the HVAC missile barrier component group should reference the GALL Report, Volume 2, Chapter III, for Group 3 structures rather than Chapter II, Group 2 structures. On this basis, the staff concludes that this line item is acceptable.

On the basis of its audit and review, the staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

Conclusion

The staff determined the applicant's claim of consistency with the GALL Report. The staff also reviewed information pertaining to the applicant's consideration of recent operating experience and proposals for managing associated aging effects. On the basis of its review, the staff finds that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.2 AMR Results That Are Consistent with the GALL Report, for Which Further Evaluation Is Recommended

Summary of Technical Information in the Application

In Section 3.5.2.2 of the LRA, the applicant provided further evaluation of aging management as recommended by the GALL Report for structures and component supports. The applicant provided information concerning how it will manage the following aging effects:

- (PWR containments) aging of inaccessible concrete areas
- (PWR containments) cracking, distortion, and increase in component stress levels due to settlement; reduction of foundation strength due to erosion of porous concrete subfoundations, if not covered by Structures Monitoring Program
- (PWR containments) reduction of strength and modulus of concrete structures due to elevated temperature
- (PWR containments) loss of material due to corrosion in inaccessible areas of steel containment shell or liner plate
- (PWR containments) loss of prestress due to relaxation, shrinkage, creep, and elevated temperature
- (PWR containments) cumulative fatigue damage
- (PWR containments) cracking due to cyclic loading and SCC
- (Class I structures) aging of structures not covered by Structures Monitoring Program
- (Class I structures) aging management of inaccessible areas

- (component supports) aging of supports not covered by Structures Monitoring Program
- (component supports) cumulative fatigue damage due to cyclic loading
- quality assurance for aging management of nonsafety-related components

Staff Evaluation

For component groups evaluated in the GALL Report for which the applicant has claimed consistency with the GALL Report, and for which the GALL Report recommends further evaluation, the staff reviewed the applicant's evaluation to determine whether it adequately addressed these issues. In addition, the staff audited the applicant's further evaluations against the criteria contained in Section 3.5.2.2 of the SRP-LR. The ANO-2 ANO-2 Audit and Review Report provides details of the staff's audit and review.

The GALL Report indicates that further evaluation should be performed for the aging effects described in the following sections.

3.5.2.2.1 PWR Containments

The staff reviewed Section 3.5.2.2.1 of the LRA against the criteria in Section 3.5.2.2.1 of the SRP-LR, which addresses several areas discussed below.

3.5.2.2.1.1 Aging of Inaccessible Concrete Areas. In Section 3.5.2.2.1.1 of the LRA, the applicant addressed aging of inaccessible concrete areas for the containment.

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.

The GALL Report recommends GALL AMP XI.S2, "ASME Section XI, Subsection IWL," for managing the aging of the accessible portions of the containment structures. The applicant addressed this issue with LRA AMP B.1.13, "Inservice Inspection—Containment Inservice Inspection," which is evaluated in Section 3.0.3.3.4 of this SER. Subsection IWL exempts from examination those portions of the concrete containment that are inaccessible (e.g., foundation, belowgrade exterior walls, or concrete covered by liner).

The applicant also credited the Structures Monitoring Program (AMP B.1.27), where accessible areas are monitored for evidence of aging effects that may apply to containment structures. Section 3.0.3.1 of this SER evaluates this program, which is consistent with GALL AMP XI.S6, "Structures Monitoring Program." It is also used for the examination of belowgrade concrete when it is exposed by excavation.

The GALL Report, Volume 2, Chapter II, Table A1 (as modified by ISG-3), recommends further evaluation to manage the aging effects for containment concrete components located in inaccessible areas if the aging mechanisms of (1) freeze-thaw, (2) leaching of calcium hydroxide, (3) aggressive chemical attack, (4) reaction with aggregates, or (5) corrosion of embedded steel are significant. Possible aging effects for containment concrete structural components from these five aging mechanisms include cracking, change in material properties, and loss of material.

(1) Freeze-thaw

Section 3.5.2.2.1.1 of the SRP-LR does not address freeze-thaw as an aging mechanism for concrete containments because the GALL Report does not recommend further evaluation. However, ISG-3 clarifies the staff position that further evaluation is appropriate if the applicant's facility is subject to moderate to severe weathering conditions, unless the concrete meets certain specifications and subsequent inspections have confirmed that the aging mechanism has not caused degradation of the concrete.

ANO-2 is located in a region considered to be subject to moderate weathering conditions. In the LRA, the applicant stated that ANO-2 concrete structures are designed in accordance with American Concrete Institute (ACI) specification ACI 318-63, "Building Code Requirements for Reinforced Concrete," which results in low permeability and resistance to aggressive chemical solutions by requiring the following:

- high cement content
- low water-to-cement ratio
- proper curing
- adequate air entrainment

The applicant stated in the LRA that ANO-2 concrete also meets the requirements of ACI 201.2R-77, "Guide to Durable Concrete." Both ACI 318-63 and ACI201.2R-77 use the same ASTM standards for selection, application, and testing of concrete.

The staff interviewed members of the applicant's technical staff and reviewed relevant operating experience to confirm that loss of material due to freeze-thaw has not been observed, either through the Containment Inservice Inspection Program or the Structures Monitoring Program.

Because concrete that satisfies the requirements of ACI 318-63 will meet the requirements of ISG-3, and on the basis of an audit of operating experience evaluated under the Containment Inservice Inspection Program and Structures Monitoring Program, the staff finds that the Containment Inservice Inspection Program will adequately manage the loss of material and cracking due to freeze-thaw.

(2) Leaching of calcium hydroxide

Section 3.5.2.2.1.1 of the SRP-LR states that cracking, spalling, and increases in porosity and permeability caused by the leaching of calcium hydroxide could occur in inaccessible areas of PWR concrete and steel containments. The GALL Report, as updated by ISG-3, recommends further evaluation of plant-specific programs to manage the aging effects for inaccessible areas if specific criteria cannot be satisfied.

The GALL Report states that leaching of calcium hydroxide becomes significant only if the concrete is exposed to flowing water. Even if reinforced concrete is exposed to flowing water, such leaching is not significant if the concrete is constructed to ensure that it is dense, well cured, and has low permeability, and that cracking is well controlled.

The applicant stated in the LRA that ANO-2 concrete structures are designed in accordance with ACI 318-63 and meet the requirements of ACI 201.2R-77.

The staff finds that because ACI 318 provides assurance that the recommendations of the GALL Report and ISG-3 are met, leaching of calcium hydroxide is not significant at ANO-2. Therefore, the staff concludes that the Containment Inservice Inspection Program will be sufficient for management of increases in porosity and permeability due to this aging mechanism. A plant-specific AMP is not required to address this aging effect.

(3) Aggressive chemical attack

Section 3.5.2.2.1.1 of the SRP-LR states that cracking, spalling, and increases in porosity and permeability caused by aggressive chemical attack could occur in inaccessible areas of PWR concrete and steel containments. The GALL Report recommends further evaluation of plant-specific programs to manage the aging effects for inaccessible areas if specific recommendations of the GALL Report and updated in ISG-3 cannot be satisfied.

The GALL Report, as updated by ISG-3, states that aggressive chemical attack is not significant unless pH is less than 5.5, chlorides are greater than 500 parts per million (ppm), or sulfates are greater than 1500 ppm. In addition, ISG-3 states that a plant-specific program is required to examine representative samples of belowgrade concrete when excavated for any reason.

The applicant stated in the LRA that the belowgrade environment is not aggressive (i.e., pH greater than 5.5, chlorides less than 500 ppm, and sulfates less than 1500 ppm). In addition, the staff noted that the applicant used the Structures Monitoring Program for the examination of belowgrade concrete when it is exposed by excavation.

On the basis of the information provided by the applicant in the LRA and the guidelines provided in the SRP-LR, the GALL Report, and ISG-3, the staff finds that increases in porosity and permeability, loss of material (e.g., spalling and scaling), and cracking caused by aggressive chemical attack are not significant for concrete in inaccessible areas. The staff finds that an appropriate plant-specific program for examination of belowgrade concrete has been identified.

(4) Reaction with aggregates

Section 3.5.2.2.1.1 of the SRP-LR does not address reaction with aggregates as an aging mechanism for concrete containments because the GALL Report does not recommend further evaluation. However, ISG-3 clarifies the staff position that further evaluation is appropriate if investigations, tests, or examinations have demonstrated that the aggregates are reactive.

The applicant stated in the LRA that ANO-2 concrete structures are designed in accordance with ACI 318-63 and meet the requirements of ACI 201.2R-77. The ACI standards call for the testing of aggregates at the time of construction. Through interviews with the applicant's technical staff, the staff confirmed that the results of those tests show that the aggregates used for concrete containment at ANO-2 are not reactive.

(5) Corrosion of embedded steel

Section 3.5.2.2.1.1 of the SRP-LR states that loss of material due to corrosion of embedded steel could occur in inaccessible areas of PWR concrete and steel containments. The GALL Report (updated in ISG-3) recommends further evaluation of plant-specific programs to manage the aging effects for inaccessible areas if specific recommendations of the GALL Report cannot be satisfied.

For cracking, loss of bond, and loss of material (e.g., spalling and scaling) due to the corrosion of embedded steel, the GALL Report states that a plant-specific program is only required if the belowgrade environment is aggressive. In addition, ISG-3 states that a plant-specific program is required to examine representative samples of belowgrade concrete when excavated for any reason.

The applicant stated in the LRA that the belowgrade environment is not aggressive (i.e., pH greater than 5.5, chlorides less than 500 ppm, and sulfates less than 1500 ppm). In addition, the staff noted that the applicant used the Structures Monitoring Program for the examination of belowgrade concrete when it is exposed by excavation.

Through interviews with the applicant's technical staff, the staff determined that the environment at the time of construction was not aggressive and, on the basis of subsequent testing, the environment has remained within the limits identified in the GALL Report. The staff finds that, in accordance with the recommendations of the GALL Report, this aging effect is not significant and is adequately managed.

The staff reviewed the results of the applicant's AMR for inaccessible concrete areas. On the basis of its review, the staff finds that the applicant appropriately evaluated AMR results involving management of aging of inaccessible concrete areas for containment, as recommended in the GALL Report and ISG-3. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

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. In Section 3.5.2.2.1.2 of the LRA, the applicant addressed (1) cracking, distortion, and increase in component stress level due to settlement and (2) reduction of foundation strength due to erosion of porous concrete subfoundations in the containment. The applicant used the Structures Monitoring Program (AMP B.1.27), which monitors accessible areas for evidence of aging effects that may apply to containment structures. Section 3.0.3.1 of this SER evaluates this program, which is consistent with GALL AMP XI.S6, "Structures Monitoring Program."

Section 3.5.2.2.1.2 of the SRP-LR states that cracking, distortion, and increase in component stress level due to settlement could occur in PWR concrete and steel containments. In addition, reduction of foundation strength due to erosion of porous concrete subfoundations could occur in all types of PWR containments. Some plants may rely on a dewatering system to lower the site ground water level. If the plant's CLB credits a dewatering system, the GALL Report recommends verification of the continued functionality of the dewatering system during the period of extended operation. The GALL Report recommends no further evaluation if this activity is included in the scope of the applicant's structures monitoring program.

The applicant stated in the LRA that ANO-2 does not rely on a dewatering system for control of settlement because seismic Category 1 structures are founded on sound bedrock. Concrete within 5 feet of the highest known ground water level is protected by membrane waterproofing, which protects the containment building concrete against exposure to ground water. Consequently, IN 97-11 does not identify ANO-2 as a plant susceptible to erosion of porous concrete subfoundations. Ground water was not aggressive during plant construction, and no changes in ground water conditions have been observed. Finally, the applicant has included these components within the plant-specific structures monitoring program, which will confirm that these aging effects are adequately managed.

The staff reviewed the AMR results involving management of aging effects resulting due to settling and erosion of porous concrete subfoundations and confirmed that the Structures Monitoring Program addresses each of the affected SCs. On the basis of this review, the staff finds that the applicant has appropriately evaluated AMR results involving cracking, distortion, and increase in component stress level due to settlement and reduction of foundation strength due to erosion, as recommended in the GALL Report.

3.5.2.2.1.3 Reduction of Strength and Modulus of Concrete Structures due to Elevated Temperature. In Section 3.5.2.2.1.3 of the LRA, the applicant addressed reduction of strength and modulus of concrete structures due to elevated temperature in containments.

Section 3.5.2.2.1.3 of the SRP-LR states that reduction of strength and modulus of elasticity due to elevated temperatures could occur in PWR concrete and steel containments. The GALL Report calls for a plant-specific AMP and recommends further evaluation if any portion of the concrete containment components exceeds specified temperature limits (i.e., general area temperature 66 °C (150 °F) and local area temperature 93 °C (200 °F)).

The applicant stated in the LRA that, during normal operation, all concrete areas within containment are below 66 °C (150 °F) ambient temperature. The applicant concluded that its containment concrete structures are not subject to changes in material properties due to elevated temperature. The applicant has included these components within the scope of AMP B.1.27, "Structures Monitoring—Structures Monitoring," and AMP B.1.13, "Inservice Inspection—Containment Inservice Inspection," to monitor for indications of change in material properties for containment concrete aging effects.

The staff reviewed the AMR results involving management of aging effects resulting from elevated temperature and confirmed that the Containment Inservice Inspection Program and Structures Monitoring Program address each of the affected SCs. On the basis of this audit and review, the staff finds that the applicant has appropriately evaluated AMR results involving reduction of strength and modulus due to elevated temperature, as recommended in the GALL Report.

In addition, because the concrete is not exposed to elevated temperatures, the staff finds that the plant-specific AMPs are acceptable for management of this aging effect, and no further evaluation is required.

The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.2.1.4 Loss of Material due to Corrosion in Inaccessible Areas of Steel Containment Shell or Liner Plate. In Section 3.5.2.2.1.4 of the LRA, the applicant addressed loss of material due to corrosion in inaccessible areas of the steel containment shell or the steel liner plate for the containment.

Section 3.5.2.2.1.4 of the SRP-LR states that loss of material due to corrosion could occur in inaccessible areas of the steel containment shell or the steel liner plate for all types of PWR containments. The GALL Report recommends further evaluation of plant-specific programs to manage this aging effect for inaccessible areas if the following four specific recommendations of the GALL Report cannot be satisfied:

(1) Concrete meeting the requirements of ACI 318 or 349 and the guidance of ACI 201.2R was used for the containment concrete in contact with the embedded containment shell or liner.

(2) The accessible concrete is monitored to ensure that it is free of penetrating cracks that provide a path for water seepage to the surface of the containment shell or liner.

(3) The accessible portion of the moisture barrier, at the junction where the shell or liner becomes embedded, is subject to aging management activities in accordance with IWE requirements.

(4) Borated water spills and water ponding on the containment concrete floor are not common and, when detected, are cleaned up in a timely manner.

The applicant stated in the LRA that the containment concrete in contact with the steel liner plate is designed in accordance with ACI 318-63 and meets the requirements of ACI 201.2R-77. Accessible concrete is monitored for cracks under the Structures Monitoring Program, evaluated in Section 3.0.3.1 of this SER. The accessible portions of the steel liner plate and moisture barrier where the liner becomes embedded are inspected in accordance with the Containment Inservice Inspection Program (IWE), evaluated in Section 3.0.3.3.4 of this SER. Spills (e.g., borated water spill) are cleaned up in a timely manner. The aging effect of loss of material due to corrosion has not been significant for this liner plate.

Since the applicant satisfied all of the recommendations of the GALL Report, the staff finds that no additional plant-specific AMP is required to manage inaccessible areas of the steel containment liner plate.

3.5.2.2.1.5 Loss of Prestress due to Relaxation, Shrinkage, Creep, and Elevated Temperature. As stated in the SRP-LR, loss of prestress due to relaxation, shrinkage, creep, and elevated temperature is a TLAA, as defined in 10 CFR 54.3. All TLAAs must be evaluated in accordance with 10 CFR 54.21(c)(1). Section 4.5 of this SER documents the staff's review of the applicant's evaluation of this TLAA. In performing this review, the staff followed the guidance in Section 4.5 of the SRP-LR.

3.5.2.2.1.6 Cumulative Fatigue Damage. As stated in the SRP-LR, fatigue is a TLAA, as defined in 10 CFR 54.3. All TLAAs must be evaluated in accordance with 10 CFR 54.21(c)(1). Section 4.6 of this SER documents the staff's review of the applicant's evaluation of this TLAA. In performing this review, the staff followed the guidance in Section 4.6 of the SRP-LR.

3.5.2.2.1.7 Cracking Caused by Cyclic Loading and Stress-Corrosion Cracking. In Section 3.5.2.2.1.7 of the LRA, the applicant addressed aging mechanisms that can lead to the cracking of penetration sleeves and penetration bellows, such as cyclic loads and SCC.

Section 3.5.2.2.1.7 of the SRP-LR states that cracking of containment penetrations (including penetration sleeves, penetration bellows, and dissimilar metal welds) due to cyclic loading or SCC could occur in containments. The SRP-LR recommends further evaluation of inspection methods to detect cracking caused by cyclic loading and SCC since visual testing (VT)-3 examinations may be unable to detect this aging effect.

(1) Cracking caused by SCC

The GALL AMP XI.S1, "ASME Section XI Subsection IWE," covers inspection of these items under examination categories E-B, E-F, and E-P (pressure tests in Appendix J to 10 CFR Part 50). Title 10, Section 50.55a, of the *Code of Federal Regulations* (10 CFR 50.55a) identifies examination categories E-B and E-F as optional during the current term of operation. For the extended period of operation, examination categories E-B and E-F and additional appropriate examinations to detect SCC in bellows assemblies and dissimilar metal welds are warranted to address this issue.

To manage this aging effect, the applicant used the Containment Leak Rate Program (AMP B.1.6) and the Containment Inservice Inspection Program (AMP B.1.13). Section 3.0.3.1 of this SER documents the staff's evaluation of the Containment Leak Rate Program. The staff determined that the Containment Inservice Inspection Program AMP B.1.13, evaluated in Section 3.0.3.3.4 of this SER, required enhancement and additional appropriate examinations to detect SCC in bellows assemblies and dissimilar metal welds using examination categories E-B and E-F.

In a letter dated April, 14, 2004, the staff asked the applicant to provide additional information regarding the containment pressure boundary bellows, relevant operating experience, and methods used to detect their age-related degradation. The staff noted that the Containment Inservice Inspection Program and Containment Leak Rate Program cannot detect cracking caused by SCC (see NRC IN 92-20, "Inadequate Local Leak Rate Testing").

By letter dated May 19, 2004, the applicant stated that the penetration bellows (LRA Table 3.5.1, Item 3.5.1-3) pertains to carbon steel penetrations, which are not susceptible to SCC and are consistent with the GALL Report, but do not require further evaluation. In addition, the applicant stated that LRA Table 3.5.1, Item 3.5.1-2, addresses SCC of stainless steel penetration bellows. The applicant further stated that bellows are not used for piping system containment penetrations at ANO-2 and that Item 3.5.1-2 applies to the fuel transfer tube sleeve, but not to the bellows, since the bellows are not part of the containment penetration boundary.

Because the bellows are not used for piping system containment penetrations, and based on the staff's review of the applicant's response, the staff finds this acceptable.

(2) Cracking caused by cyclic loading

As stated in the SRP-LR, cracking caused by cyclic loading of the liner plate and penetrations is a TLAA, as defined in 10 CFR 54.3. All TLAAs must be evaluated in accordance with 10 CFR 54.21(c)(1). Section 4.6 of this SER documents the staff's review of the applicant's evaluation. In performing this review, the staff followed the guidance in Section 4.6 of the SRP-LR.

3.5.2.2.2 Class 1 Structures

The staff reviewed Section 3.5.2.2.2 of the LRA against the criteria in Section 3.5.2.2.2 of the SRP-LR, which addresses several areas discussed below.

3.5.2.2.2.1 Aging of Structures Not Covered by Structures Monitoring Program. In Section 3.5.2.2.2.1 of the LRA, the applicant addressed aging of Class 1 structures not covered by the Structures Monitoring Program.

Section 3.5.2.2.2.1 of the SRP-LR states that the GALL Report recommends further evaluation of certain structure/aging effect combinations if they are not covered by the Structures Monitoring Program. As described in Chapter III of the GALL Report, this includes (1) scaling, cracking, and spalling due to repeated freeze-thaw for Group 1–3, 5, and 7–9 structures, (2) scaling, cracking, spalling, and increase in porosity and permeability caused by leaching of calcium hydroxide and aggressive chemical attack for Group 1–5 and 7–9 structures, (3) expansion and cracking due to reaction with aggregates for Group 1–5 and 7–9 structures, (4) cracking, spalling, loss of bond, and loss of material due to corrosion of embedded steel for Group 1–5 and 7–9 structures, (5) cracks, distortion, and increase in component stress level caused by settlement for Group 1–3, 5, and 7–9 structures, (6) reduction of foundation strength caused by erosion of porous concrete subfoundations for Group 1–3 and 5–9 structures, (7) loss of material due to corrosion of structural steel components for Group 1–5 and 7–8 structures, (8) loss of strength and modulus of concrete structures due to elevated temperatures for Groups 1–5, and (9) crack initiation and growth due to SCC and loss of material due to crevice corrosion of stainless steel liner for Group 7–8 structures. Further evaluation is necessary only for structure/aging effect combinations not covered by the Structures Monitoring Program.

Subsection 3.5.2.2.1.2 of the SRP-LR provides technical details of the aging management issue for structure/aging effect combinations (5) and (6) above. Subsection 3.5.2.2.1.3 of the SRP-LR gives the details for item (8) above.

In Table 3.5-1, Item 20, the applicant credited its Structures Monitoring Program for all types of aging effects and all component groups (except Group 6) of accessible interior and exterior concrete and steel components of Class 1 structures. Section 3.0.3.1 of this SER evaluates this program. Additional discussion of specific structure/aging effect combinations follows.

(1) Freeze-thaw

Section 3.5.2.2.1.2 of the SRP-LR does not address freeze-thaw as an aging mechanism for concrete containments, because no further evaluation is recommended in the GALL Report. However, ISG-3 clarifies the staff position that further evaluation is appropriate if the applicant's facility is subject to moderate to severe weathering conditions, unless the concrete meets certain specifications and subsequent inspections have confirmed that the aging mechanism has not caused degradation of the concrete.

ANO-2 is located in a region considered to be subject to moderate weathering conditions. In the LRA, the applicant stated that ANO-2 structures are designed in accordance with ACI 318-63, which results in low permeability and resistance to aggressive chemical solutions by requiring the following:

- high cement content
- low water-to-cement ratio
- proper curing
- adequate air entrainment

In addition to ACI 318-63, ANO-2 concrete also meets the requirements of ACI 201.2R-77. Both ACI 318-63 and ACI201.2R-77 use the same ASTM standards for selection, application, and testing of concrete.

The staff interviewed members of the applicant's technical staff and reviewed relevant operating experience to confirm that loss of material due to freeze-thaw has not been observed, either through the Containment Inservice Inspection Program or the Structures Monitoring Program.

Because concrete that satisfies the requirements of ACI 318-63 will meet the requirements of ISG-3, and on the basis of an audit of operating experience evaluated under the Structures Monitoring Program, the staff finds that the Structures Monitoring Program will adequately manage the loss of material and cracking due to freeze-thaw.

(2)(a) Leaching of calcium hydroxide

Section 3.5.2.2.2.1 of the SRP-LR states that cracking, spalling, and increases in porosity and permeability due to leaching of calcium hydroxide could occur in inaccessible areas of PWR concrete and steel containments. The GALL Report, as updated by ISG-3, recommends further evaluation of plant-specific programs to manage the aging effects for inaccessible areas exposed to flowing water, unless the requirements of ACI 201.2R are met.

The GALL Report states that leaching of calcium hydroxide becomes significant only if the concrete is exposed to flowing water. Even if reinforced concrete is exposed to flowing water, such leaching is not significant if the concrete is constructed to ensure that it is dense, well cured, and has low permeability, and that cracking is well controlled.

The applicant stated in the LRA that concrete structures are designed in accordance with ACI 318-63 and meet the requirements of ACI 201.2R-77.

The staff finds that the use of ACI 318 provides assurance that the recommendations of the GALL Report and ISG-3 are met and leaching of calcium hydroxide is not significant at ANO-2. Therefore, the staff concludes that the Structures Monitoring Program will sufficiently manage increases in porosity and permeability due to this aging mechanism. A plant-specific AMP is not required to address this aging effect.

(2)(b) Aggressive chemical attack

Section 3.5.2.2.2.1 of the SRP-LR states that cracking, spalling, and increases in porosity and permeability due to aggressive chemical attack could occur in inaccessible areas of Class 1 structures. The GALL Report recommends further evaluation of plant-specific programs to manage the aging effects for inaccessible areas if specific recommendations of the GALL Report and the updates in ISG-3 cannot be satisfied.

The GALL Report, as updated by ISG-3, states that aggressive chemical attack is not significant unless pH is less than 5.5, chlorides are greater than 500 ppm, or sulfates are greater than 1500 ppm. In addition, ISG-3 states that a plant-specific program is required to examine representative samples of belowgrade concrete when excavated for any reason.

The applicant stated in the LRA that the belowgrade environment is not aggressive (i.e., pH greater than 5.5, chlorides less than 500 ppm, and sulfates less than 1500 ppm). In addition, the staff noted that the applicant used the Structures Monitoring Program for the examination of belowgrade concrete when it is exposed by excavation.

On the basis of the information given in the LRA and the guidelines provided in the SRP-LR, the GALL Report, and ISG-3, the staff finds that increases in porosity and permeability, loss of material (e.g., spalling and scaling), and cracking caused by aggressive chemical attack are not significant for concrete in inaccessible areas. The staff finds that the applicant identified an appropriate plant-specific program for examination of belowgrade concrete (specifically, an enhancement to the Structures Monitoring Program).

(3) Reaction with aggregates

Section 3.5.2.2.2.1 of the SRP-LR does not address reaction with aggregates as an aging mechanism for concrete containments, because no further evaluation is recommended in the GALL Report. However, ISG-3 clarifies the staff position that further evaluation is appropriate if investigations, tests, or examinations have demonstrated that the aggregates are reactive.

The applicant stated in the LRA that ANO-2 concrete structures were designed in accordance with ACI 318-63 and meet the requirements of ACI 201.2R-77. The ACI standards call for the testing of aggregates at the time of construction.

Through interviews with the applicant's technical staff, the staff confirmed that the results of those tests showed that the aggregates used for concrete Class 1 structures at ANO-2 are not reactive.

(4) Corrosion of embedded steel

Section 3.5.2.2.2.1 of the SRP-LR states that loss of material due to corrosion of embedded steel could occur in inaccessible areas of Class 1 structures. The GALL Report (updated in ISG-3) recommends further evaluation of plant-specific programs to manage the aging effects for inaccessible areas if specific recommendations of the GALL Report cannot be satisfied.

For cracking, loss of bond, and loss of material (e.g., spalling and scaling) due to corrosion of embedded steel, the GALL Report states that a plant-specific program is only required if the belowgrade environment is aggressive. In addition, ISG-3 states that a plant-specific program is required to examine representative samples of belowgrade concrete when excavated for any reason.

The applicant stated in the LRA that the belowgrade environment is not aggressive. In interviews with the applicant's technical staff, the staff determined that the environment at the time of construction had a measured pH greater than 5.5, chlorides less than 500 ppm, and sulfates less than 1500 ppm, and, on the basis of subsequent testing, it has remained within these limits.

The staff finds that, in accordance with the recommendations of the GALL Report, this aging effect is not significant and is adequately managed by the enhanced Structures Monitoring Program. Section 3.0.3.1 of this SER documents the staff's evaluation of this program.

(5) Settlement

Section 3.5.2.2.2.1 of the SRP-LR refers to Section 3.5.2.2.1.2 for a discussion of settlement. Section 3.5.2.2.1.2 of the SRP-LR states that cracking, distortion, and increase in the component stress level due to settlement could occur in Class 1 structures. Some plants may rely on a dewatering system to lower the site ground water level. If the plant's CLB credits a dewatering system, the GALL Report recommends verification of the continued functionality of the dewatering system during the period of extended operation. The GALL Report recommends no further evaluation if this activity is included in the scope of the applicant's structures monitoring program.

The applicant stated in the LRA that ANO-2 does not rely on a dewatering system for control of settlement because Class 1 structures are founded on sound bedrock. Concrete within 5 feet of the highest known ground water level is protected by membrane waterproofing, which protects the containment building concrete against exposure to ground water. Consequently, IN 97-11 does not identify ANO-2 as a plant susceptible to erosion of porous concrete subfoundations. Ground water was not aggressive during plant construction, and no changes in ground water conditions have been observed. The applicant also included these components within the plant-specific structures monitoring program, which will confirm that these aging effects are adequately managed.

The staff reviewed the AMR results involving management of aging effects resulting from settling and erosion of porous concrete subfoundations and confirmed that the Structures Monitoring Program addresses each of the affected SCs. On the basis of this review, the staff finds that the applicant has appropriately evaluated AMR results involving cracking, distortion, and increase in the component stress level due to settlement and reduction of foundation strength due to erosion, as recommended in the GALL Report.

(6) Erosion of porous concrete subfoundation

Section 3.5.2.2.2.1 of the SRP-LR refers to Section 3.5.2.2.1.2 for discussion of erosion of porous concrete subfoundation. Section 3.5.2.2.1.2 of the SRP-LR states that reduction of foundation strength due to erosion of porous concrete subfoundations could occur in all types of

Class 1 structures. Some plants may rely on a dewatering system to lower the site ground water level. If the plant's CLB credits a dewatering system, the GALL Report recommends verification of the continued functionality of the dewatering system during the period of extended operation. The GALL Report recommends no further evaluation if this activity is included in the scope of the applicant's structures monitoring program.

Information Notice 97-11 does not identify ANO-2 as a plant susceptible to erosion of porous concrete subfoundations. Ground water was not aggressive during plant construction, and there is no indication that ground water chemistry has significantly changed. The applicant has not observed any changes in ground water conditions at ANO-2. Therefore, the staff finds that cracking, distortion, and increase in the component stress level due to settlement and reduction of foundation strength due to erosion of the porous concrete subfoundation are adequately managed by the Structures Monitoring Program.

(7) Corrosion of structural steel components

Section 3.5.2.2.1 of the SRP-LR states that corrosion of structural steel components could occur and that further evaluation is necessary only for structure/aging effect combinations not covered by a structures monitoring program.

The staff reviewed the AMR results involving management of aging effects resulting from corrosion of structural steel components and confirmed that the Structures Monitoring Program, evaluated in Section 3.0.3.1 of this SER, addresses each of the affected SCs. On the basis of this audit and review, the staff finds that the applicant has appropriately evaluated AMR results involving this aging effect and that the Structures Monitoring Program adequately manages the corrosion of structural steel components.

(8) Elevated temperatures

Section 3.5.2.2.2.1 of the SRP-LR refers to Section 3.5.2.2.1.3 for discussion of elevated temperatures. Section 3.5.2.2.1.3 of the SRP-LR states that reduction of strength and modulus of elasticity due to elevated temperatures could occur in Class 1 structures in Groups 1–5. The GALL Report calls for a plant-specific AMP and recommends further evaluation if any portion of the concrete components exceeds specified temperature limits (i.e., general area temperature 66 °C (150 °F) and local area temperature 93 °C (200 °F)).

The applicant stated in the LRA that, during normal operation, all concrete areas in Class 1 structures are below 66 °C (150 °F) ambient temperature. The applicant concluded that ANO-2 Class 1 concrete structures are not subject to change in material properties due to elevated temperature.

The staff reviewed the AMR results involving management of aging effects resulting from elevated temperature and confirmed that the Structures Monitoring Program, evaluated in Section 3.0.3.1 of this SER, addresses each of the affected SCs. On the basis of this review, the staff finds that the applicant has appropriately evaluated AMR results involving reduction of strength and modulus due to elevated temperature, as recommended in the GALL Report, and that it is adequately managed by the Structures Monitoring Program.

(9) Aging effects for stainless steel liners for tanks

The applicant stated that the structural AMRs do not include tanks with stainless steel liners. Instead, the applicant considered tanks subject to an AMR with their respective mechanical systems. The staff confirmed that LRA Tables 3.5.2-1 through 3.5.2-4 do not include tanks with stainless steel liners.

On the basis of its review, the staff finds that the applicant has appropriately evaluated AMR results involving management of aging of accessible interior and exterior concrete and steel components of Class 1 structures (except Group 6 water-control structures), and all are covered by the Structures Monitoring Program. This is consistent with the recommendations of the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.2.2.2 Aging Management of Inaccessible Areas. In Section 3.5.2.2.2.2 of the LRA, the applicant addressed aging of inaccessible areas of Class 1 structures.

Section 3.5.2.2.2.2 of the SRP-LR states that cracking, spalling, and increases in porosity and permeability caused by aggressive chemical attack and cracking, spalling, loss of bond, and loss of material due to corrosion of embedded steel could occur in belowgrade inaccessible concrete areas. The GALL Report recommends further evaluation to manage these aging effects in inaccessible areas of Group 1–3, 5, and 7–9 structures, if an aggressive belowgrade environment exists. ISG-3 identifies additional requirements.

The GALL Report, as updated by ISG-3, states that aggressive chemical attack and corrosion of embedded steel is not significant unless pH is less than 5.5, chlorides are greater than 500 ppm, or sulfates are greater than1500 ppm. In addition, ISG-3 states that a plant-specific program is required to examine representative samples of belowgrade concrete when excavated for any reason.

In the LRA, the applicant stated that the belowgrade environment is not aggressive (i.e., pH greater than 5.5, chlorides less than 500 ppm, and sulfates less than 1500 ppm). The applicant used the Structures Monitoring Program, evaluated in Section 3.0.3.1 of this SER, to examine belowgrade concrete when it is exposed by excavation. The applicant also stated that inspections of accessible concrete have not revealed degradation due to aggressive chemical attack or corrosion of embedded steel.

Because the belowgrade environment is not aggressive and the applicant will continue to monitor excavated concrete, the staff finds that increases in porosity and permeability, loss of material (e.g., spalling and scaling), and cracking due to aggressive chemical attack and cracking, spalling, loss of bond, and loss of material caused by corrosion of embedded steel are adequately managed for concrete in inaccessible areas.

