NUREG-1766

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

Docket Nos. 50-338, 50-339, 50-280, and 50-281

Virginia Electric and Power Company

U.S. Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation
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Abstract

This safety evaluation report documents the Nuclear Regulatory Commission's (NRC's) review of Virginia Electric and Power Company's (Dominion's) applications to renew the operating licenses for North Anna Power Station, Units 1 and 2, and Surry Power Station, Units 1 and 2. The NRC's Office of Nuclear Reactor Regulation reviewed the North Anna and Surry power stations license renewal applications for compliance with the requirements of Title 10 of the Code of Federal Regulations, Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants," and prepared this report to document the findings of the review.

On May 29, 2001, Dominion submitted applications for renewal of Operating License Nos. NPF-4 and NPF-7, issued pursuant to Section 103 of the Atomic Energy Act of 1954, as amended, for a period of 20 years beyond the current operating terms. The current operating licenses for North Anna power station, Units 1 and 2, expire on April 1, 2018, and August 21, 2020, respectively. North Anna power station is in Louisa County in northern Virginia on the shore of Lake Anna. North Anna power station units 1 and 2 are three-loop Westinghouse pressurized-water reactors nuclear steam supply systems designed to generate 2893 MW thermal, or approximately 942 MW electric.

In its submittal of May 29, 2001, Dominion also submitted an application for renewal of Operating License Nos. DPR-32 and DPR-37, issued pursuant to Section 104b of the Atomic Energy Act of 1954, as amended, for a period of 20 years beyond the current operating terms. The current operating licenses for Surry power station, Units 1 and 2, expire on May 25, 2012, and January 29, 2013, respectively. Surry power station is in Surry County in southern Virginia on the bank of the James River. Surry power station units 1 and 2 are three-loop Westinghouse pressurized-water reactors nuclear steam supply systems designed to generate 2546 MW thermal, or approximately 829 MW electric.

The NRC's project manager for the North Anna and Surry license renewal is Omid Tabatabai. Mr. Tabatabai may be reached at (301) 415-3738. Until April 10, 2002, the license renewal project manager for the North Anna and Surry was Mr. Robert Prato. Mr. Prato may be reached at (301) 415-1147. Correspondence to them should be addressed to License Renewal and Environmental Impacts Program, U.S. Nuclear Regulatory Commission, Mail Stop O-12D3, Washington, D.C. 20555-0001.

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Abbreviations

Abbreviation	Definition
AC	alternating current
AAC	alternate alternating current
ACI	American Concrete Institute
ADAMS	Agency-wide Documents Access and Management System
AEC	Atomic Energy Commission
AMA	aging management activity
AMP	aging management program
AMR	aging management review
AMSAC	ATWS mitigation system actuation circuit
ANSI	American National Standards Institute
API	American Petroleum Institute
AS	auxiliary steam
ASCO	Automatic Switch Company
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ATWS	anticipated transient without scram
ASWPH	auxiliary service water pump house
BACC	boric acid corrosion control
BC	bearing cooling
BCW	diesel cooling water
BD	blowdown
BFO	diesel fuel oil
BIW	Boston insulated wire
BLO	diesel lubricating oil
BR	boron recovery
BSA	diesel starting air
BSR	AAC Diesel Service Air
BTP	branch technical position
CA	compressed air
CASS	cast austenitic stainless steel
CC	component cooling
CD	chilled water
CD-ROM	compact disk—read only memory
CFR	Code of Federal Regulations
CH	chemical volume and control
CLB	current licensing basis
CN	condensate
CRDM	control rod drive mechanism
CS	containment spray
CSA	conductor seal assembly
CSPE	chlorosulfonated polyethylene
CUF	cumulative usage factor
CV	containment vacuum
CvUSE	charpy upper shelf energy

CW	circulating water
DA	Drains-Aerated
DB	Drains-building services
DBE	design basis event
DC	direct current
DG	Drains-Gaseous
DGSS	diesel generator support systems
DLPS	drains and liquid processing systems
DR	deviation report
ECSA	electrical conductor seal assembly
EDG	emergency diesel generator
EDS	equipment data system
EPDM	ethylene propylene diene monomer
EPR	ethylene propylene rubber
EPRI	Electric Power Research Institute
EQ	environmental qualification
EQML	equipment qualification master list
ESF	engineered safety features
ESGR	emergency switchgear room
ET	eddy current test
FAC	flow-accelerated corrosion
FC	fuel pit cooling
FMR	flame- and moisture resistant
FP	fire protection
FPH	fire pump house
FPSS	fire protection and supporting systems
FSAR	final safety analysis report
FSER	final safety evaluation report
FW	feedwater
GDC	general design criterion
GE	General Electric
GL	generic letter
GN	primary and secondary plant gas supply
GSI	generic safety issue
GTR	generic technical report
GW	gaseous waste
HC	post-accident hydrogen control
HELB	high-energy line break
HHSI	high-head safety injection
HMWPE	high-molecular-weight polyethylene
HRSS	high-radiation sampling system
HV	heating and ventilation
HVT	high-voltage termination
HVAC	heating, ventilation, and air-conditioning
I&C	instrumentation and controls
IA	instrument air
IASCC	irradiation-assisted stress corrosion cracking
IC	incore instrumentation

ICCS	inadequate core cooling system
ID	inner diameter
IE	inspection and enforcement
IGSCC	intergranular stress corrosion cracking
IN	information notice
INEL	Idaho National Engineering Laboratories
INPO	Institute of Nuclear Power Operations
IPA	integrated plant assessment
ISCH	intake structure control house
ISFSI	independent spent fuel storage installation
ISI	inservice inspection
ISRS	inside recirculation spray
ITG	issues task group
LBB	leak-before-break
LHSI	low-head safety injection
LM	leakage monitoring
LOCA	loss-of-coolant accident
LR	license renewal
LRA	license renewal application
LTOPS	low temperature overpressure protection system
LW	liquid and solid waste
MCR	main control room
MIC	microbiologically induced corrosion
MOV	motor operated valve
MS	main steam
MT	magnetic particle test
MWe	megawatt-electric
MWt	megawatt-thermal
NAS	North Anna Power Station
NAS 1/2	North Anna Power Station, Units 1 and 2
NDE	nondestructive examination
NEI	Nuclear Energy Institute
NFPA	National Fire Protection Association
NI	nuclear instrumentation
NPS	nominal pipe size
NRC	Nuclear Regulatory Commission
NSR	non-safety-related
NS	neutron shield tank cooling
NSQ	NSR with special quality/regulatory requirements
NSR>SR	non-safety-related affecting safety-related
NSSS	nuclear steam supply system
NST	neutron shield tank
OSRS	outside recirculation spray
PG	primary grade
PL	plumbing or power lead
PM	preventative maintenance
PORV	power-operated relief valve
PT	liquid penetrant test

PTS	pressurized thermal shock
P-T	pressure-temperature
PWR	pressurized water reactor
PWSCC	primary-water stress corrosion cracking
QDR	qualification document review
QS	quench spray
RAI	request for additional information
RC	reactor coolant
RCP	reactor coolant pump
RCS	reactor coolant system
RG	regulatory guide
RH	residual heat removal
RI-ISI	risk-informed inservice inspection
RL	reactor cavity purification
RM	radiation monitoring
RP	refueling purification
RS	recirculation spray
RSST	reserve station service transformer
RT	radiographic test
RTD	resistance temperature detector
RT_{PTS}	reference temperature for pressurized thermal shock
RT_{NDT}	reference nil ductility transition temperature
IR_{NDT}	irradiation-induced shift in the RT_{NDT}
RV	reactor vessel
RVI	reactor vessel internals
RVLIS	reactor vessel level instrumentation system
RW	radwaste
RWST	refueling water storage tank
SA	service air
SBO	station blackout
SCBA	self-contained breathing apparatus
SCC	stress corrosion cracking
SCs	structures and components
SD	steam drains
SDBD	system design basis document
SEC	security
SER	safety evaluation report
SG	steam generator
SG-RT	steam generator recirculation and transfer
SI	safety injection
SIS	single insulated strand
SPCS	steam and power conversion systems
SPS	Surry power station
SPS 1/2	Surry power station, Units 1 and 2
SR	safety-related
SRP	standard review plan
SS	sampling system
SSCs	systems, structures, and components

SV	secondary vents
SW	service water
SWR	service water reservoir
TCCP	transient cycle counting program
TID	total integrated dose
TGSCC	transgranular stress corrosion cracking
TLAA	time-limited aging analyses
T.S.	technical specification
UFSAR	updated final safety analysis report
USE	upper shelf energy
UT	ultrasonic testing
VA	vents-aerated
VG	vents-gaseous
VGPS	vents and gaseous processing systems
VHP	vessel head penetration
VP	vacuum priming
VS	ventilation
VT	visual test
WOG	Westinghouse Owners Group
WT	steam generator water treatment
XLPE	cross-linked polyethylene

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1.0 Introduction and General Discussion

1.1 Introduction

This safety evaluation report documents the Nuclear Regulatory Commission's (NRC's) review of Virginia Electric and Power Company's (Dominion's) applications to renew the operating licenses for North Anna power station, Units 1 and 2 (NAS 1/2), and Surry power station, Units 1 and 2 (SPS 1/2) for an additional 20 years. The NRC's Office of Nuclear Reactor Regulation reviewed the NAS 1/2 and SPS 1/2 license renewal applications (LRAs) for compliance with the requirements of Title 10 of the Code of Federal Regulations, Part 54 (10 CFR Part 54), "Requirements for Renewal of Operating Licenses for Nuclear Power Plants."

The current operating licenses for NAS 1/2 expire on April 1, 2018, and August 21, 2020, respectively. NAS 1/2 is in Louisa County in northern Virginia on the shore of Lake Anna. NAS 1/2 are three-loop Westinghouse pressurized-water reactors nuclear steam supply systems designed to generate 2893 MW thermal, or approximately 942 MW electric.

The current operating licenses for SPS 1/2 expire on May 25, 2012, and January 29, 2013, respectively. SPS 1/2 is in Surry County in southern Virginia on the bank of the James River. SPS 1/2 are three-loop Westinghouse pressurized-water reactors nuclear steam supply systems designed to generate 2546 MW thermal, or approximately 829 MW electric.

The license renewal process requires a technical review of safety issues and an environmental review. The requirements for these reviews are stated in NRC regulations in 10 CFR Part 54 and Part 51, respectively. The safety review is based on the NAS 1/2 and SPS 1/2 LRAs, the North Anna and Surry updated final safety analysis reports (UFSARs), and the applicant's responses to NRC staff requests for additional information (RAIs). The applicant's responses to the RAIs are documented and docketed in letters to the NRC, and are supplemented by meeting minutes and other docketed correspondence. The public can review both LRAs and other pertinent information and material, at the NRC Public Document Room, 11555 Rockville Pike, Rockville, MD. In addition, the North Anna and Surry LRAs and other significant information and material relating to the license renewal review are available on the NRC Web site at www.nrc.gov.

This safety evaluation report (SER) summarizes the findings of the staff's safety review of the North Anna and Surry LRAs, and describes the technical details that the staff considered in its safety evaluation of the proposed operation of NAS 1/2 and SPS 1/2 for an additional 20 years beyond the terms of the current operating licenses. The staff reviewed both LRAs in accordance with NRC regulations and the guidance in the NRC draft "Standard Review Plan (SRP) for the Review of License Renewal Applications for Nuclear Power Plants," dated August 2000. The final SRP-LR was issued as NUREG-1800 in July 2001.

Chapters 2 through 4 of this SER provide the staff's evaluation of the license renewal issues that were considered during the review of each LRA. Chapter 5 is the report from the Advisory Committee on Reactor Safeguards (ACRS). The conclusions of this report are in Chapter 6.

Appendix A is a chronology of the NRC's and the applicant's principal correspondence related to the review of the applications. Appendix B is a bibliography of the documents used during this review. Appendix C is a list of the NRC staff's principal reviewers and its contractors for this project. Appendix D is a list of the applicant's commitments to be completed prior to the expiration of the current operating license terms.

In accordance with 10 CFR Part 51, the staff prepared two draft plant-specific supplements to the generic environmental impact statement (GEIS). These supplements discuss the environmental considerations related to renewing the licenses for SPS 1/2 and NAS 1/2. The draft plant-specific supplements to the GEIS were issued separately. The NRC staff issued the draft Supplement 6 to NUREG-1437, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants Regarding the Surry Power Station, Units 1 and 2," on April 03, 2002, and draft Supplement 7 to NUREG-1437 "Generic Environmental Impact Statement for License Renewal of Nuclear Plants Regarding the North Anna Power Station, Units 1 and 2," on April 23, 2002.

The NRC's project manager for the North Anna and Surry license renewal applications is Omid Tabatabai. Mr. Tabatabai may be reached at (301) 415-3738. Until April 10, 2002, the license renewal project manager for the North Anna and Surry applications was Mr. Robert Prato. Mr. Prato may be reached at (301) 415-1147. Correspondence to them should be addressed to License Renewal and Environmental Impacts Program, U.S. Nuclear Regulatory Commission, Mail Stop O-12D3, Washington, D.C. 20555-0001.

1.2 License Renewal Background

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

In 1982, the NRC anticipated interest in license renewal and held a workshop on the aging of nuclear power plants. This workshop led the NRC to establish a comprehensive program for nuclear plant aging research (NPAR). As a result of this research, a technical review group concluded that many aging phenomena are readily manageable and do not involve technical issues that would preclude extending the life of nuclear power plants.

In 1986, the NRC published a request for comments regarding a policy statement on major policy, technical, and procedural issues related to life extension for nuclear power plants.

In 1991, the NRC published a license renewal rule in 10 CFR Part 54. The NRC participated in an industry-sponsored demonstration program to apply the rule to pilot plants and develop experience to establish implementation guidance. To establish a scope of review for license renewal, the license renewal 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 aging management programs, particularly programs implemented in accordance with the maintenance rule, 10 CFR 50.65.

As a result, the NRC amended 10 CFR Part 54 in 1995. The amended license renewal rule established a regulatory process that was simpler, more stable, and more predictable than the previous license renewal rule. In particular, 10 CFR Part 54 was revised to focus on managing the adverse effects of aging rather than on identifying all aging mechanisms. The changes to the license renewal rule were intended to ensure that systems, structures, and components (SSCs) within the scope of the rule continue to perform their intended functions during the period of extended operation. In addition, the integrated plant assessment (IPA) process was revised and simplified to be consistent with the focus on passive, long-lived structures and components (SCs).

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

1.2.1 Safety Reviews

License renewal requirements for power reactors are based on two 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 SSCs during the period of extended operation and a few other safety issues.

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 including those plant SSCs (a) that are safety-related, (b) whose failure could affect safety-related functions, and (c) that are relied on to demonstrate compliance with the Commission's regulations for fire protection, environmental qualification, pressurized thermal shock, anticipated transients without scram, and station blackout.

Pursuant to 10 CFR 54.21(a), the applicant must review all SSCs that are within the scope of the rule to identify the structures and components (SCs) that are subject to an aging management review (AMR). SCs that are 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 a qualified life or a specified time period. As required by 10 CFR 54.21(a)(3), the applicant must demonstrate that the effects of aging will be managed in such a way that the intended functions of the SCs within the scope of license renewal will be maintained consistent with the current licensing basis (CLB) for the period of extended operation.

Active equipment is considered to be adequately monitored and maintained by existing programs. In other words, the detrimental effects of aging on active equipment are more readily detectable and will be identified and corrected through routine surveillance, performance indicators, and maintenance. The surveillance and maintenance programs and activities for active equipment and other programs and activities for maintaining plant design and licensing bases, are required to continue throughout the period of extended operation.

Pursuant to 10 CFR 54.21(d), each application also is required to include a supplement to the plant's final safety analysis report (FSAR). This FSAR supplement must contain summary descriptions of the programs and activities for managing the effects of aging.

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

In July 2001, the NRC issued Regulatory Guide (RG) 1.188, "Standard Format and Content for Applications to Renew Nuclear Power Plant Operating Licenses"; NUREG-1800, "Standard Review Plan for the Review of License Renewal Application for Nuclear Plants" (SRP-LR); and NUREG-1801, "Generic Aging Lessons Learned (GALL) Report." These documents describe methods acceptable to the NRC staff for implementing the license renewal rule and methods used by the NRC staff to evaluate applications for license renewal. The draft versions of these documents were issued for public comment on August 31, 2000 (64 FR 53047). The staff assessment of public comments was issued in July 2001 as NUREG-1739, "Analysis of Public Comments on the Improved License Renewal Guidance Documents." The Regulatory Guide endorses a Nuclear Energy Institute (NEI) guideline as an acceptable method of implementing the license renewal rule. The NEI guideline, NEI 95-10, "Industry Guideline for Implementing the Requirements of 10 CFR Part 54—The License Renewal Rule", Rev. 3, was issued in March 2001. However, the NRC staff used the draft regulatory guide along with the draft SRP-LR to review the North Anna and Surry LRAs. As experience is gained, the NRC will improve the SRP-LR and clarify the regulatory guidance.

1.2.2 Environmental Reviews

In December 1996, the staff revised the environmental protection regulations in 10 CFR Part 51 to facilitate environmental reviews for license renewal. The staff prepared a "Generic Environmental Impact Statement (GEIS) for License Renewal of Nuclear Plants" (NUREG-1437) to examine the possible environmental impacts of renewing licenses of nuclear power plants. For certain types of environmental impacts, the GEIS establishes generic findings that are applicable to all nuclear power plants. These generic findings are identified as Category 1 issues in 10 CFR Part 51, Subpart A, Appendix B. Pursuant to 10 CFR 51.53(c)(3)(i), an applicant for license renewal may incorporate these generic findings in its environmental report. Environmental impacts that must be analyzed on a plant-specific basis for license renewal are identified as Category 2 issues in 10 CFR Part 51, Subpart A, Appendix B. Such analyses must be included in an environmental report in accordance with 10 CFR 51.53(c)(3)(ii).

In accordance with the NEPA and the requirements of 10 CFR Part 51, the NRC performs a plant-specific review of the environmental impacts of license renewal, including whether there is new and significant information that was not considered in the GEIS. Four public meetings were held, two near SPS 1/2 on September 19, 2001, and two near NAS 1/2 on October 18, 2001, as part of the NRC's scoping process to identify environmental issues specific to the plant. The results of the environmental reviews and preliminary recommendations on the license renewal actions were documented in the NRC draft plant-specific Supplements 6 and 7 to the GEIS, which were issued on April 3, 2002, and April 23, 2002, for SPS 1/2 and NAS 1/2, respectively.

During the 75-day comment period for the draft plant-specific Supplements 6 and 7 to the GEIS, four additional public meetings were held, two near SPS 1/2 on May 29, 2002, and two near NAS 1/2 on June 25, 2002. At these meetings, the staff described the environmental reviews and answered questions from members of the public to help them formulate their comments on the reviews. Final Supplements 6 and 7 to the GEIS were issued in November 2002.

Supplements 6 and 7 to the GEIS present the NRC staff's analysis of the environmental impacts of renewing the SPS 1/2 and NAS 1/2 operating licenses for an additional 20 years. The staff's analysis considers and weighs the environmental effects of the proposed actions, and alternatives that are available to avoid adverse environmental effects. On the basis of the analyses and findings in the "Generic Environmental Impact Statement for License Renewal of Nuclear Power Plants" (NUREG-1437), the environmental reports submitted by the applicant, consultation with other Federal, State, and local agencies, the NRC staff's own independent review, and the staff's consideration of public comments, the staff recommended in Supplements 6 and 7 to NUREG-1437 that the Commission determine that the adverse environmental impacts of license renewal for SPS 1/2 and NAS 1/2 are not so great that preserving the option of license renewal for energy planning decisionmaking would be unreasonable.

1.3 Summary of Principal Review Matters

The requirements for renewing operating licenses for nuclear power plants are described in 10 CFR Part 54. The staff performed its technical review of the North Anna and Surry LRAs in accordance with Commission guidance and the requirements of 10 CFR 54.4, 54.19, 54.21, 54.22, 54.23, and 54.25. The standards for renewing a license are set forth in 10 CFR 54.29.

In 10 CFR 54.4, the Commission provides the scoping requirements of the license renewal rule. The applicant submitted this information in Chapter 2 of its May 29, 2001, applications. The staff reviewed this information and found that the applicant submitted the information required by 10 CFR 54.4.

In 10 CFR 54.19(a), the Commission requires applicants for license renewal to submit general information. The applicant submitted this general information in Enclosure 1 to its letter of May 29, 2001, forwarding its applications for renewed operating licenses for NAS 1/2 and SPS 1/2. The staff reviewed Enclosure 1 and found that the applicant submitted the information required by 10 CFR 54.19(a).

In 10 CFR 54.19(b), the Commission requires that each LRA include "conforming changes to the standard indemnity agreement, 10 CFR 140.92, Appendix B, to account for the expiration term of the proposed renewed license." Regarding the standard indemnity agreement, the applicant states the following in each LRA:

The current Standard Indemnity Agreements for NAS 1/2 and SPS 1/2 states in Article VII that the agreement shall terminate at the time of expiration of that license specified in Item 3 of the attachment to the Standard Indemnity Agreements. Item 3 of the attachment to the Standard Indemnity Agreements, as revised by Amendment No. 6, lists NPF-4, NPF-7, DPR-32 and DPR-37 as the applicable license numbers. The applicant requested that conforming changes be made to Article VII of the Standard Indemnity Agreements, and/or Item 3 of the attachment to the Standard Indemnity Agreements, specifying the extension of the Standard Indemnity Agreements until the expiration dates of the renewed NAS 1/2 and SPS 1/2 operating licenses. Should the license numbers be changed upon issuance of the renewed license, the applicant requests that conforming changes be made to Item 3 of the attachment and any other section of Standard Indemnity Agreements, as appropriate.

The staff will use the original license numbers for the renewed licenses. Therefore, there is no need to make conforming changes to the indemnity agreement, and the requirements of 10 CFR 54.19(b) have been met.

In 10 CFR 54.21, the Commission requires that each application for a renewed license for a nuclear facility contain the following information: (a) an IPA, (b) current licensing basis changes made during the NRC review of the application, (c) evaluations of time-limited aging analyses (TLAAs), and (d) a final safety analysis report (FSAR) supplement. On May 29, 2001, the applicant submitted the information required by 10 CFR 54.21(a) and (c) in NAS LRA Exhibit A, "Application for Renewed Operating Licenses, North Anna, Units 1 and 2" and SPS LRA Exhibit A, "Application for Renewed Operating Licenses, Surry, Units 1 and 2." The applicant submitted the information to address the license renewal requirements of 10 CFR 54.21(d) in the FSAR supplements in Appendix A to Exhibit B of each LRA.

In 10 CFR 54.22, the Commission states the requirements regarding technical specifications. The applicant addressed the requirements of 10 CFR 54.22 in Appendix D to Exhibit B of each LRA.

The staff evaluated the technical information required by 10 CFR 54.4, 54.21, and 54.22 in accordance with the NRC's regulations and the guidance in the draft SRP. The staff's evaluation of this information is documented in Chapters 2, 3, and 4 of this SER.

The staff's evaluation of the environmental information required by 10 CFR 54.23 is documented in the final plant-specific supplements to the GEIS (NUREG-1437, Supplements 6 and 7), dated November 2002.

1.3.1 Westinghouse Topical Reports

In accordance with 10 CFR 54.17(e), the applicant referenced the following Westinghouse Owners Group topical reports in each LRA. The applicant used the topical reports to generically demonstrate that applicable aging effects for reactor coolant system components will be adequately managed for the period of extended operation.

- WCAP-14422, Rev. 2-A, “License Renewal Evaluation: Aging Management for Reactor Coolant System Supports,” Westinghouse Electric Corporation, February 1997.

- WCAP-14535A, “Topical Report on Reactor Coolant Pump Flywheel Inspection Elimination,” Westinghouse Electric Corporation, November 1996.

- WCAP-14574-A, “Aging Management Evaluation for Pressurizers,” Westinghouse Electric Corporation, July 1996.

- WCAP-14575-A, “Aging Management Evaluation for Class I Piping and Associated Pressure Boundary Components,” Westinghouse Energy Systems, August 1996.

- WCAP-14577, Rev. 1-A, “Aging Management Evaluation for Reactor Internals,” Westinghouse Energy Systems, September 1997.

The staff issued the safety evaluations for these topical reports on the following dates: WCAP-14422 on November 17, 2000; WCAP-14535A on September 12, 1996; WCAP-14574A on October 26, 2000; WCAP-14575A on November 8, 2000; and WCAP-14577 on February 10, 2001. In accordance with the procedures described in NUREG-0390, “Topical Report Review Status,” the staff requested that the Westinghouse Owners Group publish the accepted versions of the reports incorporating the transmittal letter and the staff safety evaluation between the title page and the abstract. The accepted versions have an *A* (for “accepted”) after the report identification number.

The safety evaluations of the topical reports are intended to be stand-alone documents. An applicant that incorporates the topical reports by reference into an LRA must ensure that the conditions of approval stated in the safety evaluations are met. The staff's evaluation of the applicant’s incorporation of the topical reports into the application is documented in Chapter 3 of this SER.

1.4 Summary of Open Items and Confirmatory Actions

As a result of its review, the NRC staff issued an SER with open items on June 6, 2002, and identified and documented 8 open items and 15 confirmatory actions. An issue was open if the applicant had not presented a sufficient basis for resolution. The applicant responded to each of the open items in two letters to NRC dated July 25, 2002, and October 1, 2002. The applicant’s responses to open items and its confirmatory actions are described below.

<u>Open Item 2.5-1.</u> In the SER with open items, the staff asked the applicant to include the plant system portion of the offsite power system within the scope of license renewal. This open item was in accordance with the requirements of 10 CFR 54.4(a)(3) and 10 CFR 50.63(a)(1).

In response to this open item, in its letter dated July 25, 2002, the applicant stated that the plant portions of the offsite power systems for Surry and North Anna have been included in the license renewal scope for a station blackout event in accordance with 10 CFR 54.4(a)(3). Separate correspondence on this subject (Serial No. 02-297 dated July 11, 2002) provides a revised response to RAI 2.5-1. The revised response summarizes the aging management reviews for components and/or materials not addressed by the original LRAs, and lists added in-scope equipment. The staff's evaluation of aging management reviews with respect to the SSCs added to the scope in response to this open item is set forth in section 3.9 of this SER.

Based on the information in the July 11 and 25, 2002 letters, the staff found the applicant's response acceptable and considers open item 2.5-1 closed.

<u>Open Item 3.9.2-1.</u> In the SER with open items, the staff asked the applicant to address the potential for moisture in the area of the degradation for the corrective actions attribute of the North Anna and Surry Non-EQ Cable Monitoring Activity.

In response to this open item, in its letter dated July 25, 2002, the applicant stated that it had provided (in the letter Serial No. 01-647 dated November 30, 2001) an evaluation of the North Anna and Surry Non-EQ Cable Monitoring Aging Management Activities in terms of the aging management program attributes. Furthermore, the description of the engineering evaluation process has been enhanced to ensure that if a degraded cable is identified, the cable environment, including the potential for moisture in the area of degradation, shall be considered in the engineering evaluation and appropriate corrective actions initiated through the corrective action system. A supplemental response to RAI 3.6.2-1 on this subject (Serial No. 02-297 dated July 11, 2002) incorporated the changes discussed above. Section 18.1.4 of the UFSAR supplement has also been revised to include consideration of the cable environment in the evaluation of degraded cable.

Based on the information in the November 30, 2001, and July 11 and 25, 2002 letters, the staff found the applicant's response acceptable and considers open item 3.9.2-1 closed.

<u>Open Item 3.9.2-2.</u> In the SER with open items, the staff asked the applicant to provide a technical justification to demonstrate that visual inspections will be effective in detecting damage in the high-voltage neutron monitoring instrumentation cables (and radiation monitor cables) before current-leakage can affect instrument loop accuracy. Since the radiation monitoring cables have been found to be particularly sensitive to thermal effects, the staff believed that the calibration approach is a more effective approach for neutron monitoring cables than visual inspections.

In response to this open item, in its letter dated July 25, 2002, the applicant stated that it had reviewed the SPS 1/2 and NAS 1/2 neutron monitoring instrumentation cables (and radiation monitoring cables) which operate between 1 kV and 5kV and generate signals supporting a license renewal intended-function. The review showed that the source, intermediate, and power range neutron detector cables are the only cables meeting the above criteria and are not included in the environmental qualification program (i.e., they are non-EQ cables). The routine calibration tests performed as part of the plant surveillance test program will be used to identify the potential existence of this aging degradation. The applicant in its supplemental response to RAI 3.6.2-1 (Serial No. 02-297, July 11, 2002) credited the normal calibration frequency specified in the plant technical specifications to provide reasonable assurance that severe aging degradation will be detected prior to loss of the cable's intended function. Section 18.1.4 of the UFSAR supplements also have been revised to include the use of calibration data in the aging management of these cables.

Based on the information in the July 11 and 25, 2002 letters, the staff found the applicant's response acceptable and considers open item 3.9.2-2 closed.

Open Item 3.9.2-3. Because cables (in open item 3.9.2-2) might be exposed to significant voltage and moisture simultaneously, the staff asked the applicant to periodically test the cables, or provide a technical basis for why not.

In response to this concern, in its letter dated July 25, 2002, the applicant stated that the LRAs identified a medium-voltage cable in the service water system at North Anna as potentially exposed to moisture but did not associate the cable with water treeing because the cable was maintained in dry condition. Water treeing is a degradation and long-term failure phenomenon that has been documented for medium-voltage electrical cable with certain extruded polyethylene and electric power research institute (EPRI) insulations. As stated in the applicant's revised response to RAI 2.5-1 (Serial No. 02-297, July 11, 2002), the cable environment for these high-voltage power cables will also be kept dry at SPS 1/2 and NAS 1/2. The applicant's approach to managing the aging mechanism of water treeing is consistent with the staff-proposed approach outlined in Section XI.E.3 of NUREG-1801. The non-environmentally-qualified (Non-EQ) cable monitoring program for SPS 1/2 and NAS 1/2 will be revised to specifically credit the programs necessary to control water in manholes and underground ducts associated with energized power cables. Additionally, the corrective action attribute of the non-EQ cable monitoring program will be revised to provide for performing appropriate tests of cables determined to have been wetted for a significant period of time. A supplemental response to RAI 3.6.2-1 on this subject (Serial No. 02-297 dated July 11, 2002) incorporated the requirement for testing of cables subjected to significant wetting.

Based on the information in the July 11 and 25, 2002 letters, the staff found the applicant's response acceptable and considers open item 3.9.2-3 closed.

Open Item 4.3-1. In the SER with open items, the staff asked the applicant to provide an assessment of charging and safety injection nozzles that is directly applicable to NAS 1/2 and SPS 1/2. The applicant had originally used the results presented in NUREG/CR-6260 (for an older vintage Westinghouse plant) to estimate the impact of the environment on fatigue usage for the NAS 1/2 and SPS 1/2 charging and safety injection nozzles.