3.5.2.2.3 Component Supports

The staff reviewed Section 3.5.2.2.3 of the LRA against the criteria in Section 3.5.2.2.3 of the SRP-LR, which addresses several areas discussed below.

3.5.2.2.3.1 Aging of Supports Not Covered by Structures Monitoring Program. In Section 3.5.2.2.3.1 of the LRA, the applicant addressed aging of component supports that are not managed by the Structures Monitoring Program.

Section 3.5.2.2.3.1 of the SRP-LR states that the GALL Report recommends further evaluation of certain component support/aging effect combinations if they are not covered by a structures monitoring program. This includes (1) reduction in concrete anchor capacity due to degradation of the surrounding concrete for Group B1–B5 supports, (2) loss of material due to environmental corrosion for Group 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 structure/aging effect combinations not covered by a structures monitoring program.

The applicant's Structures Monitoring Program includes component supports at ANO-2, evaluated in Section 3.0.3.1 of this SER, for Groups B2–B5. The Inservice Inspection Program manages component supports in Group B1, evaluated in Section 3.0.3.4 of this SER.

(1) Reduction in concrete anchor capacity due to surrounding concrete for Group B1–B5 supports

The Structures Monitoring Program includes ANO-2 concrete anchors and surrounding concrete (Groups B2–B5). The Inservice Inspection Program includes these for Group B1.

(2) Loss of material due to environmental corrosion for Group B2–B5 supports

Loss of material due to corrosion of steel support components is an AERM at ANO-2. The Structures Monitoring Program manages this aging effect.

(3) Reduction/loss of isolation function due to degradation of vibration isolation elements for Group B4 supports

The LRA did not identify any vibration isolation elements subject to aging management.

The staff finds that the applicant has appropriately evaluated AMR results involving management of aging of component supports, as recommended in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.2.3.2 Cumulative Fatigue Damage due to Cyclic Loading. As stated in the SRP-LR, fatigue is a TLAA, as defined in 10 CFR 54.3. All TLAAs must be evaluated in accordance with 10 CFR 54.21(c)(1). Section 4.3 of this SER includes the staff's review of the applicant's evaluation of this TLAA. In performing this review, the staff followed the guidance in Section 4.3 of the SRP-LR.

3.5.2.2.4 Quality Assurance for Aging Management of Nonsafety-Related Components

Section 3.0.4 of this SER provides the staff's evaluation of the applicant's Quality Assurance Program.

Conclusion

On the basis of its audit and review, the staff finds that the applicant's further evaluations, conducted in accordance with the GALL Report, are consistent with the acceptance criteria in Section 3.5.2.2 of the SRP-LR. Since the applicant's AMR results are otherwise consistent with the GALL report, the staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the current licensing basis for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3 AMR Results That Are Not Consistent with the GALL Report

3.5.2.3.1 Containment and Containment Internals

Summary of Technical Information in the Application

In Section 3.5.2.1.1 of the LRA, the applicant identified the materials, environments, and AERMs. The applicant identified the following programs that manage the AERMs for the containment and containment internals components:

- Boric Acid Corrosion Prevention Program
- Containment Leak Rate Program
- Inservice Inspection—Containment Inservice Inspection Program
- Inservice Inspection—Inservice Inspection Program
- Structures Monitoring Program

In Table 3.5.2-1 of the LRA, the applicant provided a summary of AMRs for the containment and containment internals components and identified which AMRs it considered to be consistent with the GALL Report.

Staff Evaluation

Table 3.5.2-1 of the LRA indicates that the AMR results of the following items are consistent with their corresponding GALL Report items for the component, material, environment, aging effects, and AMPs:

- abovegrade concrete dome, wall, ring girder, and buttresses
- belowgrade concrete wall and buttresses
- concrete foundation
- concrete internal structures
- personal airlock and equipment hatch

In discussing LRA Table 3.5.1, Item 3.5.1-3, the applicant asserted that the ANO-2 Containment Inservice Inspection Program and Containment Leak Rate Testing program will monitor loss of material due to corrosion of penetration bellows. Under Item A3.1 (page II

A3.6), the GALL Report recommends further evaluation regarding the SCC of containment bellows. The staff asked the applicant to provide additional information regarding the containment pressure boundary bellows at ANO-2, relevant operating experience, and method(s) used to detect their age-related degradation. The staff noted that, in many cases, VT-3 examination of IWE and Type B (Appendix J) testing cannot detect such aging effects (see NRC IN 92-20).

In its response dated May 19, 2004, the applicant stated that Item 3.5.1-3 pertains to carbon steel penetrations which are not susceptible to SCC. Consistent with the GALL Report, this item does not require further evaluation. Item 3.5.1-2 addresses SCC of stainless steel penetration bellows. No bellows are used for piping system containment penetrations. The fuel transfer tube is equipped with bellows-type expansion joints that connect the transfer tube to the liner of the refueling canal in containment and to the liner of the spent fuel pool in the auxiliary building. Tables 2.3.3-1 and 3.3.2-1 identify the fuel transfer tube (assembly). Item 3.5.1-2 applies to the fuel transfer tube sleeve but not to the bellows, since the bellows is not part of the containment penetration boundary.

Furthermore, the applicant explained that the bellows connecting the transfer tube to the refueling canal liner is an extension of the refueling canal liner, which has no license renewal intended function. The bellows on the other end of the transfer tube connects the transfer tube to the liner in the fuel tilt pit portion of the spent fuel pool. The low point of the opening connecting the spent fuel pool to the tilt pit is above the top of the spent fuel stored in the storage racks, so failure of the bellows cannot result in uncovering of the fuel. Therefore, neither bellows attached to the fuel transfer tube performs a license renewal intended function.

Based on the response, the staff understands that ANO-2 has no pressure-retaining bellows (stainless steel or carbon steel) as part of the pressure-retaining containment penetrations. The staff finds the response acceptable, as it adequately justifies not explicitly considering the cracking of containment fuel transfer tube bellows as an aging management item during the extended period of operation. However, as the fuel transfer tube penetration (refer to Table 3.3.2-1) represents containment pressure boundary, the applicant's Water Chemistry Control Program and Containment Inservice Inspection Program will monitor its aging effects.

For seals and gaskets related to containment penetrations, the staff noted that LRA Table 3.5.1, Item 3.5.1-6, gives the Containment Inservice Inspection Program and Containment Leak Rate Testing Program as the AMPs. For equipment hatches and airlocks at ANO-2, the staff agreed with the applicant's assertion that the Leak Rate Testing Program would monitor aging degradation of seals and gaskets, as their leak rate would be tested after each opening. For other penetrations with seals and gaskets, in RAI 3.5-2, the staff asked the applicant to provide information regarding the adequacy of Type B leak rate testing frequency to monitor aging degradation of seals and gaskets at ANO-2.

In its response dated May 19, 2004, the applicant stated that, for ANO-2, the equipment hatch seal listed in Table 3.5.2-4 is the only line item for seals or gaskets that credits the Containment Leak Rate Testing Program. The equipment hatch seal is the only line item that refers to Item 3.5.1-6 of Table 3.5.1.

The staff requested that the applicant provide information regarding the aging management of seals and gaskets for mechanical and electrical penetrations (other than those associated with equipment hatch and airlocks).

By letter dated July 22, 2004, the applicant provided the following additional information to address RAI 3.5-2:

> Gaskets associated with containment mechanical penetrations are consumables that are replaced each time the bolted joint is disassembled. In addition, such penetrations are tested under the containment leak rate program as required by 10 CFR 50, Appendix J. As indicated in LRA Table 3.5.2-1, containment electrical penetrations (which include cable feed-through assemblies) are included in the containment leak rate program. The effects of aging on seals and gaskets associated with mechanical and electrical penetrations are managed by the containment leak rate program. Line item 3.5.1-6 of Table 3.5.1 applies to seals and gaskets associated with mechanical penetrations and electrical penetrations.
>
> ANO-2 is committed to Option B of 10 CFR 50, Appendix J for performing containment leakage rate testing. Option B allows Type B test intervals up to 120 months; however, normally it is performed more frequently than every 120 months. Type B testing of ANO-2 mechanical and electrical penetrations is performed at least once every 120 months. Component specific testing frequency is based on the safety significance and historical performance of the penetrations in accordance with Option B of 10 CFR 50, Appendix J.

The staff found the response acceptable, as it provides adequate details regarding the aging management of pressure boundary seals and gaskets associated with containment electrical and mechanical penetrations.

In its discussion of Item 3.5.12 in Section 3.5.2.2.1.4 of the LRA, the applicant noted that the moisture barrier is monitored under the ASME Code, Subsection IWE, program for aging degradation and, since the conditions described in the GALL Report are met for inaccessible areas (i.e., liner plate), loss of material due to corrosion is insignificant. The industry experience indicates that the moisture barrier degrades with time, and any moisture accumulation in the degraded barrier corrodes the steel liner. The staff requested that the applicant provide information regarding the operating experience related to the degradation of the moisture barrier and the containment liner plate at ANO-2. The staff requested that the applicant discuss acceptable liner plate corrosion before the liner plate would be reinstated to its nominal thickness.

In response, the applicant stated the following:

> The ANO-2 operating experience review did not identify degradation of the moisture barrier and containment liner plate at ANO-2. The American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section XI, Subsection IWE provides the requirements for ISI of containment structures. The requirements include examination, evaluation, repair, and replacement of the concrete containment liner plate in accordance with 10CFR50.55a. The acceptable thickness for ANO-2 liner plate is determined in accordance with ASME Boiler and Pressure Vessel Code, Section XI, Subsection IWE.

The staff noted that the applicant has not experienced any degradation of the containment moisture barrier and liner, and that the applicant is examining these components pursuant to the requirements of Subsection IWE, as incorporated by reference in 10 CFR 50.55a. The staff finds the condition acceptable, as it provides an assurance that these components will be adequately managed for aging effects during the extended period of operation.

For structural items inside the ANO-2 containment (e.g., primary and secondary shield walls, reactor missile shields, and RV foundation), in Table 3.5.2 of the LRA, the applicant referred to Notes I and 501 to indicate that the temperatures around these components are within the GALL Report threshold, and, therefore, the aging effects (i.e., reduction in concrete strength and modulus of elasticity) do not apply (also discussed, in general, in Section 3.5.2.2.1.3 of the LRA). In this context, in RAI 3.5-4(a), (b) and (c), the staff asked the applicant to provide the following information.

(a) Provide the method(s) of monitoring temperatures within the primary shield wall concrete, around the reactor vessel, and in the reactor cavity.

In response, the applicant stated the following:

> Temperatures within the primary shield wall concrete are not directly monitored. Assurance that bulk concrete temperatures around the reactor vessel within the reactor cavity remain below 150 °F is obtained through maintaining average bulk containment temperature within the limits allowed by ANO-2 Technical Specification 3.6.1.4. Since forced cooling is provided directly to the reactor cavity, its temperature is lower than the bulk average containment temperature. A review of containment temperature readings from near the reactor vessel over the last 12 months, as recorded in the plant data system, show the area temperature has remained below 150 °F.

Based on the above assurances, the staff believes that the concrete properties will not be significantly changed as a result of these temperatures.

(b) If the primary shield wall concrete is kept below the threshold temperature (i.e., 150 °F) by means of air cooling, provide the operating experience related to the performance of the cooling system.

In response, the applicant stated the following:

> The primary shield wall concrete temperature is kept below the threshold temperature by means of air cooling. The operating experience review did not identify significant degradation or system failures. The technical specification requirement on containment temperature provides assurance that plant operation will continue only with satisfactory performance of the containment cooling system.

Based on the assurances provided in response to (a) and (b) above, the staff believes that the concrete properties around the primary shield wall and RPV support structure will not be significantly changed as a result of these temperatures.

(c) Provide the results of the latest inspection of these components, in terms of cracking, spalling, and the condition of reactor vessel support structures.

In response, the applicant stated the following:

> The results of the last inspection of the reactor vessel supports, performed during the spring 1997 refueling outage, identified inactive boron deposits on the support steel. The condition was evaluated under the Boric Acid Corrosion Program and determined to have no effect on the support's ability to perform its intended function. No other conditions were identified.

The Boric Acid Corrosion Program only addresses the conditions affected by boric acid exposure. It cannot, by itself, indicate the condition of the concrete structures. Section X.S6 of the GALL Report recommends the use of ACI 349-3R, as part of the Structures Monitoring Program (as summarized in ANO-2 AMP B.1.27), for identifying and evaluating degradation of concrete structures, including the structures inside containment. Therefore, the staff asked the applicant to provide the information requested in RAI 3.5-4(c) in terms of the criteria established in Chapter 5 of ACI 349-3R.

By letter dated July 22, 2004, the applicant provided the following information to address RAI 3.5-4(c):

> The Structures Monitoring Program is used for evaluation of concrete structures. The evaluation criteria in ACI 349-3R are incorporated in the Structures Monitoring Program. The Structures Monitoring Program provides the same criteria for identifying concrete degradation as ACI-349-3R. During the latest inspection, the concrete of the primary shield wall and the reactor pressure vessel support structure was acceptable without further evaluation in accordance with the criteria of ACI 349-3R, Section 5.1. No cracking or spalling of the primary shield wall or reactor pressure vessel support concrete structures was noted during the inspection.

The staff finds the response acceptable, as the criteria used in Structures Monitoring Program will adequately manage the aging of concrete structures subjected to elevated temperatures.

Conclusion

On the basis of its review, the staff finds the applicant has demonstrated that the effects of aging can be adequately managed so that the intended function(s) can be maintained consistent with the current licensing basis for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable FSAR Supplement program summaries and concludes that the FSAR Supplement adequately describes the AMPs credited for managing aging in these components, as required by 10 CFR 54.21(d).

3.5.2.3.2 Auxiliary Building, Turbine Building, and Yard Structures

Summary of Technical Information in the Application

In Section 3.5.2.1.2 of the LRA, the applicant identified the materials, environments, and AERMs. The applicant identified the following programs that manage the AERMs for the auxiliary building, turbine building, and yard structures components:

- Structures Monitoring—Masonry Walls Program (Appendix B.1.26)
- Structures Monitoring Program (Appendix B.1.27)
- Water Chemistry Control Program (Appendix B.1.30)

In Table 3.5.2-2 of the LRA, the applicant provided a summary of AMRs for the auxiliary building, turbine building, and yard structures components and identified which AMRs it considered to be consistent with the GALL Report.

Staff Evaluation

The applicant used the Structures Monitoring—Masonry Wall Program as the AMP for seismic Category I masonry block walls, the Structures Monitoring Program for concrete material (such as building walls, slabs, beams, columns, and foundations) and carbon steel material (such as fuel handling bridge assembly crane rails and girders, high-energy line break doors, and switchyard bus and transformer bus structural supports), and the Water Chemistry Control Program for stainless steel material (such as spent fuel pool liner and bulkhead gates).

On the basis of its review of the LRA, the staff finds that the aging effects on the structural components of the auxiliary building, turbine building, and yard structure with the environments described in Table 3.5.2-2 of the LRA are consistent with industry experience for these combinations of materials and environments. Therefore, the staff finds that the applicant identified the applicable aging effects and associated AMPs that are appropriate for the combinations of materials and environments listed.

Conclusion

On the basis of its review, the staff finds the applicant has demonstrated that the effects of aging can be adequately managed so that the intended function(s) can be maintained consistent with the current licensing basis for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable FSAR Supplement program summaries and concludes that the FSAR Supplement adequately describes the AMPs credited for managing aging in these components, as required by 10 CFR 54.21(d).

3.5.2.3.3 Intake Structure and Emergency Cooling Pond

Summary of Technical Information in the Application

In Section 3.5.2.1.3 of the LRA, the applicant noted that the intake structure and emergency cooling pond (constructed from materials of carbon steel, natural soils, and reinforced concrete and subject to environments of raw water, weather, and protected weather conditions) require management of aging effects of loss of form and loss of material. The applicant credited the following programs to manage the aging effects:

- Service Water Integrity Program (Appendix B.1.24)
- Structural Monitoring Program (Appendix B.1.27)
- Periodic Surveillance and Preventive Maintenance Program (Appendix B.1.18)

In Table 3.5.2-3 of the LRA, the applicant provided a summary of AMRs for the intake structure and emergency cooling pond and identified which AMRs it considered not to be consistent with the GALL Report.

Staff Evaluation

The applicant used the Service Water Integrity Program as the AMP for submerged pump and shaft supports (made of carbon steel) and the emergency cooling pond concrete intake (made of reinforced concrete), the Structures Monitoring Program for concrete material (such as building walls, floor slabs, roof slabs, beams, columns, and foundations) and carbon steel material (such as floor hatches, louvered doors, and beams in service water and circulating water bays), and the Periodic Surveillance and Preventive Maintenance Program for the emergency cooling pond (made of natural soils).

Table 3.5-2-3 indicates that the applicant provided no AMP for the intake canal. The staff issued RAI 3.5-9, which states that the intended function of the intake canal, as listed on Table 3.5.2-3, is to provide structural or functional support to equipment required to meet the Commission's regulations for the five regulated events in 10 CFR 54.4(a)(3). Section 2.4.3 of the LRA states that the intake canal provides a suction source for the fire water and service water pumps. However, the applicant provided no AMP for the intake canal. Therefore, the staff requested that the applicant justify not providing an AMP for the intake canal and explain how the intended function can be met without an AMP.

In its response dated May 19, 2004, the applicant stated the following:

> The intended function of the intake canal can be met without an aging management program because the canal has no aging effects requiring management. As described in ANO-2 SAR Section 2.5.5.1, the seismic stability of the intake canal slope was analyzed. The intake canal is qualified as Seismic Category 1. The intake canal has adequate vegetation and consists of engineered slopes to limit erosion caused by wind. The intake canal was completely excavated and contains no sections formed by dikes or fill. The overburden soils at the site are mainly stiff highly plastic clays. At the intake canal about 13 to 25 feet of clay overlies weathered bedrock. The underlying bedrock consists of dense shale with about two to five feet of weathered shale which prevents erosion of the bed. In addition, since the intake canal was designed with the capacity to supply circulating water to ANO-1, its capacity is far greater than required to provide service water to ANO-2. As a result no aging effects requiring management are identified in Table 3.5.2-3. This is consistent with a previously approved staff position documented in Section 3.3.6.6.2.1 of NUREG-1743, Safety Evaluation Report Related to the License Renewal of

Arkansas Nuclear One—Unit 2.

The staff disagrees with the applicant's assertion that the canal has no AERMs. The applicant's statement that the intake canal is qualified as seismic Category 1 further demonstrates the need for an AMP.

In its response, dated August 18, 2004, the applicant committed to inspect the intake canal periodically as part of the ANO Maintenance Rule program during the period of extended operation. This commitment is acceptable to the staff.

On the basis of its review of the LRA, the staff finds that the aging effects on the structural components of the intake structure, intake canal, and emergency cooling pond with the environments described in Table 3.5.2-3 of the LRA are consistent with industry experience for these combinations of materials and environments. Therefore, the staff finds that applicant identified the applicable aging effects and associated AMPs that are appropriate for the combinations of materials and environments.

Conclusion

On the basis of its review, the staff finds the applicant has demonstrated that the effects of aging can be adequately managed so that the intended function(s) can be maintained consistent with the current licensing basis for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable FSAR Supplement program summaries and concludes that the FSAR Supplement adequately describes the AMPs credited for managing aging in these components, as required by 10 CFR 54.21(d).

3.5.2.3.4 Bulk Commodities

Summary of Technical Information in the Application

In Section 3.5.2.1.4 of the LRA, the applicant identified the materials, environments, and AERMs. The applicant identified the following programs that manage the AERMs for the bulk commodities components:

- Fire Protection Program (Appendix B.1.10)
- Inservice Inspection—Inservice Inspection Program (Appendix B.1.14)
- Structures Monitoring Program (Appendix B.1.27)
- Containment Leak Rate Testing Program (Appendix B.1.6)

In Table 3.5.2-4 of the LRA, the applicant provided a summary of AMRs for the bulk commodities components and identified which AMRs it considered to be consistent with the GALL Report.

Staff Evaluation

The applicant used the Fire Protection Program as the AMP for fire doors and fire hose reels (carbon steel), fireproofing (pyrocrete material), and fire barrier seals (elastomers material); the

Inservice Inspection (IWF) Program for base plates, component supports (e.g., instrument racks and frames), main steamline support structure, piping supports, anchor bolts, and RCS component support threaded fasteners (for the steam generator, RCP, pressurizer) which are made of carbon steel; the Structures Monitoring Program for cable tray and conduit supports, embedded unistrut, electrical instrument panels and enclosures, fir damper framing, HVAC missile barrier, monorails, crane rails and girders, pipe sleeves (mechanical/electrical, not penetrating the containment liner plate), pipe whip restraints, stairs, ladders, platforms, grating, anchor bolts in switchyard structures, tank anchors, threaded fasteners, equipment pads, flood curbs, hatch covers and plugs, missile shields, support pedestals, joint elastomers at seismic gaps, and penetration seals; and the Containment Leak Rate Testing Program for equipment hatch seals.

On the basis of its review of the LRA, the staff finds that the aging effects on the structural components of the bulk commodities with the environments described in Table 3.5.2-4 of the LRA are consistent with industry experience for these combinations of materials and environments. Therefore, the staff finds that the applicant identified the applicable aging effects and associated AMPs that are appropriate for the combinations of materials and environments listed.

The staff issued RAI 3.5-5, dated May 19, 2004, given below:

> LRA Section 3.5.2.2.1.1 states that the below-grade environment is not aggressive (pH > 5.5, chlorides < 500 ppm, and sulfates < 1,500 ppm). The applicant is requested to provide the values of pH, chlorides, and sulfates at the plant site and when they were obtained. In III A7.1-e, GALL recommends periodic monitoring of below-grade water chemistry for non-aggressive environments. Since the applicant has made no commitment to periodically monitor the groundwater, the applicant is requested to submit its method for assuring the continuing verification of the non-aggressiveness of the below-grade environment.

The applicant provided the following response:

> The most recent data associated with ANO groundwater chemistry was obtained in May 1996. The results of this analysis are as follows (values obtained near ANO-2 containment):
>
> pH = 7.23
> chlorides < 5 ppm
> sulfates = 20.3 ppm
>
> Comparing this data to that of the ANO-2 SAR Table 2.4-4 (well point 1) and Figure 2.4-1 (well point location), the limiting chemistry parameters have shown no significant increase and are still far from the established limits. The existing data indicates that there has been no significant change in groundwater chemistry since original licensing (a period of approximately 25 years) that would warrant increased monitoring and it is not anticipated to significantly change in the future. Therefore, periodic monitoring of groundwater chemistry is not required to assure the non-aggressiveness of the below-grade environment.

The staff disagrees with the applicant's assertion that periodic monitoring of ground water chemistry is not required to assure the non-aggressiveness of the below-grade environment. Even though ground water chemistry has not changed significantly in the past, the ground water chemistry is not guaranteed to remain the same in the future. Therefore, periodic monitoring of ground water chemistry in the future is needed to assure that ground water chemistry does not change significantly.

The applicant submitted its response, dated August 18, 2004:

> Wells are no longer available for sampling groundwater. Consequently, in lieu of sampling groundwater to confirm that it remains non-aggressive, concrete exposed to groundwater is included in the Structures Monitoring Program for inspection to confirm the absence of aging effects. Under the Structures Monitoring Program, concrete exposed to lake water is periodically inspected. Since lake water chemistry is representative of groundwater chemistry, results of these inspections will be representative of underground concrete exposed to groundwater. In addition, when excavated for maintenance activities, inaccessible concrete exposed to groundwater will be visually inspected under the Structures Monitoring Program.

The applicant's Structures Monitoring program uses inspections of the service water bays as a surrogate for inaccessible concrete exposed to groundwater. At least one service water bay is usually inspected during each outage. The Structures Monitoring program uses these inspections in conjunction with opportunistic inspections to manage the aging effects of inaccessible concrete exposed to groundwater. The staff accepts the applicant's use of the Structures Monitoring Program as an AMP to confirm the absence of concrete aging effects due to ground water.

The staff's RAI 3.5-6, dated May 19, 2004, is given below:

> Item 3.5.1-22 of Table 3.5.1 indicates that the applicant intends to use the Structures Monitoring Program to manage the aging effect for Group 6 structures instead of using the Generic Aging Lessons Learned (GALL) Chapter XI.S7, "Regulatory Guide 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants" or the FERC/US Army Corp of Engineers dam inspections and maintenance. The applicant is requested to list the attributes, which are in the GALL but not in the ANO-2 Structures Monitoring Program, and provide justifications for use of the Structures Monitoring Program without those attributes.

In its response dated May 19, 2004, the applicant stated the following:

> Regulatory Guide (RG) 1.127, Inspection of Water-Control Structures associated with Nuclear Power Plants, is identified as XI.S7 Program in GALL for managing

operating experience.

> The attributes that are in the GALL XI.S7 aging management program, but not in the ANO-2 Structures Monitoring Program, are attributes dealing with earthen embankment water control structures. RG 1.127 proposes inspection parameters (e.g., settlement, depressions, sink holes, slope stability (e.g., irregularities in alignment and variances from originally constructed slopes), seepage, proper functioning of drainage systems, and degradation of slope protection features) and frequency (not to exceed 5 years) for earthen embankment water control structures. During the ANO-2 aging management review, the only aging effect requiring management for earthen structures was determined to be loss of form of the emergency cooling pond. Loss of form is effectively managed by sounding under the Periodic Surveillance and Preventive Maintenance Program as indicated in LRA Table 3.5.2-3. Therefore, the attributes of the NUREG-1801 XI.S7 aging management program regarding earthen structures are not necessary attributes for the ANO-2 Structures Monitoring Program for water control structures.

The applicant noted that the loss of form of the emergency cooling pond is the only aging effect that requires an AMP for earthen structures. The staff believes that the intake canal is an earthen water-control structure at ANO-2, which also requires an AMP.

The applicant submitted its response, dated July 22, 2004, and clarified that water-control structures at ANO-2 also include the intake canal. The applicant committed to inspect the intake canal periodically as part of the ANO Maintenance Rule program during the period of extended operation, as documented in Section 3.5.2.3 of this SER.

Since the intake canal is included in the water-control structures and will be periodically inspected, the staff considers the RAI resolved.

The staff's RAI 3.5-7, dated May 19, 2004, is given below:

> Item 3.5.1-23 of Table 3.5.1 indicates that the applicant does not plan to monitor the spent fuel pool water level as stated in the GALL in managing liners for crack initiation and growth due to SCC; loss of material due to crevice corrosion. The applicant is requested to provide justifications for the exclusion of this GALL aging management program.

In its response dated May 19, 2004, the applicant stated the following:

> Monitoring of spent fuel pool level is required by ANO-2 Technical Specification 4.9.10. This activity was not crediting an aging management program because of its very limited scope. As stated in the LRA, the ANO-2 Water Chemistry Program provides effective management of the effects of aging on the spent fuel pool liner.

The staff was unclear about the applicant's statement that monitoring of spent fuel pool level, "was not crediting an aging management program because of its very limited scope." And requested the applicant to explain what was meant by the "very limited scope" and why the monitoring of spent fuel pool water level can not be credited as an AMP.

The applicant submitted its response, dated July 22, 2004, given below:

> The response should have said, "This activity was not credited as an aging management program because of its very limited scope." This was intended to reflect the treatment of spent fuel pool level monitoring in NUREG-1801, which identifies spent fuel pool level monitoring in the aging management program column in Item A5.2 but does not include it in the program descriptions of Section XI of NUREG-1801. Spent fuel pool level monitoring is credited to verify effectiveness of the water chemistry control program to manage the effects of aging on the spent fuel pool liner. At ANO-2 this activity is performed as required by ANO-2 Technical Specification 4.9.10.

Since the applicant has credited the spent fuel pool water level monitoring activity for managing the effects of aging on the spent fuel pool liner, the staff considers the RAI resolved.

The staff's RAI 3.5-8, dated May 19, 2004, is given below:

> Item 3.5.1-33 of Table 3.5.1 indicates that the applicant intends to use inservice inspection (IWF) and Boric Acid Corrosion Prevention Programs to manage the crack initiation and growth due to SCC for high strength low-alloy bolts instead of using the GALL Bolting Integrity Program. The applicant is requested to identify bolts that have actual yield strength equal to or greater than 150 ksi and provide justification for not using the Bolting Integrity Program.

In its response dated May 19, 2004, the applicant stated the following:

> A more appropriate statement for "Discussion" column for item 3.5.1-33 is "This is not an applicable aging effect for ANO-2 structural bolts. This line item is not referenced in the 3.5.2-series table."
>
> The materials used in bolting and threaded structural steel connections within the scope of license renewal are identified in ANO-2 SAR Section 3.8.3.6.2.2. ANO-2 utilizes a limited number of high strength bolts (yield strength >150 ksi) in structural connections. The ANO-2 aging management review identifies loss of material (but not cracking) as the aging effect requiring management for these bolts. Cracking of bolting in an air environment due to SCC has not been observed at ANO-2 and was not identified in a survey of industry experience. For ANO-2 the Inservice Inspection (IWF) and Boric Acid Corrosion Prevention Programs are credited and have been determined to be effective in managing loss of material.

The staff did not understand the applicant's statement that: "This is not an applicable aging effect for ANO-2 structural bolts," since the applicant stated that a limited number of high-strength bolts (i.e., yield strength greater than 150 ksi) were used in structural connections. The staff requested the applicant to provide technical bases for its AMR conclusion that the

SCC is not an aging effect for these high-strength bolts, as well as references to the claim that cracking of bolting in an air environment due to SCC has not been observed in a survey of industry experience.

The applicant submitted its response, dated July 22, 2004, as given below:

> The high strength bolts referred to in the response to RAI 3.5-8 are identified in ANO-2 SAR Section 3.8.3.6.2.2. A more detailed review revealed that these bolts have a yield strength less than 150 ksi. No high strength bolts having a yield strength greater than 150 ksi were used in structural connections at ANO-2. This was confirmed through review of a number of material test reports for ANO-2 high strength bolts.

Since ANO-2 does not contain any bolts having a yield strength greater than 150 ksi, the staff considers the RAI resolved.

Conclusion

On the basis of its review, the staff finds the applicant has demonstrated that the effects of aging can be adequately managed so that the intended function(s) can be maintained consistent with the current licensing basis for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable FSAR Supplement program summaries and concludes that the FSAR Supplement adequately describes the AMPs credited for managing aging in these components, as required by 10 CFR 54.21(d).

3.5.3 Conclusion

On the basis of its review, the staff concludes that the applicant has demonstrated that the aging effects associated with the containments, structures, and component supports will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable FSAR Supplement program summaries and concludes that the FSAR Supplement adequately describes the AMPs credited for managing aging of the containments, structures, and component supports, as required by 10 CFR 54.21(d).

3.6 Electrical and Instrumentation and Controls

The applicant described the results of its AMR for electrical and instrumentation and control components subject to an AMR in Section 3.6 of the LRA. The staff reviewed this section of the application to determine whether the applicant has demonstrated that the effect of aging on electric components will be adequately managed during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.6.1 Summary of Technical Information in the Application

In Section 3.6 of the LRA, the applicant provided the results of the AMR of the electrical and I&C components listed in Table 2.5-1 of the LRA. The applicant also listed the materials, environments, AERMs, and AMPs associated with each commodity group.

In Table 3.6.1 of the LRA, the applicant provided a summary comparison of its AMRs with the AMRs evaluated in the GALL Report for the electrical and I&C components and component types. In Section 3.6.2.2 of the LRA, the applicant provided information concerning Table 3.6.1 components for which the GALL Report recommends further evaluation.

The applicant addressed the following electrical components as commodity groups requiring an AMR:

- insulated cables and connections
- phase bus
- switchyard bus
- high-voltage insulators

The following summarizes the materials, environments, aging effects requiring management, AMPs, and further evaluations of aging management recommended by the GALL Report. Table 3.6.2-1, "Electrical and I&C Components - Summary of Aging Management Evaluation," of the LRA further summarizes the results of the applicant's AMR and provides the NUREG-1801, "Generic Aging Lessons Learned (GALL) Report," comparison for electric components.

- Materials from which electrical components subject to an AMR are constructed include the following:
  - aluminum
  - cement
  - copper and copper alloys
  - porcelain
  - steel
  - organic polymers
  - galvanized metals
- Environments to which electrical components subject to an AMR are exposed include the following:
  - borated water leakage

- heat and air
- moisture and voltage stress
- radiation and air
- outdoor weather

- Aging effects associated with electrical components requiring management include the following:
    - loss of circuit continuity
    - reduced insulation resistance

- AMPs for managing the effects of aging on electrical components include the following:
    - Boric Acid Corrosion Prevention Program
    - Non-EQ Inaccessible Medium-Voltage Cable Program
    - Non-EQ Insulated Cables and Connections Program

- The GALL Report recommends further evaluation of aging management for the following:
    - electrical equipment subject to environmental qualification
    - quality assurance for aging management of nonsafety-related components

Appendix B to the LRA describes the AMPs and demonstrates that the identified aging effects will be managed for the period of extended operation. Based on these demonstrations, the applicant concluded that the effects of aging associated with electrical components will be managed such that there is reasonable assurance the intended functions will be maintained consistent with the CLB during the period of extended operation.

3.6.2 Staff Evaluation

In Section 3.6 of the LRA, the applicant describes its AMR for electric components at ANO-2. The staff reviewed 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 functions of electric components will be maintained consistent with the CLB throughout the period of extended operation, in accordance with the requirement of 10 CFR 54.21(a)(3).

The applicant referenced the GALL Report in its AMR. The staff has previously evaluated the adequacy of the aging management of electric components for license renewal as documented in 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 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 proposed FSAR supplement to ensure that it provided an adequate description of the programs credited with managing aging for electric components.

The staff performed an audit to confirm the applicant's claim that certain identified AMPs are consistent with the staff-approved AMPs in the GALL Report. The staff did not repeat its review of the matters described in the GALL Report. However, the staff did verify that the material presented in the LRA applies and that the applicant had identified the appropriate GALL AMRs. Section 3.5.2.1 of this SER summarizes the staff's audit findings.

The staff also audited those items that are consistent with the GALL Report and for which further evaluation is recommended. The staff determined that the applicant performed its further evaluations consistent with the acceptance criteria in Section 3.6.3.2 of the SRP-LR. Section 3.6.2.2 of this SER summarizes the staff's audit findings.