In its October 1, 2002 response, the applicant committed to manage the environmentally assisted fatigue of the charging and safety injection nozzles for NAS 1/2 and SPS 1/2 using one or more of the following options prior to the period of extended operation:

1. further refinement of the fatigue analyses to lower the cumulative usage factors (CUFs) to below 1.0
2. repair of the affected locations
3. replacement of the affected locations
4. manage the effects of fatigue by an inspection program that has been reviewed and approved by the NRC (e.g., periodic nondestructive examination of the affected locations at inspection intervals to be determined by a method accepted by the NRC)

The applicant indicated that, if the fourth option is selected, the inspection details, including scope, qualification, method, and frequency, will be provided to the NRC for review and approval prior to the period of extended operation. An aging management program under this option would be a departure from the design basis CUF evaluation, described in the UFSAR supplements and, therefore, would require a license amendment pursuant to 10 CFR 50.59. In view of the above, the staff finds the applicant's proposed program to be an acceptable plant-specific approach to address environmentally assisted fatigue during the period of extended operation in accordance with 10 CFR 54.21(c)(1). On the basis of the above discussion, the staff considers open item 4.3-1 closed.

<u>Open Item 4.3-2.</u> In the SER with open items, the staff asked the applicant to update the FSAR supplement to provide a more detailed discussion of its proposed program to address environmental fatigue effects. Furthermore, if the applicant selects the inspection option to manage environmentally assisted fatigue, the inspection details must be submitted to the staff prior to the period of extended operation and the method must be accepted by the staff. In addition, the staff asked the applicant to include a reference to the WCAP-15338 evaluation in the UFSAR description to provide the technical basis for the TLAA evaluation.

In its October 1, 2002 letter, the applicant provided a discussion of environmentally assisted fatigue in Section 18.3.2.4 of the revised UFSAR supplements. The applicant's revised UFSAR supplements included a discussion of the proposed approach to manage environmentally assisted fatigue for the surge line hot-leg pipe connection and the safety injection and charging nozzles. The applicant provided a further discussion of its proposed augmented inspection plan for the pressurizer surge line hot-leg nozzle in Section 18.2.1 of the revised UFSAR supplements. The applicant indicated that the inspection details regarding scope, frequency, qualifications, methods, etc., will be submitted to the NRC. Also, the applicant's July 25, 2002 response provided a revised UFSAR supplement for NAS 1/2 and SPS 1/2 which referenced WCAP-15338.

On the basis of the applicant's revised UFSAR supplements, as clarified above, the staff considers open item 4.3-2 closed.

<u>Open Item 4.6-1.</u> In the SER with open items, the staff asked the applicant to resolve the discrepancy between information provided in Table 3.8-7 of the NAS UFSAR and the NAS LRA. Specifically, Table 3.8-7 indicates that the NAS containment liner is designed to 100 cycles of operating pressure variations, 400 cycles of operating temperature variations, and 20 design basis earthquake cycles. However, the NAS LRA states that the liner plate is designed for 1,000 cycles of operating pressure variations, 4,000 cycles of temperature variation, and 20 cycles of design basis earthquakes, all simultaneously applied.

In its response to this open item, in its July 25, 2002 letter, the applicant explained that it had evaluated the NAS 1/2 and SPS 1/2 containment liner plates using a conservative estimate of the number of expected pressure and temperature cycles for the period of extended operation. This estimate includes 1500 cycles of operating-pressure variations, 6000 cycles of operating-temperature variations, and 20 design basis earthquake cycles. The staff agrees that the applicant has performed a conservative evaluation of the number of design cycles for the period of extended operation. In accordance with the requirements of 10 CFR 54.21(c)(1), the staff found the applicant's TLAA for the containment liner plate acceptable.

On the basis of the applicant's response, as clarified above, the staff considers open item 4.6-1 closed.

Open Item 4.6-2. In the SER with open items, the staff asked the applicant to revise the FSAR supplements to describe the TLAA evaluation of the containment liner plate, including the number of design cycles used for the evaluation of each facility.

In response to this open item, in its letter dated July 25, 2002, the applicant stated that the UFSAR supplements Section 18.3.4, “Containment Liner Plate,” has been revised to include a discussion of the extrapolation of cycles to 60 years of operation and clearly established the design limits for operating pressure and temperature variations as 1500 and 6000, respectively. The anticipated operating cycle values were extrapolated to 150 (pressure) and 600 (temperature). The extrapolation increased the current 40-year values by a factor of 1.5 to account for the period of extended operation. The applicant also provided a discussion of the difference between the number of anticipated cycles and the design limits for cycles for both pressure and temperature operating variations for both stations. These extrapolated, anticipated, and design-limit values for the pressure and temperature variations are included in the proposed UFSAR changes to Table 3.8-7 for North Anna and Section 15.5.1.8 for Surry.

The staff found the applicant’s revisions to FSAR supplements acceptable and considers open item 4.6-2 closed.

Confirmatory Action 2.3.1.2-1. In the SER with open items, the staff asked the applicant to correct the license renewal drawings referenced in the applications (11448-LRM-086A, sh. 1 and 11548-LRM-086A, sh. 1, for SPS 1/2 and 11715-LRM-093A, sh. 1 and 12050-LRM-093A, sh. 1, for NAS 1/2). These drawings had incorrectly indicated that certain leak detection components were within the scope of license renewal.

In response to this concern, in its letter dated July 25, 2002, the applicant stated that the listed drawings have been revised to remove the reactor vessel flange leak detection system from the scope of license renewal. Since the applicant has completed this action, the staff considers confirmatory action 2.3.1.2-1 closed.

Confirmatory Action 3.3.1.1-1. In the SER with open items, the staff asked the applicant to describe the followup actions in the appropriate aging management activity (AMA) summaries provided in UFSAR supplements of the applications. In its response to RAI B2.2.9-3, the applicant stated that it would incorporate the followup actions from Table B4.0-1 of each LRA into the UFSAR supplements for the Surry and North Anna Power Stations.

In response to this confirmatory action, in its letter dated July 25, 2002, the applicant stated that all items originally in Table B4.0-1 of the LRAs have been incorporated into the text of the respective AMA summaries in the UFSAR Supplements. The staff finds these proposed modifications to Section A2.2.1 of the UFSAR Supplements to be acceptable.

Because the applicant has completed this action, the staff considers confirmatory action 3.3.1.1-1 closed.

Confirmatory Action 3.3.1.6-1. In the SER with open items, the staff asked the applicant to revise Section A2.2.6 of the UFSAR supplements to add cracking and loss of material as aging effects for concrete structures. The applicant, in response to RAI 3.5-7, had committed to credit the civil engineering structural inspection activity to manage change in material properties and the previously cited aging effects cracking and loss of material for concrete structures.

In response to this confirmatory action, in its letter dated July 25, 2002, the applicant stated that UFSAR supplement Section 18.2.6, “Civil Engineering Structural Inspections,” has been modified to include change in material properties as an aging effect for both concrete and elastomer sealant and/or gasket materials.

Because the applicant has completed this action, the staff considers confirmatory action 3.3.1.6-1 closed.

Confirmatory Action 3.3.1.7-1. In the SER with open items, the staff asked the applicant to incorporate the followup actions from Table B4.0-1 of each LRA into the UFSAR supplements. In response to RAI B2.2.9-3, the applicant committed to describe the followup actions, including the fire protection program, in the appropriate AMA summaries in Appendix A of the applications.

In response to this concern, in its letter dated July 25, 2002, the applicant stated that all items originally in Table B4.0-1, including the fire protection program in UFSAR Supplement Section 18.2.7, of the LRAs have been incorporated into the text of the respective AMA summaries in the UFSAR supplements.

Because the applicant has completed this action, the staff considers confirmatory action 3.3.1.7-1 closed.

Confirmatory Action 3.3.1.7-2. In the SER with open items, the staff asked the applicant to supplement the NFPA pressure and flowrate testing (credited in each LRA as part of the fire protection program) with the work control process activity in order to manage aging effects for the fire protection system piping, and incorporate this commitment into Section A2.2.7 of the UFSAR supplements.

In response to this concern, in its letter dated July 25, 2002, the applicant stated that the UFSAR Supplement Section 18.2.7, “Fire Protection Program,” has been modified to credit the work control process.

Because the applicant has completed this action, the staff considers confirmatory action 3.3.1.7-2 closed.

Confirmatory Action 3.3.1.9-1. In the SER with open items, the staff asked the applicant to describe the followup actions in the appropriate AMA summaries in Appendix A of the applications. In its response to RAI B2.2.9-3, in a letter dated November 30, 2001, the applicant stated that it would incorporate the licensee followup actions in Table B4.0-1 of each LRA into the UFSAR supplements.

In response to this confirmatory action, in its letter dated July 25, 2002, the applicant stated that all items originally in Table B4.0-1 of the LRAs have been incorporated into the text of the respective AMA summaries in the UFSAR supplements. This includes General Condition Monitoring in UFSAR Supplement Section 18.2.9.

Because the applicant has completed this action, the staff considers confirmatory action 3.3.1.9-1 closed.

Confirmatory Action 3.3.1.10-1. In the SER with open items, the staff asked the applicant to implement a one-time internal inspection of a representative sample of the box girders for the polar cranes, between year 30 and the end of the current operating license term.

In response to this confirmatory action, in its letter dated July 25, 2002, the applicant stated that UFSAR supplements Section 18.2.10, "Inspection Activities - Load Handling Cranes and Devices," has been modified to include the one-time box girder inspection.

Because the applicant has completed this action, the staff considers confirmatory action 3.3.1.10-1 closed.

Confirmatory Action 3.3.1.11-1. In the SER with open items, the staff asked the applicant to follow industry activities related to failure mechanisms for small-bore piping and evaluate changes to inspection activities based on industry experience.

In response to this confirmatory action, in its letter dated July 25, 2002, the applicant stated that UFSAR supplements Section 18.2.11, "ISI Program – Component and Component Support Inspection," has been modified to include the use of industry activities and guidance related to small-bore piping issues and inspections.

Because the applicant has completed this action, the staff considers confirmatory action 3.3.1.11-1 closed.

Confirmatory Action 3.3.1.12-1. In the SER with open items, the staff asked the applicant to add the ASME Section XI, Subsection IWL, Examination Category L-A, to the in-service inspection (ISI) program for containment inspection aging management activity to manage the potential aging effects for concrete structural members of the containment.

In response to this confirmatory action, in its letter dated July 25, 2002, the applicant stated that UFSAR supplements Section 18.2.12, "ISI Program – Containment Inspection," has been revised to incorporate ASME Section XI, Subsection IWL.

Because the applicant has completed this action, the staff considers confirmatory action 3.3.1.12-1 closed.

Confirmatory Action 3.3.1.19-1. In the SER with open items, the staff asked the applicant to revise the UFSAR supplements accordingly to include the following six items:

1. In Section B2.2.19 of each LRA the applicant states: "... as a licensee follow-up action, changes will be implemented into the maintenance procedures to provide reasonable assurance that consistent internal inspections will be completed during the process of performing maintenance tasks. These changes will be implemented prior to the end of the current operating license term." This item is included in each LRA Table B4.0-1 but is not discussed in Section A2.2.19 of the UFSAR Supplement. The staff asked the applicant to add this item into UFSAR supplements.

   In response to this item, in its letter dated July 25, 2002, the applicant stated that the licensee follow-up action for changes to maintenance procedures has been added to Section 18.2.19 of the UFSAR supplements. The applicant has completed this action.

2. In response to RAIs 2.1-3, B2.2.7-2, and B2.2.19-3, a number of additional systems and components were added to the scope of the work control process. The staff asked the applicant to list these systems in the scope of the work control process in the UFSAR supplements for the Surry and North Anna Power Stations.

   In response to this item, in its letter dated July 25, 2002, the applicant stated that the commitment has been incorporated into the UFSAR supplements (Item #3 below). The applicant's response to RAI B2.2.19-3 also credited the work control process for the fire protection system. This commitment has also been incorporated into the UFSAR supplements. (Refer to Confirmatory Action 3.3.1.7-2.) Therefore, no additional revision to the UFSAR supplement is necessary to address this item.

3. In response to RAIs 2.1-3, B2.2.7-2, and B2.2.19-3, the applicant committed to audit the work control process at years 40 and 50 and to perform supplemental inspections, as necessary, within 5 years of the audit. The staff asked the applicant to revise the UFSAR supplements for the work control process AMA to include this commitment.

   In response to this item, in its letter dated July 25, 2002, the applicant stated that this commitment has been incorporated into Section 18.2.19 of the UFSAR supplements. The audit will ensure that all systems and components for which the work control process was credited, including all systems identified in RAI responses, will be represented in the program. The applicant has completed this action.

4. In response to RAIs 2.1-3, B2.2.7-2, and B2.2.19-3, the applicant committed to inspect similar material/environment components, both within the system and outside the system, if aging identified in a location within a system cannot be explained by environmental/operational conditions at that specific location. The staff asked the applicant to revise the UFSAR supplements for the work control process AMA to include this commitment.

   In response to this item, in its letter dated July 25, 2002, the applicant stated that this commitment has been incorporated into Section 18.2.19 of the UFSAR supplements. The applicant has completed this action.

5. In response to RAIs 2.1-3, B2.2.7-2, and B2.2.19-3, the applicant committed to remove references to EPRI TR-107514 from the work control process description. The staff requested the applicant to revise the UFSAR supplements accordingly.

   In response to this item, in its letter dated July 25, 2002, the applicant stated that the RAI responses withdrew the use and reference to EPRI report TR-107514. No reference to this report was made in the proposed UFSAR supplement which accompanied the LRAs. Therefore, no revision to the UFSAR Supplement is necessary. No additional action is required.

6. In Section A2.2.19 of each LRA, the applicant included two items related to "water treeing." Water treeing is a degradation and long-term failure phenomenon that has been documented for medium-voltage electrical cable with certain extruded polyethylene and EPRI insulations. Similar information was not included in Section B2.2.19 of the

LRA. In the SER with open items issued in June 2002, the staff asked the applicant to revise the UFSAR supplements to incorporate requested information.

In response to this item, in its letter dated July 25, 2002, the applicant stated that the USFAR supplement has been revised to remove the “boxed areas” (North Anna specific info) for “water treeing” from the Work Control Process AMP in Section 18.2.19. The applicant, however, indicated that water treeing is addressed in Section18.1.4 of the UFSAR Supplement, “Non- EQ Cable Monitoring program.” The applicant has completed this action.

Since the applicant has completed these actions, the staff considers confirmatory action 3.3.1.19-1 closed.

<u>Confirmatory Action 3.3.3.2-1.</u> In the SER with open items, the staff noted that the acceptance of the applicant’s transient cycle counting program (TCCP), in its discussion of the fatigue TLAA, was pending resolution of open items 4.3-1 and 4.3-2 of this SER.

Because the applicant has resolved open items 4.3-1 and 4.3-2, the staff considers confirmatory action 3.3.3.2-1 closed.

<u>Confirmatory Action 3.3.4.2-1.</u> In the SER with open items, the staff asked the applicant to include management of two additional aging effects (cracking and change in material properties) in the infrequently accessed area inspection activities.

In response to this concern, in its letter dated July 25, 2002, the applicant stated that UFSAR supplements Section 18.1.2, “Infrequently Accessed Area Inspection Activities,” has been modified to include cracking and change in material properties as aging effects requiring management for concrete.

Because the applicant has completed this action, the staff considers confirmatory action 3.3.4.2-1 closed.

<u>Confirmatory Action 3.8.1-1.</u> In the SER with open items, the staff asked the applicant to monitor groundwater chemistry to ensure that the groundwater remains nonaggressive during the period of extended operation.

In response to this confirmatory action, in its letter dated July 25, 2002, the applicant stated that UFSAR supplements Section 18.2.6, “Civil Engineering Structural Inspections,” has been modified to include annual monitoring of groundwater chemistry. Section 18.2.6 also requires that groundwater chemistry be considered in engineering evaluations of inspection results. In addition, the applicant has committed to monitor the groundwater chemistry at a different time each year so that any seasonal variations in the groundwater chemistry may be detected.

Because the applicant has completed this action, the staff considers confirmatory action 3.8.1-1 closed.

<u>Confirmatory Action 3.8.1-2.</u> In the SER with open items, the staff asked the applicant to provide justification for not including an aging management review of the dewatering system for control of hydrostatic pressure to the containment liner plate.

In response to this concern, in its letter dated July 25, 2002, the applicant stated that the subsurface drainage systems around the containments have been included within the scope of license renewal for SPS 1/2 and NAS 1/2. The UFSAR supplements Section 18.1.2, "Infrequent Accessed Area Inspection Activities," has been modified to include the structures associated with these systems. UFSAR supplements Section 18.2.19, "Work Control Process," encompasses the mechanical portions of the system.

Because the applicant has completed this action, the staff considers confirmatory action 3.8.1-2 closed.

Confirmatory Action 3.8.2-1. In the SER with open items, the staff asked the applicant to do a one-time inspection of the North Anna SWR to determine the level of sludge buildup.

In response to this concern, in its letter dated July 25, 2002, the applicant stated that UFSAR supplements Section 18.2.17, "Service Water System Inspections," has been modified to include the sludge buildup measurement commitment.

Because the applicant has completed this action, the staff considers confirmatory action 3.8.2-1 closed.

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

The staff reviewed North Anna and Surry LRAs Section 2.0, "Scoping and Screening Methodology for Identifying Structures and Components Subject to Aging management review, and Implementation Results," as part of its scoping and screening review. In addition, the staff used the NAS and SPS UFSARs as its primary means of verification. Pursuant to 10 CFR 50.34(b)(2), the UFSAR contains "[a] description and analysis of the SSCs of the facility, with emphasis upon performance requirements, the bases, with technical justification therefore, upon which such requirements have been established, and the evaluations required to show that safety functions will be accomplished." The UFSAR is required to be updated periodically pursuant to 10 CFR 50.71(e). Thus, the UFSAR contains updated plant-specific licensing-basis information regarding the systems, SSCs, and their functions. The staff also used the license renewal drawings provided with each LRA, and the applicant's responses to requests for additional information (documented in letters from the applicant), telecommunications (documented in letters to the applicant), and other documented sources, as applicable. All applicable documents and letters used in the staff's evaluation are docketed.

In Section 2.1, "Scoping and Screening Methodology," of each LRA, the applicant described its methodology for identifying the SCs that are within the scope of license renewal and subject to an AMR. In the scoping of SSCs, the applicant performed a plant review to identify those SSCs that perform those functions that are the basis for including an SSC within the scope of license renewal as specified in 10 CFR 54.4(a). The applicant documents its scoping results in Section 2.2, "Plant Level Scoping Results," of each LRA. Of the SSCs that are within the scope of license renewal the applicant identified and listed those SCs that perform an intended function as described in 10 CFR 54.4(b) without moving parts, or without a change in configuration or properties, and that are not replaced based on qualified life or specified time period. The applicant documents its screening results in Sections 2.3 through 2.5 of the NAS and SPS LRAs. The staff reviewed the scoping and screening methodology, and provided its evaluation in Section 2.1 of this SER. The staff reviewed the scoping and screening results. The review is documented in Section 2.2, "Plant Level Scoping Results," and Section 2.3, "Screening Results: Mechanical Systems," Section 2.4, "Screening Results: Structures," and Section 2.5, "Screening Results: Electrical and Instrument and Control Components," of this SER.

2.1 Scoping and Screening Methodology

2.1.1 Introduction

Pursuant to 10 CFR Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants," Section 54.21, "Contents of Application—Technical Information," each application for license renewal must contain an Integrated Plant Assessment (IPA). Furthermore, the IPA must list and identify those SCs that are subject to an AMR from among the 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 each LRA, the applicant described the scoping and screening methodology used to identify SSCs at North Anna and Surry 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 whether 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 North Anna and Surry LRAs, the applicant considered the requirements of the Rule, the SOCs for the Rule, and the guidance presented by the NEI, “Industry Guideline for Implementing the Requirements of 10 CFR Part 54 - The license renewal rule,” Revision 2, August 2000 (NEI 95-10). The applicant also considered the NRC staff’s correspondence with other applicants and with the NEI in the development of this methodology.

2.1.2 Summary of Technical Information in the Application

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

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

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

In Section 2.1.2, “Application of the Scoping Criteria in 10 CFR 54.4(a),” of each LRA, the applicant discussed the scoping methodology as it related to the safety-related criteria in accordance with 10 CFR 54.4(a)(1), non-safety-related criteria in accordance with 10 CFR 54.4(a)(2), and other scoping criteria in accordance with 10 CFR 54.4(a)(3) for regulated events.

In accordance with 10 CFR 54.4(a), with respect to the safety-related criteria, the applicant stated that the SSCs within the scope of license renewal include safety-related SSCs, which are those relied upon to remain functional during and following design basis events as defined in 10 CFR 50.49(b)(1), to ensure the following intended functions: (i) the integrity of the reactor coolant pressure boundary; (ii) the capability to shut down the reactor and maintain it in a safe shutdown condition; or (iii) the capability to prevent or mitigate the consequences of accidents that could result in potential offsite exposure comparable to the guidelines in 10 CFR 50.34(a)(1), 10 CFR 50.67(b)(2), or 10 CFR 100.11, as applicable.

The applicant initially relied on the plant Equipment Data System (EDS) and supplemental quality lists of safety-related and non-safety-related components (Q-list) to identify safety-related components and structures credited with remaining functional during and following design basis events defined in the current licensing basis. Additional scoping activities were then performed to identify systems within the scope of renewal and to determine structures within the scope of renewal.

With respect to the non-safety-related criteria, the applicant stated, in part, that a review of the UFSAR and other CLB documents has been performed to identify the non-safety-related and non-safety-related-quality SSCs whose failure could prevent satisfactory accomplishment of the safety-related intended functions identified in 10 CFR 54.4(a)(1). The review encompassed the design basis events considered within these documents. The results of the review are incorporated into a Criterion 2 report, which has been used as input to scoping and screening. The report identified the following four categories of non-safety-related and non-safety-related quality SSCs for inclusion within the scope of Criterion 2:

- SSCs relied on to mitigate or prevent flooding events
- piping relied on to maintain its integrity in order to prevent a high-energy line break outside Containment
- piping that is attached to safety-related piping and that is seismically designed and supported up to the first equivalent anchor point beyond the safety-related/non-safety-related or safety-related/non-safety-related quality boundary
- SSCs that are in close proximity to safety-related SSCs and whose failure during a seismic event could adversely interact with safety-related SSCs (Seismic II/I)
- Equipment relied on to maintain its pressure-retaining capability in order to maintain adequate intake canal level for design basis events (Surry only)

For all scoping criteria related to 10 CFR 54.4(a)(3), the applicant reviewed all SSCs relied on in safety analyses or plant evaluations to perform an intended function that demonstrates compliance with the Commission's regulations for fire protection [FP] (10 CFR 50.48), environmental qualification [EQ] (10 CFR 50.49), pressurized thermal shock [PTS] (10 CFR 50.61), anticipated transients without scram [ATWS] (10 CFR 50.62), and station blackout [SBO] (10 CFR 50.63) to ensure they were adequately accounted for in the scoping methodology. To support this review, the applicant developed a set of Criterion 3 reports which presented detailed design information for each regulated event. The Criterion 3 report described the regulatory requirements, the system descriptions, and specific equipment relied on to comply with the requirements, including components and structures. The purpose of those reports was to (1) identify the systems and structures that are relied on for each of those events, and to (2) either identify specific components or point to the documentation to be used as input for screening. In summary, the SSCs relied on in safety analyses or plant evaluations to perform an intended function that demonstrates compliance with NRC regulations for fire protection, environmental qualification, pressurized thermal shock, anticipated transients without scram, and station blackout have been included in the scope of license renewal in accordance with the criteria of 10 CFR 54.4(a)(3).

2.1.2.2 Documentation Sources Used for Scoping and Screening

Section 2.1.3 of each LRA contains a description of the relevant technical information sources used to identify the safety-related and non-safety-related intended functions for which the plant has been designed. These sources were also used to develop the list of SSCs subject to an aging management review.

- Maintenance Rule Scoping and Performance Criteria Matrix - The maintenance rule scoping and performance criteria matrix was used as a source of system intended functions for both scoping and screening. This matrix includes safety-related intended functions and those intended functions associated with fire protection, equipment qualification, anticipated transients without scram, and station blackout. The maintenance rule matrix also identifies intended functions that may fall into the category of non-safety-related affecting safety-related (non-safety-related/safety-related). The non-safety-related/safety-related criterion for license renewal (10 CFR 54.4(a)(2)) and the maintenance rule (10 CFR 50.65(b)(2)(ii)) are similar.

- Civil Engineering Structural Monitoring Program - The civil engineering structural monitoring program lists all plant structures and identifies the structures that have been included within the scope of the maintenance rule. This program has been used as a starting point for identifying the structures that should be included within the scope of license renewal under 10 CFR 54.4(a)(1) and 10 CFR 54.4(a)(2).

- System Design Basis Documents - A set of system design basis documents (SDBDs) were developed to provide a source of design basis information about selected plant systems. The SDBDs include the following information of importance to scoping and screening: (1) system descriptions, (2) references to applicable design basis documents (such as design changes and calculations) associated with the system, (3) a list of safety-related system intended functions, intended functions potentially meeting the non-safety-related/safety-related criterion, and intended functions associated with fire protection, equipment qualification, anticipated transients without scram, and station blackout. The system intended functions listed in the SDBDs were used to supplement the maintenance rule functions for both scoping and screening.

- Equipment Data System - The equipment data system (EDS) is a company database that contains (1) information for each mark-numbered structure and component, (2) the Q-List, and (3) the Environmental Qualification Master List. For each component and structure, EDS includes some or all of the following information of importance to the scoping and screening processes: (1) the quality classification (safety-related [SR], non-safety-related [NS], or non-safety-related with special quality requirements [NSQ]), (2) the intended functions of the component (provides system pressure boundary, restricts flow, provides structural integrity, etc.), and (3) the applicable classification rules (or basis) for each intended function. The classification rules that could apply include those for fire protection, station blackout, anticipated transients without scram, and several non-safety-related quality intended functions with potential applicability to Criterion 2 (non-safety-related/safety-related).

- The list of safety-related/non-safety-related quality structures and components within EDS (and the associated intended functions) is commonly referred to as the Q-List. The

Q-List was used to support the identification of safety-related components within the scope of license renewal for Criterion 1. That list was directly used in the scoping and screening processes. The EDS was also used to identify the non-safety-related/non-safety-related quality structures and components that support the identification of SSCs associated with the regulated events.

- Criterion 2 Report - A review of the UFSAR and other CLB documents was performed to identify the non-safety-related, and non-safety-related-quality SSCs whose failure could prevent satisfactory accomplishment of the safety-related intended functions identified in 10 CFR 54.4(a)(1). The review has encompassed the design basis events and other failures considered within these documents. The following SSCs were identified:

  1. SSCs relied on to mitigate or prevent flooding events

  2. piping relied on to maintain its integrity in order to prevent a high-energy line break outside containment

  3. piping that is attached to safety-related piping and that is seismically designed and supported up to the first equivalent anchor point beyond the safety-related/non-safety-related or safety-related/non-safety-related quality boundary

  4. SSCs that are in close proximity to safety-related SSCs and whose failure during a seismic event could adversely interact with safety-related SSCs (Seismic II/I)

  5. Equipment relied on to maintain its pressure retaining capability in order to maintain adequate intake canal level for design basis events (Surry only)

- Regulated Event Reports - A report was prepared for each of the five regulated events covered in 10 CFR 54.4(a)(3) to provide input to the scoping and screening processes. For each event a review of the UFSAR and other CLB documents was performed to identify any SSCs that were credited in response to these events. In addition to the Criterion 3 reports, the applicant used design drawings and other technical documentation, such as the plant technical specifications, to facilitate the identification of SSCs which met the requirements of 10 CFR 54.4.

2.1.2.3 Scoping Methodology

Scoping was performed to identify the plant systems and structures within the scope of license renewal rule. The scoping for systems and structures was performed as two separate efforts by the applicant. A discussion of each effort is presented below.

2.1.2.3.1 System Scoping Methodology

A system was initially identified as being within the scope if one or more of the following criteria were met:

1. The system performs an intended function as documented in the maintenance rule Scoping and Performance Matrix and the applicable System Design Basis Document,

2. The component data in EDS indicates that the system has one or more components that perform a safety-related, EQ, FP, SBO, ATWS or non-safety-related/safety-related intended function, or

3. The system was identified in the Criterion 2 report or in one of the five regulated event reports as being within the scope of the rule.

The preliminary scoping results were used as input to the screening process. Following the completion of system screening, the mechanical scoping results were updated to reflect any additional systems that were identified as containing or supporting in-scope components.

2.1.2.3.2 Structure Scoping Methodology

A structure was initially identified as being within the scope of license renewal if one or both of the following criteria were met:

1. The structure is included in the scope of the maintenance rule because it is safety-related or non-safety-related affecting safety-related, as indicated in the Civil Engineering Structural Monitoring Program.

2. The structure is identified in the Criterion 2 report or in one of the five Criterion 3 regulated event reports as being within the scope of the rule.

The structural scoping results were used as input to the structural screening process. Following the completion of system screening, the structural scoping results were updated to reflect any additional structures that were identified as containing or supporting in-scope components.

2.1.2.4 Screening Methodology

Following the identification of SSCs within the scope of license renewal, the applicant implemented a process for determining which SCs of the SSCs within the scope of renewal were subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1). The screening process identifies those SCs that perform an intended function without moving parts or without a change in configuration or properties (i.e., passive). SCs that were screened for further evaluation based on the passive criteria are subject to an AMR. During the AMR process, the SCs are evaluated to determine whether they are subject to replacement on the basis of a qualified life or specified time period (i.e., long-lived). In Section 2.1.5, “Screening Methodology,” of each LRA, the applicant discussed these screening activities as they related to the SSCs that are within the scope of license renewal. The specific screening activities for the various engineering disciplines are further described in Section 2.1.5.1 for mechanical components, Section 2.1.5.2 for civil/structural, and Section 2.1.5.3 for electrical, instrumentation and controls (I&C) of each LRA.