The staff conducted a technical review of the remaining items that were not consistent with the GALL Report. The review included evaluating whether the applicant identified all plausible aging effects and listed the appropriate aging effects for the combinations of materials and environments specified. Section 3.6.2.3 of this SER documents the staff's review findings. Finally, the staff reviewed the proposed FSAR Supplement to ensure that it adequately describes the programs credited with managing aging for electrical components.

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 ANO-2 Electrical Component Evaluations 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 EQ requirements (Item Number 3.6.1-1)	Degradation due to various aging mechanisms	Environmental Qualification of Electrical Components	Environmental Qualification of Electrical Components (B.1.8)	TLAA, See Section 4.4 of the SER
Electrical cables and connections not subject to 10 CFR 50.49 EQ requirements (Item Number 3.6.1-2)	Embrittlement, cracking, melting, discoloration, swelling, or loss of dielectric strength leading to reduced insulation resistance (IR); electrical failure caused by thermal/ thermoxidative degradation of organic; radiolysis and photolysis (ultraviolet [UV] sensitive materials only) of organic; radiation-induced oxidation; moisture intrusion	Electrical cables and connections not subject to 10 CFR 50.49 EQ requirements	Non-EQ Insulated Cables and Connections (B.1.16)	Consistent with GALL, which recommends no further evaluation (See Section `.3)

Component Group	Aging Effect/Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Electrical cables used in instrumentation circuits not subject to 10 CFR 50.49 EQ requirement that are sensitive to reduction in conductor resistance (Item Number 3.6.1-3)	Embrittlement, cracking, melting, discoloration, swelling, or loss of dielectric strength leading to reduced IR; electrical failure caused by thermal/therm-oxidative degradation of organic; radiation-induced oxidation; moisture intrusion	AMP for electrical cables used in instrumentation circuits not subject to 10 CFR 50.49 EQ requirements	Environmental Qualification of Electrical Components (B.1.8)	Non-GALL Program (See Section 3.6.2.1.4)
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 (Item Number 3.6.1-4)	Formation of water trees, localized damage leading to electrical failure (breakdown of insulation); water trees caused by moisture intrusion	AMP for inaccessible medium-voltage cables not subject to 10 CFR 50.49 EQ requirements	Non-EQ Insulated Cables and Connections (B.1.15)	Consistent with GALL, which recommends no further evaluation (See Section 3.6.2.1.2)
Electrical connectors not subject to 10 CFR 50.49 requirements that are exposed to borated water leakage (Item Number 3.6.1-5)	Corrosion of connector contact surfaces caused by intrusion of borated water	Boric Acid Corrosion	Boric Acid Corrosion (B.1.3)	Consistent with GALL, which recommends no further evaluation (See Section 3.0.3.2.1)

The staff's review of the ANO-2 electrical and instrumentation and controls system and associated components followed one of several approaches. One approach, documented in Section 3.6.2.1 of this SER, involves the staff's audit and review of the AMR results for components in the electrical and instrumentation and controls system that the applicant indicated are consistent with the GALL Report and do not require further evaluation. Another approach, documented in Section 3.6.2.2 of this SER, involves the staff's review of the AMR results for components in the electrical and instrumentation and controls system that the applicant indicated are consistent with the GALL Report and for which further evaluation is recommended. A third approach, documented in Section 3.6.2.3 of this SER, involves the staff's technical review of the AMR results for components in the electrical and instrumentation and controls system that the applicant indicated are not consistent with the GALL Report, or are not addressed in the GALL Report. AMPs that are credited to manage or monitor aging effects of the electrical and instrumentation and controls system components are reviewed in Sections 3.0.3.1 and 3.6.2.1 of this SER.

3.6.2.1 AMR Results That Are Consistent with the GALL Report

<u>Summary of Technical Information in the Application</u>

In Section 3.6.2.1 of the LRA, the applicant identified the materials, environments, and AERMs. The applicant identified the following programs that manage the aging effects related to the electrical and I&C components:

- Boric Acid Corrosion Prevention Program
- Non-EQ Inaccessible Medium-Voltage Cable Program
- Non-EQ Insulated Cables and Connections Program

<u>Staff Evaluation</u>

In Table 3.6.2-1 of the LRA, the applicant provided a summary of AMRs for the electrical and I&C components and identified which AMRs it considered to be consistent with the GALL Report. The applicant provided a note for each AMR line item. The notes describe how the information in the tables aligns with the information in the GALL Report. The staff audited those AMRs with notes A through E, which indicate that the AMR was consistent with the GALL Report.

Note A indicates that the AMR line item is consistent with the GALL Report for the component, material, environment, and aging effect. In addition, the AMP is consistent with the AMP identified in the GALL Report. The staff audited these line items to verify consistency with the GALL Report and the validity of the AMR for the site-specific conditions.

Note B indicates that the AMR line item is consistent with the GALL Report for the component, material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The staff audited these line items to verify consistency with the GALL Report. The staff confirmed that it had reviewed and accepted the identified exceptions to the GALL AMPs. The staff also determined whether the AMP identified by the applicant is consistent with the AMP identified in the GALL Report and whether the AMR is valid for the site-specific conditions.

Note C indicates that the component for the AMR line item is different from, but consistent with, the GALL Report for the material, environment, and aging effect. In addition, the AMP is consistent with the AMP identified by the GALL Report. This note indicates that the applicant could not find a listing of some system components in the GALL Report. However, the applicant identified a different component in the GALL Report that has the same material, environment, aging effect, and AMP as the component that was under review. The staff audited these line items to verify consistency with the GALL Report. The staff also determined whether the AMR line item of the different component applies to the component under review and whether the AMR is valid for the site-specific conditions.

Note D indicates that the component for the AMR line item is different from, but consistent with, the GALL Report for the material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The staff audited these line items to verify consistency with the GALL Report. The staff determined whether the AMR line item of the different component applies to the component under review. The staff determined that it had reviewed and accepted the identified exceptions to the GALL AMPs. The staff also determined whether the AMP identified by the applicant is consistent with the AMP identified in the GALL Report and whether the AMR is valid for the site-specific conditions.

Note E indicates that the AMR line item is consistent with the GALL Report for the material, environment, and aging effect, but a different AMP is credited. The staff audited these line items to verify consistency with the GALL Report. The staff also determined whether the identified AMP would manage the aging effect consistent with the AMP identified by the GALL Report and whether the AMR is valid for the site-specific conditions.

The staff conducted an audit and review of the LRA and program basis documents, which are available at the applicant's engineering office. The results of the audit and review are documented in the ANO-2 Audit and Review Report. On the basis of its audit and review, the staff finds that the AMR results, which the applicant claimed to be consistent with the GALL Report, are consistent with the AMR results in the GALL Report. Therefore, the staff finds that the applicant identified the applicable aging effects that are appropriate for the combinations of materials and environments listed.

Staff Evaluations Pertaining to Recent Operating Experience and Emerging Issues

Because the GALL Report and SRP-LR were issued in July 2001, these documents do not reflect the most current recommendations for managing certain aging effects that have been the subject of recent operating experience or the topic of an emerging issue. As a result, the staff reviewed the following AMR to determine how the applicant proposed to address these items for license renewal. The staff's evaluations are documented as follows.

3.6.2.1.1 AMR for Electric Connectors not Subject to 10 CFR 50.49 Requirements that are Exposed to Borated Water Leakage

Summary of Technical Information in the Application

The applicant stated in Table 3.6.2-1, "Electrical Components - Summary of Aging Management Evaluation," of the LRA that electric connections exposed to borated water leakage subject to an AMR (a) are constructed of various metals, (b) are exposed to borated water leakage, (c) performs the function of providing electrical connections to specified sections of an electrical circuit to deliver voltage and current or signals, (d) are subject to the aging effect of loss of circuit continuity, and (e) require aging management. The aging effect of loss of circuit continuity (caused by the environment consisting of borated water leakage) was identified as causing loss of capability of providing electrical connections to specified sections of an electrical circuit to deliver voltage, current or signals. The applicant concluded that an environment consisting of exposure to borated water leakage will have the aging effect over time of causing loss of circuit continuity through the various metals from which connections are constructed; therefore, an AMP is required.

Staff Evaluation

The staff agrees that an environment consisting of borated water will have a significant aging effect on various metals (the component parts from which connections are constructed); therefore, an AMP for boric acid corrosion prevention is required. The staff's evaluation of the

AMP for boric acid corrosion prevention is addressed in Section 3.0.3.2.1 of this SER. On the basis of its review, the staff therefore concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

Conclusion

On the basis of its review, the staff finds the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

Aging Management Programs

In Section 3.6.2.1 of the LRA, the applicant identified the materials, environments, and aging effects requiring management. The applicant identified the following programs that manage the aging effects requiring management for the electrical and I&C components:

- Boric Acid Corrosion Prevention Program (Appendix B.1.3)
- Non-EQ Inaccessible Medium-Voltage Cable (Appendix B.1.15)
- Non-EQ Insulated Cables and Connectors (Appendix B.1.16)

The staff's evaluation of the AMP for Boric Acid Corrosion Program is addressed in Section 3.0.3.2.1 of this SER. The staff's evaluation for the Non-EQ Inaccessible Medium-Voltage Cable Program and Non-EQ Insulated Cables and Connectors are included in this section of the SER. The applicant also identified the AMP for Environmental Qualification of Electrical Components (B.1.8) as the program to manage electrical cables used in instrumentation circuits not subject to 10 CFR 50.49 requirements that are sensitive to reduction in conductor resistance. This evaluation is contained in this section of the SER. The staff evaluated the AMPs to determine if they are appropriate for managing the identified aging effects. The staff also verified that the UFSAR Supplement adequately describes the program.

3.6.2.1.2 AMP for Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 EQ Requirements

The Non-EQ Inaccessible Medium-Voltage Cables Program is described in Section B.1.15 of the LRA. The LRA credits this Program with assuring that the intended functions of inaccessible medium-voltage cables exposed to the aging effects of moisture and voltage stress will be maintained consistent with the CLB through the period of extended operation. The staff reviewed the LRA to determine whether the applicant has demonstrated that the Non-EQ Inaccessible Medium-Voltage Cables Program will adequately manage the applicable aging effects throughout the period of extended operation, as required by 10 CFR 54.21(a)(3).

Summary of Technical Information in the Application

The applicant's Non-EQ Inaccessible Medium-Voltage Cables Program is discussed in LRA Section B.1.15, "Non-EQ Inaccessible Medium-Voltage Cable." The applicant states that their program will be consistent with the program described in the GALL Report, Section XI.E3, "Inaccessible Medium-Voltage Cables not Subject to 10CFR50.49 Environmental Qualification

Requirements." In this aging management program, the applicant indicates that periodic actions will be taken to prevent cables from being exposed to significant moisture, such as inspecting for water collection in cable manholes and conduit, and draining water, as needed. In-scope medium-voltage cables exposed to significant moisture and voltage will be tested to provide an indication of the condition of the conductor insulation. The specific type of test performed will be determined prior to the initial test.

The applicant describes the program as a new program that will be effective for managing aging effects since it will incorporate appropriate monitoring techniques. The Non-EQ Inaccessible Medium-Voltage Cable Program will provide reasonable assurance that the effects of aging will be managed such that the applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation. The program will be initiated prior to the period of extended operation.

The applicant's proposed FSAR supplement for the Non-EQ Inaccessible Medium-Voltage Cables Program is discussed in LRA Section A.2.1.16. The applicant states that this program will apply to inaccessible (e.g., in conduit or direct buried) medium-voltage cables within the scope of license renewal that are exposed to significant moisture simultaneously with applied voltage. In this aging management program, periodic actions will be taken to prevent cables from being exposed to significant moisture. In-scope medium-voltage cables exposed to significant moisture and voltage will be tested to provide an indication of the condition of the conductor insulation. The specific type of test performed will be determined prior to the initial test. The Non-EQ Inaccessible Medium-voltage Cable Program will be initiated prior to the period of extended operation.

<u>Staff Evaluation</u>

In LRA Section B.1.15, "Non-EQ Inaccessible Medium-Voltage Cable," the applicant discusses its proposed program for managing the aging effects from moisture and voltage stress. The LRA states that this program will be consistent with the GALL Report Section XI.E3 and will be initiated prior to the period of extended operation.

Based on the applicant's statement that their proposed program for managing the effects of aging will be consistent with the GALL Report Section XI.E1, the staff concludes, pursuant with the GALL Report guidelines, that no further evaluation is needed. The applicant has, therefore, 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). On the basis of its review, the staff finds that the AMP credited in the LRA for the inaccessible medium-voltage cables not subject to 10 CFR 50.49 EQ requirements will effectively manage or monitor the aging effects identified in the LRA.

Section A.2.1.16 of the LRA contains the applicant's FSAR supplement for the Non-EQ Inaccessible Medium-Voltage Cable Program. The staff reviewed this section and finds the program description is consistent with the material contained in Section B.1.15 of the LRA The staff finds that the FSAR supplement provides an adequate summary of the program activities as required by 10 CFR 54.21(d).

Conclusions

Based on the statement that their proposed program for managing aging effects will be consistent with the GALL Report Section XI.E3, the staff concludes that no further evaluation is needed. The applicant has, therefore, demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation as required by 10 CFR 54.21(a)(3). The staff also reviewed the FSAR supplement for this AMP and finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.6.2.1.3 AMP for Electric Cables and Connections Not Subject to 10 CFR 50.49 EQ Requirements

The Non-EQ Insulated Cables and Connections Program is described in Section B.1.16 of the LRA. The LRA credits this program with assuring that the intended functions of insulated cables and connections will be maintained consistent with the CLB through the period of extended operation. The program monitors and assesses the condition of cables and connections that are affected by adverse localized environments. If an unacceptable condition or situation is identified, a determination is made as to whether the same condition or situation is applicable to other accessible or inaccessible cables and connections. The staff reviewed the LRA to determine whether the applicant has demonstrated that the Non-EQ Insulated Cables and Connections Program will adequately manage the applicable aging effects throughout the period of extended operation, as required by 10 CFR 54.21(a)(3).

Summary of Technical Information in the Application

The applicant's Non-EQ Insulated Cables and Connections Program is discussed in LRA Section B.1.16, "Non-EQ Insulated Cables and Connections." The applicant states that their program will be consistent with the program described in the GALL Report, Section XI.E1, "Electrical Cables and Connections Not Subject to 10CFR50.49 Environmental Qualification Requirements". The applicant describes the program as a new program that will provide reasonable assurance that the intended functions of insulated cables and connections can be maintained consistent with the current licensing basis through the period of extended operation. The program will be effective for managing aging effects since it will incorporate proven monitoring techniques, acceptance criteria, corrective actions, and administrative controls. The program will provide reasonable assurance that the effects of aging will be managed such that the applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation. And the program will be initiated prior to the period of extended operation.

The applicant's proposed FSAR supplement for Non-EQ Insulated Cables and Connections Program is discussed in LRA Section A.2.1.17. The applicant states that this program will apply to accessible (i.e., able to be approached and viewed easily) insulated cables and connections installed in structures within the scope of license renewal and prone to adverse localized environments. The program will visually inspect a representative sample of accessible insulated cables and connections for cable and connection jacket surface anomalies. The program will be initiated prior to the period of extended operation.

Staff Evaluation

In LRA Section B.1.16, "Non-EQ Insulated Cables and Connections," the applicant discusses its proposed program for managing aging effect due to exposure to heat (or radiation and air). The LRA states that this program will be consistent with GALL AMP XI.E1, "Electrical Cables and Connections," and will be initiated prior to the period of extended operation.

Based on the statement that their proposed program for managing the effects of aging will be consistent with GALL AMP XI.E1, the staff concludes, pursuant with GALL Report guidelines, that no further evaluation is needed. The applicant has, therefore, 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).

Section A.2.1.17 of Appendix A to the LRA contains the applicant's FSAR supplement for the Non-EQ Insulated Cables and Connections Program. The staff reviewed this section and finds the program description is consistent with the material contained in Section B.1.16 of Appendix B to the LRA. The staff finds that the FSAR supplement provides an adequate summary of the program activities as required by 10 CFR 54.21(d).

Conclusions

Based on the statement that their proposed program for managing aging effects will be consistent with GALL AMP XI.E1, the staff concludes that no further evaluation is needed. The applicant has, therefore, demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation as required by 10 CFR 54.21(a)(3). The staff also reviewed the FSAR supplement for this AMP and finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.6.2.1.4 AMP for Electrical Cables Used in Instrumentation Circuits Not Subject to 10 CFR50.49 Environmental Qualification Requirement that are Sensitive to Reduction in Conductor Insulation Resistance

The AMP for instrumentation cables that are sensitive to reduction in conductor insulation resistance is described in Section B.1.8 of the LRA. The LRA credits the ANO-2 EQ Program, i.e., the AMP described in Section B.1.8 of the LRA, with assuring that the intended functions of instrumentation cables (that are sensitive to reduction in conductor insulation) will be maintained consistent with the CLB through the period of extended operation. The staff reviewed the LRA to determine whether the applicant has demonstrated that the ANO-2 EQ Program will adequately manage the applicable aging effects throughout the period of extended operation, as required by 10 CFR 54.21(a)(3).

Summary of Technical Information in the Application

Table 3.6.1 of the LRA states that the aging management program evaluated as part of the GALL Report (for electrical cables used in instrumentation circuits not subject to 10 CFR 50.49 EQ requirements that are sensitive to reduction in conductor insulation resistance) is not applicable to ANO-2. The aging management program is not applicable since ANO-2 instrumentation cables for high range radiation monitors and neutron flux detectors are subject to 10 CFR 50.49 environmental qualification (EQ) requirements.

Staff Evaluation

From the information presented in the LRA, the staff understands that instrumentation cables used for high range radiation monitors and neutron flux detectors (that are sensitive to reduction in conductor insulation resistance) will be subject the AMP defined by ANO-2's EQ program which meets the requirements of 10 CFR 50.49. 10 CFR 50.49(c)(3), however, states that environmental qualification of electric equipment important to safety located in a mild environment are not included within the scope of 10 CFR 50.49; thus, these instrumentation cables that are located in a mild environment (or not exposed to harsh environments) are not explicitly required to be within the scope of 10 CFR 50.49. Based on its review, the staff concludes, as described in section 4.4 of this SER, that a plant's EQ program (which meets the requirements of 10 CFR 50.49) is an acceptable AMP for license renewal. Therefore, subject to a commitment (included as part of proposed FSAR supplement A.2.1.8 of the LRA), the staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation as required by 10 CFR 54.21(a)(3).

Conclusions

Based on its review, the staff concludes, subject to an FSAR commitment that the subject instrumentation circuits are within the scope of 10 CFR 50.49, that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation as required by 10 CFR 54.21(a)(3).

3.6.2.1.5 Conclusion

The staff has evaluated the applicant's claim of consistency with the GALL Report. The staff also reviewed information pertaining to the applicant's consideration of recent operating experience and proposals for managing associated aging effects. On the basis of its review, the staff finds that the applicant has demonstrated that the effects of aging for these components will be adequately managed, so that their intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.6.2.2 Aging Management Evaluations That Are Consistent with the GALL Report, for Which Further Evaluation Is Recommended

Summary of Technical Information in the Application

In Section 3.6.2.2 of the LRA, the applicant provided further evaluation of aging management as recommended by the GALL Report for electrical and I&C components. The applicant provided information concerning how it will manage the following aging effects:

- electrical equipment subject to environmental qualification
- quality assurance for aging management of nonsafety-related components

Staff Evaluation

For component groups 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.

3.6.2.2.1 Environmental Qualification (EQ) of Electrical Components

The aging analysis included as part of an environmental qualification program, which meets the requirements of 10 CFR 50.49 that involve time-limited assumptions as defined by the current operating term for the ANO-2 (i.e., 40 years), 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's review of the environmental qualification program as a TLAA for license renewal is described in Section 4.4 of this SER.

3.6.2.2.2 Quality Assurance for Aging Management of Nonsafety-Related Components

The staff's review of quality assurance for aging management of non-safety-related electric components is included as part of Section 3.0.4, "Quality Assurance Program Attributes Integral to Aging Management Programs," of this SER.

In addition, the staff reviewed the applicant's further evaluations against the criteria contained in Section 3.6.3.2 of the SRP-LR. The ANO-2 audit and review report documents the details of the staff's audit and review.

Conclusion

On the basis of its audit and review, the staff finds that the applicant's further evaluations conducted in accordance with the GALL Report are consistent with the acceptance criteria in Section 3.6.3.2 of the SRP-LR. Since the applicant's AMR results are otherwise consistent with the GALL report, the staff finds that the applicant has demonstrated that the effects of aging can be adequately managed so that the intended function(s) can be maintained consistent with the current licensing basis for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.6.2.3 AMR Results That Are Not Consistent with the GALL Report or Not Addressed in the GALL Report

The applicant described the results of its AMR for electrical components in Table 3.6.2-1 of the LRA. The staff reviewed these results to determine whether the applicant has demonstrated that the effect of aging on the electrical components will be adequately managed during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.6.2.3.1 Phase Bus (Nonsegregated Bus for Station Blackout) and Connections

Summary of Technical Information in the Application

The applicant stated in Table 3.6.2-1 of the LRA that phase bus and connections subject to an AMR (1) are constructed of aluminum, copper, and steel, (2) are exposed to heat and air, or an outside weather environment consisting of temperatures up to 40 °C (105 °F), precipitation, and negligible radiation, (3) are exposed to an ohmic heating environment consisting of temperatures up to 72 °C (162 °F), (4) provide electrical connections to specified sections of an electrical circuit to deliver voltage and current, and (5) require no AMP. The applicant did not identify any aging effects from the environment (consisting of heat and air, or outside weather up to 40 °C (105 °F), ohmic heating and air up to 72 °C (162 °F), and precipitation) that would cause the loss of capability to provide electrical connections to specified sections of an electrical circuit to deliver voltage, current, or signals. The applicant concluded that an environment consisting of temperatures up to 40 °C (105 °F), ohmic heat and air up to 72 °C (162 °F), and precipitation has no significant aging effect on aluminum, copper, and steel (the component parts from which the phase bus and connections are constructed); therefore, no AMP is required.

Staff Evaluation

The staff agrees that an environment consisting of temperatures up to 40 °C (105 °F), ohmic heat and air up to 72 °C (162 °F), and precipitation has no significant aging effect on aluminum, copper, and steel (the component parts from which phase bus and connections are constructed); therefore, no AMP is required.

Conclusion

On the basis of its review, the staff finds the applicant has demonstrated that the effects of aging can 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).

The staff also reviewed the applicable FSAR Supplement program summaries and concludes that the FSAR Supplement adequately describes the AMPs credited for managing aging in these components, as required by 10 CFR 54.21(d).

3.6.2.3.2 Switchyard Bus (Switchyard Bus for Station Blackout) and Connections

Summary of Technical Information in the Application

The applicant stated in Table 3.6.2-1 of the LRA that switchyard bus and connections subject to an AMR (1) are constructed of aluminum and copper, (2) are exposed to an outdoor weather environment consisting of temperatures up to 40 °C (105 °F), precipitation, and negligible radiation, (3) provide electrical connections to specified sections of an electrical circuit to deliver voltage, current, or signals, and (4) require no AMP. The applicant did not identify any aging effects from the outdoor environment (consisting of temperatures up to 40 °C (105 °F) and precipitation) that would cause the loss of the capability to provide electrical connections to specified sections of an electrical circuit to deliver voltage, current, or signals. The applicant concluded that an environment consisting of temperatures up to 40 °C (105 °F) and precipitation has no significant aging effect on aluminum and copper (the component parts from which switchyard bus and connections are constructed); therefore, no AMP is required.

Staff Evaluation

The staff agrees that an outdoor weather environment has no significant aging effect on aluminum and copper (the component parts from which switchyard bus and connections are constructed); therefore, no AMP is required.

Conclusion

On the basis of its review, the staff finds the applicant has demonstrated that the effects of aging can 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).

The staff also reviewed the applicable FSAR Supplement program summaries and concludes that the FSAR Supplement adequately describes the AMPs credited for managing aging in these components, as required by 10 CFR 54.21(d).

3.6.2.3.3 High-Voltage Insulators

Summary of Technical Information in the Application

The applicant stated in Table 3.6.2-1 of the LRA that high-voltage insulators subject to an AMR (1) are constructed of porcelain, galvanized metal, and cement, (2) are exposed to an outdoor weather environment consisting of temperatures up to 40 °C (105 °F), precipitation, and negligible radiation, (3) insulate and support an electrical conductor, and (4) require no AMP. The applicant did not identify any aging effects from the outside environment (consisting of temperatures up to 40 °C (105 °F) and precipitation) that would cause the loss of the capability to insulate or support its associated electrical conductor. The applicant concluded that an environment consisting of temperatures up to 40 °C (105 °F) and precipitation has no significant aging effect on porcelain, galvanized metal, and cement (the component parts from which high-voltage insulators are constructed); therefore, no AMP is required.

Subsequently, in a letter dated August 18, 2004, the applicant, as part of an additional response to RAI 2.5-1(c) included in Section 3.6.2.3.7.1 of this SE, indicated that high voltage strain and suspension insulators that perform the function of insulating and supporting electrical transmission conductors, like high voltage insulator that perform the function of insulating and supporting switchyard bus described above, are within the scope of license renewal and subject to an AMR. The applicant concluded that an environment consisting of temperatures up to 105°F and precipitation (including wind) has no significant aging effect on porcelain, galvanized metal, and cement (the component parts from which high voltage insulators are constructed); therefore, no aging management program is required.

Staff Evaluation

The staff agrees that an outdoor weather environment has no significant aging effect on porcelain, galvanized metal, and cement (the component parts from which high-voltage insulators are constructed); therefore, no AMP is required. On the basis of its review, the staff therefore concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

Conclusion

On the basis of its review, the staff finds the applicant has demonstrated that the effects of aging can 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).

The staff also reviewed the applicable FSAR Supplement program summaries and concludes that the FSAR Supplement adequately describes the AMPs credited for managing aging in these components, as required by 10 CFR 54.21(d).

3.6.2.3.4 Transmission Conductors

Summary of Technical Information in the Application

By letter dated August 18, 2004, the applicant in a revised response to RAI 2.5-1(c) states:

> Based on the inclusion of Startup Transformer #2, transmission conductors, strain and suspension insulators, and insulated cables are subject to aging management review. Insulated cables were included in the ANO-2 LRA.
>
> The transmission conductor component type includes transmission conductors and the hardware used to secure the conductors to the insulators. The materials for aluminum cable-steel reinforced (ACSR) transmission conductors are aluminum and steel, and the environment is outdoor weather. Based on industry guidance, potential aging effects and aging mechanisms are loss of conductor strength due to general corrosion (atmospheric oxidation of metals) and loss of material due to wear from wind loading.
>
> Corrosion in ACSR conductors is a very slow acting mechanism. Corrosion rates are dependent on air quality. ANO is located in a mostly agricultural area with no significant nearby industries that could contribute to corrosive air quality. Corrosion testing of transmission conductors at Ontario Hydroelectric showed a 30 percent loss of composite conductor strength of an 80-year-old ACSR conductor. The Institute of Electrical and Electronic Engineers National Electrical Safety Code (NESC) requires that tension on installed conductors be a maximum of 60% of the ultimate conductor strength. Therefore, assuming a 30% loss of strength, there would still be significant margin between what is required by the NESC and the actual conductor strength. In determining actual conductor tension, the NESC considers various loads imposed by ice, wind, and

temperature as well as length of conductor span. The transmission conductors in scope for license renewal are short spans located within the high voltage switchyard. The maximum span for ANO conductors subject to aging management review is approximately 240 feet in length providing significant margin to maximum design loading limits. ANO is in the medium loading zone; therefore, the Ontario Hydroelectric heavy loading zone study is conservative with respect to loads imposed by weather conditions.

The Ontario Hydroelectric test envelops the conductors at ANO, demonstrating that the material loss on the ANO ACSR transmission conductors is acceptable for the period of extended operation. This illustrates with reasonable assurance that transmission conductors at ANO will have ample strength to perform their intended function throughout the renewal term; therefore, loss of conductor strength due to corrosion of the transmission conductors is not an aging effect requiring management.

Loss of material due to mechanical wear can be an aging effect for strain and suspension insulators that are subject to movement. Experience has shown that transmission conductors do not normally swing and that when they do swing because of substantial wind, they do not continue to swing for very long once the wind has subsided. Wear has not been identified during routine inspection. Therefore, loss of material due to wear is not an aging effect requiring management for switchyard insulators.

Entergy reviewed industry operating experience and NRC generic communications related to the aging of transmission conductors in order to ensure that no additional aging effects exist beyond those identified above. Entergy also reviewed ANO plant-specific operating experience, including nonconformance reports, licensee event reports, and condition reports, and documented interviews with transmission engineering personnel. Entergy's review did not identify unique aging effects for transmission conductors beyond those identified above.

Staff Evaluation

The staff agrees that an outdoor weather environment has no significant aging effect on aluminum and steel (the component parts from which transmission conductors are constructed); therefore, no aging management program is required. On the basis of its review, the staff therefore concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

Conclusion

On the basis of its review, the staff finds the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.6.2.3.5 Inaccessible Medium-Voltage Cables

During the site inspection that was conducted by the staff on November 15 through 19, 2004, a walk-down of the electrical manholes was conducted. The staff noted that all of the observed electrical manholes containing inaccessible medium-voltage cables were flooded, such that the electrical cables in those manholes were submerged. The applicant stated that the program for managing the aging of cables was not yet developed, but would be consistent with Generic Aging Lessons Learned, and included a periodic inspection of the electrical manholes and the removal of water. The staff noted that the cables had been wetted for an indeterminate period of time and requested that the applicant commit to cable testing in addition to periodic inspections for the period of extended operation. In a letter dated February 28, 2005, the applicant added a testing requirement to the AMP for inaccessible medium-voltage cables.

3.6.3 Conclusion

On the basis of its review, the staff concludes that the applicant has demonstrated that the aging effects associated with the electrical components will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable FSAR Supplement program summaries and concludes that the FSAR Supplement adequately describes the AMPs credited for managing aging in the electrical components, as required by 10 CFR 54.21(d).

3.7 Conclusion for Aging Management

The staff has reviewed the information in Section 3, "Aging Management Review Results," and Appendix B, "Aging Management Programs and Activities" of the LRA. On the basis of its review of the AMR results and AMPs, the staff concludes that the applicant has demonstrated that the aging effects will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the applicable FSAR Supplement program summaries and concludes that the FSAR Supplement adequately describes the AMP's credited for managing aging, as required by 10 CFR 54.21(d).

With regard to these matters, the NRC staff has concluded that there is reasonable assurance that the activities authorized by the renewed license will continue to be conducted in accordance with the current licensing basis, and that any changes made to the ANO-2 current licensing basis in order to comply with 10 CFR 54.21(a)(3) are in accord with the ACT and the Commission's regulations.

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 discussed the TLAAs in license renewal application (LRA) Sections 4.2 through 4.7. The Nuclear Regulatory Commission (NRC) staff documents its review of the TLAAs 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 Title 10, Section 54.21(c)(1), of the *Code of Federal Regulations* (10 CFR 54.21(c)(1)), an 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 exemption, 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 Arkansas Nuclear One, Unit 2 (ANO-2), against the six criteria specified in 10 CFR 54.3 to identify the TLAAs. The applicant indicated that it identified the calculations that meet the six criteria by searching the current licensing basis (CLB), which includes the Final Safety Analysis Report (FSAR); 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," (SRP-LR), issued July 2001; and Nuclear Energy Institute (NEI) 95-10, Revision 3, "Industry Guideline for Implementing the Requirements of 10 CFR Part 54—The License Renewal Rule," issued March 2001. The applicant listed the following TLAAs that apply to ANO-2 in Table 4.1-2 of the LRA:

- reactor vessel neutron embrittlement
- concrete containment tendon prestress
- metal fatigue
- environmental qualification of electrical equipment
- high-energy line break postulation based on fatigue cumulative usage factor
- low-temperature overpressure protection analyses
- fatigue analysis for the main steam supply lines to the turbine-driven auxiliary feedwater lines
- leak before break

- fatigue analysis of the containment liner plate
- containment penetration pressurization cycles

Pursuant to 10 CFR 54.21(c)(2), the applicant stated that it identified no exemptions granted under 10 CFR 50.12 that were based on a TLAA, as defined in 10 CFR 54.3.

4.1.2 Staff Evaluation

In LRA Section 4.1, the applicant identified the TLAAs applicable to ANO-2 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).

Title 10, Section 54.3, of the *Code of Federal Regulations* (10 CFR 54.3) defines TLAAs as analyses that meet the following six criteria:

- involve structures, systems, and components (SSCs) within the scope of license renewal, as delineated in 10 CFR 54.4(a)
- consider the effects of aging
- involve time-limited assumptions defined by the current operating term (e.g., 40 years)
- were determined by the applicant to be relevant in making a safety determination
- involve conclusions, or provide the basis for conclusions, related to the capability of the SSC to perform its intended functions, as delineated in 10 CFR 54.4(b)
- are contained or incorporated by reference in the CLB

The applicant provided a list of common TLAAs from the SRP-LR and those TLAAs that are applicable to ANO-2 in LRA Table 4.1-2.

Pursuant to 10 CFR 54.21(c)(2), an applicant must provide a list of all exemptions granted under 10 CFR 50.12 which it determines to be based on a TLAA and evaluates and justifies for continuation through the period of extended operation. In its LRA, the applicant stated that it performed a search of the ANO-2 docketed correspondence, the operating licenses, and the FSAR, and that it evaluated each exemption in effect for TLAA applicability. The applicant identified no TLAA-based exemptions. On the basis of the information the applicant provided regarding the process it used to identify TLAA-based exemptions, plus 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, the staff concludes that the applicant has provided an acceptable list of TLAAs, 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). The staff notes that the applicant did not initially identify the reactor coolant pump (RCP) flywheel as subject to a TLAA, but included a TLAA for it in response to RAI 4.7.3-1.

4.2 Reactor Vessel Neutron Embrittlement

The following regulations in 10 CFR Part 50 govern reactor vessel (RV) integrity:

- Section 50.60 requires that all light-water reactors (LWRs) meet the fracture toughness, pressure-temperature limits, and material surveillance program requirements for the reactor coolant boundary as set forth in Appendices G and H to 10 CFR Part 50.

- Section 50.61 contains fracture toughness requirements for protection against pressurized thermal shock.

The design bases of ANO-2 contain calculations and analyses addressing the effects of neutron irradiation embrittlement of the RV. The analyses that evaluated the reduction of fracture toughness of the ANO-2 RV for 40 years are TLAAs. The applicant updated the analyses for the initial 40-year license to address the additional 20 years of operation (i.e., 60 years total) for license renewal. The ANO-2 Reactor Vessel Integrity Program described in Appendix B to the LRA will ensure that the time-dependent parameters used in the TLAAs and described below remain valid through the period of extended operation. The applicant projected the RV neutron embrittlement TLAAs to the end of the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii), as summarized below.

The application included three TLAAs for evaluation of the RV beltline materials, including (1) calculation of the end of extended license Charpy V-notch upper-shelf energy (USE) values for each beltline material, (2) calculation of the end of extended license pressurized thermal shock (PTS) reference temperature (RT) value (i.e., RT_{PTS} values) for each beltline material, and (3) a description of the pressure-temperature (P-T) limit calculations for 48 effective full-power years (EFPYs). The applicant will prepare revised P-T limit curves for extended operation and submit them before reaching 32 EFPYs (as stated in Section 5.2.4.3.2 of the Final Safety Analysis Report (FSAR) Supplement). Each analysis has been updated to consider 20 years of additional plant operation. The TLAAs take into account the effects of the additional extended operating period neutron irradiation on the previous calculated end of license USE, RT_{PTS}, and P-T limit values for the RV at ANO-2, and they base the evaluations through 48 EFPYs of power operation.

The applicant assumed a capacity factor of 80 percent for the TLAA associated with RV neutron embrittlement evaluations that it described in Section 4.2 of the LRA. The applicant based these evaluations on end of life (EOL) fluences corresponding to 48 EFPYs of operation. In Request for Additional Information (RAI) 4.2-1, the staff asked the applicant to justify the assumed 80-percent capacity factor for the period of extended operation, in light of similar plants achieving and projecting capacity factors of 90 percent or greater. The staff also requested that the applicant justify the estimated 48-EFPY fluence for ANO-2, or, if the applicant cannot justify a 48-EFPY fluence, it should provide the results of revised evaluations of USE for higher levels of fluence projected to the end of the period of extended operation.

In response to RAI 4.2-1, the applicant stated that the ANO-2 end of license fluence estimate for the period of extended operation is based on 48 EFPYs, which assumes a plant capacity factor of 80 percent over 60 years. This is consistent with the method used to calculate 40-year fluence estimates the applicant reported in its response to Generic Letter 92-01. At present, the lifetime capacity factor for ANO-2 through 26 years of operation is approximately 80 percent. Therefore, it is reasonable to assume a lifetime capacity factor of 80 percent when evaluating 60 years of operation.

The applicant also stated that the Reactor Vessel Integrity Program addresses the impact on fracture toughness of operation at capacity factors in excess of 80 percent. As the applicant stated in Section 4.2 of the LRA, the ANO-2 Reactor Vessel Integrity Program described in Appendix B to the LRA will ensure that the time-dependent parameters (e.g., end of license fluence) used in the TLAA remain valid through the period of extended operation. As capsules are pulled and tested, the applicant will perform fluence updates and end of license vessel fluence extrapolations. The applicant will compare the updated fluence projections to the 48-EFPY fluence estimates reported in the LRA. If the revised end of license fluence extrapolations exceed the values provided in the LRA, then the applicant will update the corresponding fracture toughness parameters (adjusted reference temperature (ART), USE, and RT_{PTS}) accordingly. The staff finds the response acceptable and considers this issue closed.

4.2.1 Charpy Upper-Shelf Energy

Appendix G to 10 CFR Part 50 requires that RV beltline materials must have USE values in the transverse direction for the base metal, and along the weld for the weld material, according to the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (the ASME Code) of no less than 75 foot-pounds (ft-lb) (102 J) initially, and USE values throughout the life of the vessel of no less than 50 ft-lb (68 J). However, USE values below these criteria may be acceptable if the applicant demonstrates, in a manner approved by the Director of the Office of Nuclear Reactor Regulation, that the lower values of USE will provide margins of safety against fracture equivalent to those required by Appendix G to Section XI of the ASME Code. Regulatory Guide (RG) 1.99, Revision 2, "Radiation Embrittlement of Reactor Vessel Materials," provides an expanded discussion regarding the calculations of USE values and describes two methods for determining USE values for RV beltline materials, depending on if a given RV beltline material is represented in the plant's RV material surveillance program (i.e., Appendix H to 10 CFR Part 50).

4.2.1.1 Summary of Technical Information in the Application

Section 4.2.1 of the LRA addresses the requirement that RV beltline materials must maintain a USE value of not less than 50 ft-lb throughout the life of the vessel, unless the applicant demonstrates, in a manner approved by the Director of the Office of Nuclear Reactor Regulation, that lower values of USE will provide margins of safety against fracture that are equivalent to those required by Appendix G to Section XI of the ASME Code. The applicant stated that it calculated the USE values through the period of extended operation using guidance from RG 1.99, Revision 2. The applicant used a value of 48 EFPYs as the end of extended license criterion for the RV. The LRA contains the information derived from the USE analysis. The applicant summarized the end of extended operating period USE analyses for the ANO-2 RV beltline materials in Table 4.2-1 of the LRA. The LRA includes a list of all beltline materials, the weight percent copper in the steel, the end of license fluence for the RV located one-quarter of the way through the RV wall from the vessel's inside surface (i.e., 1/4 thickness (T) of the vessel), and the initial and final USE values.

The applicant calculated the best estimate fluence at the inside (wetted) surface of the RV using the methodology reported in the Babcock & Wilcox report BAW-2241P-A, Revision 1, "Fluence and Uncertainty Methodologies," issued April 1999. The NRC's Division of Systems, Safety, and Analysis staff approved this methodology, which meets the uncertainty requirements of RG 1.190, "Calculational and Dosimetry Methods for Determining Pressure Vessel Neutron Fluence," issued March 2001.

The applicant concluded that the end of extended license USE results for 48 EFPYs are above the screening criterion of 50 ft-lb (68 J). The applicant stated that it projected the calculations through the period of extended operation, and met the requirements of 10 CFR 54.21(c)(1)(ii).

4.2.1.2 Staff Evaluation

The technical staff reviewed the TLAA for USE to identify aspects of the TLAA that are impacted by the additional fluence levels that will occur during the period of extended operation. The review included an independent evaluation of material chemistries and properties, as listed in the NRC's Reactor Vessel Integrity Database (RVID), for consistency with the data listed in the LRA.

The staff performed an independent calculation of the end of extended license USE values for the beltline materials the applicant used to fabricate the ANO-2 RV. The staff applied Position 1.2 of RG 1.99 to estimate the percent loss of USE as a function of copper content and neutron fluence for the beltline materials, as evaluated using the 48-EFPY end of extended license fluence.

With regard to the staff's independent USE analysis of ANO-2 beltline materials, the staff confirmed that the most limiting beltline material it identified for the ANO-2 RV is the same as that identified by the applicant. Although the staff's calculated USE values for the limiting RV beltline materials were not always consistent with the applicant's calculated USE values, both the staff's and the applicant's USE analyses confirm that the USE values for the ANO-2 beltline materials will remain at or above the 50 ft-lb acceptance criteria of Appendix G to 10 CFR Part 50 through the expiration of the period of extended operation for the unit.

The staff determined that the 48-EFPY (60-year) USE assessment for the RV beltline materials is bounded (limited) by the USE value for the intermediate shell longitudinal weld 2-203 A. The staff calculated the projected USE value for this material to be 54 ft-lb through the expiration of the period of extended operation for the unit. This material meets the staff's end of license 50 ft-lb acceptance criterion for USE. The staff also performed a 54 EFPY USE assessment for the ANO-2 RV beltline materials and calculated a limiting USE of 52.5 ft-lb through the expiration of the period of extended operation.[4]

[4] Although the design basis used in the LRA for the period of extended operation is 48 EFPY, the staff also performed additional USE calculations for the RV beltline materials at 54 EFPY. The staff performed the additional calculations to resolve a question raised by the Advisory Committee on Reactor Safety (ACRS) during the ACRS Subcommittee meeting on the ANO-2 LRA. The staff calculated the limiting USE value to be 52.5 ft-lb at 54 EFPY. The staff's acceptance criterion on USE, as stated in 10 CFR Part 50, Appendix G, is a minimum of 50 ft-lb at the end of licensed life of the reactor. Thus, the ANO-2 RV will acceptable for USE even if an addition 6 EFPY is added to the 48 EFPY design basis for the period of extended operation.

The applicant did not include upper/intermediate shell weld 8-203 in Table 4.2-1 of the LRA. This material has the highest copper content (0.216 weight percent) of the vessel beltline materials. However, as listed in RVID, it has only 14 percent of the fluence of the limiting beltline welds covered by the LRA. Appendix G to 10 CFR Part 50, defines the RV beltline or beltline region as the region of the RV (shell material including welds, heat affected zones, and plates or forgings) directly surrounding the effective height of the active core and adjacent regions of the RV that are predicted to experience sufficient neutron radiation damage to be considered in the selection of the most limiting material with regard to radiation damage. The staff concurred with the applicant that this weld is not the limiting material of the RV and that it has sufficiently low fluence. Therefore, this weld would not experience significant neutron radiation damage, and it can be excluded from the list of beltline materials.

The staff determined that the methods used by the applicant for the 60-year USE assessment for the RV beltline materials are consistent with accepted methods and NRC guidance documents. The staff evaluation concluded that the USE values for the ANO-2 beltline materials will remain at or above the 50 ft-lb acceptance criteria of Appendix G to 10 CFR Part 50 through the expiration of the period of extended operation.

The staff confirmed that all RV beltline materials will continue to satisfy the USE value requirements of Appendix G to 10 CFR Part 50 through the end of the period of extended operation for ANO-2. *The staff therefore concludes that the applicant's TLAA for calculating the* USE values of the RV beltline materials is acceptable because it meets the requirements of 10 CFR 54.21(c)(1)(ii) and will ensure that the RV materials will have adequate USE levels and fracture toughness through the end of the period of extended operation.

4.2.2 Pressurized Thermal Shock

Title 10, Section 50.61, of the *Code of Federal Regulations* (10 CFR 50.61) provides the fracture toughness requirements for protecting the RVs of PWRs against the consequences of PTS. The NRC requires licensees to assess the RV materials' projected values for RT_{PTS} through the end of their operating licenses. If approved for license renewal, this would include TLAAs for PTS up through the end of the period of extended operation for ANO-2, assumed to be 48 EFPYs. The rule requires each licensee to calculate the end of license 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). Title 10, Section 50.61, of the *Code of Federal Regulations* (10 CFR 50.61) also provides screening criteria against which the applicant should evaluate the calculated RT_{PTS} values. For RV beltline base metal materials (forging or plate materials) and longitudinal (axial) weld materials, the NRC considers the materials to provide adequate protection against PTS events if the calculated RT_{PTS} values are less than or equal to 132 °C (270 °F). For RV beltline circumferential weld materials, the NRC considers the materials to provide adequate protection against PTS events if the calculated RT_{PTS} values are less than or equal to 149 °C (300 °F). Additionally, 10 CFR 50.61 discusses the calculations of RT_{PTS} values and describes two methods for determining RT_{PTS} for RV materials, depending on if a given RV beltline material is represented in the plant's RV material surveillance program (i.e., Appendix H to 10 CFR Part 50).

4.2.2.1 Summary of Technical Information in the Application

Section 4.2.2 of the LRA addresses the 10 CFR 50.61 requirement for protection of the RV from PTS. The applicant stated that the screening criteria in 10 CFR 50.61 are 132 °C (270 °F) for plates, forgings, and axial welds, and 149 °C (300 °F) for circumferential welds. According to the regulation, if the calculated RT_{PTS} values for the beltline materials are less than the screening criteria, then the RV is acceptable with respect to risk of failure during PTS transients. In this part of the LRA, the applicant described the projected values of RT_{PTS} over the period of extended operation (assumed to be 48 EFPYs in the LRA) to demonstrate that the screening criteria are not violated. The applicant stated that it carried out this analysis and that the results do not exceed the screening criteria. The applicant stated that it projected the calculations through the period of extended operation and met the requirements of 10 CFR 54.21(c)(1)(ii).

Pursuant to 10 CFR 50.61(b)(1), which provides rules for protection against PTS for pressurized-water reactors (PWRs), the NRC requires licensees to assess the projected RT values whenever a significant change occurs in projected values of RT_{PTS}, or upon request for a change in the expiration date for the operation of the facility. For ANO-2 license renewal, RT_{PTS} values are calculated for 48 EFPYs.

The applicant obtained fluence values at 48 EFPYs for ANO-2 at the clad/base metal interface using the methodology described in Reference 4.2-1, as described in Section 4.2.1 above. This method meets the uncertainty requirements of RG 1.190. The applicant estimated a peak inside vessel/clad interface fluence of 5.0896×10^{19} n/cm^2 at 48 EFPYs for the lower shell plates.

Title 10, Section 50.61(b)(2), of the *Code of Federal Regulations* (10 CFR 50.61(b)(2)) establishes screening criteria for RT_{PTS} as 132 °C (270 °F) for plates, forgings, and axial welds, and 149 °C (300 °F) for circumferential welds. Table 4.2-2 of the LRA provides the values for RT_{PTS} at 48 EFPYs for ANO-2. The applicant calculated the projected RT_{PTS} values using RG 1.99, Revision 2, Positions 1 and 2, and they are all within the established screening criteria for 48 EFPYs. The limiting beltline material is the lower shell plate C-8010-1, with a 48-EFPY RT_{PTS} of 50.3 °C (122.6 °F), which is well below the limit of 132 °C (270 °F). Therefore, the applicant has evaluated RT_{PTS} for ANO-2 in accordance with 10 CFR 54.21(c)(1)(ii) and determined it to be acceptable for the period of extended operation.

A comparison of copper content, nickel content, and unirradiated RT_{NDT} values for ANO-2 beltline materials listed in Table 4.2-2 to the values reported in the NRC RVID2 indicates slight differences for selected plate and weld materials. Chemistry factors for surveillance materials have been revised to reflect the use of RG 1.99, Revision 2, Position 2.1. These differences are not significant and do not alter the conclusion that RT_{PTS} values are within the established screening criteria for 48 EFPYs. The upper shell to intermediate shell circumferential weld material is listed in RVID2 but is not included in Table 4.2-2 since it is not a limiting material in accordance with the beltline definition provided in 10 CFR 50.61.

4.2.2.2 Staff Evaluation

The applicant provided its PTS assessment for the period of extended operation for ANO-2 RV beltline materials. The applicant included the assessment for each material in Table 4.2-2 of the LRA. In reviewing the applicant's description of the PTS analysis, the staff evaluated the methods the applicant used to calculate RT_{PTS} values and examined the data and results of the analysis, as summarized in Table 4.2-2 of the LRA.

The staff performed an independent calculation of the RT_{PTS} values for the ANO-2 beltline RV materials, based on the projected 48-EFPY neutron fluence values for the materials. The staff's independent assessment of the most limiting beltline material established that the applicant based the LRA on material information consistent with the RVID data. In reviewing the applicant's description of the PTS analysis, the staff examined the data and results of the analysis, as summarized in Table 4.2-2 of the LRA. The staff's calculated RT_{PTS} values for the RV beltline materials were equivalent to the RT_{PTS} values calculated by the applicant. Both the staff's and the applicant's PTS analyses confirm that the RT_{PTS} values for the ANO-2 beltline materials will remain below the PTS screening criteria of 10 CFR 50.61 through the period of extended operation.

The staff determined that the lower shell plate C-8010-1 is the most limiting material and calculated the 48-EFPY RT_{PTS} value for this material to be 50.3 °C (122.6 °F).

All of the beltline materials are below the 10 CFR 50.61 screening criteria. Based on these considerations, the staff finds the applicant's TLAAs for protecting the ANO-2 vessel against PTS to be acceptable because the staff confirmed that the applicant established the RT_{PTS} values for the RV beltline materials of ANO-2 with methods consistent with NRC guidance documents. The staff therefore concludes that the applicant's TLAA for calculating RT_{PTS} values for the RV beltline materials of ANO-2 is acceptable because it meets the requirements of 10 CFR 54.21(c)(1)(ii) and will ensure that the RV materials will have sufficient protection against PTS events through the end of the period of extended operation.

4.2.3 Pressure-Temperature Limits

The NRC designed the requirements in Appendix G to 10 CFR Part 50 to protect the integrity of the reactor coolant pressure boundary in nuclear power plants. The applicant established the P-T limits by calculations that use the materials and fluence data obtained through the unit-specific Reactor Surveillance Capsule Program. Normally, the P-T limits are calculated for several years into the future and remain valid for an established period of time, not to exceed the expiration date of the current operating license.

The staff evaluates the P-T limit curves based on NRC regulations and guidance. Appendix G to 10 CFR Part 50 requires that P-T limit curves be at least as conservative as those obtained by applying the methodology of Appendix G to Section XI of the ASME Code. Appendix G to 10 CFR Part 50 also provides minimum temperature requirements that an applicant must consider in the development of the P-T limit curves. Section 5.3.2 of the SRP-LR provides an acceptable method for determining the P-T limit curves for ferritic materials in the beltline of the RV based on the linear elastic fracture mechanics methodology of Appendix G to Section XI of the ASME Code. The critical locations in the RV beltline region for calculating heatup and cooldown P-T curves are the 1/4T and 3/4T locations, which correspond to the maximum depth of the postulated inside surface and outside surface defects, respectively.

4.2.3.1 *Summary of Technical Information in the Application*

In Section 4.2.3 of the LRA, the applicant addressed the requirement in Appendix G to 10 CFR Part 50 that it accomplish normal operations (including heatup, cooldown, and transient operating conditions) and pressure test operations of the RV within established P-T limits. The applicant established these limits by calculations that use the materials and fluence data obtained through the ANO-2 Reactor Surveillance Capsule Program. The applicant based the LRA on an approved license amendment request for reactor coolant system (RCS) P-T limit curves for 32 EFPYs. The curves account for a 7.5-percent power upgrade and were developed using ASME Code Case N-640, "Alternative Reference Fracture Toughness for Development of P-T Limit Curves, Section XI, Division 1," as well as Code Case N-588, "Alternative to Reference Flaw Orientation of Appendix G for Circumferential Welds in Reactor Vessels, Section XI, Division 1." In addition, the low-temperature overpressure protection (LTOP) limits are based on the licensed P-T limit analysis. The applicant will also update LTOP limits as required.

Appendix G to 10 CFR Part 50 requires that heatup and cooldown of the reactor pressure vessel be accomplished within established P-T limits. The applicant established these limits by calculations that use materials and fluence data obtained through the unit-specific Reactor Vessel Surveillance Capsule Program. Normally, the P-T limits are calculated for several years into the future and remain valid for an established period of time not to exceed the operating license expiration date.

The applicant submitted a license amendment request for RCS P-T curves for 32 EFPYs (References 4.2-2 and 4.2-3). The curves specify limits on RCS pressure and temperature for up to 32 EFPYs with a 7.5-percent power uprate. The applicant based these P-T curves on a fluence analysis that complies with RG 1.190 and utilizes ASME Code Cases N-640 and N-588. Based on the ANO-2 P-T limit curves, the operating window at 48 EFPYs is sufficient to conduct normal heatup and cooldown operations. The applicant based LTOP limits on the licensed P-T limit analyses and will update them as required.

The applicant has projected calculations of P-T limits for ANO-2 to the end of the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(ii).

4.2.3.2 *Staff Evaluation*

The current P-T limit curves for ANO-2 are acceptable through 32 EFPYs of power operation. In accordance with 10 CFR 50.90, licensees must submit new P-T limit curves for operating reactors to the NRC for review and approval. The licensee may then implement the new approved curves into the technical specifications (TSs) for the reactor units before the expiration of the most current P-T limit curves. The applicant must submit the P-T limit curves for the ANO-2 RV for the period of extended operation for NRC review and approval. The applicant may then implement the P-T limit curves into the TS before the operation of the reactors during the period of extended operation. The staff's review and approval of the extended-period-of-operation P-T limit curves will ensure that the units will be operated in a manner that ensures the integrity of the RCS during the period of extended operation.

4.2.4 FSAR Supplement

Sections A.2.2.1.1, A.2.2.1.2, and A.2.2.1.3 of Appendix A to the LRA provides the applicant's FSAR Supplement for the TLAA on RV neutron embrittlement. The applicant's appropriate consideration of RV neutron embrittlement, including the effects of neutron irradiation on the PTS, USE, and P-T limit assessments, constitutes the basis for the staff's acceptance of the licensee's TLAA evaluation for the period of extended operation.

The applicant did not include a corresponding FSAR Supplement summary description for Table 4.2-2 of the LRA. Table 4.2-2 contains a PTS evaluation for the ANO-2 RV through the expiration of the period of extended operation. The staff notes that the applicant included the corresponding table for the USE extended life evaluation (Table 4.2-1) in the FSAR Supplement. In RAI 4.2-2, the staff requested that the applicant include a corresponding FSAR Supplement summary description for LRA Table 4.2-2 in its FSAR Supplement.

In its response to RAI 4.2-2, the applicant responded that 10 CFR 54.21(d) requires a safety analysis report (SAR) Supplement that contains a summary description of the programs and activities for managing the effects of aging and the evaluation of TLAAs for the period of extended operation. Table 4.2-2 of the LRA provides data for and tabular results of the applicant's evaluation of the RV PTS TLAA for the period of extended operation. Table 4.2-2 is *neither the evaluation of the TLAA, nor a summary description of the evaluation.* Pursuant to 10 CFR 54.21(d), the applicant provided Section A.2.2.1.2 of the LRA as the SAR Supplement summary description of the evaluation of the TLAA for PTS, the results of which are shown in Table 4.2-2 of the LRA.

The ANO-2 SAR does not contain a table equivalent to Table 4.2-2 of the LRA. The applicant identified the limiting beltline material with respect to PTS within the text of SAR Section 5.2.4.3.3, as well as in the proposed SAR Supplement, in Appendix A to the LRA. The ANO-2 SAR does contain a table summarizing the results of the RV USE evaluation. Correspondingly, the proposed SAR Supplement includes an update to this table to account for the period of extended operation. However, no equivalent PTS table is required to maintain the CLB as defined in the ANO-2 SAR for the period of extended operation. The staff finds the response acceptable and considers this issue closed.

On the basis of the staff's review of the FSAR Supplement summary descriptions for the TLAAs on USE, PTS, and P-T limits, as well as the applicant's response to RAI 4.2-2, the staff concludes that the FSAR Supplement summary descriptions in Sections A.2.2.1.2, A.2.2.1.2, and A.2.2.1.3 of the LRA of the evaluations described above are adequate.

4.2.5 Conclusions

The staff has reviewed the TLAAs regarding the maintenance of acceptable Charpy USE levels for the RV materials at ANO-2, as well as the RV's ability to resist failure during postulated PTS events. The staff determined that the applicant's TLAAs for Charpy USE and PTS for ANO-2 meet the respective requirements of Appendix G to 10 CFR Part 50 and 10 CFR 50.61 for RV beltline materials, as evaluated to the end of the period of extended operation. Therefore, on *the basis of this review, the staff concludes that, pursuant to 10 CFR 54.21(c)(1)(ii),* the TLAAs on USE and PTS have been projected to the expiration of the period of extended operation for

ANO-2, and that the applicant will adequately manage the effects of aging on the pressure boundary function for the period of extended operation.

Pursuant to 10 CFR 50.90, the applicant will submit the end of the extended operating term P-T limit curves for ANO-2 before to the expiration of the 32 EFPY P-T limit curves for the plant. The staff's review and approval of the period of extended operation P-T limit curves will ensure that ANO-2 will operate in a manner that ensures the integrity of the reactor coolant pressure boundary for the period of extended operation, and that the end of the extended operating term P-T limit curves will satisfy the requirements of 10 CFR 54.21(c)(1)(ii) and Appendix G to 10 CFR Part 50 for the period of extended operation.

The staff also concludes that the FSAR Supplement contains adequate summary descriptions of the evaluations of the the TLAAs on neutron irradiation embrittlement of RV beltline materials (i.e., the TLAAs on USE, PTS, and P-T limits), 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 from fatigue. Metal fatigue of components may have been evaluated based on an assumed number of transients or cycles for the current operating term. The NRC reviews the validity of such metal fatigue analyses for the period of extended operation. NUREG-1801, "Generic Aging Lessons Learned (GALL) Report," identifies fatigue aging-related effects that require evaluation as possible TLAAs pursuant to 10 CFR 54.21(c). The SRP-LR summarizes each of these, and the applicant presented them in Section 4 of the LRA.

The applicant stated that the analyses of metal fatigue at ANO-2 are TLAAs for Class 1 and selected non-Class 1 mechanical components within the scope of license renewal. Fatigue evaluations are TLAAs since they are based on design transients defined for the life of the plant (SAR Section 5.2.1.5). Section III of the ASME Code requires a fatigue analysis for each Class 1 component, considering all transient loads based on the anticipated number of transients. The fatigue analyses require the calculation of cumulative usage factors (CUFs) based on the fatigue properties of the material and the expected fatigue service of the individual component. The ANO-2 Class 1 items that received a code fatigue evaluation in accordance with ASME Code, Section III, Subsection NB, include the pressurizer, the RV, the control element drive mechanism housing assembly, steam generators, RCPs, and the RCS piping.

Non-Class 1 pressure vessels, heat exchangers, storage tanks, and pumps at ANO-2 are designed in accordance with ASME Code, Sections VIII or III, Subsections NC or ND (Classes 2 or 3). Some tanks and pumps are designed to other industry codes and standards, such as American Water Works Association (AWWA) standards and Manufacturer's Standardization Society (MSS) standards. However, only ASME Code, Section VIII, Division 2, and ASME Code, Section III, Subsection NC-3200, include fatigue design requirements.

Fatigue evaluations are TLAAs since they are based on design transients defined for the life of the plant (SAR Section 5.2.1.5). Section 4.3.1.1 of this SER evaluates Class 1 metal fatigue TLAAs, and Section 4.3.1.2 of this SER evaluates non-Class 1 metal fatigue TLAAs.

4.3.1 Summary of Technical Information in the Application

4.3.1.1 Fatigue of ASME Class 1 Components

The applicant stated that it performed fatigue evaluations, contained in calculations and stress reports, in the design of the ANO-2 Class 1 components in accordance with the requirements specified in ASME Section III for Class 1 components. Because the applicant based these fatigue evaluations on a number of cycles assumed for a 40-year plant life, these evaluations are TLAAs.

The ability to withstand cyclic operation without fatigue failure is expressed in terms of the required calculation of CUFs for ASME Code, Section III, Class 1 components. The applicant compiled the ANO-2 CUFs for the Class 1 components designed in accordance with ASME Code, Section III, considering the RCS design transients used to develop the CUFs for the RV, the control element drive mechanism housing assembly, the pressurizer, steam generators, RCPs, and RCS piping. The applicant stated that it reviewed the number of RCS design transients accrued through 2002 for ANO-2 and linearly extrapolated them to 60 years of operation, as reported in Table 4.3-1 of the LRA. In all instances, the applicant found the number of RCS design transients assumed in the original design to be acceptable for 60 years of operation, and the CUFs will therefore remain within the ASME Code, Section III, Class 1 fatigue limit. On this basis, the applicant concluded that the metal fatigue TLAAs will remain valid for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(i). The applicant also stated that it monitors RCS design transients through the Fatigue Monitoring Program, which Appendix B discusses.

4.3.1.2 Fatigue of ASME Non-Class 1 Components

The applicant stated that each mechanical system it reviewed as part of the integrated plant assessment and reported in Sections 3.2 through 3.4 of the LRA was also screened to identify potential metal fatigue TLAAs. The applicant accomplished this using a screening process to identify non-Class 1 components that may have normal/upset condition operating temperatures in excess of 104 °C (220 °F) for carbon steel or 132 °C (270 °F) for austenitic stainless steel. The following subsections present the results of the TLAA fatigue review for non-Class 1 mechanical systems within the scope of license renewal.

4.3.1.2.1 Piping and In-Line Components

Mechanical systems containing piping components that exceed the screening criteria listed above include primary sampling, low-pressure safety injection/shutdown cooling, containment spray, chemical and volume control system (CVCS), emergency diesel generator, alternate alternating current diesel generator, containment penetrations, main feedwater, main steam, emergency feedwater, and blowdown/steam generator secondary. The piping components that exceed the screening criteria were designed to American National Standards Institute (ANSI) B31.1, which does not require an explicit fatigue analysis but specifies allowable stress levels based on the number of anticipated thermal cycles. Specifically, a stress reduction is not required in the design of piping that is not expected to experience more than 7000 cycles. These piping components were evaluated for their potential to exceed 7000 thermal cycles in 60 years of plant operation. Only the RCS hot-leg sampling piping potentially exceeds 7000 cycles during the period of extended operation. Therefore, the applicant revised a pertinent calculation to justify RCS sampling to occur at any reasonable frequency for 60 years of operation without exceeding the allowable number of cycles. On this basis, the applicant concluded that the fatigue analyses for all non-Class 1 components at ANO-2 remain valid for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(i).

4.3.1.2.2 Pressure Vessels, Heat Exchangers, Storage Tanks, and Pumps

Only non-Class 1 pressure vessels, heat exchangers, storage tanks, and pumps designed and fabricated in accordance with ASME Code, Section VIII, Division 2 or ASME Code, Section III, NC-3200 require evaluation for thermal fatigue. The NRC does not require fatigue evaluation for other design codes (e.g., ASME Code, Section VIII, Division 1; AWWA; or MSS), and components designed and fabricated with these codes are suitable for the period of extended operation without further evaluation. The applicant's engineering evaluations identified no non-Class 1 pressure vessels, heat exchangers, storage tanks, or pumps requiring evaluation for thermal fatigue.

4.3.1.3 Response to Industry Experience

The nuclear industry reviews events that occur at nuclear power plants and new findings discovered by research. Industry experience and new research have found fatigue issues such as thermal stratification and environmentally assisted fatigue that were not considered in the original plant designs. Some of these findings impact the fatigue analysis and result in the issuance of NRC generic communications. The following sections discuss the concerns that are directly related to metal fatigue.

4.3.1.3.1 Generic Safety Issue 190, "Environmentally Assisted Fatigue"

Recent test data indicate that certain environmental effects (e.g., temperature, oxygen, and strain rate) in the primary systems of LWRs could result in greater susceptibility to fatigue than fatigue analyses would predict based on the ASME Code, Section III, design fatigue curves. The ASME design fatigue curves were based on laboratory tests in air at low temperatures. Although the failure curves derived from laboratory tests were adjusted to account for effects such as data scatter, size effect, and surface finish, the NRC is concerned that these adjustments may not be sufficient to account for actual plant operating environments.

The NRC implemented a fatigue action plan to systematically assess fatigue issues in operating plants. As reported in SECY-95-245, which documented the results of the fatigue action plan, the NRC believes that no immediate staff or licensee action is necessary to deal with the fatigue issues addressed by the fatigue action plan. In addition, the staff concluded that it could not justify requiring a backfit of the environmental fatigue data to operating plants. However, the NRC concluded that because metal fatigue effects increase with service life, the action plan fatigue issues should be evaluated for any proposed period of extended operation for license renewal. Specifically, as part of the resolution of Generic Safety Issue (GSI)-166, which resulted in the initiation of GSI-190, "Environmentally Assisted Fatigue," the NRC will consider the need to evaluate a sample of components of high-fatigue usage applying the latest available environmental fatigue data. The NRC intends to ensure that components will continue to perform their intended functions during the period of extended operation associated with license renewal.

As a part of the effort to close GSI-166 for operating nuclear power plants during the current 40-year license term, Idaho National Engineering Laboratory evaluated fatigue-sensitive component locations at plants designed by the four U.S. nuclear steam supply system vendors. NUREG/CR-6260 provides the results of those evaluations. Section 5.2 of NUREG/CR-6260 identifies the following component locations to be most sensitive to environmental effects for older Combustion Engineering (CE) plants (these locations and the subsequent calculations are directly relevant to ANO-2):

- reactor vessel shell and lower head
- reactor vessel inlet and outlet nozzles
- surge line
- charging nozzle
- safety injection nozzle
- shutdown cooling system Class 1 piping

Table 5-43 of NUREG/CR-6260 summarizes the evaluation of the six limiting locations for the current term of operation (40 years) and the period of extended operation (60 years in total). Of the six limiting locations NUREG/CR-6260 evaluates, the pressurizer surge line is the only one for which the CUF exceeded 1.0 when extrapolated to 60 years. However, the evaluations contained in NUREG/CR-6260 use the interim fatigue curves published in NUREG/CR-5999, which have been superseded by the fatigue curves reported in NUREG/CR-6717. Therefore, the applicant must reevaluate the assessment of environmental effects for the limiting six locations for ANO-2 using the fatigue life correction factors reported in NUREG/CR-6717, Section 5.3. The limiting locations listed above should be evaluated for environmental effects in accordance with the guidance provided in the GALL Report using the fatigue life correction factors reported in NUREG/CR-6717, Section 5.3. The limiting vessel locations are made of low-alloy steel, the safety injection and charging nozzles are made of carbon steel, and the shutdown cooling system piping and pressurizer surge line piping are stainless steel. Using NUREG/CR-6717, the bounding fatigue life correction factor for low-alloy steel, carbon steel, and stainless steel are 2.5, 1.74, and 15.4, respectively.

The following summarizes the revised usage factors when including these environmental correction factors:

- reactor vessel head-to-shell juncture (low-alloy steel) 0.0075
- reactor vessel outlet nozzle (low-alloy steel) 0.2223
- reactor vessel inlet nozzle (low-alloy steel) 0.347
- pressurizer surge line (stainless steel) 15.24
- charging nozzle (carbon steel) 1.357
- safety injection nozzle (carbon steel) 0.6534
- shutdown cooling line (stainless steel) 9.930

For the charging nozzle, shutdown cooling line piping, and pressurizer surge line piping, the applicant would have to use more detailed stress analyses or fatigue monitoring and cycle counting to reduce the CUF below 1.0. Because of the factor of safety included in the ASME Code, a CUF greater than 1.0 does not indicate that fatigue cracking is expected. However, there is a potential for fatigue cracking during the period of extended operation at locations having CUFs exceeding 1.0. Therefore, before entering the period of extended operation, the applicant will develop an approach for each location that may exceed a CUF of 1.0 when considering environmental effects, in order to show that it can manage the effects of fatigue. The approach for addressing environmental fatigue for the above locations will include one or more of the following options:

- Further refine the fatigue analysis to lower the CUFs to below 1.0.