2.1.2.4.1 Mechanical Screening

The applicant stated that the mechanical screening process was implemented on each of the systems that were identified during the scoping review phase to identify the passive mechanical components that support one or more of the system’s intended functions. The system’s intended functions, in conjunction with component information in EDS, the Criterion 2 report, the

Criterion 3 regulated event reports, and the applicable system drawings were used to identify the passive components within the scope of license renewal. The electrical/I&C components (such as heaters) that are in-scope only because they perform a system pressure boundary function, were treated as mechanical components and also have been identified during system screening. Specific screening criteria for this effort included identifying passive components in accordance with 10 CFR 54.21(a)(1)(i), the guidance in NEI 95-10 and other industry guidance as appropriate, addressing the cascading issue by identifying support systems down to a level necessary to provide for the satisfactory accomplishment of the safety-related intended functions identified in 10 CFR 54.4(a)(1), and addressing the attendant passive components (cooling water piping, instrument lines, and valves, etc.) of complex assemblies (such as the emergency diesel generators and air-conditioning units) by screening them separately from the complex assembly. Therefore, the attendant passive components that support a system's intended function were identified for inclusion within the scope of license renewal.

Following the completion of the screening review for a system, the annotated drawings were used to generate license renewal drawings. The passive mechanical components within the scope of license renewal are identified on those drawings. This includes the short-lived passive components as determined later during the AMR process.

2.1.2.4.2 Civil/Structural Screening

After identifying the SSCs within the scope of license renewal, the applicant performed the following screening review to determine which structures and structural components were subject to an AMR in accordance with 10 CFR 54.21(a)(1).

Screening was performed for each structure identified as being within the scope of license renewal. In addition, screening was performed for the following categories of structural equipment:

1. nuclear steam supply system supports

2. load-handling cranes and devices

3. plant commodities (general structural supports and other miscellaneous structural commodities)

The purpose of civil/structural screening was to identify the types of passive structural members (walls, beams, floors, grating, block walls, missile shields, pads, liners, etc.) that support the intended functions of the structure and, therefore, require an AMR. The types of structural members that require an AMR were identified based upon a review of the structural detail drawings. For mark-numbered structural members, the data in EDS were also reviewed. The screening process for NSSS supports was similar. The structural members that require an AMR were identified based upon a review of detailed structural drawings. For mark-numbered structural members, the data in EDS were also reviewed. Load-handling cranes and devices were evaluated based upon a review of the UFSAR. For mark-numbered cranes and devices, the data in EDS were also reviewed. Cranes and devices that are seismically designed were included within the scope of license renewal for Seismic II/I considerations. In addition, certain cranes and devices of importance to plant operations were specifically identified for inclusion within the scope of license renewal. General structural supports and other miscellaneous structural items such as cable tray covers, fire/EQ barrier doors, fire penetration materials, cabinets, panels, and bench boards were evaluated as plant commodities.

2.1.2.4.3 Electrical Components Review

After identifying the SSCs within the scope of license renewal, the applicant also performed the following screening review to determine which electrical components were subject to an AMR. As part of this effort, the applicant relied on the requirements stated in 10 CFR 54.21(a)(1)(i) as supplemented by industry guidance in NEI 95-10 to develop a commodity evaluation approach on the basis of a plant-level evaluation of electrical equipment. The majority of electrical/I&C component groups (such as transmitters, switches, breakers, relays, actuators, radiation monitors, recorders, isolators, signal conditioners, meters, batteries, analyzers, chargers, motors, regulators, transformers, and fuses) are considered active, in accordance with 10 CFR 54.21(a)(1)(i) and the supplemental guidelines in NEI 95-10, and therefore, do not require an AMR. The electrical/I&C components (such as immersion heaters) that are in scope only because they perform a passive pressure boundary function are shown on system drawings. Those components were treated as mechanical components and identified during the system (mechanical) screening process. The following electrical/I&C component groups were identified as performing an electrical passive function in support of system intended functions:

1. cable and connectors

2. electrical penetrations

3. bus duct

The electrical screening results are presented in the application, which has each of the electrical/I&C component groups identified above and identifies the parts of the electrical/I&C component group that are subject to an AMR and the passive functions of the component group.

2.1.2.4.4 Screening of Stored Equipment

The applicant performed a review to identify equipment that (1) is maintained in storage, (2) is reserved for installation in the plant in response to a design basis event, and (3) requires an AMR. In addition to passive components, the review also has considered stored active components that are not routinely inspected, tested, and maintained. The Appendix R stored equipment is used to restore power to pre-selected plant components and to provide cooling to certain areas after a fire in order to attain cold shutdown. The stored equipment identified as requiring an AMR includes: cable and connectors, flexible ductwork, ventilation and vacuum systems hoses, and air and gas systems valve bodies. The applicant determined that air and gas system tools and supplies used to place the reserved equipment in service are not required for the installed equipment to remain operable (once placed in service) and are outside the scope of license renewal.

2.1.2.4.5 Screening of Thermal Insulation

Consistent with previous NRC correspondence addressed to prior license renewal applicants, the applicant performed a screening review of thermal insulation. The review considered the impact of thermal insulation with respect to (1) the effectiveness of heat tracing, (2) room cooling, (3) Seismic II/I, and (4) halogens on pipe. The applicant developed a position paper, LR-1907/2907, “Screening for Thermal Insulation,” to document its evaluation of the issue. The position paper described the NRC staff questions raised during previous LRA programs, prior applicant responses to those questions, and a discussion of the applicability of the issues to the North Anna and Surry plants. The applicant evaluated thermal insulation with respect to the criteria defined in 10 CFR 54.4(a) and determined that the insulation did not perform any safety-related function or perform a function with respect to the 10 CFR 54.4(a)(3) regulated events. The applicant evaluated the potential for the failure of the insulation to affect a safety-related intended function and concluded that thermal insulation did not meet the scoping requirements and, therefore, is not included within the scope of license renewal.

2.1.3 Staff Evaluation

As part of the review of the applicant’s LRAs, the NRC staff evaluated the scoping and screening activities described in the following Sections of the applications:

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

- Section 2.2, “Plant Level Scoping Results”; Section 2.3 “Scoping and Screening Results: Mechanical Systems”; Section 2.4 “Scoping and Screening Results: Structures”; Section 2.5 “Screening Results: Electrical and Instrumentation and Controls Systems”

In addition, the staff conducted a scoping and screening methodology audit at the Dominion Engineering offices from September 10-14, 2001. The audit team reviewed implementation procedures and engineering reports on the scoping and screening methodology implemented by the applicant. The focus of the audit was to ensure that the applicant had developed and implemented adequate guidance to conduct the scoping and screening of SSCs in accordance with the methodologies described in the application and the requirements of the Rule.

2.1.3.1 Evaluation of the Methodology for Identifying Systems, Structures, and Components Within the Scope of License Renewal

The audit team reviewed implementation procedures and engineering reports on the scoping and screening methodology implemented by the applicant. These procedures included (1) LR-1000/LR-2000, “System and Structure Scoping,” Revision 2, (2) LRPG-201, “System and Structure Screening,” Revision 2, (3) LR-1001-2001, “System/Structure Screening Methodology,” Revision 2, (4) LR-1007/2007, “Criterion 2 Report: Non-Safety-Related Affecting Safety-Related Surry and North Anna Power Stations,” Revision 2, (4) LR-1002/2002, “10 CFR 54 Regulated Programs Environmental Qualification,” Revision 0, (5) LR-1003/2003, “10 CFR 54 Regulated Programs Anticipated Transient Without Scram,” Revision 2, (6) LR-1006/2006, “10 CFR 54 Regulated Programs Loss of All Alternating Current Power (SBO),” Revision 1, (7) LR-1004/2004, “10 CFR 54 Regulated Programs Pressurized Thermal Shock,” Revision 0, (8) LR-1005/2005, “Fire Protection: 10 CFR 50.48 and Appendix R,” Revision 1, and (9) LR-1655, “Aging Management Review Cables and Connectors,” Revision 2. The team found that the scoping and screening methodology reports and procedures were consistent with Section 2.1 of each LRA and were sufficiently detailed 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 SDBDs, maintenance rule Matrix results, and the Criterion 2 and Criterion 3 reports, which were relied upon by the applicant during the scoping and screening phases of the review. The team found these design documentation sources to be useful for ensuring that the initial scope of SSCs identified by the applicant was consistent with the CLB of the North Anna and Surry plants.

During the audit, the applicant further described the process used to incorporate plant design information into the LRA development process. The applicant referenced LR-1000/LR-2000, “System and Structure Scoping,” Revision 2, LRPG-201, “System and Structure Screening,” Revision 2, and LR-1001-2001, “System/Structure Screening Methodology,” Revision 2, to describe the detailed process for developing each LRA, and specifically the incorporation of the SDBDs, maintenance rule Matrix information, Q-list information, and the Criterion 2 and Criterion 3 reports into the process. These reports outlined the specific use of the SDBDs, maintenance rule Matrix information, Q-list and other sources of information, such as emergency operating procedures, within the scoping methodology and presented formal guidance for use during the implementation phase. The applicant’s engineering staff were cognizant of the requirements for and use of these information sources during the scoping development phase of each LRA.

The applicant presented the audit team with a detailed description of the SDBD program and described how it was incorporated into the scoping and screening process. The SDBDs were developed by the applicant during the design configuration documentation project. The audit team reviewed a sample of the SDBD reports for both safety-related and non-safety-related systems to better understand the approach the applicant implemented to determine which SSCs were initially placed in scope for license renewal. The team found the SDBD documents to provide a concise, well-documented discussion of the system, including safety-related, non-safety-related, and NRC-required intended functions (i.e., intended functions which had been assigned as a result of commitments to the NRC, including those for the Commission regulations identified under 10 CFR 54.4 (a)(3)). Additionally, each SDBD identifies any intended function of the system relied upon for the five regulated events. Included in each SDBD was a detailed list of the sources of information, which included both North Anna or Surry-specific sources such as the UFSAR, technical specifications, calculations and analyses and non-plant-specific sources such as industry codes and standards, NUREGs, regulatory guides, inspection and enforcement bulletins, notices, generic letters, and Commission orders. The audit team reviewed the governing procedures and administrative controls and determined that they presented adequate guidance for the preparation, control, and maintenance of the SDBDs.

With respect to the Q-list information, the applicant’s program for the development of the Q-list is described in the applicant’s design document, VPAP-0310, “Equipment Data System Database Control.” The procedure describes the electronic component database which identifies each individual mark-numbered component and provides information specific to the components safety classifications and intended functions. During the review of the Q-list information, the audit team reviewed a sample of the database screening result tables developed by the applicant to support the LRA program. The applicant designed a series of filters which enabled the LRA review engineers to sort through the equipment data system records and provide concise tables of component records on the basis of safety classification or specific intended functions of interest, such as environmental qualification and fire protection. The audit team determined that the filter process was a useful tool for the applicant in developing the initial scope of SSCs for the program.

The applicant also presented the audit team with a detailed discussion on the development and implementation of the Criterion 2 and Criterion 3 reports. These reports were developed by the applicant's engineering staff to help ensure that all SSCs in the CLB that address the requirements of 10 CFR 54.4(a)(2) and 10 CFR 54.4(a)(3) were identified and considered for inclusion in the scope of each LRA. The Criterion 2 report provides detailed guidance for evaluating potential non-safety-related SSCs affecting safety-related SSCs, including the interpretation of guidelines during the application of the Criterion 2 requirements, interactions and events, mitigative and support functions, and a summary of potential interactions of interest as a result of certain operational occurrences such as flooding and high-energy line breaks. The Criterion 3 reports provide a detailed description of each of the regulated events of interest in accordance with 10 CFR 54.4(a)(3), including a description of the events, the regulations governing the events, and the SSCs relied upon to mitigate each event. The audit team reviewed these reports and verified that the applicant had adequately incorporated the results of these efforts into the scoping methodology effort.

On the basis of the staff's review of these procedures and from discussions with the applicant, the audit team identified certain discrepancies between the scoping and screening process described in the procedures and the actual process that was described by the applicant during the audit activities. Specifically, the Criterion 2 report did not provide a clear description and account of all essential activities in the scoping and screening process related to the determination of Criterion 2 SSCs. The report described a process by which only certain non-safety-related SSCs are brought into scope if failure of those non-safety-related SSCs is postulated in the CLB and their failure would result in the loss of a safety-related intended function. In fact, during the methodology audit, the audit team clearly established that the Rule required that all non-safety-related SSCs whose failure could result in the loss of a safety-related SSC from performing its intended function were included in scope.

On October 22, 2001, the staff issued a request for additional information to the applicant to more fully describe the actual process which was implemented for the LRA scoping and screening of Criterion 2 SSCs. By letter dated February 1, 2002, the applicant responded to the staff's request for additional information. In that response, the applicant stated that there is a statement in its Criterion 2 report that excludes certain non-safety-related equipment from license renewal scope even though its failure could result in the loss of a safety-related component. The exclusionary statement was intended to be applied whenever the CLB evaluations demonstrate acceptable consequences because the safety-related functions have not been compromised. For example, high-energy line failures outside of containment were evaluated as part of the CLB. As stated in North Anna UFSAR Section 3C.2.1, "If such an accident resulted merely in the loss of one or more components, while 100% redundancy of its function exists elsewhere, the design of the system was considered adequate." On the basis of this statement, the high-energy lines that are not subject to augmented inspections were excluded from further consideration under Criterion 2. The Surry high-energy lines outside of containment were treated in the same manner based upon a similar statement presented in Surry UFSAR Section 14B.2.1. These high-energy lines and other exclusions are addressed and were verified to be bounded by the revised methodology presented in the responses to the staff's RAIs. The applicant has revised the Criterion 2 report to delete reference to this exclusionary statement and has supplemented the guidance with the methodology outlined in the responses to staff's request for additional information. The staff reviewed the applicant's response and found it to be acceptable on the basis of the revision of the Criterion 2 report to remove the exclusionary statement, and the applicant's re-verification of non-safety-related SSCs which meet the 10 CFR 54.4(a)(2) criterion using the revised methodology.

Two additional issues regarding the application of the requirements of 10 CFR 54.4(a)(2) were identified by the audit team regarding the treatment of non-safety-related SSC's whose failure could prevent safety-related SSCs from performing their intended functions. Specifically, item b of Section 2.1.3.6, "Criterion 2 Report," of each LRA states, in part, that non-safety-related piping that is attached to safety-related piping and that is required to be seismically designed and supported up to the first equivalent anchor point beyond the safety-related/non-safety-related or safety-related/non-safety-related quality boundary, was not identified during screening. The second issue pertained to Item c of Section 2.1.3.6 of the application, which states, in part: "It should be noted that non-safety-related and non-safety-related quality mechanical components (e.g., piping, tanks, ducting) have not been included within the scope of license renewal for Seismic II/I because the failure of this equipment during a seismic event was not postulated in the CLB." The audit team discussed these issues with the applicant's staff and requested specific clarification regarding the applicant's approach to scoping and screening non-safety-related SSCs in accordance with the requirements of 10 CFR 54.4(a)(2). The audit team determined that the applicant did, in fact, bring into scope those safety-related/non-safety-related and safety-related/non-safety-related quality piping segments up through the first equivalent anchor point beyond the safety-related/non-safety-related or safety-related/non-safety-related quality boundary as part of its scoping and screening methodology implementation process but did not uniquely identify those segments on the applicable plant drawings, only the safety-related piping to which they were attached.

On October 22, 2001, the staff issued a request for additional information to the applicant to clarify that the safety-related/non-safety-related and safety-related/non-safety-related quality piping segments up through the first equivalent anchor point beyond the safety-related/non-safety-related or safety-related/non-safety-related quality boundary were in fact included within the scoping results. By letter dated February 1, 2002, the applicant responded to the staff's request for additional information. In that response, the applicant stated that safety-related/non-safety-related quality piping that is attached to safety-related piping and that is seismically designed and supported up to the first equivalent anchor point beyond the safety-related/non-safety-related or safety-related/non-safety-related quality boundary is included within the scope of license renewal. Although these non-safety-related/non-safety-related quality piping segments were not uniquely identified during the screening process or highlighted on each LRA drawings, applicable aging effects on these piping segments are managed along with the adjoining safety-related piping. The supports for the non-safety-related/non-safety-related quality piping segments are also included within the scope of license renewal as stated in Section 2.1.3.6 of each LRA. The staff has reviewed the applicant's response and finds it acceptable on the basis of the confirmation that these non-safety-related piping segments and supports were included in the scope.

With regard to the second issue, the audit team supplied the applicant with additional information on the treatment of such SSCs and requested that the applicant provide a response to a request for additional information on the issue. The staff stated that an applicant for license renewal should consider two configurations of non-safety-related piping systems that could potentially meet the 54.4(a)(2) scoping criterion. The first configuration includes non-safety-related piping systems (including piping segments and supports) which are connected to safety-related piping. These non-safety-related piping systems should be included within the scope of license renewal up to and including the first seismic support past the safety-related/non-safety-related interface. The second configuration involves non-safety-related piping systems which are not connected to safety-related piping, but have a spatial relationship such that their failure could adversely impact the performance of an intended safety function. For this piping system configuration, the applicant has two options when performing its scoping evaluation: a mitigative option or a preventive option. With the mitigative option, the applicant must demonstrate that plant mitigative features (e.g., pipe whip restraints, jet impingement shields, spray and drip shields, seismic supports, flood barriers, etc.) are supplied to protect safety-related SSCs from a failure of non-safety-related piping segments. When evaluating the failure modes of non-safety-related piping segments and the associated consequences, age-related degradation must be considered. The staff notes that pipe failure evaluations typically do not consider age-related degradation when determining pipe failure locations. Rather, pipe failure locations are normally postulated on the basis of high stress. Industry operating experience has shown that age-related pipe failures can, and do, occur at locations other than the high-stress locations postulated in most pipe failure analyses. Therefore, to utilize the mitigative option, an applicant should demonstrate that the mitigating devices are adequate to protect safety-related SSCs from failures of non-safety-related piping segments at any location where age-related degradation is plausible. If this level of protection can be demonstrated, then only the mitigative features need to be included within the scope of license renewal and the piping segments need not be included within the scope. However, if an applicant cannot demonstrate that the mitigative features are adequate to protect safety-related SSCs from the consequences of non-safety-related pipe failures, then the applicant should utilize the preventive option, which requires that the entire non-safety-related piping system be brought into the scope of license renewal and an AMR be performed on the components within the piping system. Finally, an applicant may determine that in order to ensure adequate protection of the safety-related SSC, a combination of mitigative features and non-safety-related SSCs must be brought within scope. Again, it is incumbent upon the applicant to provide adequate justification for the approach taken with respect to scoping of non-safety-related SSCs in accordance with the Rule. Given the methodology used to identify piping systems that meet the 54.4(a)(2) scoping criterion, there may be other non-safety-related SSCs which should be included within the scope of license renewal. For these other non-safety-related SSCs, an applicant can also exercise the mitigative option, the preventive option, or a combination, in order to address the scoping issue.

On October 22, 2001, the staff issued a request for additional information which further described the staff’s position on the 10 CFR 54.4(a)(2) requirements. By letter dated February 1, 2002, the applicant responded to the staff’s request for additional information. In that response, the applicant stated that the methodology implemented for scoping of systems, structures, and component did not include non-safety-related mechanical components, such as piping, tanks, valves, etc., that are considered Seismic II/I since the failure of these components during a seismic event is not postulated in the current licensing basis. On the basis of discussions with the NRC staff, the scope under 10 CFR 54.4(a)(2) is not limited to Seismic II/I supports. Therefore, the applicant has modified the scope of license renewal for Surry and North Anna to include non-safety-related SSCs that have a spatial relationship with SSCs within the scope of license renewal on the basis of 10 CFR 54.4(a)(1) and whose failure could impact the performance of an intended safety function.

The applicant used the preventative option to determine which non-safety-related components were included within the scope of license renewal. Components considered for inclusion within the scope of license renewal in response to this RAI include piping, valves, tanks, pumps, and other mechanical system equipment.

The applicant's process to determine the non-safety-related SSCs to be added to the scope of license renewal first required identifying the plant structures and spaces that contain both safety-related and non-safety-related SSCs. After the structures and spaces were identified, the equipment database was reviewed to determine the mechanical systems containing non-safety-related components within these structures and spaces. From this list of systems, a determination was made whether an assumed failure of the non-safety-related components within these systems could impact the performance of an intended function for any SSC in-scope for 10 CFR 54.4(a)(1). Failure modes considered in the evaluation were pipe whip and jet impingement for high-energy systems and fluid leakage, fluid spray, and component displacement (such as by physical contact) for all systems. The component-level intended functions of limited structural integrity and pressure boundary were identified for these non-safety-related components. The limited structural integrity function is defined as the capability of a component to maintain sufficient integrity to prevent physical interaction with spatially oriented safety-related components. The pressure boundary function prevents leakage and spray that could affect safety-related components.

Industry and site operating experience reviews were conducted by the applicant to identify potential concerns with aging of non-fluid-containing components. No failures due to aging were identified in these reviews. This operating experience is consistent with the results of aging management reviews performed for in-scope components of the same material exposed to the same environments. On the basis of this operating experience review, it was concluded that there are no credible aging effects that would result in loss of the limited structural integrity function for non-fluid-containing components. Additionally, non-fluid-containing components cannot affect safety-related SSC due to leakage or spray. Therefore, since these non-fluid-containing components cannot affect the functions of safety-related SSCs, they were not included within the scope of license renewal for this review.

An aging management evaluation was performed for the non-safety-related mechanical components that were determined to be within the scope of license renewal. This review consisted of an evaluation of the effects of aging and identification of activities credited for managing the applicable aging effects on the basis of the results of aging management reviews performed for components of the same material and exposed to the same internal and external environments. This evaluation concluded that the aging effects of loss of material and/or cracking require management and that there are no additional material and environment combinations beyond those currently considered in the application.

The aging management activities credited with managing these aging effects are currently described in the application in the indicated section. A summary of the results of the aging management evaluation for the systems within the scope of license renewal as a result of the expansion of scope for Criterion 2 was also presented.

In a followup telecommunication on March 5, 2002, the staff requested some additional clarification regarding the operating experience information reviewed by the applicant concerning non-fluid-filled systems and the methodology implemented to exclude certain non-safety systems determined not to impact the performance of an intended function for any SSC in-scope for 10 CFR 54.4(a)(1). In a letter dated May 22, 2002 (Serial No. 02-163), the applicant supplied additional clarification to the staff. Specifically, the applicant identified the sources of operating experience information regarding age-related degradation and structural degradation, including INPO SERs, site-specific deviation reports from each individual plant corrective action system, NRC generic communications and additional NRC correspondence from the NRC Web site and ADAMS. The applicant's operating experience review has identified no age-related degradation of non-fluid-containing components that would result in their loss of the limited structural integrity function. This conclusion was supported by the applicant's walkdowns and inspections in response to Generic Letter 87-02 using the Generic Implementation Procedure for Seismic Verification of Nuclear Plant Equipment.

With respect to the exclusion of certain non-safety-related component groups, the applicant supplied justification for every component group exclusion and documented those justifications in Technical Report LR-1921/2921, "Aging Management of Criterion 2 (non-safety-related/safety-related) Component Groups not Addressed in AMR Reports," Rev. 0. In all cases, non-safety-related component groups excluded from the scope were determined not to be spatially oriented near safety-related components and, therefore, did not pose a credible concern. In addition, the applicant readdressed the evaluation described in the LR-1907/2907 position paper regarding thermal insulation and verified that the evaluation results remained valid, and that no new issues regarding thermal insulation were identified as a result of the expanded scope of the 10 CFR 54.4(a)(2) evaluation. In a followup telecommunication on April 3, 2002, the staff discussed the evaluation performed by the applicant and documented in the position paper with respect to thermal insulation. The staff reviewed the evaluation described in LR1907/2907 and verified that the applicant had readdressed the documented position paper with respect to the expanded scope. The results of this expanded evaluation of the 10 CFR 54.4(a)(2) were also reviewed by the NRC regional inspection team during an inspection on February 4-8, 2002. The inspection team determined that the applicant's scoping and screening activities, including the additional effort to resolve the 10 CFR 54.4(a)(2) issue, were performed in accordance with the prescribed methodology and were adequate.

As a result of this supplemental review, the applicant brought additional non-safety-related systems and associated mechanical components into the scope of license renewal, supplied the results of the associated AMRs, and presented a summary of the programs and activities that will be used to manage aging in these systems. Section 2.3.5 of this SER describes the staff's evaluation of the expanded scoping and the resultant structures and components subject to an aging management review. Sections 3.3.1 and 3.3.4 of this SER describe the aging management programs credited for these additional structures and components.

On the basis of the additional information supplied by the applicant, including expansion of the systems within the scope of license renewal and addition of new systems within scope as a result of the revised methodology, 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 non-safety-related SSCs into the applicant's AMPs, the staff concludes that the applicant has supplied sufficient information to demonstrate that all SSCs that meet the 54.4(a)(2) scoping criterion have been identified as being within the scope of license renewal.

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

The audit team reviewed the methodology used by the applicant to identify mechanical, structural, and electrical components within the scope of license renewal that were subject to further aging management evaluation. The applicant presented the staff with a detailed discussion of the processes used for each discipline and supplied technical reports that described the screening methodology and a sample of the screening results reports for a selected group of safety-related and non-safety-related systems. The applicant referenced technical reports LR-1001/2001, Rev. 2, “System Structure Screening Methodology,” and LRPG-201, “System and Structure Screening,” during the review of the screening process. The applicant’s process followed the guidance presented in NEI 95-10 and consisted of the following three activities:

1. review of system and structure intended functions

2. identification of the equipment that supports the intended functions

3. listing of the in-scope equipment that is passive and therefore requires an AMR

The applicant’s process did not specifically attempt to determine long-lived verses short-lived components at this point in the screening methodology. That determination was performed at the AMR process implementation.

Mechanical Components

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

The methodology for identifying mechanical components within the scope of the rule included both mark-numbered (i.e., components identified in the applicant’s electronic component database) and non-mark-numbered components. For the mark-numbered components, the individual components were identified and reviewed. For the non-mark-numbered components, the components were categorized by component groups such as tubing and hoses. These component groups were then evaluated as part of the system screening table development. The audit team did not identify any discrepancies between the methodology documented and the implementation results.

Structures

During the audit of the applicant’s renewal scoping and screening process, the staff also examined the applicant’s results from the implementation of this methodology by reviewing the structural components identified as being within the scope, the corresponding structural-level intended functions, and the resulting list of structural components subject to an AMR.

The applicant performed a review of all mechanical components that were determined to be within the scope of license renewal and subject to an AMR, and identified each structure that contains any of these components as being within the scope of license renewal and subject to an AMR.

The applicant explained that because most structural members (e.g., walls, beams, grating, foundations, duct banks, sumps, etc.) do not have individual mark numbers, the structural screening was initiated by first identifying structural members which support the intended functions that the structure performs. The structural members were identified by reviewing detailed structural drawings for the in-scope structures. After the structural members were identified, they were further evaluated in the structural AMR. Structural members that support equipment, piping, and ductwork were evaluated in a specific equipment support AMR.

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

Electrical Components

During the audit of the applicant's renewal scoping and screening process, the staff also evaluated the implementation of this methodology by reviewing the list of electrical components subject to an AMR. The electrical/I&C components that are in scope because they perform a pressure boundary function are shown on system drawings. The applicant has treated these electrical/I&C components as mechanical components and has identified them during system screening. For the non-mark-numbered components, the applicant combined the components into electrical component groups on the basis of the electrical equipment categories described in the NEI 95-10, Appendix B guidance. Those component groupings were then reviewed to determine which component groups performed an intended function without moving parts or without a change in configuration or properties in accordance with 10 CFR 54.21(a)(1)(i). Based on this approach, the applicant established the set of electrical/I&C component groups which performed a passive function in support of system intended functions. The results were reviewed by the audit team with the cognizant engineers responsible for the review. The audit team did not identify any discrepancies between the methodology documented and the implementation results.

System Screening

The applicant implemented a system-level screening process to identify mechanical, structural, and electrical components subject to an AMR. The system screening process included both the mark-numbered and non-mark-numbered components as stated above for each discipline. The system screening process consisted of the following major activities:

1. identify and update system intended functions
2. generate system screening tables
3. identify passive components requiring an AMR

4. validate system intended functions and evaluation boundaries
5. prepare system screening technical reports
6. generate license renewal drawings
7. assemble system screening packages
8. update the Structure/System Scoping Report

These major activities provided a mechanism to verify that system intended functions were captured adequately by detailed system design documentation and that the components selected for further review supported those intended functions. In preparing the system screening tables, the applicant developed a series of filters which identified components from the applicant's electronic components database that were in scope and passive. The screening tables were further used in the system screening reports to document the individual system components and commodity groups for which AMRs were performed and those components for which no AMR is needed. For each component the screening table identified the license renewal scoping criteria (safety-related, non-safety-related affecting safety-related, and the five regulated events) which were used to bring the component into scope.

The audit team reviewed the screening implementation procedures and a selected sample of the system screening reports to ensure consistent application of the applicant's screening methodology. The team identified that the sample reviewed was developed in accordance with the administrative controls governing the process and was consistent in level of detail and presentation. The audit team further reviewed a sample of the license renewal drawing and system screening table results to ensure the individual components identified in the system screening tables were reflected appropriately on the drawings. For those components identified in the screening table and not requiring an AMR, the individual screening report presented a detailed explanation for the component exclusion from an AMR. The audit team reviewed a sample of these explanations and found that they were consistent with the guidance and presented adequate justification for the determination made. The team did not observe any discrepancies between the sample tables and drawings evaluated.

On the basis of the evaluation described above, the audit team determined that the methodology, as described in each LRA and implemented by the applicant, is consistent with the requirements of the Rule, and that the screening methodology will identify SCs that meet the screening criteria of 10 CFR 54.21(a)(1).

2.1.4 Conclusions

The staff's review of the information presented in Section 2.1 of each LRA, the supporting information in UFSARs, the information presented during the scoping and screening audit and inspection, and the applicant's responses to the staff's RAIs, as discussed above, formed the basis of the staff's safety determination. The staff verified that the applicant's scoping and screening methodology, including its supplemental 10 CFR 54.4(a)(2) review which brought additional non-safety-related piping segments and associated components into the scope of license renewal was consistent with the requirements of the Rule and the staff's position on the treatment of non-safety-related SSCs. The staff concludes that there is reasonable assurance that the scoping and screening methodology used by the applicant to identify SSCs within the scope of the Rule and SCs that are subject to an AMR, is consistent with the requirements of 10 CFR 54.4 and 10 CFR 54.21.