- Repair the affected locations.

- Replace the affected locations.

- Manage the effects of fatigue at the designated locations by an inspection program that the NRC staff has reviewed and approved (e.g., periodic nondestructive examination of the affected locations at inspection intervals to be determined by a method acceptable to the NRC staff). The NRC staff expects that the inspections will be able to detect cracking from thermal fatigue before the loss of function. The applicant will then implement replacement or repair such that it will maintain the intended function for the period of extended operation.

- Monitor ASME Code activities to use the environmental fatigue methodology approved by the Code committee and the NRC.

Should ANO-2 select option 4 (inspection) to manage environmentally assisted fatigue during the period of extended operation, the applicant will provide details such as scope, qualification, method, and frequency to the NRC staff for review and approval before entering the period of extended operation. To obtain NRC staff approval of its proposed inspection plan to manage fatigue prior to entering the period of extended operation for ANO-2, the applicant will submit a license amendment request. After the NRC staff's approval of the inspection plan, any future changes to the inspection plan will be evaluated in accordance with 10 CFR 50.59.

The applicant has evaluated the effects of environmentally assisted thermal fatigue for the limiting locations identified in NUREG/CR-6260 for ANO-2 in accordance with 10 CFR 54.21(c)(1)(i and ii), and the NRC finds all locations acceptable for the period of extended operation, with the exception of the charging nozzle, shutdown cooling line, and pressurizer surge line. The applicant will address cracking of these locations by environmentally assisted fatigue using one of the five approaches discussed above in accordance with 10 CFR 54.21(c)(1).

4.3.1.3.2 NRC Bulletin 88-08, "Thermal Stresses in Piping Connected to Reactor Coolant Systems"

In Section 4.3.3.2 of the LRA, the applicant addressed a concern identified in NRC Bulletin 88-08 regarding potential temperature stratification or temperature oscillations in unisolable sections of piping attached to the RCS. Previously, Entergy had provided the NRC with the responses required by Bulletin 88-08 and its supplements.

Based on the Entergy responses, the NRC staff found that ANO-2 meets the requirements of NRC Bulletin 88-08. Commitments regarding inspections at ANO-2 in response to NRC Bulletin 88-08 have been superseded by the risk-informed inservice inspection (RI-ISI) of Class 1 piping, as approved by the NRC. Although the staff does not expect aging effects from thermal stratification as described in Bulletin 88-08, the applicant will confirm the absence of cracking from thermal fatigue by inspections as part of the Inservice Inspection Program, in accordance with 10 CFR 54.21(c)(1)(iii), during the period of extended operation.

4.3.1.3.3 NRC Bulletin 88-11, "Pressurizer Surge Line Thermal Stratification"

In Section 4.3.3.3 of the LRA, the applicant addressed pressurizer surge line thermal stratification as an issue identified in NRC Bulletin 88-11. The bulletin requires the applicant to analyze the effects of this mechanism on the stress and fatigue calculations for the surge line. Combustion Engineering (CE) performed a generic and bounding analysis for all CE plants and submitted it to the NRC. To address this issue for the purposes of license renewal, the applicant will include the pressurizer surge line bounding locations in the Fatigue Monitoring Program. Therefore, the applicant will track realistic fatigue usage for the surge line and will take actions to reevaluate, repair, or replace the surge line before a fatigue-induced failure occurs. The applicant will manage the effects of aging in accordance with 10 CFR 54.21(c)(1)(iii) for the period of extended operation.

4.3.2 Staff Evaluation

4.3.2.1 Fatigue of ASME Class 1 Components

The staff has reviewed Section 4.3.1 of the LRA, in which the applicant addressed fatigue evaluations of Class 1 components.

In RAI 4.3.1-1, the staff requested that the applicant list the editions of the ASME Code, Section III, that apply to Class 1 fatigue analysis. The applicant provided these editions in its response to the RAI, and the staff found them acceptable because they conform to the codes listed in Table 3.2.4 of the ANO-2 SAR and to industry practice. In RAIs 4.3.1-2 and 4.3.1-3, the staff asked the applicant to indicate if it logged the number of transient cycles listed up to July 11, 2002, in Table 4.3.1 of the LRA since the start of operation, and if the applicant logged additional cycles since compiling the table. In its response, the applicant verified that it had logged the cycles since the start of operation, and that it had recorded two reactor trips, one cooldown cycle, and one heatup cycle, since July 11, 2002. This supported the applicant's statement that the number of projected design cycles through the period of extended operation will be well below the number of assumed design transient cycles. The staff finds the response reasonable and in conformance with general experience at operating nuclear plants, and it concurs with the applicant that the actual number of transient cycles under operating conditions will be smaller that the number of assumed design cycles through the period of extended operation.

On the basis of its review, the staff concludes that the applicant has provided an adequate demonstration, pursuant to 10 CFR 54.21(c)(1)(i), that the ANO-2 fatigue TLAAs for Class 1 components will remain valid for the period of extended operation.

Section A.2.2.2.1 of the LRA provides the applicant's supplement for the ANO-2 FSAR regarding Class 1 metal fatigue. The staff reviewed this supplement and finds it provides an adequate summary of the evaluation of Class 1 metal fatigue.

4.3.2.1.1 Conclusion

On the basis of its review, the staff concludes that the applicant has adequately demonstrated, pursuant to 10 CFR 54.21(c)(1), regarding fatigue TLAAs for ASME Class 1, that (1) some of the analyses remain valid for the period of extended operation, (2) some of the analyses have been projected to the end of the period of extended operation, or (3) it will adequately manage the effects of aging on the intended function(s) for the period of extended operation.

The staff also concludes that the FSAR Supplement contains an adequate summary description of ASME Code, Class 1 metal fatigue TLAAs evaluation for the period of extended operation, as required by 10 CFR 54.21(d).

4.3.2.2 Fatigue of ASME Non-Class 1 Components

The staff has reviewed Section 4.3.2 of the LRA, in which the applicant addressed fatigue evaluations of ASME non-Class 1 components.

In RAI 4.3.2-1, the staff requested that the applicant provide the design codes that it used for non-Class 1 fatigue analysis. In its reply, the applicant stated that non-Class 1 piping was designed to ANSI B31.1 or ASME Code, Section III, Classes 2 and 3. Non-Class 1 pressure vessels, heat exchangers, storage tanks, and pumps were designed in accordance with ASME Code, Section VIII, Division 1 or ASME Code, Section III, Classes 2 and 3. These codes conform with those listed in Table 3.2-4 of the ANO-2 SAR and with industry practice, and are therefore acceptable.

In RAI 4.3.2-2, the staff requested that the applicant provide the basis for the temperature screening criteria of 104 °C (220 °F) for carbon steel and 132 °C (270 °F) for stainless steel. In its response, the applicant stated that it based these criteria on industry-sponsored investigations and evaluations of thermal fatigue in operating nuclear power plant piping, systems, and components. The applicant also stated that these screening criteria are consistent with the screening criteria given in Section 4.3.2 of the St. Lucie LRA. The staff finds that the applicant's screening criteria conform with industry practice and are therefore acceptable.

4.3.2.2.1 Piping and In-Line Components

In RAI 4.3.2-3, the staff asked the applicant to clarify the revision of the RCS hot-leg sampling piping calculation to justify RCS sampling at any reasonable frequency for 60 years of operation, without exceeding the allowable number of cycles. In its response, the applicant provided the requested justification. The staff has evaluated the response and finds it reasonable and acceptable, because it conforms with industry practice.

4.3.2.2.2 Pressure Vessels, Heat Exchangers, Storage Tanks, and Pumps

The applicant stated that it did not identified any non-Class 1 pressure vessels, heat exchangers, storage tanks, or pumps that required evaluation for thermal fatigue. The staff finds this acceptable because it conforms to similar findings in previously accepted LRAs.

In RAI 3.3-1, the staff indicated that Tables 3.3.2-5 and 3.3.2-11 of the LRA identify fatigue-cracking as an aging effect requiring management, but that Section 4.3.2 of the LRA does not reflect this condition. The applicant credited inspections associated with the Periodic Surveillance and Preventive Maintenance Program and system walkdowns with managing this aging effect in the CVCS pump casing. The staff requested that the applicant clarify the type of fatigue managed by these inspections, the basis for inspections in lieu of a TLAA for this component, and the effectiveness of these inspections in detecting internal cracks before the loss of intended function. In its response, the applicant stated that, regarding the CVCS charging pump casing, it identified and managed cracking from high-cycle fatigue (as a result of the deflection of the charging pump plunger cap during a pump cycle) as the aging effect. The applicant discovered this cracking during plant operation and documented it in the Corrective Action Program. The applicant stated that there is no requirement for an analysis involving time-limited assumptions, and it found no such analysis for this condition during its identification of TLAAs for license renewal. It is therefore outside the scope of Section 4.3.2 of the LRA. However, the components listed in Table 3.3.2-11 of the LRA are generally nonsafety-related but are designed in accordance with ANSI B31.1, which has an implicit limit of 7000 thermal cycles. Cracking from thermal fatigue is generally not expected to occur, but the applicant conservatively identified it as an aging effect requiring management. The applicant also stated that, for the charging plunger cap, a preventive maintenance task exists to disassemble and inspect the charging pumps and plungers. Operating experience has shown this inspection to be effective in identifying the effects of aging before the loss of system function. For other components, system walkdowns detect leakage and spray from liquid-filled systems.

On the basis of its review, the staff finds that the applicant has provided an adequate demonstration, pursuant to 10 CFR 54.21(c)(1), that the ANO-2 metal fatigue for ASME non-Class 1 components will remain valid for the period of extended operation, because it conforms with industry operating practice.

Section A.2.2.2.2 of the LRA provides the applicant's supplement for the ANO-2 FSAR regarding fatigue TLAAs of ASME non-Class 1 components. The staff has reviewed this supplement and finds it provides an adequate summary of the evaluation of metal fatigue of ASME non-Class 1 components at ANO-2 , as required by 10 CFR 54.21(d).

4.3.2.2.3 Conclusion

On the basis of its review, the staff concludes that the applicant has adequately demonstrated, pursuant to 10 CFR 54.21(c)(1), regarding fatigue TLAAs for ASME Class 1 and non-Class 1 components, that (1) some of the analyses remain valid for the period of extended operation, (2) some of the analyses have been projected to the end of the period of extended operation, or (3) it will adequately manage the effects of aging on the intended function(s) for the period of extended operation.

The staff also concludes that the FSAR Supplement contains an adequate summary description of ASME Class 1 and non-Class 1 metal fatigue TLAAs evaluation for the period of extended operation, as required by 10 CFR 54.21(d).

4.3.2.3 Response to Industry Experience

4.3.2.3.1 Effects of Reactor Coolant Environment on Fatigue Life of Components and Piping (Generic Issue 190)

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 that: "*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.*"

In accordance with the staff position stated above, the applicant has evaluated the component locations listed in NUREG/CR-6260 that are applicable to older Combustion Engineering plants for the effect of the environment on the fatigue life of the corresponding components. For each location, detailed environmental fatigue calculations were performed using the appropriate correction factors reported in Section 5.3 of NUREG/CR 6717, *"Environmental Effects on Fatigue Crack Initiation in Piping and Pressure Vessel Steels,"* May 2001.

The limiting locations in NUREG-6260 were found to be acceptable for extended operation, except for the charging nozzle, the shut down cooling line, and the pressurizer surge line. The applicant has committed to manage the environmental fatigue effects at these locations during the period of extended operations in accordance with the five options listed in Section 4.3.3.1 of the LRA. The staff has reviewed these options and finds them acceptable because the options conform with the staff position on management of environmentally-assisted fatigue and were previously found acceptable in other license applications.

Based on its review, the staff finds that the effects of environmental-assisted thermal fatigue for the limiting locations identified in NUREG-6260 have been adequately evaluated for ANO-2, in accordance with 10 CFR 54.21(c)(1)(i) and 10 CFR 54.21(c)(1)(ii), and that, with the exception of the charging nozzle, shutdown cooling line, and pressurizer surge line, the remaining locations are acceptable for the period of extended operation.

In accordance with 10 CFR 54.21(c)(1), the staff also finds acceptable the applicant's commitment to address potential cracking by environmentally-assisted fatigue at these locations through the application of one of the five options discussed in Section 4.3.3.1 of the LRA, because they have been found acceptable for other license renewal applications. Should ANO-2 select the inspection option (Option 4) to manage environmentally-assisted fatigue, details of the scope, qualification, method, and frequency of the inspection will be provide to the NRC for review and approval prior to entering the period of extended operation.

In accordance with 10 CFR 54.21(d), the applicant has included a section addressing the effects of reactor coolant environment on fatigue life of components and piping (GSI-190) in the ANO-2 *FSAR Supplement Section* A.2.2.2.3. The staff finds this supplement provides a adequate summary description of the information presented, and the commitments made, in Section 4.3.3.1 of the LRA.

4.3.2.3.2 NRC Bulletin 88-08, Thermal Stresses in Piping Connected to Reactor Coolant Systems

The staff has reviewed Section 4.3.3.3 of the LRA, where the applicant addressed thermal stresses in piping connected to reactor coolant systems as an issue identified in NRC Bulletin 88-08. The applicant stated that the Entergy commitments regarding inspections at ANO-2, in response to NRC Bulletin 88-08, have been superseded by the risk-informed inspection (RI-ISI) of ASME Class 1 piping, as approved by the NRC. Although aging effects due to thermal stratification as described in Bulletin 88-08 are not expected, the absence of cracking due to thermal fatigue will be confirmed by inspections as part of the inservice inspection program through the period of extended operation.

The staff finds the applicant's statements adequate because it conforms with the staff position on thermal stratification, which forms part of the risk-informed inspection requirements of ASME

Class 1 piping, and because the effects of aging associated with thermal stresses in piping connected to reactor coolant systems will be managed, in accordance with 10 CFR 54.21 (c) (1) (iii), for the period of extended operation.

The applicant's supplement to the ANO-2 FSAR regarding thermal stresses in piping connected to reactor coolant systems is provided in Section A.2.2.2.4 of the LRA. The staff has reviewed this supplement and finds it provides an adequate summary description of the metal fatigue TLAA, as required by 10 CFR 54.21(d).

4.3.2.3.3 NRC Bulletin 88-11, Pressurizer Surge Line Thermal Stratification

The staff has reviewed Section 4.3.3.3 of the LRA, where the applicant addressed pressurizer surge line thermal stratification as an issue identified in NRC Bulletin 88-11. The applicant has addressed this issue for the purposes of license renewal, by committing to include the pressurizer surge line bounding locations in the fatigue monitoring program. The applicant stated that realistic fatigue usage for the surge line will be tracked, and actions will be taken to reevaluate, repair, or replace the surge line before a fatigue-induced failure occurs. The staff finds this acceptable because the effects of aging associated with pressurizer surge line thermal stratification will be managed in accordance with 10 CFR 54.21(c)(1)(iii) for the period of extended operation.

The applicant's supplement to the ANO-2 FSAR regarding pressurizer surge line stratification is provided in Section A.2.2.2.5 of the LRA. The staff has reviewed this supplement and finds it provides an adequate summary description of the metal fatigue TLAA, as required by 10 CFR 54.21(d).

4.3.2.3.4 Conclusion

On the basis of its review, the staff concludes that the applicant has adequately demonstrated, pursuant to 10 CFR 54.21(c)(1), that the TLAAs associated with specific industry experience are acceptable in that the fatigue analyses for affected components: (i) remain valid for the period of extended operation, or (ii) have been projected to the end of the period of extended operation, or (iii) ensure that the effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

The staff also concludes that the FSAR Supplement contains an adequate summary description of the responses to industry experience, as required by 10 CFR 54.21(d).

4.3.3 Conclusion

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 metal fatigue TLAAs are adequate in that the fatigue analyses: (i) remain valid for the period of extended operation, or (ii) have 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 also concludes that Section A.2.2.2 of the FSAR Supplement contains an adequate summary description of the metal fatigue TLAA evaluation for the period of extended operation, as required by 10 CFR 54.21(d).

4.4 Environmental Qualification of Electrical Equipment

The NRC has identified the 10 CFR 50.49 Environmental Qualification Program as a TLAA for the purposes of license renewal. The TLAA of environmental qualification (EQ) for electrical components includes all long-lived, passive, and active electrical and instrumentation and control components that are located in a harsh environment. The harsh environments are those areas of the plant that are subjected to environmental effects by a loss-of-coolant accident or high-energy line break (HELB) and that are important to safety. This equipment consists of safety-related and Q-list equipment, nonsafety-related equipment whose failure could prevent satisfactory accomplishment of any safety-related function, and the necessary postaccident monitoring equipment.

Pursuant to 10 CFR 54.21(c)(1), an applicant must provide a list of EQ TLAAs in the LRA. The applicant must demonstrate that one of the following is true for each piece of EQ equipment:

- The analyses remain valid for the period of extended operation.
- The analyses have been projected to the end of the period of extended operation.
- The effect of aging on the intended function(s) will be adequately managed for the period of extended operation.

The aging (or qualified life) analysis for electrical components involving time-limited assumptions as defined by the current operating term for ANO-2 (i.e., 40 years), included as part of the 10 CFR 50.49 Environmental Qualification Program, meets the 10 CFR 54.3 definition for a TLAA. The NRC thus considers the Environmental Qualification Program's aging evaluation for electrical components a TLAA for license renewal.

As described in Section X.E1 of the GALL Report, the staff concludes that a plant's EQ program, which implements the requirements of 10 CFR 50.49 (as further defined and clarified by the DOR Guidelines, NUREG-0588, and RG 1.89, Revision 1), meets the 10 program attributes (or elements) for an acceptable AMP as described in the GALL Report. A plant's EQ program is therefore viewed as an acceptable AMP for license renewal.

An applicant performs a reanalysis of an aging evaluation in order to extend the qualification of electrical components under 10 CFR 50.49(e) on a routine basis as part of a plant's EQ program. Important attributes for the reanalysis of an aging evaluation include analytical methods, data collection and reduction methods, underlying assumptions, acceptance criteria, and corrective actions (if acceptance criteria are not met). Section X.E1 of the GALL Report further discusses these attributes.

The applicant may apply this reanalysis program to EQ components now qualified for the current operating term (i.e., those components now qualified for 40 years or more). The staff has concluded, as described in the Section X.E1 of the GALL Report, that a reanalysis program, which meets the conditions defined in the GALL Report for important attributes, is an acceptable AMP for license renewal. Thus, the NRC recommends no further evaluation for license renewal if an applicant elects this option under 10 CFR 54.21(c)(1)(iii).

The staff reviewed Sections 4.4 and B.1.8 of the LRA to determine whether the applicant has demonstrated that it will adequately manage the effects of aging on the intended function(s) of electrical components through the ANO-2 EQ Program, together with other plant programs/processes, during the period of extended operation as required by 10 CFR 54.21(c)(1)(iii).

4.4.1 Summary of Technical Information in the Application

Sections 4.4 and B.1.8 of the LRA discuss the applicant's TLAA for electrical components. The applicant stated that the ANO-2 Environmental Qualification Program is an existing program established to meet ANO-2 commitments for 10 CFR 50.49. The Environmental Qualification Program is consistent with Section X.E1 of the GALL Report.

The applicant concluded that continued implementation of the ANO-2 Environmental Qualification Program provides reasonable assurance that the aging effects will be managed, and that electrical components, within the scope of 10 CFR 50.49 requirements, will continue to perform their intended function(s) for the period of extended operation. The ANO-2 Environmental Qualification Program will manage the effects of aging in accordance with the requirements of 10 CFR 54.21(c)(1)(iii).

Sections A.2.1.8 and A.2.2.3 of the LRA discuss the applicant's proposed FSAR Supplement for the ANO-2 EQ Program. The applicant stated that the Environmental Qualification Program manages component thermal, radiation, and cyclical aging of electrical equipment important to safety as required by 10 CFR 50.49. The Environmental Qualification Program manages aging effects through the use of aging evaluations based on 10 CFR 50.49(f) qualification methods. Aging evaluations for EQ components that specify a qualification of at least 40 years are considered TLAAs for license renewal. The Environmental Qualification Program ensures that the applicant will maintain the qualification of these EQ components. The applicant will thus manage the effects of aging in accordance with 10 CFR 54.21(c)(1)(iii).

The ANO-2 Environmental Qualification Program manages component thermal, radiation, and cyclical aging, as applicable, through the use of aging evaluations based on 10 CFR 50.49(f) qualification methods. As required by 10 CFR 50.49, the applicant must refurbish, replace, or have the qualification of EQ components not qualified for the current license term extended before reaching the aging limits established in the evaluation. The NRC considers aging evaluations for EQ components that specify a qualification of at least 40 years to be a TLAA for license renewal. The Environmental Qualification Program ensures the maintenance of these EQ components in accordance with their qualification bases.

The ANO-2 Environmental Qualification Program is an existing program established to meet ANO-2 commitments for 10 CFR 50.49. It is consistent with Section X.E1 of the GALL Report. The ANO-2 program includes consideration of operating experience to modify qualification bases and conclusions, including qualified life. Compliance with 10 CFR 50.49 provides reasonable assurance that components can perform their intended function(s) during accident conditions after experiencing the effects of inservice aging. Consistent with NRC guidance provided in RIS 2003-09, the NRC requires no additional information to address GSI-168, "EQ of Electrical Components."

Based upon a review of the existing program and associated operating experience, continued implementation of the ANO-2 Environmental Qualification Program provides reasonable assurance that the applicant will manage the aging effects and that the in-scope EQ components will continue to perform their intended function(s) for the period of extended operation. The ANO-2 Environmental Qualification Program will manage the effects of aging will be managed in accordance with the requirements of 10 CFR 54.21(c)(1)(iii).

4.4.2 Staff Evaluation

The staff reviewed the information in Sections 4.4 and B.1.8 of the LRA to determine whether the applicant has demonstrated that the effects of aging on the intended function(s) of electrical components will be adequately managed through the ANO-2 Environmental Qualification Program, together with other plant programs/processes, during the period of extended operation as required by 10 CFR 54.21(c)(1)(iii). Based on the applicant's statement that the Environmental Qualification Program is consistent with Section X.E1 of the GALL Report, the staff concludes that the ANO-2 Environmental Qualification Program will adequately manage the effects of aging on the intended function(s) of electrical components for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(iii).

Sections A.2.1.8 and A.2.2.3 of Appendix A to the LRA contain the applicant's FSAR Supplement for the Environmental Qualification Program as an AMP and TLAA for license renewal. The staff reviewed this section and finds that the program description is consistent with the material contained in Sections 4.4 and B.1.8 of the LRA. The staff finds that the FSAR Supplement provides an adequate summary of the program activities as required by 10 CFR 54.21(d).

4.4.3 Conclusions

The staff has reviewed the information in Sections 4.4 and B.1.8 of the LRA. On the basis of this review, the staff concludes that the applicant has demonstrated that it will adequately manage the effects of aging on the intended function(s) of electrical components that meet the definition for TLAA as defined in 10 CFR 54.3 during the period of extended operation, as required by 10 CFR 54.21(c)(1)(iii). In addition, the staff concluded, that the FSAR Supplement contains an adequate summary description of the programs and activities for the evaluation of TLAAs for the period of extended operation, as required by 10 CFR 54.21(d).

4.5 Concrete Containment Tendon Prestress

4.5.1 Summary of Technical Information in the Application

The applicant stated the mechanism it considered in developing the TLAA as follows:

> Loss of prestress in the containment post-tensioning system is due to material strain occurring under constant stress. The analysis of loss of prestress over the initial 40-year license term is discussed in SAR Section 3.8.1.3.4, and is a time-limited aging analysis requiring review for license renewal. By assuming an appropriate initial stress from tensile loading and using appropriate pre-stress loss parameters, the magnitude of the design losses and the final effective prestress at the end of 40 years for typical dome, vertical, and hoop tendons was calculated at the time of initial licensing and following steam generator replacement activities. A structural proof test was performed to verify the adequacy of the containment building design.

Furthermore, the applicant stated that it will manage the loss of tendon prestress in the containment building posttensioning system for license renewal through containment ISIs. The containment ISI includes tendon surveillance testing. The ANO-2 tendon surveillance procedures incorporate the requirements of ASME Code, Section XI, Subsection IWL and 10 CFR 50.55(a).

Moreover, the applicant asserted the following:

> Calculation of the effective prestress of the containment post-tensioning system at 60 years has been performed and shows the containment tendons will be acceptable for the period of extended operation. In addition, the Containment Inservice Inspections will be adequate to manage the effects of aging on the containment post-tensioning system for the period of extended operation. Therefore, the applicant considers this TLAA acceptable in accordance with 10 CFR 54.21(c)(1)(ii) and (c)(1)(iii).

4.5.2 Staff Evaluation

The applicant provided a description of the TLAA without providing any quantitative comparison as to the present level of the prestressing forces based on the measured prestressing forces, trend lines and projected forces during the extended period of operation. In order to understand the basis for its assertions in Section 4.5.1 of this SER, the staff requested the following information.

RAI 4.5-1

For the discussion of prestressing force losses over the initial 40 years, Section 4.5.1 of the LRA refers to SAR Section 3.8.1.3.4 through a hypertext link. A review of SAR Section 3.8.1.3.4 indicates that it discusses the approach used in designing the containment to satisfy the load combinations in SAR Section 3.8.1.3.3. It does not discuss the estimation of prestressing forces at 40 years. The NRC requested the applicant to provide a reference to any other SAR Section which discusses the estimation of prestress force losses.

RAI 4.5-2

The use of 10 CFR 54.21(c)(1)(ii–iii) is appropriate for the concrete containment tendon prestress TLAA. However, the staff must assess the plant-specific operating experience regarding the residual prestressing forces in the containment. Based on the analysis performed pursuant to 10 CFR 54.21(c)(1)(ii), the NRC requested the applicant to provide the following information:

(a) minimum required prestressing forces for each group of tendons

(b) trend lines of the projected prestressing forces for each group of tendons based on the regression analysis of the measured prestressing forces (see NRC Information Notice (IN) 99-10 for more information)

(c) plots showing comparisons of prestressing forces projected to 40 years and 60 years with the minimum required prestress for each group of tendons

RAI 4.5-3

In Section A.2.2.4 of the FSAR Supplement of the LRA, the applicant summarized the results of its TLAA and stated the following:

> Calculation of the acceptability of the effective prestress of the containment building post-tensioning system at 60 years has been performed to show that the containment building tendon elements will be acceptable for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii).

By letter dated June 16, 2004, the applicant provided responses to these RAIs, discussed below.

In response to RAI 4.5-1, the applicant provided the following values:

- loss from shrinkage and creep of concrete—420μ
- loss from relaxation of prestressing steel—14.28 ksi for each group of tendons

The shrinkage and creep values (considering the sustained compressive stress of 1500 psi) is in the lower bound of the values suggested in RG 1.35.1. The steel relaxation value of 14.25 kilograms per square inch (ksi) (translates as 8 percent of the initial stress in the wires of the tendons) is in the middle range of medium-relaxation prestressing steel. As a large deviation from these values in the containment will show up in the non-normalized measured prestressing forces, it is essential to have an accurate evaluation of the measured tendon forces for a credible TLAA. For the purpose of estimating the minimum required prestressing forces in each group of tendons, the staff considers these values reasonable.

In response to RAI 4.5-2(a), the applicant provided the following minimum required prestressing forces:

- hoop tendons—1205.28 kips/tendon
- dome tendons—1233.18 kips/tendon
- vertical tendons—1370.82 kips/tendon

The staff finds these to be reasonable values for this type of containment.

In response to RAI 4.5-2 (b) and (c) dated June 16, 2004, the applicant explained that it had started its random sampling program for ANO-2 containment in 1999. However, the applicant provided the normalized prestressing force values of randomly selected tendons for each group of tendons for ANO-1. A review of this data indicated that the process used for constructing trend lines is not acceptable. In figures 1, 2, and 3, the applicant provided normalized wire stress predictions based on two data points; (1) at 1 year after post-tensioning, and (2) at forty years. The staff questioned the applicant determination of a data point at 40 years considering the plant has been operating for less than 30 years. In addition, because of other irregularities, the staff did not find the trend lines acceptable as a part of the TLAA. The staff requested a supplemental clarification to the RAI:

RAI 4.5-2 (Clarification)

The responses to RAI 4.5-2 (b) and (c) indicated that prior to 1999 tendon inspection, the applicant was not measuring the tendon forces in ANO-2. Thus, reliable data for constructing trend lines was limited to only one set of readings. Under similar situation, two licensees (applicants) have performed inspections of additional randomly selected tendons at approximately two year interval. These augmented inspections were introduced to compensate for the lack of reliable prestressing force data and to comply with the basic requirements of Subsection IWL related to prestressing tendon force measurements, and 10 CFR 50.55a(b)(viii)(B). The trend lines shown in Figures 1, 2, and 3 could not be relied upon for future projections. The applicant was requested to propose a plan or a program, that would provide a valid TLAA for each group of tendons in ANO-2 containment. In developing the program, the applicant was requested to follow the precautions and guidelines provided in NRC Information Notice 99-10 [e.g., use of raw measured (non-normalized) prestressing forces, use of tendon forces (instead of wire forces), trend line construction as provided in Attachment 3].

In the July 22, 2004 letter, the applicant stated its intention to perform the TLAA using 10 CFR 54.21(c)(1)(iii). The option (iii) would allow the applicant to use an aging management program for tracking the magnitudes of prestressing forces in ANO-2 containment. The staff would accept the applicant's proposal, provided the applicant (1) addresses the ten elements of the program (NUREG-1801 AMP X.S1) and (2) provides a description of the process that will be used for developing prestressing force trend lines.

In the letter dated September 10, 2004, the applicant provided the following information:

> Consistent with 10 CFR 54.21(c)(1)(iii), loss of tendon prestress will be adequately managed during the period of extended operation by continued implementation of tendon inspections required by ASME Code Section XI IWL. Relevant operating experience, including experience with prestressing systems described in NRC Information Notice (IN) 99-10, will be considered during inspections and data analysis. Prior to the period of extended operation, trend

lines for ANO-2 tendon prestressing forces will be developed using regression analysis in accordance with guidance provided in NRC Information Notice (IN) 99-10. If future tendon examination data diverge from the expected trend, the discrepancy will be addressed in accordance with requirements of the Containment Inservice Inspection (ISI) Program (IWE/IWL) and the current licensing basis. Specifically, if prestressing force trend lines indicate that existing prestressing forces in the containment would go below the minimum required values (MRVs) prior to the next scheduled inspection (Reference 10 CFR 50.55a(b)(2)(ix)(B) or 10 CFR 50.55a(b)(2)(viii)(B)), then systematic retensioning of tendons, a reanalysis of the containment or a reanalysis of the post-tensioning system is warranted to ensure the design adequacy of the containment.

> In summary, the ANO-2 Containment ISI Program in accordance with the requirements of ASME Code Section XI IWL will provide reasonable assurance that the effects of aging on the intended functions of tendons will be adequately managed for the period of extended operation in accordance with the provisions of 10 CFR 54.21(c)(1)(iii).

The staff finds the response acceptable as it essentially provides all information that would be provided in X.S1 of NUREG-1801 for aging management of containment prestressing tendon forces. Moreover, Attachment 2 of the letter provides a commitment that the applicant will perform its TLAA based on the measured prestressing forces during the subsequent tendon inspections.

In response to RAI 4.5-3, the applicant stated;

> ANO-2's containment inservice inspection program (Section B.1.13), in accordance with ASME Section XI, delineates the required documentation and the acceptance criteria for the prestress forces applicable for the period of extended operation. The validity of the prestress analysis, per ASME Section XI, subsection IWL is demonstrated in site documents. The adequacy of the aging management program (i.e., IWL) is assured since, as described in Section B.1.13 of the LRA, the program is consistent with the NUREG-1801 program and with current regulatory requirements. In accordance with the Statements of Consideration for the license renewal rule, 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. Therefore, a summary table showing minimum required prestress forces for each group of tendons is not warranted in the SAR.

As discussed above, the applicant's statement in Section A.2.2.4 of the LRA, "Calculation of the acceptability of the effective prestress of the containment building post-tensioning system at 60 years has been performed to show that the containment building tendon elements will be acceptable for the period of extended operation in accordance with 54.21(c)(1)(ii)," is not correct, and should be modified to reflect the resolution of RAI 4.2-5. The applicant was requested to provide the revised Section A.2.2.4.

In the letter dated September 10, 2004, the applicant provided a revision to LRA section A.2.2.4 as follows:

A.2.2.4 CONCRETE CONTAINMENT TENDON PRESTRESS

The analysis of loss of prestress in the containment building post-tensioning system is a time-limited aging analysis. Loss of tendon prestress in the containment building post tensioning system will be managed for license renewal in accordance with 10 CFR 54.21(c)(1)(iii), by the Containment ISI Program. This program, discussed in Section A.2.1.14, includes tendon surveillance testing. Prior to the period of extended operation, trend lines for ANO-2 tendon prestressing forces will be developed using regression analysis in accordance with guidance provided in NRC IN 99-10. If prestressing force trend lines indicate that existing prestressing forces in the containment would go below the minimum required values (MRVs) prior to the next scheduled inspection (Reference 10 CFR 50.55a(b)(2)(ix)(B) or 10 CFR 50.55a(b)(2)(viii)(B)), then systematic retensioning of tendons, a reanalysis of the containment or a reanalysis of the post tensioning system is warranted to ensure the design adequacy of containment.

The staff finds the revision to LRA Section A.2.2.4 acceptable, as it provides an acceptable summary of the TLAA.

4.5.3 Conclusions

On the basis of the review of this section of the LRA, the staff concludes that the applicant's plans to perform TLAAs in accordance with 10 CFR 54.21(c)(1)(iii) is acceptable. As the applicant will adjust the trend lines based on the results of future tendon inspections, pursuant to 10 CFR 54.21(c)(1)(iii), the AMP implemented using the described process will ensure the adequacy of prestressing forces in the ANO-2 containment.