2.1.5 References for Section 2.1

1. NUREG-1800, “Standard Review Plan for Review of License renewal Applications for Nuclear Power Plants”, July 2001
2. NEI 95-10, “Industry Guideline for Implementing the Requirements of 10 CFR Part 54 - The License renewal rule”, Revision 2, August 2000
3. North Anna and Surry Updated Final Safety Analysis Reports
4. NRC Generic Aging Lessons Learned Report (GALL), August 2000.
5. Position Paper LR-1907/2907, “Screening for Thermal Insulation”, Rev. 1, 6/26/01
6. Regulated Events Report LR-1005, License Renewal Position Paper, “Fire Protection: 10 CFR 50.48 and Appendix R Surry Power Station, Units 1 & 2", Rev. 1, 3/2/2001
7. Regulated Events Report LR-1005, License Renewal Position Paper,”Fire Protection: 10 CFR 50.48 and Appendix R North Anna Power Station, Units 1 & 2", Rev. 1, 3/2/2001
8. Regulated Events Report LR-1006, 10 CFR 54 Regulated Programs Loss of All Alternating Current Power (SBO) Surry Power Station, Rev. 1, 2/28/2001
9. Regulated Events Report LR-2006, “10 CFR 54 Regulated Programs Loss of All Alternating Current Power (SBO) North Anna Power Station”, Rev. 1, 2/28/2001
10. Regulatory Guide 1.188, “Standard Format and Content for Applications to Renew Nuclear Power Plant Operating Licenses”, July 2001
11. STD-GN-0003, “Standard for Determining the Safety Classification of Structures, Systems, and Components,” Rev.14, 6/22/01
12. SDBD-SPS-SI, “System Design Basis Document, Safety Injection System, Surry Power Station”, Rev.3, 7/31/00
13. SDBD-NAS-SI, “System Design Basis Document, Safety Injection System, North Anna Power Station,” Rev.3, 5/31/01
14. SDBD-NAS-AFW, “System Design Basis Document, Auxiliary Feedwater System, North Anna Power Station,” Rev.3, 6/15/00
15. SDBD-SPS-AFW, “System Design Basis Document, Auxiliary Feedwater System, Surry Power Station”, Rev.3, 1/31/01
16. SDBD-SPS-FW, “System Design Basis Document, Feedwater System, Surry Power Station”, Rev.1, 1/31/00
17. Technical Report LR-1007/LR-2007, “Criterion 2 report: Non-safety-related Affecting Safety-related Surry and North Anna Power Stations”, Rev 2., 4/12/2001
18. Technical Report LR-1000/LR-2000, “License renewal System/Structure Scoping North Anna Power Station Surry Power Station”, Rev 2., 7/12/2001
19. Technical Report LR-1001/LR-2001, “System/Structure Screening Methodology Surry and North Anna Power Stations”, Rev 2., 1/31/2001
20. Technical Report LRPG-201, “License renewal Project Guideline System and Structure Screening Surry and North Anna Power Stations”, Rev 2., 3/09/2001
21. Technical Report TR CE-0087, “Guideline For Monitoring Structures, Surry Power Station”, Rev. 2, 8/24/98
22. Technical Report TR CE-0089, “Guideline For Monitoring Structures, North Anna Power Station”, Rev. 4, 12/15/99
23. Technical Report LR-1002/LR-2002, “10 CFR 54 Regulated Programs Environmental Qualification”, Rev. 0, 5/26/1999
24. Technical Report LR-1003/LR-2003, “10 CFR 54 Regulated Programs Anticipated Transient Without Scram”, Rev. 2, 9/23/1999
25. Technical Report LR-2135, “License Renewal Screening Report, Safety Injection System, North Anna Power Station”, Rev. 1, 5/25/01

26. Technical Report LR-2107, “License Renewal Screen Report, Feedwater System, North Anna Power Station”, Rev. 1, 5/25/01
27. Technical Report LR-1655, “License Renewal Project Aging Management Review, Cables and Connectors, Surry Power Station”, Rev. 2, 5/21/2001
28. Technical Report LR-1921/2921, “Aging Management of Criterion 2 (Non-safety-related/Safety-related) Component Groups not Addressed in AMR Reports”, Rev. 0
29. VPAP-0815, “Maintenance Rule Program”, Rev.11, 6/28/00
30. VPAP-0310, “Equipment Data System (EDS) Database Control”

2.2 Plant Level Scoping Results

The statements of consideration (SOC) for the license renewal rule (60 FR 22478) indicates that an applicant has the flexibility to determine the set of SCs for which an AMR is performed, provided that this set encompasses the SCs for which the Commission has determined an AMR is required. Accordingly, the staff focused its review on verifying that the implementation of the applicant's scoping and screening methodology evaluated in Section 2.1 of this SER did not result in the omission of any structure and component (SC) that is required by 10 CFR 54.21(a)(1) to be subject to an AMR. The staff performed this review using the following two-step evaluation:

- The first step was to determine whether the applicant had properly identified the SSCs that are within the scope of license renewal in accordance with 10 CFR 54.4. As described in more detail below, the staff reviewed selected SSCs that the applicant did not identify as being within the scope of license renewal to verify that they do not meet any of the scoping criteria in 10 CFR 54.4(a)

- The second step was to determine whether the applicant had properly identified the SCs that are subject to an AMR in accordance with 10 CFR 54.21(a)(1). As described in more detail below, the staff reviewed the evaluation boundaries of the systems and structures included within the scope of license renewal to verify that the applicant considered all the SCs within the scope of license renewal in accordance with 10 CFR 54.21(a)(1). From the SCs that were within the evaluation boundaries, the staff reviewed the screening results to verify that no SC that performs its intended function without moving parts or without a change in configuration or properties (passive) or that is not subject to replacement based on qualified life or specified time period (long-lived) was excluded from an AMR. The staff did not review the SCs that the applicant had identified as subject to an AMR because it is an applicant's option to perform an AMR on more SCs than those required by 10 CFR 54.21(a)(1)

The staff's review and evaluation of the scoping results is documented below. The staff's review of the applicant's screening results will be documented in subsequent sections as referenced below. The staff performed the described scoping and screening reviews for both the North Anna and Surry LRAs to determine whether there was reasonable assurance that the applicant had identified and listed those SCs that are 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), respectively.

2.2.1 Technical Information in the Application

The staff reviewed Section 2.2 of the North Anna and Surry LRAs, "Plant Level Scoping Results," as part of its scoping and screening review. The staff used the NAS and SPS UFSARs as its primary means of verification. The staff also used the license renewal drawings provided with each LRA, the applicant's responses to requests for additional information as documented in letters from the applicant, telephone responses to requests for additional information as documented in letters from the applicant, telecommunications as documented in letters to the applicant, and other documented sources, as applicable. All applicable documents and letters used in the staff's evaluation are docketed.

In each LRA Section 2.1, “Scoping and Screening Methodology,” the applicant describes its methodology for identifying the SCs that are within the scope of license renewal and subject to an AMR. In the scoping of SSCs, the applicant performed a plant review to identify those SSCs that perform those functions that are the basis for including an SCC within the scope of license renewal as specified in 10 CFR 54.4(a). The applicant documents its scoping results in Section 2.2, “Plant Level Scoping Results,” of the North Anna and Surry LRAs. In Tables 2.2-1 and 2.2-3 of each LRA, the applicant listed the systems and structures, respectively, that are within the scope of license renewal. These tables also identify the sections of each LRA that contain the screening results for each system and structure identified by the applicant as being within the scope of license renewal. In addition, in Tables 2.2-2 and 2.2-4 of each LRA, the applicant listed the systems and structures, respectively, that are not in the scope of license renewal and the UFSAR section that contains the information used by the applicant to justify not including those systems and structures as being within the scope of license renewal. From those SSCs that are within the scope of license renewal the applicant identified and lists those SCs that perform their intended functions without moving parts or without a change in configuration or properties and that are not replaced based on qualified life or specified time period. The applicant documents its screening results in Sections 2.3 through 2.5 of each LRA. The staff reviewed the applicant’s scoping and screening methodology, and documented its evaluation in Section 2.1 of this SER. The staff’s review and evaluation of the applicant’s scoping for both North Anna and Surry is documented in the following paragraphs. The staff review and evaluation of the applicants screening results are documented in Sections 2.3 through 2.5 of this SER.

2.2.2 Staff Review

To ensure that the scoping methodology, as described in Section 2.1 of the North Anna and Surry LRAs, identified the SSCs that are within the scope of license renewal, the staff performed the following review of the scoping results as documented in Section 2.2 of each LRA. The staff sampled the content of the NAS and SPS UFSARs based on the listing of systems and structures in Tables 2.2-1 through 2.2-4 of each LRA to identify those systems or structures that may perform a function that meets the scoping requirements of 10 CFR 54.4 that the applicant does not include within the scope of license renewal. The staff selected several systems and structures from Tables 2.2-2 and 2.2-4, such as (but not limited to) the alternate AC (AAC) diesel service air (BSR), boron recovery tank building, and condensate storage tank foundation for further evaluation.

The staff reviewed the North Anna and Surry UFSARs and found no reference to the AAC diesel service air (BSR) systems, indicating that these systems have no functions important to safety. In addition, on October 3, 2001, in a telecommunication that is documented in a letter to the applicant dated October 11, 2001, the staff requested that the applicant describe the function of the North Anna and Surry BSR systems, and why these support systems of the AAC diesel generator systems (the AAC diesel generator systems are within the scope of license renewal) were not included within the scope of license renewal. The applicant explained that the function of the BSR system is to provide pressurized service air for pneumatic maintenance equipment and it is not used in the operation of the AAC diesel during a station blackout or any other safety-related or safety-supporting function. Therefore, the BSR system does not perform any of the functions that are the bases for identifying an SCC as being within the scope of license renewal in accordance with 10 CFR 54.4(a). The staff found other AAC diesel generator support systems such as AAC diesel starting air, fuel oil, lube oil, and cooling water systems that do affect the operability of the AAC diesel generators that were included within the scope of license renewal consistent with the requirements of 10 CFR 54.4(a). On the basis of the information provided above, the staff found the applicant's exclusion of the North Anna and Surry BSR systems from the scope of license renewal to be acceptable.

In addition to this sample review, the staff did an independent and more thorough review to verify that the boron recovery tank (refer to Section 2.3.3.25 of the SER) and condensate storage tank (refer to Sections 2.3.4.3 and 2.3.4.4 of the SER) do not perform any of the functions that are the bases for identifying an SCC as being within the scope of license renewal in accordance with 10 CFR 54.4(a). Because the staff verified that the boron recovery and condensate storage tanks are not within the scope of license renewal the staff did not identify any function for the boron recovery tank building and condensate storage tank foundation that would require including these structures within the scope of license renewal in accordance with 10 CFR 54.4 and, therefore, finds the applicant's decision not to include them within the scope of license renewal to be acceptable.

As part of the scoping review, however, the staff identified a concern with the legends in the license renewal drawings submitted with the North Anna and Surry LRAs. The legend for each drawing explains the highlighted portions of the system and is intended to represent the SCs that are within the scope of license renewal. However, the license renewal drawing legends for both North Anna and Surry contain a statement that the highlighted portions of the systems represent the "components subject to aging management review." The staff reviewed a number of the drawings to verify that the highlighted portions of the drawings represent the passive components that are within the scope of license renewal. In addition, in a conference call with the applicant on September 17, 2001, as documented in a letter to the applicant dated October 11, 2001, the applicant confirmed that the highlighted portions of the drawings represent the passive SCs that are within the scope of license renewal and that some of the highlighted SCs may be screened out if they are replaced based on qualified life or specified time period. Active components within the evaluation boundaries (indicated by the highlighted portions of the drawings) are not highlighted. The staff has interpreted the drawing correctly in its review.

In the North Anna and Surry LRAs, Sections 2.3 through 2.5, the applicant identified and lists the SCs that are subject to an AMR in accordance with 54.21(a)(1). The applicant identified the mechanical system components and the structural components that are subject to an AMR in Section 2.3, "Scoping and Screening Results: Mechanical Systems," and Section 2.4, "Scoping and Screening Results: Structures," of each LRA, respectively. The staff documents the findings from its review and evaluation of the applicant's mechanical systems and plant structural components screening results in Sections 2.3 and 2.4 of this SER, respectively.

The applicant categorizes the equipment and structural supports that are within the scope of license renewal as bulk commodities, and presents the scoping and screening results for these bulk commodities in Sections 2.4.9, "NSSS Equipment Supports," and 2.4.10, "General Structural Supports," of each LRA. The staff documents the findings from its review and evaluation of the applicant's structure support scoping and screening results in Sections 2.4.9 and 2.4.10 of this SER. In addition, the applicant categorizes electrical, and instrumentation and control (EIC) components that support the operation of the systems presented throughout Sections 2.3 of the LRAs into commodity groups and presents the screening results for these commodities in Section 2.5, "Screening Results: Electrical and Instrumentation and Control

Systems," of each LRA. The staff documents the findings from its review and evaluation of the applicant's EIC component groupings in Section 2.5 of this SER.

2.2.3 Conclusion

On the basis of the review described above, the staff finds that there is reasonable assurance that the applicant has identified the SSCs for NAS 1/2 and SPS 1/2 that are within the scope of license renewal in accordance with 10 CFR 54.4.

2.3 Scoping and Screening Results: Mechanical Systems

In both the North Anna and Surry LRAs, Section 2.3, "Scoping and Screening Results: Mechanical Systems," the applicant documents its scoping and screening results for the mechanical components for NAS 1/2 and SPS 1/2 for the purpose of license renewal. This review was performed for the mechanical systems of the reactor coolant systems, the engineered safety feature systems, the auxiliary systems, and the steam and power conversion systems. The following is the staff's evaluation of the information provided in each LRA Section 2.3, the license renewal drawings provided with each LRA, information contained in the North Anna and Surry UFSARs, and the applicant's response to the staff's request for additional information.

2.3.1 Reactor Coolant System

In both the North Anna and Surry LRAs, Section 2.3.1, "Reactor Coolant System," the applicant describes the components of the reactor cooling system (RCS) that are within the scope of license renewal and subject to an AMR. The following staff evaluation applies to the RCSs of all four units (NAS 1/2 and SPS 1/2) for the purpose of license renewal. Any differences in any of the four RCSs or unique information that applies to a specific unit or site will be clearly identified as to which unit or site the information applies. Other than what is specifically stated, the following evaluation is applicable to the RCSs for NAS 1/2 and SPS 1/2.

2.3.1.1 Reactor Coolant

In the North Anna and Surry LRAs, Section 2.3.1.1, "Reactor Coolant," the applicant describes the piping and components of the RCSs that are within the scope of license renewal and subject to an AMR for NAS 1/2 and SPS 1/2. The RCSs are similar for both facilities with some minor differences in system design. Any notable differences are specifically identified and discussed in the staff's evaluation. Unless otherwise specified, the information provided below is applicable to the NAS 1/2 and SPS 1/2 RCSs. The RCS structural components that are subject to AMR are presented separately by the applicant in Section 2.4.9 of each LRA, "NSSS Equipment Supports," as commodity groups and, therefore, are evaluated separately by the staff in Section 2.4.9 of this SER. The reactor coolant (RC) piping and mechanical components are further described in Chapter 5 of the North Anna UFSAR and Chapter 4 of the Surry UFSAR.

2.3.1.1.1 Technical Information in the Application

The RCS piping and components for NAS 1/2 and SPS 1/2 are used to transfer the heat produced in the reactor cores to the steam generators, where steam is generated to drive the turbine generator. The RC circulates through each reactor core at a flow rate and temperature consistent with achieving the desired reactor core thermal-hydraulic performance. The reactor coolant for each of the four units also serves as a neutron moderator, a reflector, and a solvent for the neutron absorber.

The NAS 1/2 and SPS 1/2 RC piping and components within the scope of this review are similar and contain the following features. The RC piping and components provide a pressure boundary for containing the reactor coolant to limit the uncontrolled release of radiation to its secondary system and other parts of the plant.

For each unit, the RC piping and components consist of a reactor vessel and three loops (A, B, and C) that interconnect at the reactor vessel. Each loop consists of one reactor coolant pump, one steam generator, valves, and interconnecting piping. Each RCS also has a pressurizer that is connected to the Loop C hot-leg, and provides a means for controlling RCS pressure. The following major RC components are presented separately in each LRA and will be evaluated separately by the staff in the following sections of this SER:

- Reactor Vessel — SER, Section 2.3.1.2
- Reactor Vessel Internals — SER, Section 2.3.1.3
- Pressurizer — SER, Section 2.3.1.4
- Steam Generator — SER, Section 2.3.1.5

The remaining RC piping and components included within the scope of license renewal and subject to an AMR include the piping and valves of the three-loops for each of the four units, the RC piping and components that allow venting of the reactor vessel and pressurizer, and the RC piping and components that connect the RCS to the safety injection system. The safety injection systems deliver cooling water to the RCSs to provide for emergency cooling of the reactor core and reactor shutdown during a loss-of-coolant accident (LOCA).

The RC piping and components include a neutron shield tank for each unit that is located inside the primary shield wall around the reactor vessel. These tanks provide support for the reactor vessel and limit the heat transferred to the primary shield wall concrete. The neutron shield tanks are described further in Section 2.4.9 of the LRA, “NSSS Equipment Supports.” Cooling for the tank is described in Section 2.3.3.9 of the LRA, “Neutron Shield Tank Cooling.” The neutron shield tanks and neutron shield tank cooling (NS) system are further evaluated in Section 2.4.9 and Section 2.3.3.11 of this SER, respectively.

For NAS 1/2, the reactor coolant pump (RCP) motor oil collection systems are considered part of the RCSs and are included within the scope of this staff evaluation. Although these components are also included within the scope of license renewal and subject to an AMR for SPS 1/2, they are considered to be part of the fire protection (FP) system for Surry, and the parts of these systems that are within the scope of license renewal and the SCs that are subject to an AMR are evaluated by the staff with the FP system in Section 2.3.3.37 of this SER.
The applicant describes its process for identifying the mechanical components that are within the scope of license renewal in Section 2.1.4, “Scoping Methodology,” of each LRA. As described in the scoping methodology, the applicant identified the RC piping and components (the portions of the RCSs) that are within the scope of license renewal on the license renewal drawings listed in Section 2.3.1.1 of each LRA. Consistent with the method described in each LRA, Section 2.1.5, “Screening Methodology,” the applicant listed the RC mechanical

component commodity groups that are within the license renewal evaluation boundaries and that are subject to an AMR in Table 2.3.1-1 of each LRA. The tables also list the intended functions and the LRA section containing the AMR for each commodity group.

The RC piping and components that are subject to AMR include the following component commodity groups: bellows (reactor vessel level instrumentation system), bolting, flow elements, flexible connections/hoses, bottom-mounted instrumentation flux thimble tubes, instrument valve assemblies, neutron shield tanks, piping, pump casings, RCP motor lower bearing oil coolers, RCP motor stator coolers, RCP motor upper bearing oil coolers, reactor cavity seals, restricting orifices, thermowells, tubing, and valve bodies. The applicant identified maintaining pressure boundary integrity, flow restriction, and structural and/or functional support as the intended functions for the RC piping and components that are subject to an AMR for the NAS and SPS.

2.3.1.1.2 Staff Evaluation

The staff reviewed the North Anna and Surry LRAs, Section 2.3.1.1, to determine whether there is reasonable assurance that the applicant appropriately identified the portions of the RCSs that are within the scope of license renewal in accordance with 10 CFR 54.4(a), and that the applicant appropriately identified the SCs that are subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff reviewed the information provided in Section 2.3.1.1 of each LRA, the applicable license renewal drawings, and the North Anna and Surry UFSARs to determine whether the applicant adequately identified the portions of the RCSs that are within the scope of license renewal. The staff verified that those portions of the RCSs that meet the scoping requirements of 10 CFR 54.4 were included within the scope of license renewal and were identified as such by the applicant in Section 2.3.1.1 of each LRA. To verify that the applicant did include the applicable portions of the NAS 1/2 and SPS 1/2 RCSs as being within the scope of license renewal, the staff focused its review on those portions of the RCS that were not identified as being within the scope of license renewal and verified that they did not meet the scoping criteria of 10 CFR 54.4. In addition, the staff reviewed the North Anna and Surry UFSARs to identify any additional system functions that were not identified in each LRA and verified that these additional functions did not meet the scoping requirements of 10 CFR Part 54.4. The staff did not identify any omissions.

The staff then determined whether the applicant had properly identified the RC piping and components that are subject to AMR from among those portions of the RCSs that were identified as being within the scope of license renewal. The applicant used the screening methodology described in Section 2.1 of each LRA to identify and list the SCs subject to AMR. The staff evaluation of the scoping and screening methodology is documented in Section 2.1 of this SER.

In the NAS LRA, the applicant identified the portions of the RCSs that are within the scope of license renewal on the license renewal drawing listed on page 2-37, and lists the mechanical component commodity groups that are subject to AMR in Table 2.3.1-1 of the LRA. This table provides the intended functions and a reference to the AMR results section for each component group.

In the SPS LRA, the applicant identified the portions of the RCSs that are within the scope of license renewal on the license renewal drawing listed on page 2-36, and lists the mechanical component commodity groups that are subject to AMR in Table 2.3.1-1 of the LRA. The table provides the intended functions and a reference to the AMR results section for each component group.

The license renewal drawings were highlighted by the applicant to identify those portions of the RCSs that meet at least one of the scoping requirements of 10 CFR 54.4. The staff compared the LRA drawings to the system drawings and the descriptions in the UFSAR to ensure they were representative of the RCSs. The staff performed its review by sampling the SCs that the applicant determined as being within the scope of license renewal but not subject to AMR to verify that no RC pipe or component that performs its intended function without moving parts or without a change in configuration or properties or is not subject to replacement based on qualified life or specified time period was excluded from an AMR. The staff did not identify any omissions.

2.3.1.1.3 Conclusion

On the basis of the staff's review of the information presented in Section 2.3.1.1 of each LRA, the supporting information in the North Anna and Surry UFSARs, and LRA drawings, as described above, the staff did not identify any omissions in the scoping and screening of the NAS 1/2 and SPS 1/2 RC piping and components by the applicant. Therefore, the staff concludes that there is reasonable assurance that the applicant has identified those portions of the North Anna and Surry RCSs that are within the scope of license renewal and the RC piping and components that are subject to an AMR in accordance with 10 CFR 54.4(a) and 10 CFR 54.21(a)(1), respectively.

2.3.1.2 Reactor Vessel

In the North Anna and Surry LRAs, Section 2.3.1.2, "Reactor Vessel," the applicant describes the reactor vessels (RV) and RV subcomponents that are within the scope of license renewal and subject to an AMR for NAS 1/2 and SPS 1/2. The RVs are similar for both facilities with some minor differences in vessel design. Any notable differences are specifically identified and discussed in the staff's evaluation. Unless otherwise specified, the information provided below is applicable to the NAS 1/2 and SPS 1/2 RVs. The RV structural components that are subject to AMR are evaluated separately in Section 2.4.9 of each LRA, "NSSS Equipment Supports," as commodity groups and, therefore, are evaluated separately by the staff in Section 2.4.9 of this SER. The RVs and RV subcomponents are further described in Chapter 5 of the North Anna UFSAR and Chapter 4 of the Surry UFSAR.

2.3.1.2.1 Technical Information in the Application

The RVs for NAS 1/2 and SPS 1/2 are categorized as standard Westinghouse 157-inch inner-diameter three-loop RVs. Each RV is a cylindrical shell with a welded, hemispherical lower head and a flanged hemispherical upper head. Each RV provides structural support for its reactor core and serves as a pressure boundary to contain the RC and prevent the uncontrolled release of radioactive material.

For NAS 1/2, the reactor vessel shell is constructed of forged rings (upper, intermediate, and lower) welded together circumferentially. At SPS 1/2, the reactor vessel shell is constructed of plate segments welded together both circumferentially and longitudinally.

All four RVs are vertically mounted on welded support pads attached to the bottom of the primary nozzles, which are spaced circumferentially around the vessel just below the vessel flange. For each RV, the three reactor coolant loop hot and cold legs are welded to the primary nozzles. The internal surfaces of the RVs are clad with a stainless steel overlay, which provides corrosion resistance for the surfaces of the RVs that are in contact with borated reactor coolant. The RV lower heads have penetrations (instrumentation tubes), for movable in-core nuclear flux thimble tubes, which extend into the reactor vessel interiors and mate with the lower internal assemblies. The core support ledge, located inside each of the four RVs just below the vessel flanges, supports the weight of the RV internals and the fuel. The lower internal assemblies hang from the core support ledges and are supported laterally by core support lugs.

Each of the four RVs has a vessel flange that mates with its closure head flange. The flanges are bolted together by 58 6-inch closure studs, nuts, and spherical washers. Each RV has two concentric, hollow, metallic O-rings between the vessel flange and closure head flange that form an inner and outer seal. This dual O-ring arrangement forms a dynamic seal when the closure head is bolted in place and internal pressure is applied. Each of the RV closure head domes are penetrated by the CRDM housing tubes and a vent pipe.

Nozzle support pads located below each of the primary nozzles provide a point of interface, and support for each of the RVs. The weight of the RVs is transmitted through the nozzle support pads to the neutron shield tank that surrounds each vessel.

The applicant describes its process for identifying the mechanical components that are within the scope of license renewal in Section 2.1.4, “Scoping Methodology,” of each LRA. As described in the scoping methodology, the applicant identified the RVs as being within the scope of license renewal. Consistent with the method described in the LRA, Section 2.1.5, “Screening Methodology,” the applicant listed the RV subcomponents that are subject to an AMR in Table 2.3.1-2 of each LRA. The tables also list the intended functions, and the LRA sections containing the AMR for each subcomponent.

The RV subcomponents that are subject to AMR include the following items: bottom-mounted instrumentation flux thimble tubes, bottom-mounted instrumentation guide tubes, bottom head domes and torus (and cladding), closure head domes and flange (and cladding), closure studs, nuts and washers, core support lugs, CRDM housing flanges, CRDM housing tubes, CRDM latch housings, CRDM rod travel housings, seal table fittings, instrumentation port assemblies, instrumentation tubes, instrumentation tube safe ends, lifting lugs, primary nozzles and support pads (and cladding), primary nozzle safe end, refueling seal ledge, seal table, vent pipe, ventilation shroud support ring, vessel flange and core support ledge and cladding, and vessel shell (upper, intermediate and lower) and cladding. The applicant identified maintaining pressure boundary integrity and structural and/or functional support as the intended functions for the RV subcomponents that are subject to an AMR for the NAS and SPS.

2.3.1.2.2 Staff Evaluation

The staff reviewed the North Anna and Surry LRAs, Section 2.3.1.2, to determine whether there is reasonable assurance that the applicant appropriately identified the portions of the RVs that are within the scope of license renewal in accordance with 10 CFR 54.4(a), and that the applicant appropriately identified the NAS 1/2 and SPS 1/2 RVs subcomponents that are subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff reviewed the information provided in Section 2.3.1.2 of each LRA, the applicable license renewal drawings, and the North Anna and Surry UFSARs to determine whether the applicant adequately identified the portions of the RVs that are within the scope of license renewal. The staff verified that those portions of the NAS 1/2 and SPS 1/2 RVs that meet the scoping requirements of 10 CFR 54.4 were included within the scope of license renewal and were identified as such by the applicant in Section 2.3.1.2 of each LRA. To verify that the applicant did include the applicable portions of the RVs within the scope of license renewal, the staff focused its review on those portions of the RVs that were not identified as being within the scope of license renewal and verified that they did not meet the scoping criteria of 10 CFR 54.4. In addition, the staff reviewed the UFSARs for each facility to identify any additional system functions that were not identified in each LRA and verified that these additional functions did not meet the scoping requirements of 10 CFR 54.4.

As a result of this review, the staff identified the following potential omissions. The staff confirmed that the two concentric, hollow, metallic O-rings between the closure head flange and the reactor vessel flange form an inner and outer seal. Furthermore, it was stated in the UFSARs that leakage through the reactor vessel head flange will leak between the double O-ring seal to the leakoff path provided. Leakage into this leakoff path will cause high temperature in this line, which will actuate an alarm in the control room. On the basis of the staff's experience with license renewal the staff has generally concluded that the inner O-ring, the leakoff lines, and the outer O-ring all support the reactor vessel closure head flange pressure boundary. Although in select cases the staff has accepted a site-specific technical justification, in general, the leakoff lines are subject to an AMR. Therefore, the staff issued an RAI to the applicant to provide a site-specific technical justification for both NAS and SPS as to why aging management is not required or perform an aging management review for these components.

In a letter to the NRC dated January 4, 2002, the applicant informed the staff that the leakage detection system for NAS 1/2 and SPS 1/2 RVs begins with a 1/4" hole in the RV flanges. This 1/4" hole drains into a 1" tubing a short distance from the RV flanges; however, leakage flow past the inner O-ring is limited to the flow rate allowed by the 1/4" diameter hole in each of the RV flanges. The potential flowrate (through the 1/4" diameter hole) for each of the four RVs is well within the normal makeup capability of the charging system and, therefore, does not meet any of the scoping criteria in 10 CFR 54.4(a). In the same January 4, 2002 letter, the applicant also informed the staff that the license renewal drawings referenced in the applications (11448-LRM-086A, sh. 1, and 11548-LRM-086A, sh. 1, for Surry and 11715-LRM-093A, sh. 1, and 12050-LRM-093A, sh. 1 for North Anna) incorrectly indicate the leak detection components within the scope of license renewal, and the applicant committed to revise the affected license renewal drawings consistent with this justification. In its letter dated July 25, 2002, the applicant stated that the listed drawings have been revised to remove the reactor vessel flange leak detection system from the scope of license renewal. Since the applicant has completed this action, the staff considers confirmatory action 2.3.1.2-1 closed.

The staff reviewed this information and the affected drawings, and concluded that the components of the leak detection system need not be included within the scope of license renewal because they do not meet the requirements of 10 CFR 54.4(a). The staff did not identify any additional potential omissions.

2.3.1.2.3 Conclusion

On the basis of the staff's review of the information presented in Section 2.3.1.2 of each LRA and the supporting information in the Surry and North Anna UFSARs and LRA drawings, as described above, the staff did not identify any omissions in the scoping of the RV and screening of the RV subcomponents for the NAS 1/2 and SPS 1/2 by the applicant. Therefore, the staff concludes that there is reasonable assurance that the applicant has identified those portions of the NAS 1/2 and SPS 1/2 RVs that are within the scope of license renewal and the RV subcomponents that are subject to an AMR in accordance with 10 CFR 54.4(a) and 10 CFR 54.21(a)(1), respectively.

2.3.1.3 Reactor Vessel Internals

In the North Anna and Surry LRAs, Section 2.3.1.3, "Reactor Vessel Internals," the applicant describes the internal components of the NAS 1/2 and SPS 1/2 RVs that are within the scope of license renewal and subject to an AMR. The reactor vessel internals (RVI) are similar for both facilities with some minor differences in system design. Any notable differences are specifically identified and discussed in the staff's evaluation. Unless otherwise specified, the information provided below is applicable to the NAS 1/2 and SPS 1/2 RVIs. The RVI components are further described in Section 4.2.2 of the North Anna UFSAR and Section 3.5.1 of the Surry UFSAR.

2.3.1.3.1 Technical Information in the Application

In Section 2.3.1.3 of each LRA, the applicant states that the NAS 1/2 and SPS 1/2 RVI components are designed to direct coolant flow, to support the reactor core, and to guide the control rod assemblies in the withdrawn position. The RVIs consist of two basic assemblies: an upper internals assembly that is removed during each refueling operation to obtain access to the reactor core, and a lower internals assembly, which includes the core barrel and baffle/former assembly and can be removed, if desired, following a complete core unload. In addition, both Surry units' lower internal assemblies have a diffuser plate that is used to enhance flow uniformity entering the lower core plate. The North Anna RVIs do not have diffuser plates.

The unique Westinghouse RV design that allows the removal of the RVIs provides the capability to perform periodic inspections to determine the condition of the internals and to repair if needed. This unique capability provides a more direct means (than other designs) to determine the functionality of the RVIs during the extended period of operation.

The lower internal assembly is installed and supported in the RV by clamping the assembly to a ledge below the vessel-head mating surface, which is closely guided into place at the bottom by radial support/clevis assemblies. This core support ledge supports the entire weight of the reactor vessel internals and the fuel. The lower internal assembly hangs from the ledge.

The upper internal assembly sits on a circumferential spring that rests on top of the lower internal flange, which also rests on the core support ledge. The bottom of the upper internals assembly is closely guided into place by the core plate alignment pins. The spring is compressed when the vessel head is lowered and tightened down, holding the lower internal assembly against the core support ledge and the upper internal assembly against the vessel head. This minimizes flow-induced vibrations and prevents upward motion of the lower internal assembly.

The applicant describes its process for identifying the mechanical components that are within the scope of license renewal in Section 2.1.4, "Scoping Methodology," of each LRA. As described in the scoping methodology, the applicant identified the internal portions of the RVs that are within the scope of license renewal on the license renewal drawings listed in Section 2.3.1.3 of each LRA. Consistent with the method described in the LRA, Section 2.1.5, "Screening Methodology," the applicant listed the RVI subcomponents that are within the license renewal evaluation boundaries and that are subject to an AMR in Table 2.3.1-3 of each LRA. The tables also list the intended functions and the LRA section containing the AMR for each commodity group.

The NAS 1/2 and SPS 1/2 RVIs that are subject to AMR include the following subcomponents: baffle and former assembly, bolting (baffle/former and barrel/former), control rod guide tube split pins, control rod guide tubes, core barrel, core barrel holddown spring, diffuser plate (SPS 1/2 only), head and vessel alignment pins, head cooling spray nozzles, instrument guide tubes, lower core plate, lower support plate and columns, radial support clevis inserts, radial support keys, secondary support assembly, thermal shield, upper core plate, upper core plate alignment pins, upper instrument columns, upper support column, and upper support plate. The applicant identified providing for flow distribution and structural and/or functional support as the intended functions for the RVIs that are subject to an AMR for the NAS and SPS.

2.3.1.3.2 Staff Evaluation

The staff reviewed the North Anna and Surry LRAs, Section 2.3.1.3, to determine whether there is reasonable assurance that the applicant appropriately identified the internal portions of the NAS 1/2 and SPS 1/2 RVs that are within the scope of license renewal in accordance with 10 CFR 54.4(a), and that the applicant appropriately identified the RVI subcomponents that are subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff reviewed the information provided in Section 2.3.1.3 of each LRA and the North Anna and Surry UFSARs to determine whether the applicant adequately identified the internal portions of the RVs that are within the scope of license renewal. The staff verified that the NAS 1/2 and SPS 1/2 RVIs that meet the scoping requirements of 10 CFR 54.4 were included within the scope of license renewal and were identified as such by the applicant in Section 2.3.1.3 of each LRA. To verify that the applicant did include the appropriate RVIs within the scope of license renewal, the staff focused its review on those RVIs that were not identified within the scope of license renewal and verified that they did not meet the scoping criteria of 10 CFR 54.4. In addition, the staff reviewed the UFSARs for each facility to identify any additional system functions that were not identified in each LRA and verified that these additional functions did not meet the scoping requirements of 10 CFR 54.4. The staff did not identify any omissions.

The staff then determined whether the applicant had properly identified the RVI subcomponents that were subject to AMR from among those internal portions of the RVs that were identified as being within the scope of license renewal. The applicant used the screening methodology described in Section 2.1 of each LRA to identify and list the RVIs subject to AMR. The staff's evaluation of the scoping and screening methodology is documented in Section 2.1 of this SER.

In the NAS LRA, the applicant refers to the NAS UFSAR, Figures 4.2-13, 14, and 15, for details on the North Anna RVIs, and lists the RVI subcomponents that are subject to AMR in Table 2.3.1-3 of the LRA. The table provides the intended functions and a reference to the AMR results section for each component group.

In the SPS LRA, the applicant refers to the SPS UFSAR, Figures 3.5-2, 6, and 7, for details on the Surry RVIs, and lists the RVI subcomponents that are subject to AMR in Table 2.3.1-3 of the LRA. The table provides the intended functions and a reference to the AMR results section for each component group.

The staff compared the description of the NAS 1/2 and SPS 1/2 RVIs provided in the North Anna and Surry LRAs and UFSARs. The staff continued its review by sampling the RVI subcomponents that the applicant identified as being within the scope of license renewal but not subject to AMR to verify that no subcomponent that performs its intended function without moving parts or without a change in configuration or properties, or is not subject to replacement based on qualified life or specified time period was excluded from an AMR. The staff did not identify any omissions.

2.3.1.3.3 Conclusion

On the basis of the staff's review of the information presented in Section 2.3.1.3 of each LRA and the supporting information in the North Anna and Surry UFSARs, as described above, the staff did not identify any omissions in the scoping and screening of the NAS 1/2 and SPS 1/2 RVIs by the applicant. Therefore, the staff concludes that there is reasonable assurance that the applicant has identified those internal portions of the NAS 1/2 and SPS 1/2 RVs that are within the scope of license renewal and the RVI subcomponents that are subject to an AMR in accordance with 10 CFR 54.4(a) and 10 CFR 54.21(a)(1), respectively.

2.3.1.4 Pressurizers

In the North Anna and Surry LRAs, Section 2.3.1.4, "Pressurizer," the applicant describes the NAS 1/2 and SPS 1/2 pressurizer and pressurizer subcomponents that are within the scope of license renewal and subject to an AMR. The pressurizers are identical for both facilities with no notable differences for the purpose of license renewal. Therefore, the information provided below is applicable to the NAS 1/2 and SPS 1/2 pressurizers. The pressurizer structural components that are subject to AMR are evaluated separately in Section 2.4.9 of each LRA, "NSSS Equipment Supports," as commodity groups and, therefore, are evaluated separately by the staff in Section 2.4.9 of this SER. The pressurizer and pressurizer subcomponents are further described in Section 5.5.5 of the North Anna UFSAR and Section 4.2.2.2 of the Surry UFSAR.

2.3.1.4.1 Technical Information in the Application

The pressurizers for NAS 1/2 and SPS 1/2 are ASME Section III Code vessels that are connected to each of the RCSs through a surge line welded to the C loop hot-leg piping and a spray line welded to the cold leg piping. The spray line and surge line nozzles are provided with thermal sleeves which provide thermal shielding. The internal surfaces of the pressurizer that are in contact with borated reactor coolant are clad with a stainless steel overlay for corrosion resistance. Access to the inside of the pressurizers is provided by a manway opening near the top of each of the pressurizers.

During normal operation, a pressurized water reactor pressurizer contains a combination of borated reactor coolant and steam that is maintained in the desired temperature and pressure range by electric heaters and the pressurizer spray system to provide pressure control for the RCS. The chemical and volume control system maintains the desired water level in the pressurizer during steady-state operation.

Pressurizers are designed to accommodate in-surges and out-surges caused by load transients. During an in-surge, the spray system is used to condense steam in the pressurizer to maintain pressurizer and overall RCS pressure within nominal limits, and to prevent the pressurizer pressure from reaching the operating point of the power-operated relief valve. A continuous spray flow is also provided to maintain reactor coolant chemistry and boron concentration in the pressurizer and associated piping consistent with the reactor coolant system. Additionally, the continuous spray flow prevents thermal stratification of the spray and surge line piping. During an out-surge, the pressure drops, causing water to flash to steam and automatic initiation of heaters to generate more steam to keep pressurizer pressure above the minimum allowable limit.

The applicant describes its process for identifying the systems and structures that are within the scope of license renewal in Section 2.1.4, “Scoping Methodology,” of North Anna and Surry LRAs. As described in the scoping methodology, the applicant identified the pressurizers within the scope of license renewal. Consistent with the method described in each LRA Section 2.1.5, “Screening Methodology,” the applicant listed the NAS 1/2 and SPS 1/2 pressurizer subcomponents that are subject to an AMR in Table 2.3.1-4 of each LRA. The tables also list the intended functions, and each LRA sections containing the AMR for each subcomponent.

The NAS 1/2 and SPS 1/2 pressurizer subcomponents that are subject to AMR include the following items: heater well and heater sheath, instrument nozzles, lower head (and cladding), manway (including pad and cladding), manway cover bolts, manway cover with insert, relief nozzle (and cladding), relief nozzle safe end, safety nozzle (and cladding), safety nozzle safe end, sample line nozzle, seismic support lugs, shell (and cladding), spray nozzle (and cladding), spray nozzle safe end, spray nozzle thermal sleeve, support skirt and flange, surge nozzle (and cladding), surge nozzle safe end, surge nozzle thermal sleeve, and upper head (and cladding). The applicant identified maintaining pressure boundary integrity as the intended function for the pressurizer subcomponents that are subject to an AMR for the NAS and SPS. In addition, certain pressurizer subcomponents provide structural support to maintain the integrity of pressure boundary components. The pressurizer structural support components that are subject to AMR are evaluated separately in Section 2.4.9 of each LRA, “NSSS Equipment Supports,” as commodity groups and, therefore, are evaluated separately by the staff in Section 2.4.9 of this SER.

2.3.1.4.2 Staff Evaluation

The staff reviewed the North Anna and Surry LRAs, Section 2.3.1.4, to determine whether there is reasonable assurance that the applicant appropriately identified the portions of the NAS 1/2 and SPS 1/2 pressurizers that are within the scope of license renewal in accordance with 10 CFR 54.4(a), and that the applicant appropriately identified the pressurizer subcomponents that are subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff reviewed the information provided in Section 2.3.1.4 of each LRA and the North Anna and Surry UFSARs to determine whether the applicant adequately identified portions of the pressurizers that are within the scope of license renewal. The staff verified that those portions of the NAS 1/2 and SPS 1/2 pressurizers that meet the scoping requirements of 10 CFR 54.4 were included within the scope of license renewal and were identified as such by the applicant in Section 2.3.1.4 of each LRA. To verify that the applicant did include the applicable portions of the pressurizers within the scope of license renewal, the staff focused its review on those portions that were not identified within the scope of license renewal and verified that they did not meet the scoping criteria of 10 CFR 54.4. In addition, the staff reviewed the UFSARs for each facility to identify any additional system functions that were not identified in each LRA and verified that these additional functions did not meet the scoping requirements of 10 CFR 54.4. The staff did not identify any omissions.

The staff then determined whether the applicant had properly identified the NAS 1/2 and SPS 1/2 pressurizer subcomponents that are subject to AMR from among those portions of the pressurizers that were identified as being within the scope of license renewal for North Anna and Surry. The applicant used the screening methodology described in Section 2.1 of each LRA to identify and list the pressurizer subcomponents that are subject to AMR for each of the four units. The staff evaluation of the scoping and screening methodology is documented in Section 2.1 of this SER.

In the North Anna LRA, the applicant refers to the NAS UFSAR, Figure 5.5-5, for details on the North Anna pressurizers, and lists the pressurizer subcomponents that are subject to AMR in Section 2.3.1.4 of the LRA. The table provides the intended functions and a reference to the AMR results section for each component group.

In the Surry LRA, the applicant refers to the SPS UFSAR, Figure 4.2-3, for details of the Surry pressurizers, and lists the pressurizer subcomponents that are subject to AMR in Table 2.3.1-4 of the LRA. The table provides the intended functions and a reference to the AMR results section for each component group.

The staff compared the description of the NAS 1/2 and SPS 1/2 pressurizers provided in the North Anna and Surry LRAs and UFSARs. The staff continued its review by sampling the pressurizer subcomponents that the applicant identified as being within the scope of license renewal but not subject to AMR to verify that no subcomponent that performs its intended function without moving parts or without a change in configuration or properties, or is not subject to replacement based on qualified life or specified time period was excluded from an AMR. The staff did not identify any omissions.

2.3.1.4.3 Conclusions

On the basis of the staff's review of the information presented in Section 2.3.1.4 of each LRA and the supporting information in the North Anna and Surry UFSARs, as described above, the staff did not identify any omissions in the scoping and screening of the NAS 1/2 and SPS 1/2 pressurizers by the applicant. Therefore, the staff concludes that there is reasonable assurance that the applicant has identified those portions of the NAS 1/2 and SPS 1/2 pressurizers that are within the scope of license renewal and the pressurizer subcomponents that are subject to an AMR in accordance with 10 CFR 54.4(a) and 10 CFR 54.21(a)(1), respectively.

2.3.1.5 Steam Generator

In the North Anna and Surry LRAs, Section 2.3.1.5, "Steam Generator," the applicant describes the NAS 1/2 and SPS 1/2 steam generators (SG) and SG subcomponents that are within the scope of license renewal and subject to an AMR. The SGs are identical for both facilities with no notable differences in design for the purpose of license renewal. Therefore, the information provided below is applicable to the NAS 1/2 and SPS 1/2 SGs. The SG structural components that are subject to AMR are evaluated separately in Section 2.4.9 of each LRA, "NSSS Equipment Supports," as commodity groups and, therefore, are evaluated separately by the staff in Section 2.4.9 of this SER. The SGs and SG subcomponents are further described in Sections 5.5.2.1 and 10.3.2 of the North Anna UFSAR and Sections 4.2.2.3 and 10.3.1.2 of the Surry UFSAR.

2.3.1.5.1 Technical Information in the Application

The NAS 1/2 and SPS 1/2 each contain three SGs, one SG is installed in each of the three reactor coolant loops on each of the four units. The SGs are vertical, shell and U-tube heat exchangers with integral moisture-separating equipment. The SGs are used to transfer heat from the single-phase, high-pressure, high-temperature borated reactor coolant on the primary side of the tubes to the two-phase steam-water mixture on the secondary side of the tubes. The internal surfaces of the SG in contact with borated reactor coolant are clad with nickel-based alloys, stainless steel weld overlay, which provides corrosion resistance. The tubesheets are clad with Inconel.

The original recirculating SGs have experienced significant tube degradation and have undergone an extensive repair program. The SG repair program consisted of replacement of the lower assembly (including the channel head, U-tubes, tubesheet, and lower shell section) and refurbishment of the upper assembly.

Each SG is a recirculating design and consists of a primary (tube) side and a secondary (shell) side. Reactor coolant flows through the primary side through inverted U-tubes, entering and leaving through the primary nozzles located in the hemispherical bottom chambers (channel head). The channel heads are welded to plates (tubesheets) from which the tube bundles extend. The channel heads are divided into inlet and outlet chambers by vertical divider plates extending from the channel heads to the tubesheets. Manways are provided for access to both sides of the divided channel head of each SG. Pressure boundary integrity is maintained by manway covers that are bolted to the manways.

On the secondary side of each SG, tube support plates, stay rods, stay rod spacer pipes, and antivibration bars are provided for structural support of the U-tubes. The tube support plates closest to the tubesheets are identified as flow distribution baffles.

Each SG tube bundle is contained inside a cylindrical wrapper. The space between the wrapper and the inside of the SG shell forms an annular region called the downcomer. Feedwater enters the SGs through the feedwater inlet nozzle located in the upper shell and is distributed around the periphery of the SG by an internal feedwater distribution ring (feedring). Feedwater exits from the top of each of the feedring through J-nozzles, where it mixes with recirculated water from the moisture separators and flows down the downcomers. The mixture of subcooled feedwater and saturated recirculated water exits from the downcomers' annular regions at the tube sheet, where it flows under the wrappers and is distributed across the tube sheets. The mixture is heated to boiling by RC heat that transfers through the U-tubes. The saturated steam/water mixture enters the moisture separator section of each SG, where liquid is removed from the mixture and returned to the evaporator section of each SG. Essentially dry steam exiting the moisture separator section of each SG passes through steam outlet nozzles that are fitted with a flow-limiting device designed to limit steam flow in the event of a main steam pipe rupture. Secondary side penetrations (handholes, access ports, blowdown nozzles, instrument taps, and manways) are provided for instrumentation and for maintenance and inspection activities. In addition, a nozzle in the upper shell of each SG facilitates the maintenance of wet layup chemistry conditions in the SG during shutdown periods via the SG recirculation and transfer system.

In each LRA Table 2.3.1-5, the applicant identified the following NAS 1/2 and SPS 1/2 SG subcomponents that are subject to AMR: antivibration bars, channel head (and cladding), channel head divider plate, feedwater inlet nozzle, primary inlet and outlet nozzles (and cladding), primary inlet and outlet nozzle safe ends, primary manway (including pad and cladding), primary manway cover bolting, primary manway cover and insert, secondary manway (including pad), secondary closure cover bolting, secondary closure covers, secondary side shell penetrations, secondary side shell (head, upper shell, lower shell, transition cone, girth weld, stay rod, steam flow limiter, steam outlet nozzle, support pads, tube bundle wrapper, tube plugs, tube support plates, tubesheet (and cladding), and U-tubes. The applicant also identifies maintaining pressure boundary integrity, structural and/or functional support, and flow distribution as the intended functions for the SG subcomponents that are subject to an AMR. In addition, certain SG structural supports that provide overall support for the SGs that are subject to AMR are evaluated separately in Section 2.4.9 of each LRA, "NSSS Equipment Supports," as commodity groups and, therefore, are evaluated separately by the staff in Section 2.4.9 of this SER.

2.3.1.5.2 Staff Evaluation

The staff reviewed North Anna and Surry LRAs, Section 2.3.1. 5, to determine whether there is reasonable assurance that the applicant appropriately identified the portions of the NAS 1/2 and SPS 1/2 SGs that are within the scope of license renewal in accordance with 10 CFR 54.4(a), and that the applicant appropriately identified the SG subcomponents that are subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff reviewed the information provided in each LRA and the North Anna and Surry UFSARs to determine whether the applicant adequately identified the portions of the SGs that are within the scope of license renewal. The staff verified that those portions of the NAS 1/2 and SPS 1/2 SGs that meet the scoping requirements of 10 CFR 54.4 were included within the scope of license renewal, and were identified as such by the applicant in Section 2.3.1.5 of each LRA. To verify that the applicant did include the appropriate portions of the SGs within the scope of license renewal, the staff focused its review on those portions that were not identified within the scope of license renewal and verified that they did not meet the scoping criteria of 10 CFR 54.4. In addition, the staff reviewed the North Anna and Surry UFSARs to identify any additional system functions that were not identified in each LRA and to verify that these additional functions did not meet the scoping requirements of 10 CFR 54.4. The staff did not identify any omissions.

The staff then determined whether the applicant had properly identified the NAS 1/2 and SPS 1/2 SG subcomponents that are subject to AMR from among those portions of the SGs that were identified as being within the scope of license renewal. The applicant used the screening methodology described in Section 2.1 of each LRA to identify and list the SG subcomponents that are subject to AMR. The staff evaluation of the scoping and screening methodology is documented in Section 2.1 of this SER.

In the NAS LRA, the applicant refers to the NAS UFSAR, Figure 5.5-3, for details on the North Anna SGs, and lists the SG subcomponents that are subject to AMR in Table 2.3.1-5 of the LRA. The table also provides the intended functions and a reference to the AMR results section for each component group.

In the SPS LRA, the applicant refers to the SPS UFSAR, Figures 10.3-2 and 10.3-3, for details of the Surry SGs, and lists the SG subcomponents that are subject to AMR in Table 2.3.1-5 of the LRA. The table also provides the intended functions and a reference to the AMR results section for each component group.

The staff compared the UFSAR figures with the description of the SGs provided in each LRA and UFSARs. The staff continued its review by sampling the NAS 1/2 and SPS 1/2 SG subcomponents that the applicant identified as being within the scope of license renewal but not subject to AMR to verify that no subcomponent that performs its intended function without moving parts or without a change in configuration or properties, or is not subject to replacement based on qualified life or specified time period was excluded from an AMR. The staff did not identify any omissions.

2.3.1.5.3 Conclusions

On the basis of the staff's review of the information presented in Section 2.3.1.5 of each LRA and the supporting information in the North Anna and Surry UFSARs, as described above, the staff did not identify any omissions in the scoping and screening of the NAS 1/2 and SPS 1/2 SGs by the applicant. Therefore, the staff concludes that there is reasonable assurance that the applicant has identified those portions of the NAS 1/2 and SPS 1/2 SGs that are within the scope of license renewal and the SG subcomponents that are subject to an AMR in accordance with 10 CFR 54.4(a) and 10 CFR 54.21(a)(1), respectively.

2.3.2 Engineered Safety Features Systems

In both the North Anna and Surry LRAs, Section 2.3.2, “Engineered Safety Features Systems,” the applicant describes the SSCs of the engineered safety features (ESF) systems that are within the scope of license renewal and subject to an AMR. The following staff evaluation applies to the ESF systems of all four units (NAS 1/2 and SPS 1/2) for the purpose of license renewal. Any differences in any of the SSCs that make up the ESF systems for each of the four units or unique information that applies to a specific unit or site will be clearly identified as to which unit or site the information applies. Other than what is specifically stated, the following evaluation is applicable to the ESF systems for NAS 1/2 and SPS 1/2.

2.3.2.1 North Anna Quench Spray/Surry Containment Spray

The Quench Spray system (QS) at NAS and the Containment Spray system (CS) at SPS are functionally equivalent. In Sections 2.3.2.1 of the NAS LRA, “Quench Spray,” and the SPS LRA, “Containment Spray,” the applicant describes the components of the NAS quench spray and SPS containment spray (QS/CS) system that is within the scope of license renewal and subject to an AMR. This system is further described in Section 6 of the North Anna and Surry UFSARs.

2.3.2.1.1 Technical Information in the Application

The QS/CS systems are designed to pump cool and borated water from the refueling water storage tank (RWST), mixed with a sodium hydroxide solution from the chemical addition tank (CAT), through spray ring headers and nozzles into the containment. The spray solution absorbs heat from the containment atmosphere to reduce pressure and prevent challenging the structural integrity of the containment. In addition, the spray reduces the airborne iodine concentration in the post-LOCA containment atmosphere to maintain accident-dose within limits. The RWST also provides the source of water to the safety injection (SI) system (Section 2.3.2.5) for the injection phase of design basis accident mitigation.

The applicant describes its process for identifying the mechanical components that are within the scope of license renewal in Section 2.1.4, “Scoping Methodology,” of the LRA. As described in the scoping methodology, the applicant identified the portions of the QS/CS system that are within the scope of license renewal on the piping and instrument drawings listed in Section 2.3.2.1 of each LRA. Consistent with the method described in the LRA, Section 2.1.5, “Screening Methodology,” the applicant listed the QS/CS system mechanical component commodity groups that are within the license renewal evaluation boundaries and are subject to an AMR in Table 2.3.2-1 of each LRA. The tables also list the intended functions and the LRA section containing the AMR for each commodity group.

The portion of the QS/CS system that is subject to aging management review includes the major flowpaths of the system. In each LRA, Table 2.3.2-1, the applicant listed the following twelve component commodity groups as subject to an AMR: boltings, filters/strainers, flow elements, instrument valve assemblies, nozzles, pipes, pump casings, restricting orifices, tanks, thermowells, tubings, and valve bodies. The applicant states that the intended functions for the SCs that are subject to an AMR are maintaining the pressure boundary integrity, providing filtration, restricting flow, and providing spray pattern.

2.3.2.1.2 Staff Evaluation

The staff reviewed Section 2.3.2.1 of each LRA to determine whether there is reasonable assurance that the applicant appropriately identified portions of the QS/CS system that are within the scope of license renewal in accordance with 10 CFR 54.4 and that the applicant appropriately identified the SCs that are subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

In addition to the information provided in Section 2.3.2.1 of each LRA, the staff reviewed the applicable piping and instrument drawings, and the North Anna and Surry UFSARs to determine if the applicant adequately identified the portions of the QS/CS system that are within the scope of license renewal. The staff verified that those portions of the QS/CS system that meet the scoping requirements of 10 CFR 54.4 were included within the scope of license renewal, and were identified as such by the applicant in Section 2.3.2.1 of each LRA. To verify that the applicant did include the applicable portions of the QS/CS system as being within the scope of license renewal, the staff focused its review on those portions of the QS/CS system that were not identified as being within the scope of license renewal and verified that they did not meet the scoping criteria of 10 CFR 54.4. In addition, the staff reviewed the UFSARs for each facility to identify any additional system functions that was not identified in each LRA, and verified that these additional functions did not meet the scoping requirements of 10 CFR 54.4. The staff did not identify any omissions.

The staff then determined whether the applicant had properly identified the SCs that are subject to AMR from among those portions of the QS/CS systems that were identified as being within the scope of license renewal. The applicant used the screening methodology described in Section 2.1 of each LRA to identify and list the SCs subject to AMR. The staff evaluation of the scoping and screening methodology is documented in Section 2.1 of this SER.

In the NAS LRA, the applicant identified the portions of the QS system that are within the scope of license renewal in the drawings listed below. The applicant also listed the mechanical component commodity groups that are subject to AMR and its intended functions in Table 2.3.2-1 of the LRA.

Unit 1	Unit 2
11715-LRM-091A, Sh. 1	12050-LRM-091A, Sh. 1
11715-LRM-091A, Sh. 2	12050-LRM-091A, Sh. 2
11715-LRM-091A, Sh. 3	12050-LRM-091A, Sh. 3

In the SPS LRA, the applicant identified the portions of the CS system that are within the scope of license renewal in the drawings listed below. In addition, the applicant listed the mechanical component commodity groups that are subject to AMR and its intended functions in Table 2.3.2-1 of the LRA.

Unit 1	Unit 2
11448-LRM-084A, Sh. 1	11548-LRM-084A, Sh. 1
11448-LRM-084A, Sh. 2	11548-LRM-084A, Sh. 2
11448-LRM-084A, Sh. 3	11548-LRM-084A, Sh. 3

The piping and instrumentation drawings were highlighted by the applicant to identify those portions of the QS/CS system that perform at least one of the scoping requirements of 10 CFR 54.4. The staff compared the LRA drawings to the system drawings and the descriptions in the UFSAR to ensure they were representative of the QS/CS system. The staff performed its review by sampling the SCs that the applicant determined are within the scope of license renewal, but not subject to AMR, to verify that no structure or component that performs its intended functions without moving parts or without a change in configuration or properties, or are not subject to replacement based on qualified life or specified time period, was excluded from an AMR. The staff did not identify any omissions.

2.3.2.1.3 Conclusions

On the basis of its review of the information contained in Section 2.3.2.1 of each LRA, the supporting information in the UFSARs, and LRA drawings, as described above, the staff did not identify any omissions in the scoping of the QS/CS system by the applicant. The staff concludes that there is reasonable assurance that the applicant has identified those portions of the QS/CS systems that are within the scope of license renewal, and the SCs that are subject to an AMR in accordance with 10 CFR 54.4(a) and 10 CFR 54.21(a)(1), respectively.

2.3.2.2 Fuel Pit Cooling

In the North Anna and Surry LRAs, Section 2.3.2.2, “Fuel Pit Cooling,” the applicant describes the components of the fuel pit cooling (FC) systems that are within the scope of license renewal and subject to an AMR for both NAS and SPS. The NAS 1/2 and SPS 1/2 each has an FC system. These systems are similar for both facilities with some minor differences in system design. Any notable differences are specifically identified and discussed in the staff’s evaluation. Unless otherwise specified, the information provided below is applicable to both the North Anna and Surry FC systems. The FC structural components that are subject to AMR are presented separately by the applicant in Section 2.4.10 of each LRA, “General Structural Supports,” as commodity groups and, therefore, are evaluated separately by the staff in Section 2.4.10 of this SER. These systems are further described in Section 9 of the North Anna or Surry UFSARs.

2.3.2.2.1 Technical Information in the Application

At both North Anna and Surry, the FC systems transfer heat from the spent fuel pools to the component cooling (CC) systems. The NAS and SPS FC systems also provide a means for water chemistry control for the spent fuel pools. The FC systems are used to circulate borated water from the spent fuel pools through the FC heat exchangers and back to the pools. The FC systems pump suctions connect to the spent fuel pools at an elevation that would prevent the pools from draining below the limiting water level in the event of a leak in the FC systems. A bypass purification loop associated with each FC system provides the capability to filter and demineralize the spent fuel pool water.

The applicant describes its process for identifying the mechanical components that are within the scope of license renewal in Section 2.1.4, “Scoping Methodology,” of each LRA. As described in the scoping methodology, the applicant identified the portions of the FC systems that are within the scope of license renewal on the license renewal drawings listed in Section 2.3.3.2 of each LRA. Consistent with the method described in each LRA, Section 2.1.5, “Screening Methodology,” the applicant listed the NAS 1/2 and SPS 1/2 FC system mechanical component commodity groups that are within the license renewal evaluation boundaries and that are subject to an AMR in Table 2.3.2-2 of both LRA. These tables also list the intended functions and the LRA sections that contain the AMR for each commodity group.

The portion of each FC system that is subject to an AMR for NAS and SPS includes the components used to remove heat from the spent fuel pools. In Table 2.3.2-2 of each LRA, the applicant listed the following eight component commodity groups subject to an AMR: bolting, instrument valve assemblies, pipe, pump casings, spent fuel pit coolers, thermowells, tubing, and valve bodies. In addition, the NAS LRA, Table 2.3.2-2, also lists expansion joints, and the SPS LRA, Table 2.3.2-2, also lists strainers as component commodity groups that are subject to an AMR for the applicable facility. The applicant identified maintaining pressure boundary integrity as the only intended function for the SCs that is subject to an AMR for the NAS and SPS FC systems.

2.3.2.2.2 Staff Evaluation

The staff reviewed each LRA Section 2.3.3.2, to determine whether there is reasonable assurance that the applicant appropriately identified the portions of the North Anna and Surry FC systems that are within the scope of license renewal in accordance with 10 CFR 54.4, and that the applicant appropriately identified the SCs that are subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff reviewed the information provided in Section 2.3.3.2 of each LRA, the applicable license renewal drawings, and the North Anna and Surry UFSARs to determine whether the applicant adequately identified the portions of the FC systems that are within the scope of license renewal. The staff verified that those portions of the FC systems that meet the scoping requirements of 10 CFR 54.4 were included within the scope of license renewal and were identified as such by the applicant in Section 2.3.3.2 of each LRA. To verify that the applicant did include the applicable portions of the FC systems within the scope of license renewal, the staff focused its review on those portions of the FC system that were not identified within the scope of license renewal and verified that they did not meet the scoping criteria of 10 CFR 54.4. In addition, the staff reviewed the UFSARs for each facility to identify any additional system functions that were not identified in each LRA and verified that the additional functions did not meet the scoping requirements of 10 CFR 54.4. The staff did not identify any omissions.