4.6 Containment Liner Plate and Penetration Fatigue Analyses

4.6.1 Summary of Technical Information in the Application

The applicant stated in Section 4.6 of the LRA that the interior surface of the containment is lined with welded carbon steel plate to provide an essentially leak-tight barrier. At the penetrations, the containment liner plate is thickened to reduce stress concentrations. The criteria in SAR Sections 3.8.1.3.4 and 3.8.1.6.3 were applied to the containment design to ensure that the integrity of the liner plate is not exceeded under design-basis accident (DBA) conditions. The applicant's evaluation of this issue for license renewal is based on an analytical assessment of the containment liner and penetrations as described in SAR Section 3.8.1.4.2, as well as on the results of recently completed containment liner plate evaluations for ANO-2.

The TLAAs for the ANO-2 reactor containment structure include containment liner and containment penetration fatigue analyses. Mechanical penetrations are leak-tight, welded assemblies. As described in SAR Section 3.8.1.4.2, containment penetrations are designed to meet the requirements of ASME Code, Section III.

The evaluation for mechanical penetrations covers the penetration assembly and the weld to the process piping, but does not include the process piping within the penetration. The closure of the pipe to the liner plate is accomplished with special heads welded to the pipe and the liner plate reinforcement. Penetration anchorage to the containment wall is designed to resist pipe rupture, seismic loads, and thermal loads.

The liner plate stress analyses indicate a conservative maximum stress of approximately 30 ksi for worst case (i.e., DBA) conditions. Stresses from normal operating cycles such as heatup and cooldown are less than 30 ksi. Using the ASME Code, Section III, Division 1 design fatigue curve, at 30 ksi the maximum cycles for the liner would be approximately 25,000. The number of normal operating cycles for the liner plate is projected to be well below this value. Therefore, the liner plate and penetrations are suitable for the cyclic loads of normal operating conditions throughout the period of extended operation. On this basis, the applicant concluded that the containment liner plate and penetration fatigue analyses remain valid for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(i).

4.6.2 Staff Evaluation

In RAI 4.6-1, the staff asked the applicant to provide the loading conditions and corresponding transient cycles used in the fatigue analysis of the containment liner plate and penetrations. In its response, the applicant clarified that it provided the loading conditions in Section 3.8.1.3 of the SAR. The applicant also stated that it did not explicitly address fatigue in the containment analysis because the calculated peak stress intensities resulted in allowable fatigue cycles, which far exceed the projected number of anticipated cycles for all operating conditions. In RAI 4.6-2, the staff requested that the applicant provide the ASME Code, Section III, CUFs and locations from the recently completed containment liner plate and containment penetration fatigue analyses, showing that these fatigue TLAAs will remain valid for the period of extended operation. In its reply, the applicant stated that, in accordance with its response to RAI 4.6-1, it did not determine ASME Code, Section III, CUFs because the allowable fatigue cycles far exceed the projected number of anticipated cycles for all operating conditions. These cycles were listed as 60 annual outdoor temperature variations, 500 cycles of reactor building interior temperature variation, and 1 thermal cycle because of a postulated DBA. The staff finds these responses reasonable and adequate because they correspond with similar results evaluated and accepted by the staff in previous LRA reviews.

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)(i), that, based on fatigue TLAAs for the containment liner plate and penetration, the analyses remain valid for the period of extended operation.

The staff also concludes that Section A.2.2.5 of the FSAR Supplement contains an adequate summary description of the containment liner plate and the penetrations fatigue TLAA evaluation for the period of extended operation, as required by 10 CFR 54.21(d).

4.7 Other Plant-Specific Time-Limited Aging Analyses

Other potential plant-specific TLAAs include leak before break (LBB) analyses, fracture mechanics evaluation of the RCP casing and flywheel, steam generator flow-induced vibration (FIV) analysis, qualification analyses of Alloy 600 nozzle repairs, and HELB analyses.

4.7.1 Reactor Coolant System Piping Leak Before Break Analysis

4.7.1.1 Summary of Technical Information in the Application

The NRC modified 10 CFR Part 50 General Design Criterion (GDC) 4, "Environmental and Missile Design Bases," in 1987. This change allows licensees to disregard the dynamic effects of postulated ruptures in primary coolant loop piping in the design of PWRs if LBB criteria are met. In 1990, an LBB analysis (Topical Report CEN-367-A) was performed for CE-designed nuclear steam supply systems (Reference 4.7-1). This analysis demonstrated that plant monitoring systems can detect potential leaks in the RCS primary loop piping before a postulated crack causing the leak would grow to unstable proportions during the 40-year plant life. The NRC approved this analysis in its safety evaluation (SE) dated October 30, 1990 (Reference 4.7-5). The original design basis for the ANO-2 RCS considered postulated breaks for the purposes of evaluating protection from the dynamic and environmental effects of the main coolant line (MCL) breaks. The changes to GDC 4 allowed the application of LBB criteria for the selection of MCL breaks. The NRC approved the criteria for use at ANO-2 through its SE dated June 18, 1996 (Reference 4.7-2). This application of LBB has eliminated the requirement to consider postulated breaks on the MCL in evaluating the dynamic effects on the RCS. The original LBB analysis was updated for the steam generator replacement and power uprate to demonstrate that conclusions of the original analysis remain valid.

The analysis consideration that could be time-limited is the accumulation of fatigue transient cycles over time, which could invalidate the fatigue crack growth analysis reported in CEN-367-A, Section 3.0. The crack growth rate laws were evaluated for the fatigue transients presented in Table 3-1 of CEN-367-A. Section 4.3.1 of this SER reviews the ANO-2 fatigue transient cycle definitions, demonstrating the Fatigue Monitoring Program to be capable of monitoring the Class 1 thermal fatigue design-basis transients for the period of extended operation, including the transient assumptions reported in CEN-367-A.

A review of CEN-367-A identified the fatigue crack growth analysis as a TLAA. Continued implementation of the ANO-2 Fatigue Monitoring Program provides reasonable assurance that the fatigue crack growth analysis reported in CEN-367-A will remain valid during the period of extended operation. The LBB TLAA remains valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

The applicant described its LBB analysis for the RCS in Section 4.7.1 of the LRA. The staff reviewed this section to determine if the applicant provided adequate information to meet the requirements contained in 10 CFR 54.21(c), related to the TLAA for LBB.

In CEN-367-A, Revision 000, "Leak-Before-Break Evaluation of Primary Coolant Loop Piping in Combustion Engineering Designed Nuclear Steam Supply Systems," CE describes a successful application of LBB to the RCS primary loop piping. This report provides the technical basis for evaluating two distinct postulated flaws in the RCS main-loop piping as an essential element of the LBB methodology, (1) the determination of the leakage flaw size under the normal loading condition and (2) the determination of the allowable critical flaw size under the faulted loading condition.

The applicant stated that the LBB analysis considered the accumulation of actual fatigue transient cycles over the period of extended operation that could invalidate the fatigue flaw growth analysis performed as part of the original LBB analysis. The applicant reviewed the accumulation of the applicable fatigue transient cycles to meet the TLAA definition. The applicant completed this review within the scope of the Fatigue Monitoring Program that it implemented at ANO-2. The applicant stated that the continued implementation of the Fatigue Monitoring Program provides reasonable assurance that the fatigue crack growth analysis reported in CEN-367-A will remain valid during the period of extended operation. The LRA concludes that the LBB TLAA remains valid in accordance with 10 CFR 54.21(c)(1)(i).

4.7.1.2 Staff Evaluation

In RAI-4.7.1-1, the staff asked the applicant to discuss its basis and conclusions regarding the additional crack growth predicted by the updated calculations for the end of 60 years compared to that originally predicted for 40 years. The staff confirmed that the NRC generically approved the LBB applications for the primary loop piping for Combustion Engineering Owners Group (CEOG) plants on October 30, 1990, and specifically for ANO-2 on June 18, 1996. The CEOG provides this generic LBB evaluation in CEN-367-A. There are two time-limited considerations for LBB analysis, crack growth and thermal aging. The material properties of cast austenitic stainless steel (CASS) can change over time. Thermal aging causes an elevation in the yield strength of the material and a degradation of the fracture toughness, with the degree of degradation being a function of the level of ferrite in the material. Thermal aging in CASS will continue until a saturated or fully aged point is reached.

In response to RAI-4.7.1-1, the applicant stated that the LBB fatigue crack growth analysis reported in CEN-367-A is based on 40-year design limits for RCS fatigue transient cycles. In CEN-367-A, the applicant performed fatigue crack growth to show that fatigue will not cause degradation of the pressure boundary integrity. In the fatigue crack growth analysis, the normal and upset cyclical loadings cause postulated flaws to grow. These cyclical loadings are based on reactor coolant design transient cycles. As described in Section 4.3.1 of the LRA, the number of transient cycles assumed in the original design for 40 years was found acceptable for 60 years of operation. Therefore, the postulated flaw growth in CEN-367-A (based on the RCS original design transient cycles) is unchanged for 60 years of operation. The staff finds the response acceptable and considers this issue closed.

The assessment in CEN-367-A uses the fracture toughness values of the SA-515 Grade 70 carbon steel weld in the LBB analysis, which are the lowest among all base and weld materials in the primary loop piping system. The staff has compared the fracture toughness values in CEN-367-A with the more recent information in NUREG-6177, "Assessment of Thermal Embrittlement of Cast Stainless Steels," and found that the fracture toughness data in CEN-367-A data are more conservative than the NUREG-6177 lower-bound fracture toughness curve. Therefore, because the original analysis supporting LBB bounds fully aged CASS, the analysis does not have a material property time dependency that requires further evaluation for license renewal.

For the primary loop piping, instead of revising the original analyses by taking into account the fatigue transient cycles for the period of extended operation, the applicant relied on the plant-specific Fatigue Management Program to ensure that the accumulation of the applicable fatigue transient cycles over time will not invalidate the fatigue flaw growth analysis that it performed as part of the original LBB analyses. With this program in place, which calls for constant review of the accumulation of applicable fatigue transient cycles, the applicant concluded that the continued implementation of the Fatigue Management Program will provide reasonable assurance that the RCS components within the scope of license renewal will continue to perform their intended function(s) consistent with the CLB for the period of extended operation. The staff reviewed the Fatigue Management Program and determined that the program is adequate to monitor the applicable set of transients and their limits, and to count the actual thermal cycle transients to ensure that it is within the allowable limits of the defined transients. In the event that design cycle limits are approached, the applicant will review the Fatigue Management Program and determine appropriate actions.

Based on the above evaluation, the staff agrees with the applicant's conclusion that the continued implementation of the Fatigue Management Program provides reasonable assurance that it will manage thermal fatigue for the primary loop piping and components, and therefore the analyses for this TLAA remain valid for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(ii).

Since the V.C. Summer main coolant loop weld cracking event involving Alloy 82/182 weld material, the staff has considered the effect of primary water stress-corrosion cracking on Alloy 82/182 piping welds as an operating plant issue affecting all piping with or without approved LBB applications. To resolve this issue, the industry has taken the initiative to (1) develop overall inspection and evaluation guidance, (2) assess the current inspection technology, and (3) assess the current repair and mitigation technology. An interim industry report, "PWR Materials Reliability Project Interim Alloy 600 Safety Assessment for US PWR Plants (MRP-44), Part 1: Alloy 82/182 Pipe Butt Welds," was published in April 2001 to justify the continued operation of PWRs while the industry completes the development of the final report. The staff accepted this interim report in an SE dated June 14, 2001, stating that, "Should the industry not be timely in resolving inspection capabilities to identify PWSCC in Alloy 600 welds, regulatory action may result." Little has been accomplished in the interim and the staff is pursuing further regulatory action.

4.7.1.3 FSAR Supplement

Section A.2.2.6.1 of Appendix A to the LRA provides the applicant's FSAR Supplement regarding LBB for RCS piping. The plant design cycles in the applicant's LBB analysis are consistent with those used in the fatigue crack growth analysis, and they bound the period of extended operation. In addition, the applicant's appropriate consideration of thermal aging of the CASS material constitutes the basis for the staff's acceptance of the licensee's evaluation of the LBB TLAA for the period of extended operation. On the basis of its review of the FSAR Supplements, the staff concludes that the summary description of the applicant's TLAA evaluation to address LBB for the period of extended operation is adequate and satisfies 10 CFR 54.21(d).

4.7.1.4 Conclusions

The staff concludes that, pursuant to 10 CFR 54.21(c)(1)(i), the applicant has provided an acceptable demonstration that, for the TLAA on LBB of the RCS main-loop piping, the analysis will remain valid for the period of extended operation, and the applicant will adequately manage the effects of aging on the pressure boundary function for the period of extended operation. The staff also concludes that the FSAR Supplements contain an adequate summary description of the evaluation of the TLAA for LBB, as required by 10 CFR 54.21(d).

4.7.2 Reactor Coolant Pump Code Case N-481

4.7.2.1 Summary of Technical Information in the Application

In Section 4.7.2 of the ANO-2 LRA, the applicant described an analysis based on ASME Code Case N-481 for alternative inspection criteria for RCP casings. The staff reviewed this section to determine whether the applicant provided adequate information to meet the requirements contained in 10 CFR 54.21(c) related to the TLAA for the RCP casings, as based on the criteria of ASME Code Case N-481.

The two analysis considerations of concern to the TLAA identified in the LRA are (1) loss of fracture toughness of the pump casing's CASS material of the because of thermal aging and (2) the accumulation of actual fatigue transient cycles over time that could invalidate the fatigue crack growth analysis of the ANO-2 ASME Code Case N-481 evaluation.

Because the ASME Code Case N-481 analysis assumes fully aged (saturated) properties, the LRA concludes that the TLAA needs no further evaluation for license renewal to address concerns with material property changes. The LRA describes a review of the accumulation of the applicable fatigue transient cycles that the applicant performed to meet the TLAA definition. The applicant performed this review within the scope of the Fatigue Monitoring Program that it implemented at ANO-2. The applicant stated that the continued implementation of the FMP provides reasonable assurance that the fatigue crack growth analysis will remain valid during the period of extended operation. The LRA concludes that the TLAA will remain valid in accordance with 10 CFR 54.21(c)(1)(i).

The applicant evaluated a demonstration of compliance of the primary loop pump casings to ASME Code Case N-481 for ANO-2. This analysis considers thermal aging of the CASS pump casings and fatigue crack growth. Because these evaluations could be influenced by time, the Code Case N-481 analysis is a potential TLAA.

The first analysis consideration that could be time limited is the material properties of CASS. Such steels used in the RCS are subject to thermal aging during service. Since the Code Case N-481 analysis relied on fully aged (saturated) stainless steel material properties, the analysis does not have a material property time dependency that requires further evaluation for license renewal.

In addition, the accumulation of actual fatigue transient cycles over time could invalidate the fatigue crack growth analysis of the ANO-2 Code Case N-481 evaluation. Section 4.3.1 of this SER discusses a review of the ANO-2 fatigue transient cycle definitions, demonstrating that the

Fatigue Monitoring Program adequately monitors thermal fatigue design transients, including the transient cycle assumptions reported in the ANO-2 Code Case N-481 evaluation, for the period of extended operation. The continued implementation of the Fatigue Monitoring Program provides reasonable assurance that the ANO-2 Code case N-481 fatigue crack growth analysis will remain valid during the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(i).

4.7.2.2 Staff Evaluation

There are two time-limited considerations for the ASME Code Case N-481 analysis. First, the material properties of CASS can change over time. Thermal aging of the pump casing material causes an elevation in the yield strength material and a degradation of the fracture toughness, with the degree of degradation being a function of the level of ferrite in the material. Thermal aging in CASS will continue until a saturated or fully aged point is reached. The applicant used fully aged (saturated) properties in its analysis and concluded that it addressed the effects of thermal aging on material properties of the CASS RCP casings for the period of extended operation. In RAI 4.7.2-1, the staff asked the applicant to discuss whether the properties considered in the analysis are the same bounding properties that it used for fully aged CASS materials, as assumed in CEN-367-A. If the applicant considered other material properties for the ASME Code Case N-481 analysis, the staff asked the applicant to justify its use of those properties.

In response to RAI 4.7.2-1, the applicant stated that, because of the variety of materials used at the different plants, it used bounding values from participating plants in CEN-367-A for the material properties for stainless steel safe ends. In contrast, the applicant completed the ASME Code Case N-481 evaluation specifically for ANO-2, and thus used ANO-2 specific material properties for the RCP casings. The staff finds the response acceptable and considers this issue closed.

The applicant performed a qualitative assessment in order to show that the plant-specific Fatigue Monitoring Program can programmatically manage the assumptions, including the fatigue cycles, in the existing analyses for the period of extended operation. In RAI-4.7.2-2, the staff asked the applicant to discuss the additional crack growth that the updated calculations predicted for the end of 60 years and compare the crack growth to that originally predicted for 40 years. The staff also asked the applicant to provide the criteria or basis for concluding that this amount of additional crack growth is sufficiently small to justify continued application of ASME Code Case N-481.

In response to RAI-4.7.2-2, the applicant stated that it did not update the ASME Code Case N-481 calculation for 60 years. As described in Section 4.7.2 of the ANO-2 LRA, the ASME Code Case N-481 analysis remains valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i). In the ASME Code Case N-481 evaluation, the applicant determined fatigue crack growth in order to assure that fatigue will not cause degradation of pressure boundary integrity. In the fatigue crack growth analysis, the normal and upset cyclical loadings cause postulated flaws to grow. These cyclical loadings are based on RCS design transient cycles. As described in Section 4.3.1 of the LRA, the number of transient cycles assumed in the original design for 40 years was found acceptable for 60 years of operation (i.e., the number of transients used for 40 years of operation are still bounding for 60 years of operation). Therefore, the postulated flaw has no additional crack growth when extending the period of operation to 60 years. The staff finds the response acceptable and considers this issue closed.

4.7.2.3 FSAR Supplement

Section A.2.2.6.2 of Appendix A to the LRA provides the applicant's FSAR Supplement summary description for the TLAA on the RCP casings, as performed in accordance with the ASME Code Case N-481 criteria. The plant design cycles considered in the applicant's analysis are consistent with those it used in the fatigue crack growth analysis and bound the period of extended operation. In addition, the applicant's appropriate consideration of thermal aging of the CASS material constitutes the basis for the staff acceptance of the licensee's evaluation of the TLAA for the period of extended operation. On the basis of its review of the FSAR Supplements, the staff concludes that the summary description of the applicant's TLAA evaluations to address the ASME Code Case N-481 evaluation for the period of extended operation is adequate and satisfies 10 CFR 54.21(d).

4.7.2.4 Conclusions

The staff concludes that, pursuant to the acceptability criteria of 10 CFR 54.21(c)(1)(i), the applicant has provided an acceptable demonstration that, for the TLAA on the RCP casings, as performed in accordance with the ASME Code Case N-481 criteria, the analysis will remain valid for the period of extended operation for ANO-2, and the applicant will adequately manage the effects of aging on the pressure boundary function for the period of extended operation. The staff also concludes that the FSAR Supplement contains an adequate summary description of the TLAA evaluation for the RCP casings, as required by 10 CFR 54.21(d).

4.7.3 Reactor Coolant Pump Flywheel

4.7.3.1 Summary of Technical Information in the Application

In Section 4.7.3 of the ANO-2 LRA, the applicant describes an analysis of fatigue crack initiation and growth for the RCP flywheel. The staff reviewed this section to determine whether the applicant provided adequate information to meet the requirements of 10 CFR 54.21(c)(1), as the information relates to the TLAA for the RCP flywheel.

To reduce the RCP flywheel inspection frequency and scope, ANO-2 submitted a topical report in 1995 that uses a fatigue crack growth calculation to evaluate the effects of cyclic stresses and fatigue. The NRC staff reviewed and approved the topical report on May 21, 1997. Crack growth calculations were based on an assumed 4,000 cycles of RCP startups and shutdowns rather than a specific time period of operation. The LRA states that the number of cycles from actual plant operating conditions through the end of the extended period of operation will be much less than the assumed 4,000 cycles. On this basis, the applicant originally concluded that the analysis of the 1995 topical report applies to the extended period of plant operation, and that the flywheel analysis is not a time-limited analysis from the standpoint of the license renewal application.

In the applicant's response to RAI 4.7.3-1, dated September 10, 2004 (Entergy Letter No. 2CAN090402), the applicant modified its position and stated that it will treat the low-cycle fatigue crack growth analysis for ANO-2 RCP flywheels as a TLAA for the ANO-2 LRA.

4.7.3.2 Staff Evaluation

In the ANO-2 LRA, the applicant concluded that the RCP flywheel is not a TLAA. The basis for this conclusion is a 1997 safety evaluation of a fatigue crack growth analysis that was presented in a Combustion Engineering Owner's Group topical report. This safety evaluation allowed the licensee to lengthen the RCP flywheel inspection period for ANO, Units 1 and 2 and five other units. The fatigue crack growth analysis for ANO, Units 1 and 2 is based on 4,000 RCP startup and shutdown cycles. Table 4.1-3 of the NUREG-1800, *Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants,* identifies that low-cycle fatigue crack growth analyses for PWR RCP flywheels are TLAAs for PWR-designed light-water reactors. In RAI 4.7.3-1, the staff requested that the applicant provide the TLAA for the RCP Flywheel for ANO Unit 2, and include the justification for why 4,000 RCP startup and shutdown cycles remain bounding through the end of the extended period of operation for ANO-2.

In the applicant's response to RAI 4.7.3-1, dated September 10, 2004, the applicant has states that it will treat the low-cycle fatigue crack growth analysis for ANO-2 RCP flywheels as a TLAA for the ANO-2 LRA and that the 4000 plant startup/shutdown cycles assumed in the crack growth analysis remain bounding for the number of plant startup/shutdown cycles (RCP start/trip cycles) assumed for the facility through both 40 years and 60 years of licensed (500 plant startup/shutdown cycles is assumed in design basis for both the current operating term and extended operating term). The applicant concluded that the the low-cycle fatigue crack growth analysis for the RCP flywheels meets the TLAA analysis acceptability criteria of 10 CFR 54.21(c)(1)(i).

Section 5.2.6 of the ANO-2 FSAR provides the design basis for how the applicant's design, fabrication, testing, inspection, and analysis program for the RCP flywheels is designed to conform to staff's design, fabrication, testing, inspection, and analysis criteria that are recommended in NRC Regulatory Guide 1.14, Revision 1, *Reactor Coolant Pump Flywheel Integrity (August 1975).* Subsection 5.2.6.2 to Section 5.2.6 of the ANO-2 FSAR indicates that a 1.0 inch deep crack is assumed to occur in the keyway of the limiting flywheel disc and that the critical crack size for the flywheel is 1.8 inches. The low-cycle fatigue crack growth analysis for the RCP flywheels demonstrates that the postulated flaw in the analysis will not grow in excess of the critical crack size for the flywheel disc, even when the flywheels have been subjected to the change in the stress intensity factor for the flywheel discs associated with 4000 RCP startup/shutdown cycles. Since this bounds the number of RCP startups/shutdown cycles assumed for both the current operating period and the proposed period of extended operation, the staff concludes that the low-cycle fatigue crack growth analysis for the RCP flywheels meets the acceptance criterion for TLAAs in 10 CFR 54.21(c)(1)(i), in that the analysis remains bounding for the period of extended operation.

4.7.3.3 FSAR Supplement

Appendix A of the applicant's FSAR supplement does not address the fatigue analysis for the reactor coolant pump flywheel. The LRA states that the existing analysis of the 1995 topical report does not involve time limiting assumptions which would restrict application to only the current operating term or preclude application to the extended period of plant operation. The staff concluded that the fatigue analysis for the reactor coolant pump flywheel is a TLAA, and that the applicant should submit the TLAA for staff evaluation. In the applicant's response to RAI 4.7.3-1, dated September 10, 2004, the applicant stated that it will treat the low-cycle fatigue crack growth analysis for ANO-2 RCP flywheels as a TLAA for the ANO-2 LRA. The applicant provided the following FSAR Supplement summary description (i.e., Section A.2.2.6.6, *RCP Motor Flywheel,* of Appendix A to the ANO-2 LRA) for the TLAA on the TLAA on the low-cycle fatigue crack growth analysis for the RCP flywheels.

> A.2.2.6.6 RCP Motor Flywheel
>
> The flaw growth analysis associated with the reactor coolant pump motor flywheel is conservatively treated as a time-limited aging analysis. The analysis addresses the growth of pre-existing cracks subjected to 4,000 reactor coolant pump motor startup or shutdown cycles, which exceeds by a factor of eight the number of RCP cycles projected through the period of extended operation. Therefore, the flaw growth analysis remains valid for the period of extended operation.

The applicant's FSAR Supplement summary description provides a summary description basis for the low-cycle fatigue crack growth analysis that is consistent with the staff's evaluation that is discussed in Section 4.7.3.2 of this SER. The FSAR Supplement summary description for the TLAA on the RCP Motor Flywheel is therefore acceptable to the staff, and satisfies the criterion for FSAR Supplement summary descriptions in 10 CFR 54.21(d). Section 5.2.6 of the ANO-2 FSAR provides additional details and information on the applicant's inspection programs and structural integrity analyses for the RCP flywheels, as implemented in conformance with the NRC's recommended guidelines in Regulatory Guide 1.14, Revision 1, *Reactor Coolant Pump Flywheel Integrity (August 1975).*

4.7.3.4 Conclusions

The staff concludes that the applicant has provided an acceptable demonstration pursuant to 10 CFR 54.21(c)(1)(i) that, for the TLAA on the RCP motor flywheel, the analysis remains valid for the period of extended operation.

The staff also concludes that the FSAR supplements contain an adequate summary description of this TLAA evaluation for the period of extended operation, as required by 10 CFR 54.21(d).

4.7.4 Steam Generator Tubes—Flow-Induced Vibration

4.7.4.1 Summary of Technical Information in the Application

TLAAs applicable to the steam generators include analyses of steam generator tube FIV. The ANO-2 steam generator design life extends to 2040, as they were installed in 2000. This exceeds the period of extended operation sought through this LRA. Therefore, the steam generator FIV analysis remains valid for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(i).

4.7.4.2 Staff Evaluation

The ANO-2 replacement steam generators were installed in 2000. The applicant states that the design life of the replacement steam generators extends to 2040, which exceeds the period of extended operation sought in its LRA. The applicant concludes that the steam generator FIV analysis remains valid for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(i).

In addition to a valid FIV analysis, the ANO-2 steam generators are designed to minimize potential FIV occurring on tubes. Steam generator tubes are supported to minimize excessive vibration which could be detrimental to their structural integrity. The impact of FIV will most likely cause tube wear at the intersection of antivibration bars and the tubes. However, periodic inspections required by the applicant's Steam Generator Integrity Program will monitor and detect any potential tube wear. On the basis of the information the applicant submitted, the staff concludes that the applicant's TLAA of FIV on steam generator tubes meets the acceptance criteria stated in 10 CFR 54.21(c)(1)(i) and 10 CFR 54.21(c)(1)(iii) and is therefore acceptable.

4.7.4.3 FSAR Supplement

The applicant provided the FSAR Supplement summary descriptions for the TLAA on the Steam Generator Tubes - Flow-Induced Vibration in Section A.2.2.6.3 of Appendix A to the LRA. The staff reviewed the FSAR Supplement summary descriptions for the TLAA, as given in Section A.2.2.6.3 of Appendix A to the LRA. The staff determined that the FSAR description for the TLAA provides an adequate summary of the evaluation of the TLAA for the Steam Generator Tubes - Flow-Induced Vibration. This commitment will ensure compliance with the requirements of 10 CFR 54.21(c)(1)(i). Therefore, the staff has reviewed the to the FSAR Supplement summary description for this TLAA and concludes that it provides an adequate summary description of the TLAA, as required by 10 CFR 54.21(d).

4.7.4.4 Conclusions

The staff concludes that, pursuant to 10 CFR 54.21(c)(1)(i), the applicant has provided an acceptable demonstration that, for the TLAA on FIV of the steam generator tubes, the analysis will remain valid for the period of extended operation for ANO-2, and the applicant will adequately manage the effects of aging on the pressure boundary function for the period of extended operation. The staff also concludes that the FSAR Supplements contain an adequate summary description of the evaluation of TLAA for FIV, as required by 10 CFR 54.21(d).

4.7.5 Alloy 600 Nozzle Repairs

4.7.5.1 Summary of Technical Information in the Application

In 2000, nondestructive examination evaluations revealed that a number of pressurizer heater penetrations, as well as resistance temperature detector (RTD) and pressure measurement nozzle penetrations on the RCS hot leg, had developed leaks. The repair for the pressurizer heater penetration replaced the pressure boundary weld on the inside surface of the pressurizer nozzle with an outer diameter (OD) weld attached to a temper-bead weld pad on the pressurizer

OD. The hot-leg piping penetration modification consisted of removing a portion of the old RTD or pressure tap by cutting it near the outer wall of the RCS piping and replacing it with a new nozzle welded on the outside surface of the RCS piping. The applicant performed a fracture mechanics evaluation in order to evaluate the potential for a crack in the remaining pressurizer and RCS hot-leg penetration welds to propagate into the pressurizer vessel or hot-leg pipe wall. The applicant used transient cycles in the crack growth evaluations, which it assumed for a 40-year plant lifetime. To prevent further penetration leakage, the applicant replaced all primary piping RTD nozzles at ANO-2. The applicant qualified the replacement nozzles and attachment welds for structural adequacy in accordance with ASME code criteria. This analysis included a simplified fatigue evaluation which considered cyclic loads from pressure, thermal gradients, and mechanical loads.

As discussed in Section 4.3.1 of the LRA, the applicant has completed a review of the ANO-2 fatigue transient cycle definitions. The Fatigue Monitoring Program will monitor thermal fatigue design-basis transients, including those assumed in the analysis of the Alloy 600 nozzle repairs, for the period of extended operation. The continued implementation of the Fatigue Monitoring Program provides reasonable assurance that the fatigue crack growth analysis for the repairs will remain valid during the period of extended operation. Similarly, the fatigue analysis for the replacement nozzles and attachment welds remains valid for the period of extended operation. This result demonstrates that the Alloy 600 nozzle repair TLAAs remain valid for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(i).

4.7.5.2 Staff Evaluation

In a nozzle repair technique, the leaking (cracked) Alloy 600 nozzle is cut outboard from the partial-penetration J-groove weld that was used to join the nozzle to the RCS hot-leg piping or pressurizer shell. The section of the nozzle near the outer surface of the pressure boundary component is removed and replaced with a short Alloy 690 nozzle section. The inserted Alloy 690 nozzle section is then welded to the pressure boundary component's outside surface. This half-nozzle repair method leaves a short section of the original nozzle attached to the inside surface with the J-groove weld and exposes the ferritic (i.e., low-alloy steel or carbon steel) pressure boundary material to the borated water conditions of the reactor coolant.

In Section 4.7.5 of the LRA, the applicant indicated that it performed a fracture mechanics analysis to support the ANO-2 pressurizer heater penetrations. The fracture mechanics analysis justifies the acceptability of indications in the original J-groove weld based on a postulated flaw size and flaw growth, considering the applicable design cycles. Based on the results of the analysis, the applicant concluded that the postulated flaw size for the worst-case instrument nozzle is acceptable for the remaining design life of the plant.

In RAI 4.7.5-1, the staff requested that the applicant demonstrate that the designs of repaired nozzles will have sufficient structural integrity against the loss of material by corrosion and will meet the minimum wall thickness requirements through the expiration of the period of extended operation.

In response to RAI 4.7.5-1, the applicant stated that it completed analyses to estimate the corrosion rate assuming a repaired nozzle has a through-wall crack, and the crevice between the repaired nozzle and underlying ferritic steel will be exposed to aerated borated water. The service lifetimes for repairs to the hot-leg pipe nozzles, pressurizer nozzles, and pressurizer heater sleeves are 76, 56, and 196 years, respectively, before they would exceed ASME Code limits. The most limiting service lifetime is that of 56 years for the pressurizer nozzle repair. The 56-year lifetime from the date of the nozzle repair extends the service life beyond the period of extended operation. Therefore, loss of material by corrosion will not impair the ability of the repaired nozzles to maintain sufficient structural integrity for the period of extended operation.

In RAI 4.7.5-2, the staff asked the applicant to justify and validate the CEOG conclusion that the growth of the existing flaw in the original Alloy 82/182 J-groove weld material by stress-corrosion cracking into the carbon steel or low-alloy steel base metal is not a plausible effect during the period of extended operation.

In response to RAI 4.7.5-2, the applicant stated that the repaired nozzles will have cracks in the Alloy 600 nozzles or the partial penetration attachment welds remaining after completing the repair. Since residual stresses from the welding will remain, these cracks may continue to propagate through the nozzle/weld metal by stress-corrosion cracking to the carbon or low-alloy steel base metal. Further growth into the carbon or low-alloy steel base metal is unlikely since low oxygen levels resulting from PWR water chemistry will result in corrosion potentials below the critical cracking potential in a high-temperature environment. As described in Section B.1.30.3 of the LRA, the applicant based the ANO-2 Primary Water Chemistry Control Program on the Electric Power Research Institute TR-105714, which requires stringent oxygen controls. This program will continue into the period of extended operation. Therefore, the applicant concluded that the ANO-2 Primary Water Chemistry Program will provide an environment which limits the corrosion potential of the applicable material below the critical cracking potentials, and stress-corrosion cracking will not cause growth of the existing flaw into the carbon steel or low-alloy steel base metal. The staff finds the response acceptable and considers this issue closed.

It should be noted that Westinghouse Electric Corp. has revised CE NPSD-1198-P, Revision 00, since the staff issued its review of the report (as given in the staff's SE of February 8, 2002), and since the applicant issued its response (October 10, 2002). The revisions to the topical report address potential issues with the original boric acid wastage analysis for the half-nozzle designs that came up as a result of the boric acid corrosion (wastage) event of the Davis-Besse RV head, and they also address a design calculation error Westinghouse discovered in the original fatigue crack growth analysis for the half-nozzle designs. The Class 2 proprietary report, WCAP-15973-P, "Low-Alloy Steel Component Corrosion Analysis Supporting Small-Diameter Alloy 600/690 Nozzle Repair/Replacement Programs," issued November 2002, provides the revisions, which the applicant submitted to the NRC for review and approval in letter CEOG-02-243, dated November 11, 2002. This report applies to the ANO-2 half-nozzle designs.