The staff then determined whether the applicant had properly identified the SCs that are subject to AMR from among those portions of the FC systems that were identified as being within the scope of license renewal. The applicant used the screening methodology described in Section 2.1 of each LRA to identify and list the SCs subject to AMR. The staff evaluation of the scoping and screening methodology is documented in Section 2.1 of this SER.

In the NAS LRA, the applicant identified the portions of the FC systems that are within the scope of license renewal in Unit 1 drawing 11715-LRM-088A, Sheet 4, the fuel pit cooling and refueling purification system, and lists the mechanical component commodity groups that are subject to AMR and their intended functions in Table 2.3.2-2 of the LRA. The staff also verified that the portions of the NAS FC system that are within the scope of license renewal did not contain any strainers, similar to the SPS FC system.

In the SPS LRA, the applicant identified the portions of the FC systems that are within the scope of license renewal in Unit 1 drawing 11448-LRM-081A, Sh. 1, the fuel pit system, and lists the mechanical component commodity groups that are subject to AMR and their intended functions in Table 2.3.2-2 of the LRA. The staff also verified that the portions of the SPS FC system that are within the scope of license renewal did not contain any expansion joints, similar to the NAS FC system.

The license renewal drawings were highlighted by the applicant to identify those portions of the FC systems that meet at least one of the scoping requirements of 10 CFR 54.4. The staff compared the license renewal drawings to the system drawings and the written descriptions in the North Anna and Surry UFSARs to ensure they were representative of the FC systems. The staff performed its review by sampling the SCs that the applicant identified as being within the scope of license renewal but not subject to AMR to verify that no structure or component that performs its intended function without moving parts or without a change in configuration or properties, or are not subject to replacement based on qualified life or specified time period was excluded from an AMR. The staff did not identify any omissions.

2.3.2.2.3 Conclusions

On the basis of its review of the information contained in Section 2.3.2.2 of each LRA the supporting information in the UFSARs, and the license renewal drawings, as described above, the staff did not identify any omissions in the scoping and screening of the SCs of the North Anna and Surry FC systems by the applicant. Therefore, the staff concludes that there is reasonable assurance that the applicant has identified those portions of the North Anna and Surry FC systems that are within the scope of license renewal and the SCs that are subject to an AMR in accordance with 10 CFR 54.4(a), and 10 CFR 54.21(a)(1), respectively.

2.3.2.3 Recirculation Spray

In Section 2.3.2.3, “Recirculation Spray,” of each LRA, the applicant describes the components of the recirculation spray (RS) system that are within the scope of license renewal and subject to an AMR. This system is further described in Section 6 of the North Anna and Surry UFSARs.

2.3.2.3.1 Technical Information in the Application

The recirculation spray (RS) system is designed to provide long-term heat removal from the containment atmosphere and to provide core cooling water following a design basis loss-of-coolant accident (LOCA). The RS system transfers heat from the reactor core via coolant spilled from the break and from the containment atmosphere to the service water (SW) system through the RS heat exchangers. The water collected in the containment sump is pumped back into the containment atmosphere through the heat exchangers and spray ring headers and nozzles.

The RS system is designed to return the post-LOCA-containment to subatmospheric pressure, and to maintain subatmospheric conditions for the duration of the accident recovery. Thus, it prevents the outleakage of fission products. The cooled water in the containment sump is pumped back through the reactor core by the safety injection system (Section 2.3.2.5).

In addition, at NAS, casing cooling components of the RS system provide a source of cool, borated water to the suction of the outside containment RS pumps to provide adequate net positive suction head (NPSH).

The applicant describes its process for identifying the mechanical components that are within the scope of license renewal in Section 2.1.4, "Scoping Methodology," of the LRA. As described in the scoping methodology, the applicant identified the portions of the RS systems that are within the scope of license renewal on the piping and instrument drawings listed in Section 2.3.2.3 of each LRA. Consistent with the method described in the LRA, Section 2.1.5, "Screening Methodology," the applicant listed the RS system mechanical component commodity groups that are within the license renewal evaluation boundaries and that are subject to an AMR in Table 2.3.2-3 of each LRA. The tables also list the intended functions, and the LRA section containing the AMR, for each commodity group.

The portion of the RS system that is subject to aging management review includes the major flowpaths of the system. In Table 2.3.2-3 of each LRA, the applicant listed the following fifteen component commodity groups as subject to an AMR: boltings, expansion joints, flow elements, instrument valve assemblies, nozzles, pipe, pump casings, pump seal coolers, recirculation spray coolers, restricting orifices, sump screens, tanks, thermowells, tubings, and valve bodies. In addition, Table 2.3.2-3 of the NAS LRA, also lists filter/strainers as component commodity groups that are subject to an AMR for NAS. The applicant states that the intended functions of the SCs that are subject to an AMR are maintaining pressure boundary integrity, providing filtration, restricting flow, and providing spray patterns.

2.3.2.3.2 Staff Evaluation

The staff reviewed Section 2.3.2.3 of each LRA to determine whether there is reasonable assurance that the applicant appropriately identified the portions of the RS system that are within the scope of license renewal in accordance with 10 CFR 54.4, and that the applicant appropriately identified the SCs that are subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

In addition to the information provided in Section 2.3.2.3 of each LRA, the staff reviewed applicable piping and instrument drawings, and the North Anna and Surry UFSARs to determine whether the applicant adequately identified the portions of the recirculation spray system that are within the scope of license renewal. The staff verified that those portions of the recirculation spray system that meet the scoping requirements of 10 CFR 54.4 were included within the scope of license renewal and were identified by the applicant in Section 2.3.2.3 of each LRA. To verify that the applicant did include the applicable portions of the RS system as being within the scope of license renewal, the staff focused its review on those portions of the RS system that were not identified as being within the scope of license renewal and verified that they did not meet the scoping criteria of 10 CFR 54.4. In addition, the staff reviewed the UFSARs for each facility to identify any additional system functions that was not identified in each LRA, and verified that these additional functions did not meet the scoping requirements of 10 CFR 54.4. The staff did not identify any omissions.

The staff then determined whether the applicant had properly identified the SCs that are subject to AMR from among those portions of the RS system that were identified as being within the scope of license renewal. The applicant used the screening methodology described in Section 2.1 of each LRA to identify and list the SCs subject to AMR. The staff evaluation of the scoping and screening methodology is documented in Section 2.1 of this SER.

In the NAS LRA, the applicant identified the portions of the RS system that are within the scope of license renewal in the drawings listed below. The applicant also listed the mechanical component commodity groups that are subject to AMR and its intended functions in Table 2.3.2-3 of the LRA.

Unit 1	Unit 2
11715-LRM-091A, Sh. 3	12050-LRM-091A, Sh. 3
11715-LRM-091A, Sh. 4	12050-LRM-091A, Sh. 4
11715-LRM-091B, Sh. 1	12050-LRM-091B, Sh. 1

In the SPS LRA, the applicant identified the portions of the RS system that are within the scope of license renewal in the drawings listed below. In addition, the applicant listed the mechanical component commodity groups that are subject to AMR and its intended functions in Table 2.3.2-3 of the LRA.

Unit 1	Unit 2
11448-LRM-084A, Sh. 2	11548-LRM-084B, Sh. 1
11448-LRM-084B, Sh. 1	11548-LRM-084B, Sh. 2
11448-LRM-084B, Sh. 2	

The piping and instrumentation drawings were highlighted by the applicant to identify those portions of the RS system that perform at least one of the scoping requirements of 10 CFR 54.4. The staff compared the LRA drawings to the system drawings and the descriptions in the UFSAR to ensure they were representative of the RS system. The staff performed its review by sampling the SCs that the applicant determined as being within the scope of license renewal, but not subject to AMR, to verify that no structure or component that performs its intended functions without moving parts or without a change in configuration or properties, or are not subject to replacement based on qualified life or specified time period, was excluded from an AMR. The staff did not identify any omissions.

2.3.2.3.3 Conclusions

On the basis of its review of the information contained in Section 2.3.2.3 of each LRA and supporting information in the UFSARs and LRA drawings, the staff did not identify any omissions in the scoping of the RS system by the applicant. The staff concludes that there is reasonable assurance that the applicant has identified those portions of the RS system that are within the scope of license renewal, and the SCs that are subject to an AMR in accordance with 10 CFR 54.4(a) and 10 CFR 54.21(a)(1), respectively.

2.3.2.4 Residual Heat Removal

In the North Anna and Surry LRAs, Section 2.3.2.4, “Residual Heat Removal,” the applicant describes the piping and mechanical components of the residual heat removal (RHR) systems that are within the scope of license renewal and subject to an AMR for NAS 1/2 and SPS 1/2. NAS 1/2 and SPS 1/2 each has a RHR system. These systems are identical for both facilities with no notable differences in system design for the purpose of license renewal. Therefore, the information provided below is applicable to the NAS 1/2 and SPS 1/2 RHR systems. The RHR structural components that are subject to AMR are presented separately by the applicant in Section 2.4.10 of each LRA, “General Structural Supports,” as commodity groups and, therefore, are evaluated separately by the staff in Section 2.4.10 of this SER. The RHR piping and mechanical components are further described by the applicant in Chapter 5.5.4 of the North Anna UFSAR and Chapter 9.3 of the Surry UFSAR.

2.3.2.4.1 Technical Information in the Application

The RHR systems for NAS 1/2 and SPS 1/2 is used to transfer heat from the RCS to the component cooling (CC) system during reactor shutdown conditions. Water is drawn from the RCS, pumped through the RHR heat exchangers, and returned to the RCS to control primary system temperature. The RHR systems are in service only when RCS temperature and pressure are reduced to 350 °F and 450 psig, respectively.

In addition to its primary function of transferring heat during reactor shutdown conditions, the NAS 1/2 and SPS 1/2 RHR systems have a number of other system functions that need to be considered for license renewal. The RHR systems provide the capability to pump the reactor cavity water back to the refueling water storage tank following refueling operations. In accordance with 10 CFR Part 50, Appendix R, “Fire Protection,” the applicant’s relies on the RHR systems to remove heat from the RCS to reach cold shutdown conditions. In addition, portions of RHR system piping and components are within the NAS 1/2 and SPS 1/2 ASME Class 1 RCS pressure boundary. Therefore, the major flowpaths of the RHR systems are within the scope of license renewal and subject to an AMR.

The applicant describes its process for identifying the mechanical components that are within the scope of license renewal in Section 2.1.4, “Scoping Methodology,” of the North Anna and Surry LRAs. As described in the scoping methodology, the applicant identified the portions of the RHR system that are within the scope of license renewal on the license renewal drawings listed in Section 2.3.2.4 of each LRA. Consistent with the method described in each LRA, Section 2.1.5, “Screening Methodology,” the applicant listed the NAS 1/2 and SPS 1/2 RHR mechanical component commodity groups that are subject to an AMR in Table 2.3.2-4 of each LRA. These tables also list the intended functions and the LRA sections that contain the AMR for each commodity group.

The portions of each RHR system that are subject to an AMR for NAS 1/2 and SPS 1/2 include the components that make up the major flowpaths for each system. In each LRA Table 2.3.2-4, the applicant listed the following 11 component commodity groups subject to an AMR: bolting, filters/strainers, flow element, instrument valve assemblies, pipe, pump casings, pump seal coolers, residual heat removal heat exchangers, thermowells, tubing, and valve bodies. The applicant identified maintaining pressure boundary integrity and restricting flow as the intended functions of the SCs that are subject to an AMR for the NAS 1/2 and SPS 1/2 RHR systems.

2.3.2.4.2 Staff Evaluation

The staff reviewed Section 2.3.2.4 of the North Anna and Surry LRAs to determine whether there is reasonable assurance that the applicant appropriately identified the portions of the NAS 1/2 and SPS 1/2 RHR systems that are within the scope of license renewal in accordance with 10 CFR 54.4, and that the applicant appropriately identified the SCs of the RHR systems that are subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff reviewed the information provided in Section 2.3.2.4 of each LRA, the applicable license renewal drawings, and the North Anna and Surry UFSARs to determine whether the applicant adequately identified the portions of the NAS 1/2 and SPS 1/2 RHR systems that are within the scope of license renewal. The staff verified that those portions of the RHR systems that meet the scoping requirements of 10 CFR 54.4 were included within the scope of license renewal and were identified as such by the applicant in Section 2.3.2.4 of each LRA. To verify that the applicant did include the applicable portions of the RHR systems within the scope of license renewal, the staff focused its review on those portions of the NAS 1/2 and SPS 1/2 RHR systems that were not identified within the scope of license renewal and verified that they did not meet the scoping criteria of 10 CFR 54.4. In addition, the staff reviewed the UFSARs for each facility to identify any additional system functions that were not identified in each LRA and verified that these additional functions did not meet the scoping requirements of 10 CFR 54.4. The staff did not identify any omissions.

The staff then determined whether the applicant had properly identified the SCs of the NAS 1/2 and SPS 1/2 RHR systems that are subject to AMR from among those portions of the RHR systems that are identified as being within the scope of license renewal. The applicant identified and lists the SCs subject to AMR for the RHR systems in Table 2.3.2-4 of each LRA using the screening methodology described in Section 2.1 of each LRA. The staff evaluated the scoping and screening methodology and documented its findings in Section 2.1 of this SER.

In the North Anna LRA, the applicant identified the portions of the RHR systems that are within the scope of license renewal in the drawings listed below. The applicant also listed the mechanical component commodity groups that are subject to AMR and their intended functions in Table 2.3.2-4 of the North Anna LRA.

Unit 1	Unit 2
11715-LRM-091A, Sh. 1	12050-LRM-091A, Sh. 1
11715-LRM-093A, Sh. 1	12050-LRM-093A, Sh. 1
11715-LRM-094A, Sh. 1	12050-LRM-094A, Sh. 1
11715-LRM-094A, Sh. 2	12050-LRM-094A, Sh. 2
11715-LRM-095C, Sh. 1	12050-LRM-095C, Sh. 1
11715-LRM-096B, Sh. 2	12050-LRM-096B, Sh. 2
11715-LRM-096B, Sh. 3	12050-LRM-096B, Sh. 3

In the Surry LRA, the applicant identified the portions of the RHR systems that are within the scope of license renewal in the drawings listed below. In addition, the applicant listed the mechanical component commodity groups that are subject to AMR and their intended functions in Table 2.3.2-4 of the Surry LRA.

Unit 1	Unit 2
11448-LRM-086A, Sh. 1	11548-LRM-086A, Sh. 1
11448-LRM-087A, Sh. 1	11548-LRM-087A, Sh. 1
11448-LRM-087A, Sh. 2	11548-LRM-087A, Sh. 2
11448-LRM-089B, Sh. 2	11548-LRM-089B, Sh. 2
11448-LRM-089B, Sh. 3	11548-LRM-089B, Sh. 3

The license renewal drawings were highlighted by the applicant to identify those portions of the RHR systems that meet at least one of the scoping requirements of 10 CFR 54.4. The staff compared the LRA drawings to the system drawings and the descriptions in the North Anna and Surry UFSARs to ensure they were representative of the RHR systems. The staff performed its review by sampling the SCs that the applicant identified as being within the scope of license renewal but not subject to AMR to verify that no structure or component that performs its 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 was excluded from an AMR.

As a result of this review, the staff identified that the applicant had modified the NAS 1/2 and SPS 1/2 containment sumps by installing vortex suppressing devices so that the containment sumps will be free of any harmful vortices for any postulated operating conditions. The modifications involved the installation of two layers of floor grating in the sump and the installation of perforated vortex breakers inside the cylindrical screens (Sections 3A.79 and 6.2.2.4.3 of the North Anna UFSAR). These components are not discussed in each LRA and do not appear to be included within the scope of license renewal. The staff requested that the applicant address this concern.

In a letter to the NRC dated January 4, 2002, the applicant explained that the perforated vortex breakers are considered an integral part of the cylindrical sump screens since they are constructed of the same material and exposed to the same environment as the sump screens. The applicable aging effects for the cylindrical sump screens (including the perforated vortex breakers) are managed by the infrequently accessed area inspection activity as identified in Table 3.2-3 of the license renewal application. In addition, the two layers of floor grating installed in the sump function as vortex suppressors were added to the scope of license renewal and are subject to an AMR. The floor grating/vortex suppressors are subject to loss of material, and this aging effect will be managed by the infrequently accessed area inspection activity. The staff has no concern with grouping the perforated vortex breakers with the cylindrical sump screens, and agrees with the applicant’s decision to include the vortex suppressors within the scope of license renewal and subject to an AMR. The staff did not identify any additional omissions.

2.3.2.4.3 Conclusion

On the basis of its review of the information contained in Section 2.3.2.4 of each LRA, the supporting information in the North Anna and Surry UFSARs, and the license renewal drawings, as described above, the staff did identify that the applicant did not include the floor grating/vortex suppressors within the scope of license renewal and subject to an AMR for the NAS 1/2 and SPS 1/2 RHR systems. However, the applicant did add the floor grating/vortex suppressors to the scope of components subject to an AMR. No additional omissions were identified. Therefore, the staff concludes that there is reasonable assurance that the applicant has identified those portions of the NAS 1/2 and SPS 1/2 RHR systems that are within the scope of license renewal and the SCs that are subject to an AMR in accordance with 10 CFR 54.4(a) and 10 CFR 54.21(a)(1), respectively.

2.3.2.5 Safety Injection

In the North Anna and Surry LRAs, Section 2.3.2.5, “Safety Injection,” the applicant describes the piping and mechanical components of the safety injection (SI) systems that are within the scope of license renewal and subject to an AMR for NAS 1/2 and SPS 1/2. Each unit of NAS and SPS has an SI system. These systems are identical with no notable differences in system design for the purpose of license renewal. Therefore, the information provided below is applicable to the NAS 1/2 and SPS 1/2 SI systems. The SI structural components that are subject to AMR are presented separately by the applicant in Section 2.4.10 of each LRA, “General Structural Supports,” as commodity groups and, therefore, are evaluated separately by the staff in Section 2.4.10 of this SER. The SI piping and mechanical components are further described by the applicant in Chapter 6.3 of the North Anna UFSAR and Chapter 6.2 of the Surry UFSAR.

2.3.2.5.1 Technical Information in the Application

The SI systems for NAS 1/2 and SPS 1/2 are designed to provide emergency cooling to the reactor core and to provide adequate shutdown margin in the event of a loss-of-coolant accident (LOCA). The SI systems use high-head injection pumps, low-head injection pumps, and hydro-pneumatic accumulator tanks to inject borated water into the RCS during emergency/accident conditions. In addition, the SI systems provide the capability to remove decay heat from the reactor cores for extended periods following an accident. This is accomplished by recirculating coolant, which is cooled by the recirculation spray system, from the containment sump through the core.

The SI system high-head pumps are also used as charging pumps by the chemical and volume control (CH) system. The AMR for the high-head pumps is included in the AMR for the CH system. In addition, portions of SI system piping and components are within the NAS 1/2 and SPS 1/2 ASME Class 1 RCS pressure boundary. Therefore, the major flowpaths of the SI systems are within the scope of license renewal and subject to an AMR.

The applicant describes its process for identifying the mechanical components that are within the scope of license renewal in Section 2.1.4, “Scoping Methodology,” of the North Anna and Surry LRAs. As described in the scoping methodology, the applicant identified the portions of the SI systems that are within the scope of license renewal on the license renewal drawings listed in Section 2.3.2.5 of each LRA. Consistent with the method described in each LRA, Section 2.1.5, “Screening Methodology,” the applicant listed the NAS 1/2 and SPS 1/2 SI mechanical component commodity groups that are subject to an AMR in Table 2.3.2-5 of each LRA. These tables also list the intended functions and the LRA sections that contain the AMR for each commodity group.

The portions of each SI system that are subject to an AMR for NAS 1/2 and SPS 1/2 include the components that make up the major flowpaths for each system. In each LRA Table 2.3.2-5, the applicant listed the following 12 component commodity groups subject to an AMR: accumulators (and cladding), bolting, flow element, flow orifices, instrument valve assemblies, pipe, pump casings, pump seal coolers, sump screens, tanks, tubing, and valve bodies. The applicant identified maintaining pressure boundary integrity, providing filtration, and restricting flow as the intended functions of the SCs that are subject to an AMR for the NAS 1/2 and SPS 1/2 SI systems.

2.3.2.5.2 Staff Evaluation

The staff reviewed Section 2.3.2.5 of the North Anna and Surry LRAs to determine whether there is reasonable assurance that the applicant appropriately identified the portions of the NAS 1/2 and SPS 1/2 SI systems that are within the scope of license renewal in accordance with 10 CFR 54.4, and that the applicant appropriately identified the SCs of the SI systems that are subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff reviewed the information provided in Section 2.3.2.5 of each LRA, the applicable license renewal drawings, and the North Anna and Surry UFSARs to determine whether the applicant adequately identified the portions of the NAS 1/2 and SPS 1/2 SI systems that are within the scope of license renewal. The staff verified that those portions of the SI systems that meet the scoping requirements of 10 CFR 54.4 were included within the scope of license renewal and were identified as such by the applicant in Section 2.3.2.5 of each LRA. To verify that the applicant did include the applicable portions of the SI systems within the scope of license renewal, the staff focused its review on those portions of the NAS 1/2 and SPS 1/2 SI systems that were not identified as being within the scope of license renewal and verified that they did not meet the scoping criteria of 10 CFR 54.4. In addition, the staff reviewed the UFSARs for each facility to identify any additional system functions that were not identified in each LRA and verified that these additional functions did not meet the scoping requirements of 10 CFR 54.4. The staff did not identify any omissions.

The staff then determined whether the applicant had properly identified the SCs of the NAS 1/2 and SPS 1/2 SI systems that are subject to AMR from among those portions of the SI systems that were identified within the scope of license renewal. The applicant identified and lists the SCs subject to AMR for the SI systems in Table 2.3.2-5 of each LRA using the screening methodology described in Section 2.1. The staff evaluated the scoping and screening methodology and documented its findings in Section 2.1 of this SER.

In the North Anna LRA, the applicant identified the portions of the SI systems that are within the scope of license renewal in the drawings listed below. The applicant also listed the mechanical component commodity groups that are subject to AMR and their intended functions in Table 2.3.2-5 of the North Anna LRA.

Unit 1	Unit 2
11715-LRM-091A, Sh. 1	12050-LRM-091A, Sh. 1
11715-LRM-095B, Sh. 2	12050-LRM-095B, Sh. 2
11715-LRM-095C, Sh. 1	12050-LRM-095C, Sh. 1
11715-LRM-096A, Sh. 1	12050-LRM-096A, Sh. 1
11715-LRM-096A, Sh. 2	12050-LRM-096A, Sh. 2
11715-LRM-096A, Sh. 3	12050-LRM-096A, Sh. 3
11715-LRM-096B, Sh. 1	12050-LRM-096B, Sh. 1
11715-LRM-096B, Sh. 2	12050-LRM-096B, Sh. 2
11715-LRM-096B, Sh. 3	12050-LRM-096B, Sh. 3
11715-LRM-096B, Sh. 4	12050-LRM-096B, Sh. 4

In the Surry LRA, the applicant identified the portions of the SI systems that are within the scope of license renewal in the drawings listed below. In addition, the applicant listed the mechanical component commodity groups that are subject to AMR and their intended functions in Table 2.3.2-5 of the Surry LRA.

Unit 1	Unit 2
11448-LRM-084A, Sh. 1	11548-LRM-084A, Sh. 1
11448-LRM-088B, Sh. 1	11548-LRM-088B, Sh. 1
11448-LRM-088C, Sh. 1	11548-LRM-088C, Sh. 1
11448-LRM-089A, Sh. 1	11548-LRM-089A, Sh. 1
11448-LRM-089A, Sh. 2	11548-LRM-089A, Sh. 2
11448-LRM-089A, Sh. 3	11548-LRM-089A, Sh. 3
11448-LRM-089B, Sh. 1	11548-LRM-089B, Sh. 1
11448-LRM-089B, Sh. 2	11548-LRM-089B, Sh. 2
11448-LRM-089B, Sh. 3	11548-LRM-089B, Sh. 3
11448-LRM-089B, Sh. 4	11548-LRM-089B, Sh. 4

The license renewal drawings were highlighted by the applicant to identify those portions of the SI systems that meet at least one of the scoping requirements of 10 CFR 54.4. The staff compared the LRA drawings to the system drawings and the descriptions in the North Anna and Surry UFSARs to ensure they were representative of the SI systems. The staff performed its review by sampling the SCs that the applicant identified as being within the scope of license renewal but not subject to AMR to verify that no structure or component, that performs its intended function without moving parts or without a change in configuration or properties and that is not subject to replacement based on qualified life or specified time period was excluded from an AMR. The staff did not identify any omissions.

2.3.2.5.3 Conclusion

On the basis of its review of the information contained in Section 2.3.2.5 of each LRA, the supporting information in the North Anna and Surry UFSARs, and the license renewal drawings, as described above, the staff did not identify any omissions in the scoping and screening of the

SCs of the NAS 1/2 and SPS 1/2 SI systems by the applicant. Therefore, the staff concludes that there is reasonable assurance that the applicant has identified those portions of the NAS 1/2 and SPS 1/2 SI systems that are within the scope of license renewal and the SCs that are subject to an AMR in accordance with 10 CFR 54.4(a) and 10 CFR 54.21(a)(1), respectively.

2.3.3 Auxiliary Systems

In both the North Anna and Surry LRAs, Section 2.3.3, "Auxiliary Systems," the applicant describes the SSCs of the auxiliary systems that are within the scope of license renewal and subject to an AMR. The following staff evaluation applies to the auxiliary systems of NAS 1/2 and SPS 1/2 for the purpose of license renewal. Any differences in any of the SSCs that make up the auxiliary systems for each of the four units or unique information that applies to a specific unit or site will be clearly identified as to which unit or site the information applies. Other than what is specifically stated, the following evaluation is applicable to the auxiliary systems for NAS 1/2 and SPS 1/2.

2.3.3.1 Chemical and Volume Control

In the North Anna and Surry LRAs, Section 2.3.3.1, "Chemical and Volume Control," the applicant describes the piping and mechanical components of the chemical and volume control (CH) systems that are within the scope of license renewal and subject to an AMR for NAS 1/2 and SPS 1/2. Each unit of NAS and SPS has a CH system. These systems are identical with no notable differences in system design for the purpose of license renewal. Therefore, the information provided below is applicable to the NAS 1/2 and SPS 1/2 CH systems. The CH structural components that are subject to AMR are presented separately by the applicant in Section 2.4.10 of each LRA, "General Structural Supports," as commodity groups and, therefore, are evaluated separately by the staff in Section 2.4.10 of this SER. The CH piping and mechanical components are further described by the applicant in Chapter 9.3.4 of the North Anna UFSAR and Chapter 9.1 of the Surry UFSAR.

2.3.3.1.1 Technical Information in the Application

The CH systems for NAS 1/2 and SPS 1/2 provide RCS letdown and makeup for chemistry control and purification of RCS fluid and control of chemical shim concentration for reactivity control. The CH systems also provide RC pump seal injection flow, processing of RC pump seal leakoff flow, and RCS pressurizer level control. In addition, portions of CH system piping and components are within the NAS 1/2 and SPS 1/2 ASME Class 1 RCS pressure boundary. Other CH systems functions that need to be considered for license renewal includes chemical addition, boric acid batching, and borated water storage capability. Therefore, the major flowpaths of the CH systems are within the scope of license renewal and are subject to AMR.

The CH system charging pumps serve a second function as the high-head safety injection pumps during emergency conditions as described in Section 2.3.2.5, "Safety Injection" of each LRA. The NAS 1/2 and SPS 1/2 charging pumps are evaluated as part of the CH system by the staff in this section of the SER.

The applicant describes its process for identifying the mechanical components that are within the scope of license renewal in Section 2.1.4, "Scoping Methodology," of the North Anna and Surry LRAs. As described in the scoping methodology, the applicant identified the portions of the CH systems that are within the scope of license renewal on the license renewal drawings listed in Section 2.3.3.1 of each LRA. Consistent with the method described in each LRA, Section 2.1.5, "Screening Methodology," the applicant listed the NAS 1/2 and SPS 1/2 CH mechanical component commodity groups that are subject to an AMR in Table 2.3.3-1 of each LRA. These tables also list the intended functions and the LRA sections that contain the AMR for each commodity group.

The portions of each CH system that are subject to an AMR for NAS 1/2 and SPS 1/2 include the components that make up the major flowpaths for each system. In each LRA Table 2.3.3-1, the applicant listed the following 21 component commodity groups subject to an AMR: bellows, bolting, filters/strainers, flow elements, flow indicators, heaters, instrument valve assemblies, level indicators, nonregenerative and excess letdown heat exchangers, pipe, pump casings, pump lube oil coolers, pump seal coolers, RCP seal water heat exchangers, regenerative heat exchangers, restricting orifices, tanks, temperature sensors, thermowells, tubing, and valve bodies. The applicant identified maintaining pressure boundary integrity, providing heat transfer, providing filtration, and restricting flow as the intended functions of the SCs that are subject to an AMR for the NAS 1/2 and SPS 1/2 CH systems.

2.3.3.1.2 Staff Evaluation

The staff reviewed Section 2.3.3.1 of the North Anna and Surry LRAs to determine whether there is reasonable assurance that the applicant appropriately identified the portions of the NAS 1/2 and SPS 1/2 CH systems that are within the scope of license renewal in accordance with 10 CFR 54.4, and that the applicant appropriately identified the SCs of the CH systems that are subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff reviewed the information provided in Section 2.3.3.1 of each LRA, the applicable license renewal drawings, and the North Anna and Surry UFSARs to determine whether the applicant adequately identified the portions of the NAS 1/2 and SPS 1/2 CH systems that are within the scope of license renewal. The staff verified that those portions of the CH systems that meet the scoping requirements of 10 CFR 54.4 were included within the scope of license renewal and were identified as such by the applicant in Section 2.3.3.1 of each LRA. To verify that the applicant did include the applicable portions of the CH systems within the scope of license renewal, the staff focused its review on those portions of the NAS 1/2 and SPS 1/2 CH systems that were not identified within the scope of license renewal and verified that they did not meet the scoping criteria of 10 CFR 54.4. In addition, the staff reviewed the UFSARs for each facility to identify any additional system functions that were not identified in each LRA and verified that these additional functions did not meet the scoping requirements of 10 CFR 54.4. The staff did not identify any omissions.

The staff then determined whether the applicant had properly identified the SCs of the NAS 1/2 and SPS 1/2 CH systems that are subject to AMR from among those portions of the CH systems that are identified as being within the scope of license renewal. The applicant identified and lists the SCs subject to AMR for the CH systems in Table 2.3.3-1 of each LRA using the screening methodology described in Section 2.1 of each LRA. The staff evaluated the scoping and screening methodology and documented its findings in Section 2.1 of this SER.

In the North Anna LRA, the applicant identified the portions of the CH systems that are within the scope of license renewal in the drawings listed below. The applicant also listed the mechanical component commodity groups that are subject to AMR and their intended functions in Table 2.3.3-1 of the North Anna LRA.

Unit 1	Unit 2
11715-LRM-088A, Sh. 1	12050-LRM-091A, Sh. 1
11715-LRM-091A, Sh. 1	12050-LRM-093A, Sh. 1
11715-LRM-093A, Sh. 1	12050-LRM-093A, Sh. 2
11715-LRM-093A, Sh. 2	12050-LRM-093A, Sh. 3
11715-LRM-093A, Sh. 3	12050-LRM-093B, Sh. 1
11715-LRM-093B, Sh. 1	12050-LRM-095A, Sh. 1
11715-LRM-095A, Sh. 1	12050-LRM-095A, Sh. 2
11715-LRM-095A, Sh. 2	12050-LRM-095B, Sh. 1
11715-LRM-095A, Sh. 3	12050-LRM-095B, Sh. 2
11715-LRM-095A, Sh. 4	12050-LRM-095C, Sh. 1
11715-LRM-095B, Sh. 1	12050-LRM-095C, Sh. 2
11715-LRM-095B, Sh. 2	12050-LRM-95D, Sh. 1
11715-LRM-095C, Sh. 1	12050-LRM-95D, Sh. 2
11715-LRM-095C, Sh. 2	12050-LRM-096A, Sh. 3
11715-LRM-95D, Sh. 1	
11715-LRM-95D, Sh. 2	
11715-LRM-096A, Sh. 2	
11715-LRM-096A, Sh. 3	

In the Surry LRA, the applicant identified the portions of the CH systems that are within the scope of license renewal in the drawings listed below. In addition, the applicant listed the mechanical component commodity groups that are subject to AMR and their intended functions in Table 2.3.3-1 of the Surry LRA.

Unit 1	Unit 2
11448-LRM-071B, Sh. 2	11548-LRM-071B, Sh. 2
11448-LRM-079D, Sh. 1	11548-LRM-084A, Sh. 1
11448-LRM-082A, Sh. 1	11548-LRM-086A, Sh. 1
11448-LRM-084A, Sh. 1	11548-LRM-086A, Sh. 2
11448-LRM-086A, Sh. 1	11548-LRM-086A, Sh. 3
11448-LRM-086A, Sh. 2	11548-LRM-086B, Sh. 1
11448-LRM-086A, Sh. 3	11548-LRM-087A, Sh. 2
11448-LRM-086B, Sh. 1	11548-LRM-088A, Sh. 1
11448-LRM-087A, Sh. 2	11548-LRM-088A, Sh. 2
11448-LRM-088A, Sh. 1	11548-LRM-088B, Sh. 1
11448-LRM-088A, Sh. 2	11548-LRM-088B, Sh. 2
11448-LRM-088A, Sh. 3	11548-LRM-088B, Sh. 3
11448-LRM-088A, Sh. 4	11548-LRM-088C, Sh. 1
11448-LRM-088B, Sh. 1	11548-LRM-088C, Sh. 2
11448-LRM-088B, Sh. 2	11548-LRM-089A, Sh. 2
11448-LRM-088B, Sh. 3	
11448-LRM-088C, Sh. 1	
11448-LRM-088C, Sh. 2	
11448-LRM-089A, Sh. 2	

The license renewal drawings were highlighted by the applicant to identify those portions of the CH systems that meet at least one of the scoping requirements of 10 CFR 54.4. The staff compared the license renewal drawings to the system drawings and the descriptions in the North Anna and Surry UFSARs to ensure they were representative of the CH systems. The staff performed its review by sampling the SCs that the applicant identified as being within the scope of license renewal but not subject to AMR to verify that no structure or component, that performs its intended function without moving parts or without a change in configuration or properties and that is not subject to replacement based on qualified life or specified time period was excluded from an AMR. The staff did not identify any omissions.

2.3.3.1.3 Conclusion

On the basis of its review of the information contained in Section 2.3.3.1 of each LRA the supporting information in the North Anna and Surry UFSARs, and the license renewal drawings, as described above, the staff did not identify any omissions in the scoping and screening of the NAS 1/2 and SPS 1/2 CH systems by the applicant. Therefore, the staff concludes that there is reasonable assurance that the applicant has identified those portions of the NAS 1/2 and SPS 1/2 CH systems that are within the scope of license renewal and the SCs that are subject to an AMR in accordance with 10 CFR 54.4(a) and 10 CFR 54.21(a)(1), respectively.

2.3.3.2 High-Radiation Sampling System (HRSS)

In general, the North Anna and Surry high-radiation sampling systems (HRSSs) do not meet the scoping criteria set forth by 10 CFR 54.4. However, at North Anna, the applicant groups the components of the component-cooling system (CC) that supply the HRSS sample coolers in the North Anna HRSS, and subsequently identifies these components using HRSS component identification numbers. Therefore, the applicant includes the North Anna HRSS within the scope of license renewal. In the North Anna LRA, Section 2.3.3.2, “High-Radiation Sampling System,” the applicant describes the piping and mechanical components of the HRSS that are within the scope of license renewal and subject to an AMR.

The components of the Surry CC system that supply the HRSS sample coolers have component cooling identification numbers, and do not need to be included within the scope of license renewal because they do not meet the scoping criteria set forth by 10 CFR 54.4. Therefore, the following evaluation only applies to the North Anna LRA.

2.3.3.2.1 Technical Information in the Application

The North Anna and Surry HRSSs provide the capability to obtain grab samples from various systems and plant areas that can be used as indications of post-accident plant conditions. In addition, the North Anna and Surry HRSSs are normally isolated from other plant systems. However, the North Anna component cooling isolation valves to the HRSS sample cooler have HRSS component identification numbers and, therefore, are considered part of the HRSS even though these valves are a functional part of the component cooling systems. On the basis of system function and operating configuration, with the exception of the component cooling isolation valves to the North Anna HRSS sample cooler, the applicant determined that North Anna and Surry HRSSs are not safety-related and do not support safety-related functions and, therefore, are not within the scope of license renewal.

The applicant describes its process for identifying the mechanical components that are within the scope of license renewal in Section 2.1.4, “Scoping Methodology,” of the North Anna LRA. As described in the scoping methodology, the applicant identified the portion of the North Anna HRSS that are within the scope of license renewal on license renewal drawings listed in Section 2.3.3.2 of the North Anna LRA. Consistent with the method described in each LRA, Section 2.1.5, “Screening Methodology,” the applicant listed the HRSS mechanical component commodity groups that are subject to an AMR in Table 2.3.3-2 of the North Anna LRA. This table lists piping and valve bodies as the component commodity groups that are subject to an AMR. The table also identifies the intended function and the LRA section that contains the AMR for the commodity groups.

2.3.3.2.2 Staff Evaluation

The staff reviewed the HRSS scoping and screening results to determine whether there is reasonable assurance that the applicant appropriately identified the portions of the North Anna and Surry HRSSs that are within the scope of license renewal in accordance with 10 CFR 54.4, and that the applicant appropriately identified the SCs of the HRSSs that are subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff reviewed the information in Section 2.3.3.2 of the North Anna LRA, the applicable license renewal drawings, and the North Anna and Surry UFSARs to determine whether the applicant adequately identified the portions of the North Anna HRSS that are within the scope of license renewal and to determine whether any portions of the Surry HRSS should be included within the scope of license renewal. The staff verified that the portion of the North Anna HRSS that meet the scoping requirements of 10 CFR 54.4 was included within the scope of license renewal and were identified as such by the applicant in Section 2.3.3.2 of the North Anna LRA.

To verify that the applicant did include the applicable portion of the North Anna HRSS within the scope of license renewal, the staff focused its review on those portions of the HRSS that were not identified within the scope of license renewal and verified that they did not meet the scoping criteria of 10 CFR 54.4. In addition, the staff reviewed the North Anna UFSAR to identify any additional system functions that were not identified in the LRA and verified that these additional functions did not meet the scoping requirements of 10 CFR 54.4. The staff did not identify any omissions. The staff also reviewed the Surry UFSAR and verified that the Surry HRSS need not be included within the scope of license renewal.

The staff then determined whether the applicant had properly identified the SCs of the North Anna HRSS that are subject to AMR from the portion of the HRSSs that is identified as being within the scope of license renewal. The applicant identified and lists the SCs subject to AMR for the HRSS in Table 2.3.3-2 of the North Anna LRA using the screening methodology described in Section 2.1 of the LRA. The staff evaluated the scoping and screening methodology and documented its findings in Section 2.1 of this SER.

In the North Anna LRA, the applicant identified the portion of the HRSS that is within the scope of license renewal in the drawings listed below. The applicant also listed the mechanical component commodity groups that are subject to AMR and their intended functions in Table 2.3.3-2 of the North Anna LRA.

Unit 1	Unit 2
11715-LRM-079C, Sh. 4	Common
11715-LRM-108A, Sh. 1	

The license renewal drawings were highlighted by the applicant to identify the SCs of the North Anna HRSS that meet at least one of the scoping requirements of 10 CFR 54.4. The staff compared the license renewal drawings to the system drawings and the descriptions in the North Anna UFSARs to ensure that they were representative of the HRSS. The staff performed its review by sampling the SCs that the applicant identified as being within the scope of license renewal but not subject to AMR to verify that no structure or component, that performs its intended function without moving parts or without a change in configuration or properties and, that is not subject to replacement based on qualified life or specified time period, was excluded from an AMR. The staff did not identify any omissions.

2.3.3.2.3 Conclusion

On the basis of its review of the information contained in Section 2.3.3.2 of the North Anna LRA, the supporting information in the North Anna and Surry UFSARs, and the license renewal drawings, as described above, the staff did not identify any omissions in the scoping and screening of the HRSS by the applicant. Therefore, the staff concludes that there is reasonable assurance that the applicant has identified the portion of the North Anna HRSS that is within the scope of license renewal and the SCs that are subject to an AMR in accordance with 10 CFR 54.4(a) and 10 CFR 54.21(a)(1), respectively.

2.3.3.3 Incore Instrumentation

In the North Anna LRA, Section 2.3.3.3, and the Surry LRA, Section 2.3.3.2, both entitled "Incore Instrumentation," the applicant describes the piping and mechanical components of the incore instrumentation (IC) systems that are within the scope of license renewal and subject to an AMR for NAS 1/2 and SPS 1/2. Each unit of NAS and SPS has an IC system. These systems are identical with no notable differences in system design for the purpose of license renewal. Therefore, the information provided below is applicable to the NAS 1/2 and SPS 1/2 IC systems. The IC structural components that are subject to AMR are presented separately by the applicant in Section 2.4.10 of each LRA, "General Structural Supports," as commodity groups and, therefore, are evaluated separately by the staff in Section 2.4.10 of this SER. The IC piping and mechanical components are further described by the applicant in Chapter 7.7.1.9 of the North Anna UFSAR and Chapter 7.6.1 of the Surry UFSAR.

2.3.3.3.1 Technical Information in the Application

The IC systems for NAS 1/2 and SPS 1/2 provide reactor core performance information in the form of neutron flux distribution data. The IC system consists of moveable incore neutron detectors, bottom-mounted instrumentation guide tubes, a seal table with seal assemblies/fittings, and isolation valves. The guide tubes, seal table, and seal table fittings form a pressure boundary for the reactor coolant system. The isolation valves normally do not provide a reactor coolant system pressure boundary, but are designed to be closed in the event of a leak in the IC system pressure boundary components. If closed, the isolation valves form the reactor coolant system pressure boundary. The portions of the IC systems that are subject to AMR consist of the components that provide, or could be required to provide, a reactor coolant system pressure boundary.

The applicant describes its process for identifying the mechanical components that are within the scope of license renewal in Section 2.1.4, "Scoping Methodology," of the North Anna and Surry LRAs. As described in the scoping methodology, the applicant identified the portions of the IC systems that are within the scope of license renewal on the license renewal drawings listed in the North Anna LRA, Section 2.3.3.3, and the Surry LRA, Section 2.3.3.2. Consistent with the method described in each LRA, Section 2.1.5, "Screening Methodology," the applicant listed the NAS 1/2 and SPS 1/2 mechanical component commodity groups that are subject to an AMR in Tables 2.3.3-3 and 2.3.3-2, respectively, of each LRA. These tables also list the intended functions and the LRA sections that contain the AMR for each commodity group.

The portions of each IC systems that are subject to an AMR for NAS 1/2 and SPS 1/2 include the following four component commodity groups: seal table, seal table fittings, bottom-mounted instrumentation guide tubes, and valve bodies. The applicant identified maintaining pressure boundary integrity as the intended function of the SCs that are subject to an AMR for the NAS 1/2 and SPS 1/2 IC systems.

2.3.3.3.2 Staff Evaluation

The staff reviewed Section 2.3.3.3 of the North Anna LRA and Section 2.3.3.2 of the Surry LRA to determine whether there is reasonable assurance that the applicant appropriately identified the portions of the NAS 1/2 and SPS 1/2 IC systems that are within the scope of license renewal in accordance with 10 CFR 54.4, and that the applicant appropriately identified the SCs of the IC systems that are subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff reviewed the information provided in each LRA, the applicable license renewal drawings, and the North Anna and Surry UFSARs to determine whether the applicant adequately identified the portions of the NAS 1/2 and SPS 1/2 IC systems that are within the scope of license renewal. The staff verified that those portions of the IC systems that meet the scoping requirements of 10 CFR 54.4 were included within the scope of license renewal and were identified as such by the applicant in Sections 2.3.3.3 and 2.3.3.2 of the North Anna and Surry LRAs, respectively. To verify that the applicant did include the applicable portions of the IC systems within the scope of license renewal, the staff focused its review on those portions of the NAS 1/2 and SPS 1/2 IC systems that were not identified within the scope of license renewal and verified that they did not meet the scoping criteria of 10 CFR 54.4. In addition, the staff reviewed the UFSARs for each facility to identify any additional system functions that were not identified in each LRA and verified that these additional functions did not meet the scoping requirements of 10 CFR 54.4. The staff did not identify any omissions.

The staff then determined whether the applicant had properly identified the SCs of the NAS 1/2 and SPS 1/2 IC systems that are subject to AMR from among those portions of the IC systems that are identified as being within the scope of license renewal. The applicant identified and listed the SCs subject to AMR for the IC systems in Table 2.3.3-3 of the North Anna LRA and Table 2.3.3-2 of the Surry LRA using the screening methodology described in Section 2.1 of each LRA. The staff evaluated the scoping and screening methodology and documented its findings in Section 2.1 of this SER.

In the North Anna LRA, the applicant identified the portions of the IC systems that are within the scope of license renewal in the drawings listed below. The applicant also listed the mechanical component commodity groups that are subject to AMR and their intended functions in Table 2.3.3-3 of the North Anna LRA.

Unit 1	Unit 2
11715-LRM-054F, Sh. 1	12050-LRM-054F, Sh. 1

In the Surry LRA, the applicant identified the portions of the IC systems that are within the scope of license renewal in the drawings listed below. In addition, the applicant listed the mechanical component commodity groups that are subject to AMR and their intended functions in Table 2.3.3-2 of the Surry LRA.

Unit 1	Unit 2
11448-LRM-42B, Sh. 1	11548-LRM-42B, Sh. 1

The license renewal drawings were highlighted by the applicant to identify those portions of the IC systems that meet at least one of the scoping requirements of 10 CFR 54.4. The staff compared the license renewal drawings to the system drawings and the descriptions in the North Anna and Surry UFSARs to ensure they were representative of the IC systems. The staff performed its review by sampling the SCs that the applicant identified as being within the scope of license renewal but not subject to AMR to verify that no structure or component, that performs its 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, was excluded from an AMR. The staff did not identify any omissions.

2.3.3.3.3 Conclusion

On the basis of its review of the information contained in Section 2.3.3.3 of the North Anna LRA and Section 2.3.3.2 of the Surry LRA, the supporting information in the North Anna and Surry UFSARs, and the license renewal drawings, as described above, the staff did not identify any omissions in the scoping and screening of the NAS 1/2 and SPS 1/2 IC systems by the applicant. Therefore, the staff concludes that there is reasonable assurance that the applicant has identified those portions of the NAS 1/2 and SPS 1/2 IC systems that are within the scope of license renewal and the SCs that are subject to an AMR in accordance with 10 CFR 54.4(a) and 10 CFR 54.21(a)(1), respectively.

2.3.3.4 North Anna Refueling Purification/Surry Reactor Cavity Purification

In the North Anna LRA, Section 2.3.3.4, “Refueling Purification,” and the Surry LRA, Section 2.3.3.3, “Reactor Cavity Purification,” the applicant describes the piping and mechanical components of the refueling purification (RP) and reactor cavity purification (RL) systems (from hereon referred to collectively as RP/RL systems) that are within the scope of license renewal and subject to an AMR for NAS 1/2 and SPS 1/2. The RP/RL systems are identical with no notable differences in system design for the purpose of license renewal. Therefore, the information provided below is applicable to the NAS 1/2 and SPS 1/2 RP/RL systems. The RP/RL structural components that are subject to AMR are presented separately by the applicant in Section 2.4.10 of each LRA, “General Structural Supports,” as commodity groups and, therefore, are evaluated separately by the staff in Section 2.4.10 of this SER. The RP/RL piping and mechanical components are further described by the applicant in Chapter 9.1.3 of the North Anna UFSAR and Chapter 11.3.1 of the Surry UFSAR.

2.3.3.4.1 Technical Information in the Application

The RP/RL systems for NAS 1/2 and SPS 1/2 provide a means to maintain the water quality of the filled reactor cavity during refueling operations. The systems also include the capability to pump the reactor cavity water to the refueling water storage tank. The portion of the RP/RL systems that are subject to AMR consists of the components that perform a pressure boundary function as part of the RP/RL system containment penetrations, the components that provide a pressure boundary for the reactor cavity, and the components that provide a pressure boundary at interfaces with other in-scope systems.

The applicant describes its process for identifying the mechanical components that are within the scope of license renewal in Section 2.1.4, “Scoping Methodology,” of the North Anna and Surry LRAs. As described in the scoping methodology, the applicant identified the portions of the RP/RL systems that are within the scope of license renewal on the license renewal drawings listed in the North Anna LRA, Section 2.3.3.4, and the Surry LRA, Section 2.3.3.3. Consistent with the method described in each LRA, Section 2.1.5, “Screening Methodology,” the applicant listed the NAS 1/2 and SPS 1/2 mechanical component commodity groups that are subject to an AMR in Tables 2.3.3-4 and 2.3.3-3, respectively, of each LRA. These tables also list the intended functions and the LRA sections that contain the AMR for each commodity group.

The portions of each RP/RL systems that are subject to an AMR for NAS 1/2 and SPS 1/2 include the following three component commodity groups: bolting, pipe, and valve bodies. The applicant identified maintaining pressure boundary integrity as the intended function of the SCs that are subject to an AMR for the NAS 1/2 and SPS 1/2 RP/RL systems.

2.3.3.4.2 Staff Evaluation

The staff reviewed Section 2.3.3.4 of the North Anna LRA and Section 2.3.3.3 of the Surry LRA to determine whether there is reasonable assurance that the applicant appropriately identified the portions of the NAS 1/2 and SPS 1/2 RP/RL systems that are within the scope of license renewal in accordance with 10 CFR 54.4, and that the applicant appropriately identified the SCs of the RP/RL systems that are subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff reviewed the information provided in each LRA, the applicable license renewal drawings, and the North Anna and Surry UFSARs to determine whether the applicant adequately identified the portions of the NAS 1/2 and SPS 1/2 RP/RL systems that are within the scope of license renewal. The staff verified that those portions of the RP/RL systems that meet the scoping requirements of 10 CFR 54.4 were included within the scope of license renewal and were identified as such by the applicant in Sections 2.3.3.4 and 2.3.3.3 of the North Anna and Surry LRAs, respectively. To verify that the applicant did include the applicable portions of the RP/RL systems within the scope of license renewal, the staff focused its review on those portions of the NAS 1/2 and SPS 1/2 RP/RL systems that were not identified within the scope of license renewal and verified that they did not meet the scoping criteria of 10 CFR 54.4. In addition, the staff reviewed the UFSARs for each facility to identify any additional system functions that were not identified in each LRA and verified that these additional functions did not meet the scoping requirements of 10 CFR 54.4. The staff did not identify any omissions.

The staff then determined whether the applicant had properly identified the SCs of the NAS 1/2 and SPS 1/2 RP/RL systems that are subject to AMR from among those portions of the RP/RL systems that are identified as being within the scope of license renewal. The applicant identified and lists the SCs subject to AMR for the RP/RL systems in Table 2.3.3-4 of the North Anna LRA and Table 2.3.3-3 of the Surry LRA using the screening methodology described in Section 2.1 of each LRA. The staff evaluated the scoping and screening methodology and documented its findings in Section 2.1 of this SER.

In the North Anna LRA, the applicant identified the portions of the RP systems that are within the scope of license renewal in the drawings listed below. The applicant also listed the mechanical component commodity groups that are subject to AMR and their intended functions in Table 2.3.3-4 of the North Anna LRA.

Unit 1	Unit 2
11715-LRM-088A, Sh. 1	12050-LRM-095B, Sh. 1
11715-LRM-088A, Sh. 2	12050-LRM-096A, Sh. 1
11715-LRM-088A, Sh. 3	
11715-LRM-088A, Sh. 4	
11715-LRM-095B, Sh. 1	
11715-LRM-096A, Sh. 1	

In the Surry LRA, the applicant identified the portions of the RL systems that are within the scope of license renewal in the drawings listed below. In addition, the applicant listed the mechanical component commodity groups that are subject to AMR and their intended functions in Table 2.3.3-3 of the Surry LRA.

Unit 1	Unit 2
11448-LRM-088A, Sh. 4	11548-LRM-088A, Sh. 2
11448-LRM-118A, Sh. 1	11548-LRM-118A, Sh. 1
11448-LRM-118A, Sh. 2	

The license renewal drawings were highlighted by the applicant to identify those portions of the RP/RL systems that meet at least one of the scoping requirements of 10 CFR 54.4. The staff compared the license renewal drawings to the system drawings and the descriptions in the North Anna and Surry UFSARs to ensure they were representative of the RP/RL systems. The staff performed its review by sampling the SCs that the applicant identified as being within the scope of license renewal but not subject to AMR to verify that no structure or component, that performs its 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, was excluded from an AMR. The staff did not identify any omissions.

2.3.3.4.3 Conclusion

On the basis of its review of the information contained in Section 2.3.3.4 of the North Anna LRA and Section 2.3.3.3 of the Surry LRA, the supporting information in the North Anna and Surry UFSARs, and the license renewal drawings, as described above, the staff did not identify any omissions in the scoping and screening of the NAS 1/2 and SPS 1/2 RP/RL systems by the applicant. Therefore, the staff concludes that there is reasonable assurance that the applicant has identified those portions of the NAS 1/2 and SPS 1/2 RP/RL systems that are within the scope of license renewal and the SCs that are subject to an AMR in accordance with 10 CFR 54.4(a) and 10 CFR 54.21(a)(1), respectively.

2.3.3.5 Sampling Systems

In the North Anna and Surry LRAs, Section 2.3.3.5, “Sampling System,” the applicant describes the components of the NAS 1/2 and SPS 1/2 sampling systems (SSs) that are within the scope of license renewal and subject to an AMR. Each unit of NAS and SPS has an SS system. These systems are identical with no notable differences in system design for the purpose of license renewal. Therefore, the information provided below is applicable to the NAS 1/2 and

SPS 1/2 SS systems. These systems are further described in Section 9 of the North Anna and Surry UFSARs.

2.3.3.5.1 Technical Information in the Application

At both North Anna and Surry, the SSs provide a means to monitor fluid quality and other system performance parameters for various plant systems. The SSs consist of sample tubing and piping, valves, sample coolers, and other components that provide a means to control sample streams. Sample cooling is provided by the component cooling systems. Some portions of the SSs are within the ASME Class 1 RCS pressure boundary.

The applicant describes its process for identifying the mechanical components that are within the scope of license renewal in Section 2.1.4, "Scoping Methodology" of each LRA. As described in the scoping methodology, the applicant identified the portions of the NAS 1/2 and SPS 1/2 SSs that are within the scope of license renewal on the license renewal drawings listed in Section 2.3.3.4 of each LRA. Consistent with the method described in each LRA, Section 2.1.5, "Screening Methodology," the applicant listed the SSs mechanical component commodity groupings that are within the license renewal evaluation boundaries and that are subject to an AMR in Table 2.3.3-4 of each LRA. These tables also list the intended functions, and the LRA sections containing the AMR for each component commodity grouping.

The portions of the NAS 1/2 and SPS 1/2 SSs that are subject to AMR consist of the components that form the pressure boundary for other in-scope systems via sample points and sample coolers and the components that perform the containment pressure boundary function as part of the SSs containment penetration. In each LRA Table 2.3.3-4, the applicant listed the following five component commodity groups subject to an AMR: bolting, pipe, sample coolers, tubing, and valve bodies. The applicant identified maintaining pressure boundary integrity as the only intended function for the NAS 1/2 and SPS 1/2 SS SCs that are subject to an AMR.

2.3.3.5.2 Staff Evaluation

The staff reviewed Section 2.3.3.4 of the North Anna and Surry LRAs to determine whether there is reasonable assurance that the applicant appropriately identified the portions of the NAS 1/2 and SPS 1/2 SSs that are within the scope of license renewal in accordance with 10 CFR 54.4, and that the applicant appropriately identified the SCs of the SSs that are subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff reviewed the information provided in Section 2.3.3.4 of each LRA, the applicable license renewal drawings, and the North Anna and Surry UFSARs to determine whether the applicant adequately identified the portions of the NAS 1/2 and SPS 1/2 SSs that are within the scope of license renewal. The staff verified that those portions of the SSs that meet the scoping requirements of 10 CFR 54.4 were included within the scope of license renewal and were identified as such by the applicant in Section 2.3.3.4 of each LRA. To verify that the applicant did include the applicable portions of the SSs within the scope of license renewal, the staff focused its review on those portions of the SSs that were not identified within the scope of license renewal and verified that they did not meet the scoping criteria of 10 CFR 54.4. In addition, the staff reviewed the UFSARs for each facility to identify any additional system functions that were not identified in each LRA and verified that these additional functions did not meet the scoping requirements of 10 CFR 54.4. The staff did not identify any omissions.

The staff then determined whether the applicant had properly identified the SCs that are subject to AMR from among those portions of the SSs that are identified as being within the scope of license renewal. The applicant identified and lists the SCs subject to AMR for the SSs in Table 2.3.3-4 of each LRA using the screening methodology described in Section 2.1 of each LRA. The staff evaluated the scoping and screening methodology and documented its findings in Section 2.1 of this SER.

In the NAS LRA, the applicant identified the portions of the SSs that are within the scope of license renewal in the drawings listed below. The applicant also listed the mechanical component commodity groups that are subject to AMR and their intended functions in Table 2.3.3-4 of the NAS LRA.

Unit 1	Unit 2
11715-LRM-079B, Sh. 1	12050-LRM-079A, Sh. 1
11715-LRM-079C, Sh. 2	12050-LRM-089A, Sh. 3
11715-LRM-079C, Sh. 5	12050-LRM-089B, Sh. 1
11715-LRM-089B, Sh. 3	12050-LRM-093A, Sh. 1
11715-LRM-089D, Sh. 1	12050-LRM-093A, Sh. 2
11715-LRM-093A, Sh. 1	12050-LRM-093A, Sh. 3
11715-LRM-093A, Sh. 2	12050-LRM-093B, Sh. 1
11715-LRM-093A, Sh. 3	12050-LRM-094A, Sh. 1
11715-LRM-093B, Sh. 1	12050-LRM-094A, Sh. 2
11715-LRM-094A, Sh. 1	
11715-LRM-094A, Sh. 2	

In the SPS LRA, the applicant identified the portions of the SSs that are within the scope of license renewal in the drawings listed below. In addition, the applicant listed the mechanical component commodity groups that are subject to AMR and its intended functions in Table 2.3.3-4 of the SPS LRA.

Unit 1	Unit 2
11448-LRM-072C, Sh. 3	11548-LRM-072C, Sh. 1
11448-LRM-072C, Sh. 5	11548-LRM-082A, Sh. 2
11448-LRM-072E, Sh. 1	11548-LRM-082A, Sh. 3
11448-LRM-072G, Sh. 1	11548-LRM-086A, Sh. 1
11448-LRM-082A, Sh. 1	11548-LRM-086A, Sh. 2
11448-LRM-082B, Sh. 2	11548-LRM-086A, Sh. 3
11448-LRM-086A, Sh. 1	11548-LRM-086B, Sh. 1
11448-LRM-086A, Sh. 2	11548-LRM-087A, Sh. 2
11448-LRM-086A, Sh. 3	11548-LRM-088A, Sh. 2
11448-LRM-086B, Sh. 1	11548-LRM-088B, Sh. 1
11448-LRM-087A, Sh. 1	11548-LRM-088B, Sh. 2
11448-LRM-087A, Sh. 2	
11448-LRM-088A, Sh. 4	
11448-LRM-088B, Sh. 1	

The license renewal drawings were highlighted by the applicant to identify those portions of the SSs that meet at least one of the scoping requirements of 10 CFR 54.4. The staff compared the LRA drawings to the system drawings and the descriptions in the North Anna and Surry UFSARs to ensure they were representative of the SSs. The staff performed its review by sampling the SCs that the applicant identified as being within the scope of license renewal but not subject to AMR to verify that no structure or component, that performs its intended function without moving parts or without a change in configuration or properties and, that is not subject to replacement based on qualified life or specified time period, was excluded from an AMR. The staff did not identify any omissions.

2.3.3.5.3 Conclusions

On the basis of its review of the information contained in Section 2.3.3.4 of each LRA the supporting information in the North Anna and Surry UFSARs, and the license renewal drawings, as described above, the staff did not identify any omissions in the scoping and screening of the SCs of the NAS 1/2 and SPS 1/2 SSs by the applicant. The staff concludes that there is reasonable assurance that the applicant has identified those portions of the NAS 1/2 and SPS 1/2 SSs that are within the scope of license renewal and the SCs that are subject to an AMR in accordance with 10 CFR 54.4(a), and 10 CFR 54.21(a)(1), respectively.