4.7.5.3 FSAR Supplement

The applicant provided the FSAR Supplement summary descriptions for the TLAAs on the Alloy 600 nozzle repairs in Section A.2.2.6.4 of Appendix A to the LRA. The staff reviewed the FSAR Supplement summary descriptions for the TLAA, as given in Section A.2.2.6.4 of Appendix A to the LRA. The staff determined that the FSAR descriptions for the TLAA on the nozzle repairs provide an adequate summary of the evaluation of the TLAA for the ANO-2 nozzle repairs. This commitment will ensure compliance with the requirements of 10 CFR 54.21(c)(1) and 10

CFR 50.55a(a)(3). The staff therefore concludes that the FSAR Supplement summary descriptions for the TLAA are acceptable.

4.7.5.4 Conclusions

The staff concludes that the applicant has provided an adequate demonstration pursuant to 10 CFR 54.21(c)(1)(ii) that, for the nozzle repairs TLAA, the applicant has projected the analyses to the end of the period of extended operation. The staff also concludes that the FSAR Supplements contain an adequate summary description of the evaluation of this TLAA for the period of extended operation, as required by 10 CFR 54.21(d).

4.7.6 High-Energy Line Break Analyses

4.7.6.1 Summary of Technical Information in the Application

The applicant stated in Section 4.7.6 of the LRA that, in accordance with GDC 4, it has taken special measures in the design and construction of ANO-2 to protect SSCs required to place the reactor in a safe, cold-shutdown condition from the dynamic effects associated with the postulated rupture of piping. The applicant used RG 1.46, "Protection Against Pipe Whip Inside Containment," in establishing the design criteria for piping systems inside the containment. As defined in SAR Section 3.6.2.1, the applicant determined the postulated break locations for ASME Code, Section III, Class 1 piping, in part, using any intermediate locations between terminal ends where the CUF derived from the piping fatigue analysis under the loadings associated with specified seismic events and operational plant conditions exceeded 0.1 (Reference 4.7-3). As discussed in Section 4.3 of this SER, these fatigue evaluations are TLAAs since they are based on a set of design transients that are dependent on the life of the plant.

Fatigue evaluations for Class 1 mechanical components at ANO-2, as described in Section 4.3.1 of the LRA, demonstrate ample margin exists between the projected and analyzed number of thermal cycles for all Class 1 components for the period of extended operation. Therefore, the analyzed usage factors the applicant employed for the current HELB location determinations remain valid for the period of extended operation.

In addition, the applicant stated that ANO-2 monitors transient cycles that contribute to fatigue usage in accordance with requirements in the ANO-2 TSs, Section 6.8.4(b). The continued implementation of the ANO-2 Fatigue Monitoring Program, which the applicant discussed in Appendix B to the LRA, also provides reasonable assurance that the ANO-2 HELB analyses will remain valid during the period of extended operation. The applicant concluded that this result demonstrates that the HELB TLAA remains valid for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(i).

4.7.6.2 Staff Evaluation

In RAI 4.7.6-1, the staff asked the applicant to indicate that it reevaluated the surge line fatigue TLAA to determine if additional intermediate pipe breaks needed to be postulated at locations where the CUF may exceed the pipe break postulation criterion for Class 1 piping (CUF=0.1), stated in SAR Section 3.6.2.1, during the period of extended operation. In its response, the applicant stated that the number of RCS transients assumed in the original design is greater than the number projected for 60 years of operation, and therefore the CUFs will not exceed the criterion for intermediate breaks and remain valid for the period of extended operation. Since the CUFs do not change, no new break locations need to be postulated. The staff concurs with the applicant's conclusion that it need not postulate any new breaks.

The staff has reviewed the technical information in Section 4.7.6 of the LRA regarding the fatigue TLAAs for the postulation of HELB in ASME Code, Section III, Class 1 piping, including the response to RAI 4.7.6.1. The staff finds the information adequate because the applicant has demonstrated that the fatigue TLAAs which form the basis for postulating HELBs, in accordance with SAR Section 3.6.2.1, will remain valid during the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(i).

4.7.6.3 FSAR Supplement

The applicant provided the FSAR Supplement summary descriptions for the TLAAs on the High-Energy Line Break Analyses in Section A.2.2.6.5 of Appendix A to the LRA. The staff reviewed the FSAR Supplement summary descriptions for the TLAA, as given in Section A.2.2.6.5 of Appendix A to the LRA. The staff determined that the FSAR description for the TLAA provides an adequate summary of the evaluation of the TLAA for the High-Energy Line Break Analyses. This commitment will ensure compliance with the requirements of 10 CFR 54.21(c)(1)(i). Therefore, the staff has reviewed the to the FSAR Supplement summary description for this TLAA and concludes that it provides an adequate summary description of the TLAA, as required by 10 CFR 54.21(d).

4.7.6.4 Conclusions

Section A.2.2.6.5 of the LRA provides the applicant's supplement for the ANO-2 FSAR regarding the HELB fatigue TLAA of ASME Code, Section III, Class 1 piping. The staff has reviewed the supplemental section and finds it acceptable because it provides a reasonable summary of the information the applicant presented in Section 4.7.3 of the LRA.

On the basis of its review, the staff concludes that the applicant has provided an adequate demonstration, pursuant to 10 CFR 54.21(c)(1)(i), that the TLAAs that form the basis for postulating HELB remain valid for the period of extended operation.

The staff also concludes that the FSAR 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).

4.8 Conclusions for Time-Limited Aging Analyses

The staff has reviewed the information in Section 4, "Time-Limited Aging Analysis", 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 that (1) the TLAAs will remain valid for the period of extended operation, as required by 10 CFR 54.21(c)(1)(i), (2) the TLAAs have been projected to the end of the period of extended operation, as required by 10 CFR 54.21(c)(1)(ii), or (3) that the aging effects will be adequately managed for the period of extended operation, as required by 10 CFR 54.21(c)(1)(iii). The staff has also reviewed the FSAR Supplements for the TLAAs and finds that the FSAR Supplement contains descriptions of the TLAA's sufficient to satisfy the requirements of 10 CFR 54.21(d). In addition, the staff concludes that no plant-specific exemptions are in effect that are based on TLAA's, as required by 10 CFR 54.21(c)(2).

With regard to these matters, the NRC staff has concluded that there is reasonable assurance that the activities authorized by the renewed licenses will continue to be conducted in accordance with the current licensing basis, and that any changes made to the ANO-2 current licensing basis in order to comply with 10 CFR 54.29(a) are in accord with the Act and the Commission's regulations.

5. REVIEW BY THE ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

The NRC staff issued its safety evaluation report (SER) related to the renewal of operating license for Arkansas Nuclear One, Unit 2 on November 5, 2004. On December 1, 2004, the applicant presented its license renewal application, and the staff presented its review findings to the ACRS Plant License Renewal Subcommittee. The staff reviewed the applicant's comments on the SER and completed its review of the license renewal application. The staff's evaluation is documented in an SER that was issued by letter dated April 7, 2005.

During the 522nd meeting of the ACRS, May 5-6, 2005, the ACRS completed its review of the Arkansas Nuclear One, Unit 2 license renewal application and the NRC staff's SER. The ACRS documented its findings in a letter to the Commission dated May 13, 2005. A copy of this letter is provided on the following pages of this SER.

ACRSR-2124

May 13, 2005

The Honorable Nils J. Diaz
Chairman
U.S. Nuclear Regulatory Commission
Washington, DC 2005-0001

SUBJECT: REPORT ON THE SAFETY ASPECTS OF THE LICENSE RENEWAL APPLICATION FOR ARKANSAS NUCLEAR ONE, UNIT 2

Dear Chairman Diaz:

During the 522nd meeting of the Advisory Committee on Reactor Safeguards, May 5-6, 2005, we completed our review of the license renewal application for Arkansas Nuclear One, Unit 2 (ANO-2), and the associated final Safety Evaluation Report (SER) prepared by the NRC staff. Our Plant License Renewal Subcommittee also reviewed this matter during a meeting on December 1, 2004. During our review, we had the benefit of discussions with representatives of the NRC staff and Entergy Operations, Inc. (Entergy). We also had the benefit of the documents referenced. This report fulfills the requirements of 10 CFR 54.25 that the ACRS review and report on all license renewal applications.

CONCLUSION AND RECOMMENDATION

1. The programs established and committed to by the applicant to manage age-related degradation provide reasonable assurance that ANO-2 can be operated in accordance with its current licensing basis for the period of extended operation without undue risk to the health and safety of the public.

2. The Entergy application for renewal of the operating license for ANO-2 should be approved.

BACKGROUND AND DISCUSSION

ANO-2 is a Combustion Engineering pressurized water reactor rated at 3026 MWt, enclosed in a large dry containment building. The current power rating includes a 7.5% power uprate implemented in 2002. The ANO-2 steam generators were replaced with new Westinghouse Delta steam generators with Alloy 690 tubing in conjunction with this power uprate.

Entergy requested renewal of the ANO-2 operating license for 20 years beyond the current license term, which expires on July 17, 2018. In the final SER, the staff documents its review of the license renewal application and other information submitted by Entergy and obtained during the audits and inspections at the plant site. The staff reviewed the completeness of the applicant's identification of structures, systems, and components (SSCs) that are within the scope of license renewal; the integrated plant assessment process; the applicant's identification of plausible aging mechanisms associated with passive, long-lived components; the adequacy of the applicant's aging management programs; and the identification and assessment of time-limited aging analyses (TLAAs).

The ANO-2 application demonstrates consistency with the Generic Aging Lessons Learned (GALL) Report or documents deviations from the approaches specified in that report. The ANO-2 application is the second one evaluated by the staff using the new audit and review process developed to confirm consistency with, and the acceptability of deviations from, the GALL Report. The new process requires that more review activities be conducted at the site. As in the first application, this approach has resulted in more effective interactions between the applicant and the staff and has significantly reduced requests for additional information (RAIs).

During its review, the staff identified several components that the applicant should have included in the scope of license renewal but did not. The applicant subsequently brought them into scope. The staff concluded that these omissions were the result of minor oversights or different interpretations of the scoping methodology, and not an indication of process problems. The staff also concluded that the applicant's scoping and screening processes have successfully identified SSCs within the scope of license renewal and subject to an aging management review. We agree with these conclusions.

The applicant performed a comprehensive aging management review of all SSCs within the scope of license renewal. In the application, Entergy describes 34 aging management programs for license renewal, including existing, enhanced, and new programs. We agree with the staff's conclusion that these programs are adequate.

Implementation is key to effective aging management programs. Although the applicant's Structures Monitoring-Masonry Wall Program is consistent with the GALL Report, the staff's audit of this program revealed that the initial baseline examinations were not documented properly, the first 5-year reexamination was not performed, and qualifications for personnel responsible for walkdowns were not established. The Annual Assessment Letter for ANO, Units 1 and 2, dated March 3, 2004, had already identified a substantive cross-cutting issue concerning problem identification and resolution. Based on the Annual Assessment Letter dated March 2, 2005, the weaknesses in the ANO-2 Problem Identification and Resolution Program appear to have been corrected. Maintaining an effective problem identification and resolution program is critical to the success of the aging management programs.

As in previous reviews, we questioned the adequacy of relying on opportunistic inspections of inaccessible buried piping and tanks, in lieu of periodic inspections at a plant-specific frequency, as specified in the GALL Report. The applicant has committed to enhance its Buried Piping Inspection Program by performing an inspection within 10 years of entering the period of extended operation unless an opportunistic inspection has occurred within this 10-year period. This program enhancement is appropriate.

The applicant identified and reevaluated systems and components requiring TLAAs for 20 more years of operation. The applicant's analyses of reactor vessel embrittlement (upper shelf energy, pressurized thermal shock, and pressure-temperature limits), independently verified by the staff, demonstrate that the limiting beltline materials will satisfy the acceptance criteria at 48 effective full-power years (EFPYs). This value corresponds to a constant capacity factor of 80% for 60 years. We questioned the use of 48 EFPYs, rather than the 54 EFPYs used by other applicants to bound 60 years of operation. Given the current performance of the fleet, 54 EFPYs seems to be a more appropriate value for 60 years of operation. The staff independently verified that the upper shelf energy and pressurized thermal shock acceptance criteria would still be met at 54 EFPYs.

In 2000, nondestructive examinations revealed a number of leaks in pressurizer and hot-leg penetration nozzles. The applicant implemented repairs using the half-nozzle repair technique. The applicant evaluated the potential for existing flaws in the remaining pressurizer and hot-leg penetration welds to propagate into the pressurizer or hot leg. The applicant has performed a TLAA to bound the period of extended operation and has demonstrated that stress corrosion cracking will not cause existing flaws to propagate into the carbon steel or low-alloy steel base metal.

Since a shroud prevents a complete 360° bare metal visual inspection of some of the control rod drive mechanism (CRDM) penetrations, the applicant performed alternative eddy current and volumetric inspections. Although these inspections did not identify any cracking or leakage, ANO-2 is ranked as highly susceptible to CRDM cracking. The applicant has scheduled the procurement of a new reactor vessel head in 2006. Meanwhile, the applicant plans to modify the shroud to allow increased access for visual examinations.

We agree with the staff that no issues related to the matters described in 10 CFR 54.29(a)(1) and (a)(2) preclude renewal of the operating license for ANO-2. The programs established and committed to by Entergy provide reasonable assurance that ANO-2 can be operated in accordance with its current licensing basis for the period of extended operation without undue risk to the health and safety of the public. The Entergy application for renewal of the operating license for ANO-2 should be approved.

Sincerely,

/RA/

Graham B. Wallis
Chairman

References

1. U.S. Nuclear Regulatory Commission, "Safety Evaluation Report Related to the License Renewal of the Arkansas Nuclear One, Unit 2," April 2005
2. Entergy Operations Inc., "License Renewal Application Arkansas Nuclear One - Unit 2," October 2003
3. U.S. Nuclear Regulatory Commission, "Draft Safety Evaluation Report Related to the License Renewal of the Arkansas Nuclear One, Unit 2," November 2004
4. U.S. Nuclear Regulatory Commission, "Arkansas Nuclear One, Unit 2 - NRC License Renewal Scoping and Screening Inspection Report 05000368/2004-06," April 19, 2004

5. Information Systems Laboratories, Inc., "Audit and Review Report for Plant Aging Management Reviews and Programs, Arkansas Nuclear One - Unit 2," July 29, 2004

6. CONCLUSIONS

The staff of the U.S. Nuclear Regulatory Commission (NRC or Commission) reviewed the license renewal application for Arkansas Nuclear One, Unit 2, in accordance with Commission regulations and NUREG-1800, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants," dated July, 2001. Title 10, Section 54.29, of the Code of Federal Regulations (10 CFR 54.29) provides the standards for issuance of a renewed license.

On the basis of its evaluation of the license renewal application, the NRC staff has determined that the requirements of 10 CFR 54.29(a) have been met.

The NRC staff notes that any requirements of Subpart A of 10 CFR Part 51 are documented in Supplement 19 to NUREG-1437, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants: Regarding Arkansas Nuclear One - Unit 2. Final Report", dated April 2005.

APPENDIX A: COMMITMENTS FOR LICENSE RENEWAL

During the review of the Arkansas Nuclear One, Unit 2, LRA by the NRC staff, the applicant made commitments related to aging management programs (AMPs) to manage aging effects of structures and components (SCs) prior to the period of extended operation. 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	ANO-2 will submit a description of the Alloy 600 Aging Management Program, which includes the inspection plan, to the NRC staff for review and approval.	At least 24 months prior to the period of extended operation	Letter 2CAN090402, Attachment 2, pg 6.
2	The FSAR Supplement A.2.1.1 will be revised to state the following: The Alloy 600 Aging Management Program will manage aging effects of alloy 600/690 items and alloy 52/152 and 82/182 welds in the reactor coolant system that are not addressed by the Reactor Vessel Head Penetration Inspection Program, Section A.2.1.21, and the Steam Generator Integrity Program, Section A.2.1.26. This program will detect primary water stress corrosion cracking (PWSCC) by using the examination and inspection requirements of ASME Section XI, as augmented by the commitments made by the applicant in NRC correspondence.	Upon issuance of the renewed license.	Letter 2CAN090403, Attachment 1, pg 2 Letter 2CAN090403, Attachment 1

ITEM NUMBER	COMMITMENT	IMPLEMENTATION SCHEDULE	SOURCE
3	A description of the Alloy 600 Aging Management Program, which includes the inspection plan, will be submitted to the NRC for review and approval. The submittal date will be at least 24 months prior to the period of extended operation.	At least 24 months prior to the period of extended operation	Letter 2CAN090403, Attachment 2, pg 1.
	Buried Piping Inspection Program		
4	The Buried Piping Inspection Program will include preventive measures to mitigate corrosion and periodic inspection to manage the effects of corrosion on buried carbon steel piping. Preventive measures will be in accordance with standard industry practice for maintaining external coatings and wrappings. Buried pipes will be inspected when they are excavated during maintenance.	Prior to entering the period of extended operation.	ANO-2 LRA, Appendix A, Section A.2.1.4
	Cast Austenitic Stainless Steel (CASS) Evaluation Program		
5	The CASS evaluation program will augment the inspection of reactor coolant system components in accordance with the ASME Boiler and Pressure Vessel Code, Section XI. The CASS evaluation program will manage the effects of loss of fracture toughness in reactor coolant system CASS components susceptible to thermal aging embrittlement using additional inspections and a component-specific flaw tolerance evaluation.	Prior to entering the period of extended operation.	ANO-2 LRA, Appendix A, Section A.2.1.5.

ITEM NUMBER	COMMITMENT	IMPLEMENTATION SCHEDULE	SOURCE
	Environmental Qualification of Electrical Components		
6	Entergy will continue to include the entire length of cable from the detector to the control room instrumentation in the EQ program during the period of extended operation even though this is not required by 10 CFR 50.49.	Prior to entering the period of extended operation.	Letter 2CAN010401, Attachment 1, pg 1.
	Fire Water System Program		
7	The Fire Water System Program will be enhanced to inspect a sample of sprinkler heads using the guidance in NFPA 25.	Prior to entering the period of extended operation..	ANO-2 LRA, Appendix A, Section A.2.1.11.

ITEM NUMBER	COMMITMENT	IMPLEMENTATION SCHEDULE	SOURCE
	Heat Exchanger Monitoring Program		
8	The Heat Exchanger Monitoring Program will manage loss of material and cracking, as applicable, on heat exchangers in various systems. The Heat Exchanger Monitoring Program will inspect heat exchangers for degradation using non-destructive examinations, such as eddy-current inspections and visual inspections. If degradation is found, then an evaluation will be performed to determine its effects on the heat exchanger's design functions. The acceptance criterion for the tube eddy current inspections of the heat exchanger monitoring program will be wall-loss less than 60% through-wall. Ferritic stainless steel tubes in the shutdown cooling heat exchanger of the Heat Exchanger Monitoring Program will be monitored, where practical, using appropriate non-destructive examination (NDE) techniques such as eddy current testing with specific NDE processes suitable for ferritic stainless material.	Prior to entering the period of extended operation.	ANO-2 LRA, Appendix A, Section A.2.1.13. Letter 2CAN010401 Attachment 1, pg 2 Letter 2CAN010401 Attachment 1, pg 2
9	Entergy will perform a fatigue evaluation showing the acceptability of the regenerative heat exchangers for the period of extended operation or the regenerative heat exchangers will be replaced.	Prior to the end of the current operating license term.	Letter 2CAN030401 Attachment 1, pg 2
	Non-EQ Insulated Cables and Connections Program		
10	The Non-EQ Insulated Cables and Connections Program will apply to accessible (i.e., able to be approached and viewed easily) insulated cables and connections installed in structures within the scope of license renewal and prone to adverse	During the period of extended operation.	ANO-2 LRA, Appendix A, Section A.2.1.17.

ITEM NUMBER	COMMITMENT	IMPLEMENTATION SCHEDULE	SOURCE
	Periodic Surveillance and Preventive Maintenance		
11	The Periodic Surveillance and Preventive Maintenance (PSPM) Program will manage the effects of aging on flexible hoses through visual examination of external and internal surfaces. This visual examination looks for evidence of cracking and changes in material properties such as loss of flexibility and embrittlement. The flexibility of the hoses will be verified through physical manipulation of the hose concurrent with the visual inspection. The details on inspection criteria and frequency for the flex hoses that are included in the PSPM Program will be determined prior to entering the period of extended operation. It is expected that a visual inspection of the internal and external surfaces will be performed. However, it may be determined that periodic replacement of the hoses is preferable and inspections will not be performed. If evidence of degradation is detected, the hoses will be replaced. These hoses will be inspected at least once every 10 years. The hoses that credit the PSPM Program are in the emergency diesel generator, fuel oil, alternate AC, and nitrogen systems. Alternatively, periodic replacement of the hose may be implemented in lieu of periodic inspection.	Prior to entering the period of extended operation.	Letter 2CAN080401 Attachment 2, pg 3 Letter 2CAN060402 Attachment 2, pg 1

ITEM NUMBER	COMMITMENT	IMPLEMENTATION SCHEDULE	SOURCE

ITEM NUMBER	COMMITMENT	IMPLEMENTATION SCHEDULE	SOURCE
	Reactor Vessel Internals Cast Austenitic Stainless Steel (CASS) Program		
15	The Reactor Vessel Internals CASS Program will manage aging effects of cast austenitic stainless steel reactor vessel internals components. This program will supplement the reactor vessel internals inspections required by the ASME Section XI Inservice Inspection Program. The program will manage cracking, reduction of fracture toughness, and dimensional changes using inspections of applicable components which will be determined based on the neutron fluence and thermal embrittlement susceptibility of the component. A description of the the Reactor Vessel Internals CASS Program, which includes the inspection plan, will be submitted to the NRC for review and approval.	At least 24 months prior to the period of extended operation	ANO-2 LRA, Appendix A, Section A.2.1.23. Letter 2CAN090402 Attachment 2, pg 7 Letter 2CAN100403, Attachment 2, pg 1
16	ANO-2 will begin inspections under the Reactor Vessel (RV) Internals CASS Program during the 20-year period of extended operation, and the inspections will be performed once during the period. ANO-2 plans to perform the inspections of the RV internals CASS components in the fifth inspection interval. The need for subsequent inspections will be based on the results from this inspection.	During the period of extended operation.	Letter 2CAN050401 Attachment 2, pg 1
17	Engineering Report A2-EP-2002-002-0, Section 3.8.2.B.5, Detection of Aging Effects will be revised to reference enhanced VT-1 only as follows, "The enhanced VT 1 examinations of CASS reactor vessel internal parts will be performed one time during the period of extended operation.	Prior to entering the period of extended operation.	Letter 2CAN050401 Attachment 2, pg 2

ITEM NUMBER	COMMITMENT	IMPLEMENTATION SCHEDULE	SOURCE
18	Table 5.2-12, note (a) of the FSAR will be revised to add the following statement: The ANO-2 specimen capsule withdrawal schedule will be revised to withdraw and test a standby capsule to cover the peak fluence expected through the end of the period of extended operation.	Upon Issuance of the renewed licences.	Letter 2CAN010401 Attachment 1, pg 1

ITEM NUMBER	COMMITMENT	IMPLEMENTATION SCHEDULE	SOURCE
	Reactor Vessel Internals Stainless Steel Plates, Forgings, Welds, and Bolting Program		
19	The Reactor Vessel Internals Stainless Steel Plates, Forgings, Welds, and Bolting Program will manage aging effects of reactor vessel internals plates, forgings, welds, and bolting. This program will supplement the reactor vessel internals inspections required by the ASME Section XI inservice inspection program. This program will manage the effects of crack initiation and growth due to stress corrosion cracking or irradiation assisted stress corrosion cracking, loss of fracture toughness due to neutron irradiation embrittlement, and distortion due to void swelling. This program will provide visual inspections and non-destructive examinations of reactor vessel internals. In the development of this program, Entergy will support reactor vessel internals aging effects research through EPRI, the Materials Reliability Program, and other applicable industry efforts to better characterize the internals aging effects and to provide material property data to generate acceptance standards for inspections. Appropriate examination techniques will be selected based on the results of these industry efforts. A description of this program, which includes the inspection plan, will be submitted to the NRC for review and approval.	At least 24 months prior to the period of extended operation.	ANO-2 LRA, Appendix A, Section A.2.1.24. Letter 2CAN050401 Attachment 2, pg 2 Letter 2CAN090402 Attachment 2, pg 7 Letter 2CAN100403, Attachment 2, pg 1

ITEM NUMBER	COMMITMENT	IMPLEMENTATION SCHEDULE	SOURCE
20	Engineering Report A2-EP-2003-002-0, Section 3.8.1.B 6.b will be revised to include the following statement: "Any indication or relevant condition of degradation will be evaluated in accordance with ASME Code Section XI, IWB-3100 by comparing inservice inspection results with acceptance standards of IWB-3400 and IWB-3500."	Prior to entering the period of extended operation.	Letter 2CAN090402 Attachment 2, pg 2
	Steam Generator Integrity Program		
21	The ANO-2 Steam Generator Integrity Program manages the applicable aging effects for the anti-vibration bars and tube support plates. The program requires visual inspection of the steam generator lower internals (tube support structures and tube bundle). This inspection is completed at least once every five years. This inspection checks for loose parts as well as corrosion and other damage in this region. An integrity assessment is performed after each steam generator inspection which addresses all known degradation mechanisms in the steam generator being evaluated. The ANO-2 Steam Generator Integrity Program will include visual inspection of the steam generator lower internals (tube support structures and tube bundle including the U-bend). This inspection is completed at least once every five years. This inspection checks for loose parts as well as corrosion and other damage in this region. The steam generator upper internals (moisture separators) require a thorough visual inspection once every five years. This inspection examines for mechanical damage, corrosion, or other unusual conditions.	During the period of extended operation.	Letter 2CAN070404 Attachment 2, pg 1

ITEM NUMBER	COMMITMENT	IMPLEMENTATION SCHEDULE	SOURCE
	Service Water Integrity Program		
22	The Service Water Integrity Program will be enhanced to check for evidence of selective leaching during visual inspections. Specific details on the enhancements to the Service Water Integrity Program for managing loss of material due to selective leaching will be developed prior to the period of extended operation. The enhancements to the program to manage loss of material due to selective leaching will be consistent with NUREG-1801 Aging Management Program XI.M33 which includes hardness testing.	Prior to entering the period of extended operation.	Letter 2CAN070409 Attachment 2, pg 1
	Structures Monitoring - Masonry Wall Program		
23	The Structures Monitoring - Masonry Wall Program will manage cracking of masonry walls within the scope of license renewal. Masonry walls are visually inspected as part of the Structures Monitoring - Masonry Wall Program conducted pursuant to the Maintenance Rule, 10CFR50.65.	During the period of extended operation.	ANO-2 LRA, Appendix A, Section A.2.1.27.

ITEM NUMBER	COMMITMENT	IMPLEMENTATION SCHEDULE	SOURCE
	Structures Monitoring - Structural Monitoring		
24	Wells are no longer available for sampling groundwater. Consequently, in lieu of sampling groundwater to confirm that it remains non-aggressive, concrete exposed to groundwater is included in the Structures Monitoring - Structural Monitoring Program for inspection to confirm the absence of aging effects. Under the Structures Monitoring - Structural Monitoring Program concrete exposed to lake water is periodically inspected. Since lake water chemistry is representative of groundwater chemistry, results of these inspections will be representative of underground concrete exposed to groundwater. In addition, when excavated for maintenance activities, inaccessible concrete exposed to groundwater will be visually inspected under the Structures Monitoring - Structural Monitoring Program.	During the period of extended operation.	Letter 2CAN080401 Attachment 2, pg 1
	System Walkdown Program		
25	The System Walkdown Program will include inspections to manage loss of material, loss of mechanical closure integrity and cracking, as applicable, for systems and components within the scope of license renewal. The program will use general visual inspections of readily accessible system and component surfaces during system walkdowns.	Prior to entering the period of extended operation.	ANO-2 LRA, Appendix A, Section A.2.1.29.
	Wall Thinning Monitoring Program		
26	In lieu of disassembling the expansion joints in the AAC diesel, nondestructive examinations such as ultrasonic testing of the expansion joints will be performed as part of the Wall Thinning Monitoring Program to detect loss of material and cracking.	During the period of extended operation.	Letter 2CAN060402 Attachment 2, pg 1

ITEM NUMBER	COMMITMENT	IMPLEMENTATION SCHEDULE	SOURCE
27	Wall thickness will be the parameter monitored for the Wall Thinning Monitoring Program. The method of detection of aging effects will be non-destructive examinations using industry-accepted methods, such as ultrasonic testing, to determine wall thickness of susceptible components. Inspections will be performed to ensure wall thickness is above the minimum required in order to avoid failures.	During the period of extended operation.	ANO-2 LRA, Appendix A, Section A.2.1.30. Letter 2CAN010401 Attachment 1, pg 2
	Water Chemistry Control - Primary and Secondary Water Chemistry Control Program		
28	The FSAR Supplement for the Primary and Secondary Water Chemistry Program, LRA Section A.2.1.33, will be revised to include a reference to the EPRI reports TR-105714 and TR-102134 used in the development of the program.	Upon issuance of the renewed license	Letter 2CAN050401 Attachment 2, pg 2

ITEM NUMBER	COMMITMENT	IMPLEMENTATION SCHEDULE	SOURCE
	One-Time Inspection Program		
29	ANO-2 will implement a One-Time Inspection Program for the components subject to aging management review that were included for 10CFR54.4(a)(2) in the following systems. • Auxiliary building heating and ventilation • Auxiliary building sump • Drain collection header • Liquid radwaste management • Post accident sampling • Resin transfer • Regenerative waste • Spent resin The ANO-2 One-Time Inspection Program will be consistent with the program description in NUREG-1801 Vol. 2, XI.M32, One-Time Inspection. Adverse conditions identified during the inspections will be addressed as part of the ANO-2 Corrective Action Program. Corrective actions may include additional inspections, if warranted based on the inspection results.	Prior to entering the period of extended operation.	Letter 2CAN090402 Attachment 2, pg 2

ITEM NUMBER	COMMITMENT	IMPLEMENTATION SCHEDULE	SOURCE
30	The following description of the One-Time Inspection Program will be added to the FSAR Supplement as Section A.2.1.34: A.2.1.34 ONE-TIME INSPECTION The One-Time Inspection Program confirms that the aging effects are being adequately managed for components in raw or untreated water. This program will perform destructive or nondestructive inspections on internal surfaces of a sample of components in the following systems. • Auxiliary building heating and ventilation • Auxiliary building sump • Drain collection header • Liquid radwaste management • Post accident sampling • Resin transfer • Regenerative waste • Spent resin The One-Time Inspection Program will be initiated prior to the period of extended operation.	Upon Issuance of renewed license	Letter 2CAN090402 Attachment 2, pg 3

ITEM NUMBER	COMMITMENT	IMPLEMENTATION SCHEDULE	SOURCE
	Concrete Containment Tendon Prestress		
31	Loss of tendon prestress will be managed during the period of extended operation by continued implementation of tendon inspections required by ASME Code Section XI IWL. Relevant operating experience, including experience with prestressing systems described in NRC Information Notice (IN) 99-10, will be considered during inspections and data analysis. Prior to the entering the period of extended operation, trend lines for ANO-2 tendon prestressing forces will be developed using regression analysis in accordance with guidance provided in NRC Information Notice (IN) 99-10. If future tendon examination data diverge from the expected trend, the discrepancy will be addressed in accordance with requirements of the Containment Inservice Inspection (ISI) Program (IWE/IWL) and the current licensing basis. Specifically, if prestressing force trend lines indicate that existing prestressing forces in the containment would go below the minimum required values (MRVs) prior to the next scheduled inspection (Reference 10CFR50.55a(b)(2)(ix)(B) or 10CFR50.55a(b)(2)(viii)(B)), then systematic retensioning of tendons, a reanalysis of the containment or a reanalysis of the post-tensioning system is required to ensure the design adequacy of containment.	Prior to entering the period of extended operation.	Letter 2CAN090402 Attachment 2, pg 4

ITEM NUMBER	COMMITMENT	IMPLEMENTATION SCHEDULE	SOURCE
32	The FSAR Supplement for Section A.2.2.4 will be revised as follows: **A.2.2.4 CONCRETE CONTAINMENT TENDON PRESTRESS** The analysis of loss of prestress in the containment building post-tensioning system is a time-limited aging analysis. Loss of tendon prestress in the containment building post-tensioning system will be managed for license renewal in accordance with the Containment ISI Program. This program, discussed in Section A.2.1.14, includes tendon surveillance testing. Prior to the period of extended operation, trend lines for ANO-2 tendon prestressing forces will be developed using regression analysis in accordance with guidance provided in NRC IN 99 10. If prestressing force trend lines indicate that existing prestressing forces in the containment would go below the minimum required values (MRVs) prior to the next scheduled inspection (Reference 10CFR50.55a(b)(2)(ix)(B) or 10CFR 50.55a(b)(2)(viii)(B)), then systematic retensioning of tendons, a reanalysis of the containment or a reanalysis of the post tensioning system is required to ensure the design adequacy of containment.	Upon issuance to the renewed license.	Letter 2CAN090402 Attachment 2, pg 5

ITEM NUMBER	COMMITMENT	IMPLEMENTATION SCHEDULE	SOURCE
	Reactor Coolant Pump Flywheel		
33	The FSAR Supplement for Section A.2.2.6.6 will be revised as follows: The flaw growth analysis associated with the reactor coolant pump motor flywheel is conservatively treated as a time-limited aging analysis. The analysis addresses the growth of pre-existing cracks subjected to 4,000 reactor coolant pump motor startup or shutdown cycles, which exceeds by a factor of eight the number of RCP cycles projected through the period of extended operation. Therefore, the flaw growth analysis remains valid for the period of extended operation.	Upon issuance of the renewed license.	Letter 2CAN090402 Attachment 2, pg 6
	Miscellaneous Systems		
34	The FSAR Supplement will be revised as follows: The Quality Assurance Program implements the requirements of 10CFR50, Appendix B. The Quality Assurance Program includes the elements of corrective action, confirmation process, and administrative controls and is applicable to all aging management programs credited for license renewal including programs for safety-related and non-safety related structures, systems and components.	Upon issuance of the renewed license.	Letter 2CAN050403 Attachment 2, pg 1
35	The intake canal is periodically inspected as part of the ANO Maintenance Rule Program. Periodic inspections will continue during the period of extended operation.	During the period of extended operation.	Letter 2CAN080401 Attachment 2, pg 1

ITEM NUMBER	COMMITMENT	IMPLEMENTATION SCHEDULE	SOURCE
36	Periodic maintenance will be used to manage the loss of material in the Starting Air System for the AAC diesel. The use of periodic maintenance will ensure the proper operation of the air dryers such that significant moisture will not be entrained in the portion of the system that is subject to aging management review.	During the period of extended operation.	Letter 2CAN060402 Attachment 2, pg 1
37	Periodic inspections will be used to manage the loss of material in the Starting Air System for the EDGs.	During the period of extended operation.	Letter 2CAN060402 Attachment 2, pg 1
38	For gray cast iron, ANO-2 will manage loss of material due to selective leaching by one of the following programs that include the management of loss of material due to selective leaching. Periodic Surveillance and Preventive Maintenance Service Water Integrity Program Fire Protection Program	During the period of extended operation.	Letter 2CAN030401 Attachment 1, pg 1
	Environmentally-Assisted Fatigue (GSI-190)		
39	Should ANO-2 select the inspection option (Option 4) to manage environmentally-assisted fatigue, details of the scope, qualification, method, and frequency of the inspections will be provided to the NRC for review and approval prior to entering the period of extended operation.	Prior to entering the period of extended operation.	License Renewal Application, pg. 4.3-6

ITEM NUMBER	COMMITMENT	IMPLEMENTATION SCHEDULE	SOURCE
	Non-EQ Inaccessible Medium-Voltage Cables		
40	The ANO-2 "Non-EQ Inaccessible Medium-Voltage Cable Program" will include testing of underground medium-voltage cables exposed to significant voltage that perform a license renewal intended function, regardless of preventive actions to prevent exposure to significant moisture.	Prior to entering the period of extended operation.	Letter 2CAN020502 Attachment 1, pg 1
	Additional Commitments		
41	The chemistry procedure and engineering report will be revised to address loss of the passive layer if chemistry limits are out of specification for an extended period.	Prior to entering the period of extended operation	Letter 2CAN120403 Attachment 1, pg 1
42	The PSPM Program will be revised to include an inspection of the alternate AC diesel generator starting air tank.	Prior to entering the period of extended operation	Letter 2CAN120403 Attachment 1, pg 1

APPENDIX B: CHRONOLOGY

This appendix contains a chronological listing of the routine licensing correspondence between the U.S. Nuclear Regulatory Commission (NRC) staff and the Entergy Operations, Inc. (Entergy), and other correspondence regarding the NRC staff's reviews of the Arkansas Nuclear One, Unit 2 (ANO-2), (under Docket Number 50-368) license renewal application (LRA).

October 14, 2003	In a letter (signed by C. Anderson), Entergy submitted its LRA for the Arkansas Nuclear One, Unit 2. ML032890492
October 21, 2003	In a letter (signed by P. Kuo), NRC informed Entergy of the receipt of the LRA for ANO-2 and Gregory Suber will be the PM for safety review and Thomas Kenyon will be PM for environmental review. ML032940160
November 14, 2003	In a letter (signed by P. Kuo), NRC informed Entergy the LRA was accepted and sufficient for docketing and proposed review schedule and issued notice of opportunity for hearing for the LRA of ANO-2. ML033210028
January 22, 2004	In a letter (signed by T. Mitchell), Entergy provided clarifications related to questions from the staff's aging management audit. ML040300229
February 20, 2004	In a letter (signed by G. Suber), NRC provided Entergy a revised schedule for the conduct of review for ANO-2. ML040550582
February 26, 2004	In a memorandum (signed by G. Suber), NRC summarized the December 15 and 16, 2004 conference calls between the NRC staff and Entergy regarding draft Request for Additional Information (RAI) concerning the staff's review of the LRA. ML040610542
March 8, 2004	In a letter (signed by G. Suber), NRC provided ANO-2 requests for additional information concerning its review of the LRA. ML040710466
March 24, 2004	In a letter (signed by G. Suber), NRC provided ANO-2 requests for additional information concerning its review of the LRA. ML040710466
March 29, 2004	In a letter (signed by T. Mitchell), Entergy provided clarifications related to questions from the staff's aging management audit. ML040860665
April 6, 2004	In a letter (signed by T. Mitchell), Entergy provided responses to NRC concerning RAIs related to the staff's review of the LRA. ML041000168
April 13, 2004	In a letter (signed by G. Suber), NRC provided ANO-2 requests for additional information concerning its review of the LRA. ML041050820
April 14, 2004	In a letter (signed by G. Suber), NRC provided ANO-2 requests for additional information concerning its review of the LRA. ML041050858

April 19, 2004	In a letter (signed by L. Smith), NRC provided Entergy the Screening and Scoping Inspection Report 05000368/2004-06. ML041100648
April 23, 2004	In a letter (signed by G. Suber), NRC provided ANO-2 requests for additional information concerning its review of the LRA. ML041200384
May 5, 2004	In a letter (signed by G. Suber), NRC provided ANO-2 requests for additional information concerning its review of the LRA. ML041280554
May 11, 2004	In a letter (signed by G. Suber), NRC provided ANO-2 requests for additional information concerning its review of the LRA. ML041330486
May 17, 2004	In a letter (signed by G. Suber), NRC provided ANO-2 requests for additional information concerning its review of the LRA. ML041380284
May 19, 2004	In a letter (signed by T. Mitchell), Entergy provided responses to NRC concerning RAIs related to the staff's review of the LRA. ML041420057
May 19, 2004	In a letter (signed by T. Mitchell), Entergy provided responses to NRC concerning RAIs related to the staff's review of the LRA. ML041420062
May 19, 2004	In a letter (signed by T. Mitchell), Entergy provided responses to NRC concerning RAIs related to the staff's review of the LRA. ML041420067
May 19, 2004	In a letter (signed by T. Mitchell), Entergy provided responses to NRC concerning RAIs related to the staff's review of the LRA. ML041420060
May 24, 2004	In a letter (signed by T. Mitchell), Entergy provided responses to NRC concerning RAIs related to the staff's review of the LRA. ML041480292
May 25, 2004	In a letter (signed by G. Suber), NRC provided ANO-2 requests for additional information concerning its review of the LRA. ML041470021
May 26, 2004	In a letter (signed by G. Suber), NRC provided ANO-2 requests for additional information concerning its review of the LRA. ML041480134
June 10, 2004	In a letter (signed by T. Mitchell), Entergy provided responses to NRC concerning RAIs related to the staff's review of the LRA. ML041670312
June 11, 2004	In a letter (signed by G. Suber), NRC provided ANO-2 requests for additional information concerning its review of the LRA. ML041620247
June 16, 2004	In a letter (signed by T. Mitchell), Entergy provided responses to NRC concerning RAIs related to the staff's review of the LRA. ML041700183
June 21, 2004	In a memorandum (signed by G. Suber), NRC summarized the May 20, 2004 conference call between the NRC staff and Entergy regarding draft Request for Additional Information (RAI) concerning the staff's review of the LRA. ML041730571

June 21, 2004	In a memorandum (signed by G. Suber), NRC summarized the March 24 and April 16, 2004 conference calls between the NRC staff and Entergy regarding draft Request for Additional Information (RAI) concerning the staff's review of the LRA. ML041730526
June 21, 2004	In a letter (signed by T. Mitchell), Entergy provided responses to NRC concerning RAIs related to the staff's review of the LRA. ML041750125
June 21, 2004	In a letter (signed by T. Mitchell), Entergy provided responses to NRC concerning RAIs related to the staff's review of the LRA. ML041750119
June 23, 2004	In a memorandum (signed by G. Suber), NRC summarized the March 24 and May 27, 2004 conference calls between the NRC staff and Entergy regarding draft Request for Additional Information (RAI) concerning the staff's review of the LRA. ML041770037
June 24, 2004	In a letter (signed by G. Suber), NRC provided ANO-2 requests for additional information concerning its review of the LRA. ML041770557
July 01, 2004	In a letter (signed by T. Mitchell), Entergy provided responses to NRC concerning RAIs related to the staff's review of the LRA. ML041880147
July 22, 2004	In a letter (signed by T. Mitchell), Entergy provided responses to NRC concerning RAIs related to the staff's review of the LRA. ML042160356
July 22, 2004	In a letter (signed by T. Mitchell), Entergy provided responses to NRC concerning RAIs related to the staff's review of the LRA. ML042160349
July 22, 2004	In a letter (signed by T. Mitchell), Entergy provided responses to NRC concerning RAIs related to the staff's review of the LRA. ML042160860
August 18, 2004	In a letter (signed by D James), Entergy provided clarification responses to NRC concerning RAIs related to the staff's review of the LRA. ML042660110
Sept. 10, 2004	In a letter (signed by D. James), Entergy provided clarification responses to NRC concerning RAIs related to the staff's review of the LRA. ML042390431
Sept. 23, 2004	In a letter (signed by D. James), Entergy provided responses to NRC concerning RAIs related to the staff's review of the LRA. ML042790302
October 13, 2004	In a letter (signed by D. James), Entergy provided an annual update to the LRA. ML043010592
December 13, 2004	In a letter (signed by D. James), Entergy provided comments on the Draft Safety Evaluation Report. ML043560138

February 28, 2004	In a letter (signed by D. James), Entergy provided clarification on responses to RAIs related to the NRC staff's review of the LRA. ML050670491

APPENDIX C: PRINCIPAL CONTRIBUTORS

LICENSE RENEWAL AND ENVIRONMENTAL IMPACTS PROGRAM

Name	RESPONSIBILITY
Pao-Tsin Kuo	Branch Chief
Samson Lee	Section Chief
Gregory Suber	Project Manager
Thelma Davis	Clerical Support
Yvonne Edmonds	Administrative Support
Melissa Jenkins	Administrative Support
Kimberley Corp	Technical Support
Juan Ayala	Technical Support
Tae Kim	Technical Support
Kamishan Martin	Technical Support
Maurice Heath	Technical Support
Frank Akstulewicz	Management Supervision
Hansraj Ashar	Civil Engineering
Jose Calvo	Management Supervision
Terence Chan	Management Supervision
Stephanie Coffin	Management Supervision
Gregory Cranston	Team Leader
Robert Dennig	Management Supervision
Richard Dipert	Fire Protection
James Drake	Regional Inspector
Johnny Eads	Project Manager
Greg Galletti	Quality Assurance
George Georgiev	Materials Engineering
Raj Goel	Safety Assessment
Jin-Sien Guo	Plant Systems
Mark Hartzman	Civil Engineering
Gene Imbro	Management Supervision
Ronaldo Jenkins	Electrical Engineering
John Knox	Electrical Engineering
Carolyn Lauron	Materials Engineering
Arnold Lee	Mechanical Engineering
Andrea Lee	Materials Engineering
Chang Li	Plant Systems
Renee (Yueh-Li) Li	Mechanical Engineering
Tilda Liu	Project Management
Louise Lund	Management Supervision
John Ma	Civil Engineering
Kamal Manoly	Management Supervision
James Medoff	Materials Engineering
Richard McNally	Mechanical Engineering

Matthew McConnell	Electrical Engineering
Rebecca Nease	Inspection Team Leader
Duc Nguyen	Electrical Engineer
Janak Raval	Safety Assessment
Bill Roger	Quality Assurance
David Solorio	Management Supervision
David Terao	Management Supervision
Dale Thatcher	Management Supervision
George Thomas	Reactor Systems
John Tsao	Materials Engineering
Harold Walker	Safety Assessment
Steve West	Management Supervision
Sunil Weerakkody	Management Supervision

CONTRACTORS

Contractor	Technical Area
Kim Green	Mechanical Engineering
Richard Morante	Civil Engineering
Shuiwing Pam	Mechanical Engineering
Steve Pope	Team Leader

APPENDIX D: REFERENCES

This appendix contains a listing of references used in the preparation of the Safety Evaluation Report prepared during the review of the license renewal application for Arkansas Nuclear One, Unit 2, Docket Number 50-368.

American Society of Mechanical Engineers (ASME)

ASME Code, Section III

ASME Code, Section III, Class 1

ASME Code, Section III, Classes 2 and 3

ASME Code, Section III, Subsection NC-3200

ASME Code, Section VIII, Division 1

ASME Code, Section VIII, Division 2

ASME Code, Section VIII, Division 1; AWWA; or MSS

ASME Code, Sections VIII or III, Subsections NC or ND

ASME Code, Section XI

ASME Code, Section XI, Subsection IWL

ASME Code Appendix G to Section XI

ASME Code Case N-481

ASME Code Case N-588

ASME Code Case N-640, "Alternative Reference Fracture Toughness for Development of P-T Limit Curves, Section XI, Division 1,"

ANSI B31.1, Power Piping

American Society for Testing and Materials (ASTM)

ASTM E185-82, "Recommended Practice for Surveillance Tests for Nuclear Reactor Vessels"

ASTM E-185, "Standard Practice for Conducting Surveillance Tests for Light Water Cooled Nuclear Power Vessels"

ASTM standard D 1796, Standard Test Method for Water and Sediment in Fuel Oils by the Centrifuge Method (Laboratory Procedure), 2002

ASTM standard D 2709, Standard Test Method for Water and Sediment in Middle Distillate Fuels by Centrifuge, 2001

ASTM standard D 2276, Standard Test Method for Particulate Contaminant in Aviation Fuel by Line Sampling

ASTM Standard D 4057, Standard Practice for Manual Sampling of Petroleum and Petroleum Products, 2000

Code of Federal Regulations (CFR)

10 CFR 50.34a, Design Objectives for Equipment to Control Release of Radioactive Material In Effluents - Nuclear Power Reactors, US Nuclear Regulatory Commission

10 CFR 50.48, Fire Protection, US Nuclear Regulatory Commission

10 CFR 50.49, Environmental Qualification of Electric Equipment to Safety For Nuclear Power Plants, US Nuclear Regulatory Commission

10 CFR 50.55a, Codes and Standards, US Nuclear Regulatory Commission

10 CFR 50.59, Changes, Tests, and Experiments, US Nuclear Regulatory Commission

10 CFR 50.61, Fracture Toughness Requirement For Protection Against Pressurized Thermal Shock Events, US Nuclear Regulatory Commission

10 CFR 50.62, Requirements For Reduction of Risk From Anticipated Transients Without Scram (ATWS) Events For Light-Water-Cooled Nuclear Power Plants, US Nuclear Regulatory Commission

10 CFR 50.63, Loss of All Alternating Current Power, US Nuclear Regulatory Commission

10 CFR 50.67, Accident Source Term, US Nuclear Regulatory Commission

10 CFR 50 Appendix J, Primary Reactor Containment Leakage Testing For Water-Cooled Power Plants, US Nuclear Regulatory Commission

10 CFR 54.21, Contents of Application—Technical Information, US Nuclear Regulatory Commission

10 CFR Part 54, Requirements for Renewal of Operating Licenses for Nuclear Power Plants, US Nuclear Regulatory Commission

10 CFR 54.4, Scope, US Nuclear Regulatory Commission

10 CFR 54.30, Matters Not Subject To A Renewal Review, US Nuclear Regulatory Commission

10 CFR 100.11, Determination of Exclusion Area, Low Population Zone, and Population Center Distance, US Nuclear Regulatory Commission

29 CFR Chapter XVII, 1910.134, Respiratory Protection, US Nuclear Regulatory Commission

29 CFR Chapter XVII, 1926.134, Respiratory Protection, US Nuclear Regulatory Commission

42 CFR Chapter I, Part 84, Approval of Respiratory Protective Devices, US Nuclear Regulatory Commission

Entergy Operations, Inc.

Entergy Letter No. 0CAN070404, Response to NRC 2004-01 Regarding Inspection of Alloy 82/182/600 Materials Used in Pressurizer Penetrations and Steam Space Piping Components (July 27, 2004)

Entergy Letter No. Letter No. 2CAN090402, dated September 10, 2004.

Entergy Letter No. 2CAN090403, dated September 23, 2004

Engineering Report 02-R-2008-01, the Scoping Methods and Results Report

Engineering Report A2-EP-2002-004, "TLAA and Exemption Evaluation"

Engineering Report A2-ME-2003-001-0, Revision 1, Section 3.62, "Plant Heating," and Section 3.87, "Turbine Building Sump,"

Engineering Report A2-ME-2003-001-1, "Aging Management Review of Nonsafety-related Systems and Components Affecting Safety-related Systems"

Electric Power Research Institute (EPRI) and Material Reliability Program (MRP)

EPRI NP-1406-SR, "Nondestructive Examination Acceptance Standards."

EPRI NP-5067, Good Bolting Practices

EPRI NP-5569, Chromate Substitutes for Corrosion Inhibitors in Cooling Systems, December 1987

EPRI NP-5769, Degradation and Failure of Bolting in Nuclear Power Plants, Volumes 1 and 2, May 1988

EPRI TR-105714, PWR Primary Water Chemistry Guidelines: Vol. 1: Revision 4; Vol. 2: Revision 4 Volume 2, January 1999

EPRI TR-102134,Revision 5, PWR Secondary Water Chemistry Guidelines, January 1999

EPRI TR-104213, Bolted Joint Maintenance & Applications Guide, December 1995

EPRI TR-105504, Primer on Maintaining the Integrity of Water-Cooled Generator Stator Windings, October 1995

EPRI TR-107396, Closed Cooling Water Chemistry Guidelines, April 2004

Nuclear Energy Institute (NEI)

NEI 95-10, Industry Guidelines for Implementing the Requirement of 10CFR Part 54 The License Renewal Rule, Revision 3, March 2001

NEI 97-06, Steam Generator Program Guidelines

United States Nuclear Regulatory Commission (NRC)

Bulletins
(IE) Bulletin 79-01B, "Environmental Qualification of Class IE Equipment ," February 8, 1979

NRC Bulletin 88-08, "Thermal Stresses in Piping Connected to Reactor Coolant Systems," June 22, 1988

NRC Bulletin 88-11, "Pressurizer Surge Line Thermal Stratification," December 20, 1988

NRC Bulletin 2001-01, "Circumferential Cracking of Reactor Pressure Vessel Head Penetration Nozzles," August 3, 2001

NRC Bulletin 2002-01, "Reactor Pressure Vessel Head Degradation and Reactor Coolant Pressure Boundary Integrity," March 18, 2002

NRC Bulletin 2002-02, "Reactor Pressure Vessel Head and Vessel Head Penetration Nozzle Inspection Programs," August 9, 2002

NRC Bulletin 2004-01, "Inspection of Alloy 82/182/600 Materials Used in the Fabrication of Pressurizer Penetrations and Steam Space Piping Connections at Pressurized-Water Reactors," May 28, 2004

Executive Orders
NRC Order EA-03-009, ISSUANCE OF ORDER ESTABLISHING INTERIM INSPECTION REQUIREMENTS FOR REACTOR PRESSURE VESSEL HEADS AT PRESSURIZED WATER REACTORS

Generic Safety Issue
GSI-166, Adequacy of the Fatigue Life of Metal Components

GSI-168, EQ of Electrical Components

GSI-190, Fatigue Evaluation of Metal Components for 60-year Plant Life

Information Notices
NRC Information Notice (IN) 89-33, "Potential Failure of Westinghouse Steam Generator Tube Mechanical Plugs,"

NRC Information Notice (IN) 89-65, "Potential For Stress Corrosion Cracking in Steam Generator Tube Plugs Supplied by Babcock and Wilcox," September 8, 1989

NRC Information Notice (IN) 90-04, "Cracking of The Upper Shell-to-transition Cone Girth Welds in Steam Generators," January 26, 1990

NRC Information Notice (IN) 92-20, "Inadequate Local Leak Rate Testing"

NRC Information Notice (IN) 94-87, "Unanticipated Crack in a Particular Heat Of Alloy 600 Used For Westinghouse Mechanical Plugs For Steam Generator Tubes," December 1994

NRC Information Notice (IN) 99-10, "Degradation of Prestressing Tendon Systems in Prestressed Concrete Containment," October 1999

Generic Letters
NRC Generic Letter (GL) 88-05, "Boric Acid Corrosion Of Carbon Steel Reactor Pressure Boundary Component in PWR Plants," March 17, 1988

NRC Generic Letter (GL) 89-13, "Service Water System Problems Affecting Safety-Related Equipment," July 18, 1989

Inspection Reports
NRC 2004-01 Regarding Inspection of Alloy 82/182/600 Materials Used in Pressurizer Penetrations and Steam Space Piping Components (July 27, 2004)

NRC Inspections Guideline 71111.08, "Inservice Inspection Activities."

Miscellaneous
Interim Staff Guidance (ISG)-2, "NRC Staff Position on License Renewal Rule (10 CFR 54.4) As It Relates to the Station Blackout Rule (SBO) (10 CFR 50.63)

SECY-95-245, "Completion of the Fatigue Action Plan," September 25, 1995

Regulatory Information Summary (RIS) 2003-09

ISO 4406, "Hydraulic fluid power -- Fluids -- Method for coding the level of contamination by solid particles," 1999

NUREG-Series Reports
NUREG-0313, "Technical Report on Material Selection and Processing Guidelines for BWR Coolant Pressure Boundary Piping," U.S. Nuclear Regulatory Commission, July 1977, (Rev. 1) July 1980, (Rev. 2) January 1988

NUREG-1743, "Safety Evaluation Report Related to the License Renewal of Arkansas Nuclear One, Unit 1."

NUREG-1766, Section 2.1.3.1, "Safety Evaluation Report Related to the License Renewal of North Anna Power Station, Units 1 and 2, and Surry Power Station, Units 1 and 2," December 2002

NUREG-1800, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants," April 2001

NUREG-1801, "Generic Aging Lessons Learned (GALL) Report, U.S. Nuclear Regulatory Commission," April 2001

NUREG/CR-6177, "Assessment of Thermal Embrittlement of Cast Stainless Steels,"
"PWR Materials Reliability Project Interim Alloy 600 Safety Assessment for US PWR Plants (MRP-44), Part 1: Alloy 82/182 Pipe Butt Welds,"

NUREG/CR 6717, Section 5.3, "Environmental Effects on Fatigue Crack Initiation in Piping and Pressure Vessel Steels," May 2001.

Regulatory Guides
NRC Regulatory Guide 1.14, Revision 1, Reactor Coolant Pump Flywheel Integrity (August 1975)

NRC Regulatory Guide 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants

NRC Regulatory Guide 1.190, "Calculational and Dosimetry Methods for Determining Pressure Vessel Neutron Fluence (March 2001)"

NRC Regulatory Guide 1.46, "Protection Against Pipe Whip Inside Containment,"

NRC Regulatory Guide 1.99, Revision 2, "Radiation Embrittlement of Reactor Vessel Materials (May 1988),"

<u>**Industry Reports**</u>

Babcock & Wilcox
Babcock & Wilcox report BAW-2241P-A, Revision 1, "Fluence and Uncertainty Methodologies,"

Babcock and Wilcox report BAW-2241P-A, Revision 1, "Fluence and Uncertainty Methodologies," which was published in April 1999.

Babcock and Wilcox Topical Report BAW-2399, Analysis of Capsule W-104, Entergy Operations, Inc., Arkansas Nuclear One Unit 2 Power Plant (September 2001).

Combustion Engineering
CEN-367-A, Revision 000, Leak-Before-Break Evaluation of Primary Coolant Loop Piping in Combustion Engineering Designed Nuclear Steam Supply Systems

CE-NPSD-448, Review of Inhibitors used in Closed Cycle Cooling Water Systems

CE NPSD-1198-P, Revision 00, Low-Alloy Steel Component
Corrosion Analysis Supporting Small-Diameter Alloy 600/690 Nozzle Repair/Replacement Programs

Combustion Engineering Topical Report No. A-NLM-005, dated October 30, 1974

Combustion Engineering Topical Report No. TR-MCD-002, dated March 1976

Westinghouse Topical Reports (WCAP)
WCAP-15973-P, "Low-Alloy Steel Component Corrosion Analysis Supporting Small-Diameter Alloy 600/690 Nozzle Repair/Replacement Programs,"

APPENDIX E: REQUEST FOR ADDITIONAL INFORMATION

Request for Additional Information (RAI)	Issuance Date	Response Date
Section 1		
Section 2: Structures and Components Subject to Aging Management Review		
Section 2.1 Scoping and Screening Methodology		
RAI 2.1-1 RAI 2.1-2	February 26, 2004	May 19, 2004
RAI 2.1-3 RAI 2.1-4 RAI 2.1-5 RAI 2.1-6 RAI 2.1-7	April 13, 2004	May 19, 2004
Section 2.2 Plant Level Scoping		
RAI 2.2-1	May 11, 2004	June 10, 2004

Section 2.3 Systems Scoping and Screening: Mechanical		
RAI 2.3-1 RAI 2.3.3.3-1 RAI 2.3.3.4-1 RAI 2.3.3.11-1 RAI 2.3.3.12-1 RAI 2.3.3.12-2 RAI 2.3.3.12-3 RAI 2.3.4.1-1 RAI 2.3.4.2-1 RAI 2.3.4.3-1 RAI 2.3.4.3-2	May 11, 2004	June 10, 2004
RAI 2.3-1a RAI 2.3-1b RAI 2.3-1c RAI 2.3-2 RAI 2.3-3a RAI 2.3-3b RAI 2.3-4 RAI 2.3-5	April 8, 2004	May 19, 2004
RAI 2.3.1.1-1 RAI 2.3.1.4-1 RAI 2.3.1-2-1 RAI 2.3.1-2-2 RAI 2.3.1-2-3 RAI 2.3.1-2-6 RAI 2.3.1-2-7 RAI 2.3.1-2-8 RAI 2.3.1-3-1 RAI 2.3.1-5-1 RAI 2.3.1-5-2 RAI 2.3.1-5-3 RAI P&ID-1	April 23, 2004	May 24, 2004
Section 2.4 Scoping and Screening Results: Structures		
RAI 2.4-1a RAI 2.4-1b RAI 2.4-1c RAI 2.4-2 RAI 2.4-3 RAI 2.4-4 RAI 2.4-5 RAI 2.4-6 RAI 2.4-7 RAI 2.4-8	April 14, 2004	May 19, 2004

Section 2.5 Scoping and Screening Results: Electrical and Instrumentation Controls		
RAI 2.5-1	May 25, 2004	June 21, 2004
RAI 2.5-2	May 25, 2004	August 18, 2004
RAI 2.5-3	May 25, 2004	June 21, 2004

Section 3: Aging Management Review Results		
Section 3.1 Aging Management of Reactor Vessels, Internals, and Reactor Coolant System		
RAI 3.1.1-1	May 26, 2004	July 1, 2004
RAI 3.1.1-2		
RAI 3.1.1-3		
RAI 3.1.1-4		
RAI 3.1.2-1.1	June 11, 2004	July 22, 2004
RAI 3.1.2-1.2		
RAI 3.1.2-1.3		
RAI 3.1.2-1.4		
RAI 3.1.2-2.1		
RAI 3.1.2-3.1		
RAI 3.1.2-4.1		
RAI 3.1.2-4.2		
RAI 3.1.2-4.5		
RAI 3.1.2-5.1	May 26, 2004	July 1, 2004
RAI 3.1.2-5.2		
RAI 3.1.2-5.3		
RAI 3.1.2-5.4		
RAI 3.1.2-5.5		
RAI 3.1.2-5.6	May 26, 2004	July 1, 2004
RAI 3.1.2-5.7		
RAI 3.1.2-5.8		
RAI 3.1.2-5.9		
RAI 3.1.2-5.10		
RAI 3.1.2-5.11		
RAI 3.1.2-5.12		
RAI 3.1.2-5.13		
RAI 3.1.2-5.14		

Section 3.2 Aging Management of Engineered Safety Features		
RAI 3.2-1	March 8, 2004	April 6, 2004
RAI 3.2-2		
RAI 3.2-3		
RAI 3.2-4		
RAI 3.2-5		
RAI 3.2-6		
RAI 3.2-7		
RAI 3.2-8		
RAI 3.2-9		
RAI 3.2-10		
RAI 3.2-11	June 24, 2004	July 22, 2004
RAI 3.2-12		
Section 3.3 Aging Management of Auxiliary Systems		
RAI 3.3-1	May 5, 2004	June 21, 2004
RAI 3.3-2		
RAI 3.3-3		
RAI 3.3-4		
RAI 3.3.2.4.1-1		
RAI 3.3.2.4.3-1		
RAI 3.3.2.4.3-2		
RAI 3.3.2.4.4-1		
RAI 3.3.2.4.5-1		
RAI 3.3.2.4.7-1		
RAI 3.3.2.4.8-1		
RAI 3.3.2.4.8-2		
RAI 3.3.2.4.10-1		
RAI 3.3.2.4.11-1		June 21, 2004 September 23, 2004

Section 3.4 Aging Management of Steam and Power Conversion Systems		
RAI 3.4-1	March 8, 2004	April 6, 2004
RAI 3.4-2		
RAI 3.4-3		
RAI 3.4-4		
RAI 3.4-5		
RAI 3.4-6		
RAI 3.4-7		
Section 3.5 Aging Management of Containments, Structures, and Components		
RAI 3.5-1	April 14, 2004	May 19, 2004 July 22, 2004
RAI 3.5-2		
RAI 3.5-3		
RAI 3.5-4		
RAI 3.5-5		
RAI 3.5-6		
RAI 3.5-7		
RAI 3.5-8		
RAI 3.5-9		
Section 3.5 Electrical Instrumentation and Controls		
No RAI Issued	na	na
Section 4 Time-Limited Aging Analyses		
Section 4.2 Reactor Vessel Neutron Embrittlement		
RAI 4.2-1	June 11, 2004	July 22, 2004
RAI 4.2-2		
Section 4.3 Metal Fatigue		
RAI 4.3.1-1	May 17, 2004	June 16, 2004
RAI 4.3.1-2		
RAI 4.3.1-3		
RAI 4.3.1-4		

RAI 4.3.2-1		
RAI 4.3.2-2		
RAI 4.3.2-3		
RAI 4.3.3.3-1		
Section 4.4 Environmental Qualification of Electrical Equipment		
No RAI Issued		
Section 4.5 Concrete Containment Tendon Prestress		
RAI 4.5-1	May 17, 2004	July 22, 2004
RAI 4.5-2		July 22, 2004 September 10, 2004
RAI 4.5-3		July 22, 2004

Section 4.6 Containment Liner Plate and Penetration Fatigue Analyses		
RAI 4.6-1	May 17, 2004	June 16, 2004
RAI 4.6-2		
Section 4.7 Other Plant-Specific Time-Limited Aging Analyses		
Section 4.7.1 Reactor Coolant System Piping Leak-Before-Break Analysis		
RAI 4.7.1-1	June 1, 2004	July 22, 2004
Section 4.7.2 Reactor Coolant Pump Code Case N-481		
RAI 4.7.2-1	June 1, 2004	July 22, 2004
RAI 4.7.2-2		
Section 4.7.3 Reactor Coolant Pump Flywheel		
RAI 4.7.3-1	June 1, 2004	September 10, 2004
Section 4.7.4 Steam Generator Tubes - Flow-Induced Vibration		
No RAI Issued	na	na
Section 4.7.5 Alloy 600 Nozzle Repairs		
RAI 4.7.5-1	June 1, 2004	July 22, 2004
RAI 4.7.5-2		
Section 4.7.6 High Energy Line Break Analysis		
RAI 4.7.6-1	May 17, 2004	June 16, 2004

NRC FORM 335 (9-2004) NRCMD 3.7 — U.S. NUCLEAR REGULATORY COMMISSION

BIBLIOGRAPHIC DATA SHEET

(See instructions on the reverse)

1. REPORT NUMBER (Assigned by NRC, Add Vol., Supp., Rev., and Addendum Numbers, if any.)

NUREG-1828

2. TITLE AND SUBTITLE

Safety Evaluation Report related to the License Renewal of the Arkansas Nuclear One, Unit 2

3. DATE REPORT PUBLISHED

MONTH	YEAR
June	2005

4. FIN OR GRANT NUMBER

5. AUTHOR(S)

Gregory F. Suber

6. TYPE OF REPORT

7. PERIOD COVERED *(Inclusive Dates)*

8. PERFORMING ORGANIZATION - NAME AND ADDRESS *(If NRC, provide Division, Office or Region, U.S. Nuclear Regulatory Commission, and mailing address; if contractor, provide name and mailing address.)*

Division of Regulatory Improvement Programs (DRIP)
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

9. SPONSORING ORGANIZATION - NAME AND ADDRESS *(If NRC, type "Same as above"; if contractor, provide NRC Division, Office or Region, U.S. Nuclear Regulatory Commission, and mailing address.)*

Same as above

10. SUPPLEMENTARY NOTES

11. ABSTRACT *(200 words or less)*

The safety evaluation report (SER) documents the technical review of the Arkansas Nuclear One, Unit 2 (ANO-2), license renewal application (LRA) by the U.S. Nuclear Regulatory Commission staff (staff). By letter dated October 14, 2003, Entergy Operations, Inc. (Entergy or the applicant), submitted the LRA for ANO-2 in accordance with Title 10 of the Code of Federal Regulations Part 54. Entergy is requesting renewal of the operating license for ANO-2, (Facility Operating License No. NPF-6) for a period of 20 years beyond the current expiration date (midnight, July 17, 2018).

The ANO site is located in southwestern Pope County, Arkansas, on a peninsula formed by Lake Dardanelle. The NRC issued ANO-2 construction permit on December 6, 1972. The operating license was issued by the NRC on September 1, 1978. ANO-2 consists of a Combustion Engineering pressurized water reactor to generate 3026 megawatts-thermal (MWt) or approximately 1023 megawatts-electric (MWe).

This SER presents the staff's review of information submitted to the NRC in the application. The staff's conclusion of its review of the ANO-2 LRA can be found in Section 6 of this SER.

The NRC ANO-2 license renewal project manager is Mr. Gregory F. Suber. Mr. Suber may be reached at 301-415-1124. Written correspondence should be addressed to the Licensee Renewal and Environmental Impacts Program, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001.

12. KEY WORDS/DESCRIPTORS *(List words or phrases that will assist researchers in locating the report.)*

license renewal, nuclear power

13. AVAILABILITY STATEMENT

unlimited

14. SECURITY CLASSIFICATION

(This Page) unclassified

(This Report) unclassified

15. NUMBER OF PAGES

16. PRICE

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, DC 20555-0001

OFFICIAL BUSINESS