2.3.3.6 Circulating Water

In the Surry LRA, Section 2.3.3.5, “Circulating Water,” the applicant described the piping and mechanical components of the circulating water (CW) system for the SPS 1/2 that are within the scope of license renewal and subject to an AMR. In general, the function of CW systems at both North Anna and Surry do not meet the requirements of 10 CFR 54.4, therefore, are not within the scope of license renewal. However, portions of the SPS 1/2 CW system support the service water systems at Surry and are designated as Seismic Category I components. This is not the case for NAS 1/2. The North Anna CW systems are not in the scope of license renewal and, therefore, the following evaluation only applies to Surry LRA. The Surry CW systems structural components that are subject to AMR are presented separately by the applicant in Section 2.4.10 of the LRA, “General Structural Supports,” as commodity groups and, therefore, are evaluated separately by the staff in Section 2.4.10 of this SER. The SPS 1/2 CW systems piping and mechanical components are further described by the applicant in Section 10.3.4 of the Surry UFSAR.

2.3.3.6.1 Technical Information in the Application

The CW systems for SPS 1/2 provide cooling water for the main condensers and the service water systems. Circulating water pumps discharge water from the James River into the intake canal. The intake canal water level is at a higher elevation than the discharge canal, and water is gravity fed to plant systems and components. Although the intake canal water inventory is maintained during plant operation by the four CW pumps per unit, the applicant states that the CW pumps are not relied upon to maintain intake canal inventory during emergency conditions and, therefore, are not within the scope of license renewal.

The applicant describes its process for identifying the mechanical components that are within the scope of license renewal in Section 2.1.4, “Scoping Methodology,” of the Surry LRA. As described in the scoping methodology, the applicant identified the portions of the SPS 1/2 CW systems that are within the scope of license renewal on the license renewal drawings listed in Section 2.3.3.5 of the Surry LRA. Consistent with the method described in the LRA, Section 2.1.5, "Screening Methodology," the applicant listed the SPS 1/2 CW mechanical component commodity groups that are subject to an AMR in Table 2.3.3-5 of the Surry LRA. This table also lists the intended functions and the LRA section that contains the AMR for each commodity group.

The portions of each CW systems that are subject to an AMR for SPS 1/2 include the components that make up the limited portions of each system that support the Surry service water systems. In each LRA Table 2.3.3-5, the applicant listed the following five component commodity groups subject to an AMR: condenser waterboxes, filters/strainers, piping, spray shields, valve bodies. The applicant identified maintaining pressure boundary integrity, and providing a flood barrier as the intended functions of the SCs that are subject to an AMR for the SPS 1/2 CW systems.

The applicant describes its methodology for identifying the components that are within the scope of license renewal in Section 2.0 of the application, "Scoping and Screening Methodology for Identifying Structures and Components Subject to Aging Management Review, and Implementation Results." Systems within the scope of license renewal were listed by the applicant in Table 2.2-1 of each LRA. Systems not within the scope of license renewal are listed in Table 2.2-2 of each LRA. Structures within the scope of license renewal are listed by the applicant in Table 2.2-3 and structures not within the scope of license renewal are listed in Table 2.2-4 of each LRA. These tables link the reader to the appropriate section in the license renewal application to view the "screening results."

Initial scoping identifies plant systems and structures that are candidates for inclusion within the scope of 10 CFR Part 54. For systems and structures that are "scoped-in," screening was then performed to identify the passive components and structural members that support an intended function of the "in-scope" system or structure. These SC's are then subject to an AMR in accordance with 10 CFR 54.21(a). The results of the screening review were used to generate license renewal drawings. These drawings show all components that are within the scope of license renewal and those subject to AMR as highlighted.

The applicant identified "component groups" for the circulating water system that require AMR. These are presented in Table 2.3.3-5 of each LRA. This table presents the component groups with their passive function identified and a link to their AMR results. The applicant has identified the following component groups for the circulating water system that are subject to AMR: condenser waterboxes, filters/strainers, pipe, spray shields, and valve bodies.

2.3.3.6.2 Staff Evaluation

The staff reviewed the Surry LRA, Section 2.3.3.5 to determine whether there is reasonable assurance that the applicant appropriately identified the portions of the SPS 1/2 CW systems that are within the scope of license renewal in accordance with 10 CFR 54.4, and that the applicant appropriately identified the SCs of the CW systems that are subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff reviewed the information provided in Section 2.3.3.5 of the Surry LRA, the applicable license renewal drawings, and the Surry UFSAR to determine whether the applicant adequately identified the portions of the SPS 1/2 CW systems that are within the scope of license renewal. The staff verified that those portions of the CW systems that meet the scoping requirements of 10 CFR 54.4 were included within the scope of license renewal and were identified as such by the applicant in Section 2.3.3.5 of the Surry LRA. To verify that the applicant did include the applicable portions of the CW systems within the scope of license renewal, the staff focused its review on those portions of the SPS 1/2 CW systems that were not identified within the scope of license renewal and verified that they did not meet the scoping criteria of 10 CFR 54.4. In addition, the staff reviewed the Surry UFSAR to identify any additional system functions that were not identified in the LRA, and verified that these additional functions did not meet the scoping requirements of 10 CFR 54.4. The staff did not identify any omissions.

In addition, the staff reviewed the North Anna UFSAR to identify any intended functions of the NAS 1/2 CW systems that met the scoping requirements of 10 CFR 54.4. The staff did not identify any intended function that would require including NAS 1/2 CW systems within the scope of license renewal.

The staff then determined whether the applicant had properly identified the SCs of the SPS 1/2 CW systems that are subject to AMR from among those portions of the CW systems that are identified as being within the scope of license renewal. The applicant identified and lists the SCs subject to AMR for the CW systems in Table 2.3.3-5 of Surry LRA using the screening methodology described in Section 2.1 of each LRA. The staff evaluated the scoping and screening methodology and documented its findings in Section 2.1 of this SER.

In the Surry LRA, the applicant identified the portions of the CW systems that are within the scope of license renewal in the drawings listed below. In addition, the applicant listed the mechanical component commodity groups that are subject to AMR and their intended functions in Table 2.3.3-5 of the Surry LRA.

Unit 1	Unit 2
11448-LRM-071A, Sh. 2	11548-LRM-071A, Sh. 2
	11548-LRM-071C, Sh. 1

The license renewal drawings were highlighted by the applicant to identify those portions of the CW systems that meet at least one of the scoping requirements of 10 CFR 54.4. The staff compared the license renewal drawings to the system drawings and the descriptions in the Surry UFSAR to ensure they were representative of the CW systems. The staff performed its review by sampling the SCs that the applicant identified as being within the scope of license renewal but not subject to AMR to verify that no structure or component, that performs its 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, was excluded from an AMR. The staff did not identify any omissions.

2.3.3.6.3 Conclusion

On the basis of its review of the information contained in Section 2.3.3.5 of Surry LRA, the supporting information in the North Anna and Surry UFSARs, and the license renewal drawings, as described above, the staff did not identify any omissions in the scoping and screening of the

SPS 1/2 CW systems by the applicant. Therefore, the staff concludes that there is reasonable assurance that the applicant has identified those portions of the SPS 1/2 CW systems that are within the scope of license renewal and the SCs that are subject to an AMR in accordance with 10 CFR 54.4(a) and 10 CFR 54.21(a)(1), respectively.

2.3.3.7 Service Water

In the North Anna and Surry LRAs, Section 2.3.3.6, "Service Water," the applicant describes the piping and mechanical components of the service water (SW) systems that are within the scope of license renewal and subject to an AMR for North Anna and Surry. These systems are similar for both facilities with some differences in system design. Any notable differences are specifically identified and discussed in the staff's evaluation. Unless otherwise specified, the information provided below is applicable to both the North Anna and Surry SW systems. The SW systems structural components that are subject to AMR are presented separately by the applicant in Section 2.4.10 of each LRA, "General Structural Supports," as commodity groups and, therefore, are evaluated separately by the staff in Section 2.4.10 of this SER. The SW systems piping and mechanical components are further described by the applicant in Chapter 9.2.1 of the North Anna UFSAR and Chapter 9.9 of the Surry UFSAR.

2.3.3.7.1 Technical Information in the Application

The North Anna and Surry service water systems are common to both units at each facility and are designed to remove heat from various SSCs resulting from the simultaneous operation of NAS 1/2 and SPS 1/2. The major system loads for the North Anna and Surry service water systems during normal operations are the NAS 1/2 and SPS 1/2 component cooling water systems. The major load for the SW systems during accident conditions are the NAS 1/2 and SPS 1/2 recirculation spray system.

For North Anna, the SW system is a forced feed-flow system supplied by four SW system pumps. The sources of cooling water for the North Anna SW system are the North Anna reservoir and the North Anna SW system reservoir. These two independent sources of water form the ultimate heat sink for NAS 1/2.

The Surry SW system is a gravity flow system. Three emergency SW pumps are available under abnormal conditions, but are not used during normal plant operation. The Surry SW system transfers heat from other station systems and components to the ultimate heat sink via the circulating water system. Cooling water flows from the intake canal to the SW system through branch lines from the circulating water system piping. The portions of the Surry circulating water systems that interact with the Surry SW system are reviewed and evaluated by the staff in Section 2.3.3.6 of this SER, and will not be discussed any further in this evaluation. The source of cooling water for the Surry SW system is the James River. Water is transferred from the James River by way of the intake canal. In addition to the component cooling system, the Surry SW system is used during normal plant operations to cool the bearing cooling water system, the charging pump service water subsystem, and other station applications such as air-conditioning and chilled water.

Both the North Anna and Surry SW systems are two-loop systems. For North Anna, however, most of the SW system heat loads can be aligned to operate on either loop. During a design basis accident (DBA) the two loops are cross-connected at the recirculation spray heat exchanger supply and return headers of the affected unit. The North Anna SW system is not a typical "two train" system. It is designed so that no single active component failure during a DBA will prevent the service water system from performing its safety-related (design) functions, even though it acts as a single system. Two operable loops are required to provide this capability. For Surry, the SW system is not typically cross-connected under normal and accident conditions. However, each loop is capable of supplying the necessary heat removal for normal and accident operations.

The applicant describes its process for identifying the mechanical components that are within the scope of license renewal in Section 2.1.4, "Scoping Methodology," of the North Anna and Surry LRAs. As described in the scoping methodology, the applicant identified the portions of the SW system that are within the scope of license renewal on the license renewal drawings listed in Section 2.3.3.6 of each LRA. Consistent with the method described in each LRA, Section 2.1.5, "Screening Methodology," the applicant listed the North Anna and Surry SW systems mechanical component commodity groups that are subject to an AMR in Table 2.3.3-6 of each LRA. These tables also list the intended functions and the LRA sections that contain the AMR for each commodity group.

The portions of each SW systems that are subject to an AMR for North Anna and Surry include the components that make up the major flowpaths for each system. In each LRA Table 2.3.3-6, the applicant listed the component commodity groups subject to an AMR. For the North Anna SW system the applicant listed the following 18 component commodity groups subject to an AMR: SW instrument air receivers, corrosion rate monitor, expansion joints, filters/strainers, flexible connections, flow element, flow orifices, instrument valve assemblies, instrumentation, spray nozzles, piping, pump casings, radiation sensors, restricting orifices, temperature sensors, thermowells, tubing, and valve bodies. The applicant identified maintaining pressure boundary integrity, providing filtration, providing spray pattern, and restricting flow as the intended functions of the SCs that are subject to an AMR for the North Anna SW system. For the Surry SW system the applicant listed the following 21 component commodity groups subject to an AMR: charging pump intermediate seal coolers, emergency service water pump diesel jacket water radiators, emergency service water pump diesel oil coolers, expansion joints, emergency service water pump diesel fan/blower housing, emergency service water pump diesel filters, filters/strainers, flexible connections, flow elements, instrument valve assemblies, instrumentation, emergency service water pump diesel oil pans, piping, pump casings, radiation sensors, emergency service water pump diesel fuel oil tanks, spray shields, temperature sensors, thermowells, tubing, and valve bodies. The applicant identified maintaining pressure boundary integrity, providing heat transfer, filtration, flood barrier, and restricting flow as the intended functions of the SCs that are subject to an AMR for the Surry SW system.

2.3.3.7.2 Staff Evaluation

The staff reviewed Section 2.3.3.6 of the North Anna and Surry LRAs to determine whether there is reasonable assurance that the applicant appropriately identified the portions of the North Anna and Surry SW systems that are within the scope of license renewal in accordance with 10 CFR 54.4, and that the applicant appropriately identified the SCs of the SW systems that are subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff reviewed the information provided in Section 2.3.3.6 of each LRA, the applicable license renewal drawings, and the North Anna and Surry UFSARs to determine whether the applicant adequately identified the portions of the North Anna and SPS 1/2 SW systems that are within the scope of license renewal. The staff verified that those portions of the SW systems that meet the scoping requirements of 10 CFR 54.4 were included within the scope of license renewal and were identified as such by the applicant in Section 2.3.3.6 of each LRA. To verify that the applicant did include the applicable portions of the SW systems within the scope of license renewal, the staff focused its review on those portions of the North Anna and Surry SW systems that were not identified within the scope of license renewal and verified that they did not meet the scoping criteria of 10 CFR 54.4. In addition, the staff reviewed the UFSARs for each facility to identify any additional system functions that were not identified in each LRA and verified that these additional functions did not meet the scoping requirements of 10 CFR 54.4. The staff did not identify any omissions.

The staff then determined whether the applicant had properly identified the SCs of the North Anna and Surry SW systems that are subject to AMR from among those portions of the SW systems that are identified as being within the scope of license renewal. The applicant identified and lists the SCs subject to AMR for the SW systems in Table 2.3.3-6 of each LRA using the screening methodology described in Section 2.1 of each LRA. The staff evaluated the scoping and screening methodology and documented its findings in Section 2.1 of this SER.

In the North Anna LRA, the applicant identified the portions of the SW systems that are within the scope of license renewal in the drawings listed below. The applicant also listed the mechanical component commodity groups that are subject to AMR and their intended functions in Table 2.3.3-6 of the North Anna LRA.

Unit 1	Unit 2
11715-LRM-040D, Sh. 1	12050-LRM-074A, Sh. 3
11715-LRM-040D, Sh. 2	12050-LRM-079B, Sh. 3
11715-LRM-074A, Sh. 3	
11715-LRM-078A, Sh. 1	
11715-LRM-078A, Sh. 2	
11715-LRM-078A, Sh. 3	
11715-LRM-078A, Sh. 4	
11715-LRM-078A, Sh. 5	
11715-LRM-078B, Sh. 1	
11715-LRM-078B, Sh. 3	
11715-LRM-078C, Sh. 1	
11715-LRM-078C, Sh. 2	
11715-LRM-078G, Sh. 1	
11715-LRM-078G, Sh. 2	
11715-LRM-078H, Sh. 1	
11715-LRM-078J, Sh. 1	
11715-LRM-078K, Sh. 1	
11715-LRM-078L, Sh. 1	
11715-LRM-079C, Sh. 3	
11715-LRM-079D, Sh. 4	

In the Surry LRA, the applicant identified the portions of the SW systems that are within the scope of license renewal in the drawings listed below. In addition, the applicant listed the mechanical component commodity groups that are subject to AMR and their intended functions in Table 2.3.3-6 of the Surry LRA.

Unit 1	Unit 2
11448-LRM-071A, Sh. 1	11548-LRM-071A, Sh. 2
11448-LRM-071A, Sh. 2	11548-LRM-071A, Sh. 3
11448-LRM-071A, Sh. 3	11548-LRM-071B, Sh. 1
11448-LRM-071A, Sh. 4	11548-LRM-71C, Sh. 1
11448-LRM-071B, Sh. 1	11548-LRM-130A, Sh. 1
11448-LRM-071D, Sh. 1	
11448-LRM-071D, Sh. 2	
11448-LRM-071E, Sh. 1	
11448-LRM-077C, Sh. 1	
11448-LRM-130A, Sh. 1	

The license renewal drawings were highlighted by the applicant to identify those portions of the SW systems that meet at least one of the scoping requirements of 10 CFR 54.4. The staff compared the license renewal drawings to the system drawings and the descriptions in the North Anna and Surry UFSARs to ensure they were representative of the SW systems. The staff performed its review by sampling the SCs that the applicant identified as being within the scope of license renewal but not subject to AMR to verify that no structure or component, that performs its intended function without moving parts or without a change in configuration or properties and that is not subject to replacement based on qualified life or specified time period, was excluded from an AMR. The staff did not identify any omissions.

As part of its review, the staff determined that the applicant occasionally uses a temporary service water (SW) flow path to perform maintenance on the single SW supply to the component cooling water heat exchangers. The Surry updated final UFSAR indicates that this temporary flow path piping is routed through the turbine building basement from the circulating water inlet piping to the supply piping of two of the component cooling heat exchangers. The UFSAR also indicates that the temporary flow path must be in accordance with an approved temporary change to the Surry technical specifications and an associated license condition, and is used only during a SPS Unit 1 outage. The staff asked the applicant if the temporary flow path piping received an AMR. The applicant responded that the temporary flow path piping is not within the scope of license renewal. The piping of concern is part of a temporary modification that is submitted to, and reviewed by, the staff as a technical specification exception to allow the applicant to operate outside of normal plant design and operating configuration to perform special maintenance activities. The staff found the applicant's response to be acceptable.

In addition, the SPS SW is supplied by the circulating water (CW) system. Intake canal water inventory is maintained during plant operation by up to four CW pumps per unit that take a suction from the James River at the low-level intake structure and discharge through large-bore pipes to the higher elevation intake canal. Antisiphoning standpipes are provided on the pump discharge pipes to prevent draining the intake canal in the event of backflow through these lines. The Surry UFSAR indicates that this antisiphon function is provided by active (air-operated) vacuum breakers. The standpipes are also equipped with passive vacuum breakers to provide the important antisiphon function in the event of failure of the active vacuum breakers. The staff asked the applicant if the passive vacuum breakers have received an AMR. The applicant responded that the antisiphoning passive vacuum breakers are simply large holes in the piping at a specific elevation to ensure that the siphoning effect will not drain the intake canal below a certain level. The applicant stated that because the potential loss of material is the only applicable aging effect, and an increase in the size of the hole will not affect the intended function, no aging management is required. The staff found this explanation to be acceptable.

The additional discussions between the staff and the applicant regarding the Surry SW system temporary flow path and antisiphoning device are documented in a letter from the staff to the applicant dated October 11, 2001. This additional information can be found on the docket for the Surry LRA review.

2.3.3.7.3 Conclusion

On the basis of its review of the information contained in Section 2.3.3.6 of each LRA, the supporting information in the North Anna and Surry UFSARs, and the license renewal drawings, as described above, the staff did not identify any omissions in the scoping and screening of the North Anna and Surry SW systems by the applicant. Therefore, the staff concludes that there is reasonable assurance that the applicant has identified those portions of the North Anna and Surry SW systems that are within the scope of license renewal and the SCs that are subject to an AMR in accordance with 10 CFR 54.4(a) and 10 CFR 54.21(a)(1), respectively.

2.3.3.8 Chilled Water

In the North Anna LRA, Section 2.3.3.7, “Chilled Water,” the applicant describes the piping and mechanical components of the chilled water (CD) systems that are within the scope of license renewal and subject to an AMR for NAS 1/2. These systems are identical for the purposes of license renewal for both NAS units without any notable differences in system design. The North Anna CD structural components that are subject to AMR are presented separately by the applicant in Section 2.4.10 of NAS LRA “General Structural Supports,” as commodity groups and, therefore, are evaluated separately by the staff in Section 2.4.10 of this SER. The CD piping and mechanical components are further described by the applicant in Chapter 9.2.2 and 9.4.1 of the North Anna UFSAR.

The Surry LRA does not have a section dedicated to the CD system. The intended functions of the CD systems for Surry are performed by the SPS 1/2 containment air recirculation cooler flowpaths (included in component cooling systems), the main control room and emergency switchgear room air-conditioning (included in Ventilation System and bearing cooling systems.) These systems have evaluated in Sections 2.3.3.10, 2.3.3.24, and 2.3.3.9 of this SER. Therefore, the following evaluation only applies to NAS 1/2.

2.3.3.8.1 Summary of Technical Information in the Application

The CD systems for NAS 1/2 are defined in the North Anna UFSAR as subsystems of the component cooling systems. For NAS 1/2, the CD system designation is applied to the CD system and the main control room and emergency switchgear room (MCR/ESGR) air-conditioning CD system. Each CD subsystem provides chilled water to remove heat from various plant loads including the containment air recirculation coolers. The applicant states that the CD subsystems do not remove heat from equipment that is required to maintain the plant in a safe condition. However, the applicant identified the portions of the CD systems that perform a containment pressure boundary function within the scope of license renewal and subject to an AMR. In addition, the portions of the CD system that performs an SW system pressure boundary function when the SW systems are cross-connected are also identified as being within the scope of license renewal and subject to an AMR, but are considered in the staff review of the heating and ventilation systems in Section 2.3.3.24 of this SER.

The applicant describes its process for identifying the mechanical components that are within the scope of license renewal in Section 2.1.4, “Scoping Methodology,” of the North Anna and LRA. As described in the scoping methodology, the applicant identified the portions of the CD systems that are within the scope of license renewal on the license renewal drawings listed in Section 2.3.3.7 of the North Anna LRA. Consistent with the method described in each LRA, Section 2.1.5, “Screening Methodology,” the applicant listed the NAS 1/2 CD mechanical component commodity groups that are subject to an AMR in Table 2.3.3-7 of the North Anna LRA. This table also list the intended functions and the LRA sections that contain the AMR for each commodity group.

The portions of each CD system that are subject to an AMR for NAS 1/2 include the components that make up the containment pressure boundary. In the NAS LRA Table 2.3.3-7, the applicant listed the following four component commodity groups subject to an AMR: filters/strainers, instrument valve assemblies, pipe, and valve bodies. The applicant identified maintaining pressure boundary integrity and filtration as the intended functions of the SCs that are subject to an AMR for the NAS 1/2 CD systems.

2.3.3.8.2 Staff Evaluation

The staff reviewed Section 2.3.3.7 of the North Anna LRA to determine whether there is reasonable assurance that the applicant appropriately identified the portions of the NAS 1/2 CD systems that are within the scope of license renewal in accordance with 10 CFR 54.4, and that the applicant appropriately identified the SCs of the CD systems that are subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff reviewed the information provided in Section 2.3.3.7 of the North Anna LRA, the applicable license renewal drawings, and the North Anna UFSAR to determine whether the applicant adequately identified the portions of the NAS 1/2 CD systems that are within the scope of license renewal. The staff verified that those portions of the CD systems that meet the scoping requirements of 10 CFR 54.4 were included within the scope of license renewal and were identified as such by the applicant in Section 2.3.3.7 of the North Anna LRA. To verify that the applicant did include the applicable portions of the CD systems within the scope of license renewal, the staff focused its review on those portions of the NAS 1/2 CD systems that were not identified within the scope of license renewal and verified that they did not meet the scoping criteria of 10 CFR 54.4. In addition, the staff reviewed the North Anna UFSAR to identify any additional system functions that were not identified in the LRA, and verified that these additional functions did not meet the scoping requirements of 10 CFR 54.4. The staff did not identify any omissions.

The staff then determined whether the applicant had properly identified the SCs of the NAS 1/2 CD systems that are subject to AMR from among those portions of the CD systems that are identified as being within the scope of license renewal. The applicant identified and lists the SCs subject to AMR for the CD systems in Table 2.3.3-7 of the North Anna LRA using the screening methodology described in Section 2.1 of each LRA. The staff evaluated the scoping and screening methodology and documented its findings in Section 2.1 of this SER.

In the North Anna LRA, the applicant identified the portions of the CD systems that are within the scope of license renewal in the drawings listed below. The applicant also listed the mechanical component commodity groups that are subject to AMR and their intended functions in Table 2.3.3-7 of the North Anna LRA.

Unit 1	Unit 2
11715-LRM-040C, Sh. 1	12050-LRM-079B, Sh. 3
11715-LRM-040C, Sh. 2	
11715-LRM-040E, Sh. 1	
11715-LRM-040E, Sh. 2	
11715-LRM-079D, Sh. 4	
12050-LRM-079B, Sh. 3	

The license renewal drawings were highlighted by the applicant to identify those portions of the CD systems that meet at least one of the scoping requirements of 10 CFR 54.4. The staff compared the license renewal drawings to the system drawings and the descriptions in the North Anna UFSAR to ensure they were representative of the CD systems. The staff performed its review by sampling the SCs that the applicant identified as being within the scope of license renewal but not subject to AMR to verify that no structure or component, that performs its 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, was excluded from an AMR. The staff did not identify any omissions.

2.3.3.8.3 Conclusion

On the basis of its review of the information contained in Section 2.3.3.7 of the NAS LRA, the supporting information in the North Anna UFSAR, and the license renewal drawings, as described above, the staff did not identify any omissions in the scoping and screening of the NAS 1/2 CD systems by the applicant. Therefore, the staff concludes that there is reasonable assurance that the applicant has identified those portions of the NAS 1/2 CD systems that are within the scope of license renewal and the SCs that are subject to an AMR in accordance with 10 CFR 54.4(a) and 10 CFR 54.21(a)(1), respectively.

2.3.3.9 Bearing Cooling

In the Surry LRA, Section 2.3.3.7, "Bearing Cooling," the applicant describes the components of the bearing cooling (BC) systems for SPS 1/2 that are within the scope of license renewal and subject to an AMR for SPS 1/2. These systems are identical for the purposes of license renewal for both SPS units without any notable differences in system design. The Surry BC structural components that are subject to AMR are presented separately by the applicant in

Section 2.4.10 of each LRA, “General Structural Supports,” as commodity groups and, therefore, are evaluated separately by the staff in Section 2.4.10 of this SER. These systems are further described in Section 10.3.9 of the Surry UFSAR. The NAS 1/2 do not have bearing cooling systems; therefore, the following staff evaluation only applies to the Surry LRA.

2.3.3.9.1 Summary of Technical Information in the Application

The SPS 1/2 BC systems are intermediate cooling systems whose primary function is to transfer heat from a number of plant systems and components to the SPS service water systems. These systems also provide makeup water to the main control rooms and emergency switchgear rooms air-conditioning chilled water systems. The BC systems are closed cooling water systems utilizing a corrosion inhibitor.

The applicant describes its process for identifying the mechanical components that are within the scope of license renewal in Section 2.1.4, “Scoping Methodology,” of each LRA. As described in the scoping methodology, the applicant identified the portions of the BC systems that are within the scope of license renewal on the license renewal drawings listed in Section 2.3.3.7 of each LRA. Consistent with the methodology described in the LRA, Section 2.1.5, “Screening Methodology,” the applicant listed the BC system mechanical component commodity groupings that are within the license renewal evaluation boundaries and that are subject to an AMR in Table 2.3.3-7 of the Surry LRA. The tables also list the intended functions, and the Surry LRA section containing the AMR for each commodity group.

The portions of the BC systems that are subject to AMR include the BC system components that form part of the chilled water system pressure boundary for the main control rooms and emergency switchgear rooms air-conditioning units. In the LRA, Table 2.3.3-7, the applicant listed the following three component commodity groups as subject to an AMR: pipes, tanks, and valve bodies. The applicant identified maintaining pressure boundary integrity as the only intended function of the SCs that is subject to an AMR.

2.3.3.9.2 Staff Evaluation

The staff reviewed Section 2.3.3.7 of the SPS LRA to determine whether there is reasonable assurance that the applicant appropriately identified the portions of the BC systems that are within the scope of license renewal in accordance with 10 CFR 54.4, and that the applicant appropriately identified the SCs that are subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff reviewed the information provided in Section 2.3.3.7 of the LRA, the applicable license renewal drawings, and the Surry UFSAR to determine whether the applicant adequately identified the portions of the BC systems that are within the scope of license renewal. The staff verified that those portions of the BC systems that meet the scoping requirements of 10 CFR 54.4 were included within the scope of license renewal and were identified as such by the applicant in Section 2.3.3.7 of the SPS LRA. To verify that the applicant did include the applicable portions of the BC systems within the scope of license renewal, the staff focused its review on those portions of the BC systems that were not identified within the scope of license renewal and verified that they did not meet the scoping criteria of 10 CFR 54.4(a). In addition, the staff reviewed the SPS UFSAR to identify any additional system functions that were not identified in the LRA, and verified that these additional functions did not meet the scoping requirements of 10 CFR 54.4. The staff did not identify any omissions.

The staff then determined whether the applicant had properly identified the SCs that are subject to AMR from among those portions of the BC systems that are identified within the scope of license renewal. The applicant identified and lists the SCs subject to AMR for the SPS BC systems in Table 2.3.3-7 of the LRA using the screening methodology described in Section 2.1 of each LRA. The staff evaluated the scoping and screening methodology and documented its findings in Section 2.1 of this SER.

In the SPS LRA, the applicant identified the portions of the BC systems that are within the scope of license renewal in the drawings listed below. In addition, the applicant listed the mechanical component commodity groups that are subject to AMR and their intended functions in Table 2.3.3-7 of the LRA:

Unit 1	Unit 2
11448-LRB-041A, Sh. 2	11548-LRM-73A, Sh. 1

The license renewal drawings were highlighted by the applicant to identify those portions of the BC systems that meet at least one of the scoping requirements of 10 CFR 54.4. The staff compared the license renewal drawings to the system drawings and the description in the SPS UFSAR to ensure that they were representative of the BC systems. The staff performed its review by sampling the SCs that the applicant identified as being within the scope of license renewal but not subject to AMR to verify that no structure or component, that performs its 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, was excluded from an AMR. The staff did not identify any omissions.

2.3.3.9.3 Conclusions

On the basis of its review of the information contained in Section 2.3.3.7 of the Surry LRA and the supporting information in the Surry UFSAR and license renewal drawings, as described above, the staff did not identify any omissions in the scoping of the BC systems by the applicant. Therefore, the staff concludes that there is reasonable assurance that the applicant has identified those portions of the SPS 1/2 BC systems that are within the scope of license renewal and the SCs that are subject to an AMR in accordance with 10 CFR 54.4(a) and 10 CFR 54.21(a)(1), respectively.

2.3.3.10 Component Cooling

In the North Anna and Surry LRAs, Section 2.3.3.8, “Component Cooling,” the applicant describes the piping and mechanical components of the component cooling (CC) systems that are within the scope of license renewal and subject to an AMR for NAS 1/2 and SPS 1/2. NAS 1/2 and SPS 1/2 each has a CC system. These systems are similar for both facilities, but with some differences in system design and application. Any notable differences are specifically identified and discussed in the staff’s evaluation. Unless otherwise specified, the information provided below is applicable to both the North Anna and Surry CC systems. The CC structural components that are subject to AMR are presented separately by the applicant in Section 2.4.10 of each LRA, "General Structural Supports," as commodity groups and, therefore, are evaluated separately by the staff in Section 2.4.10 of this SER. The CC piping and mechanical components are further described by the applicant in Chapter 9.2.2 of the North Anna UFSAR and Chapter 9.4 of the Surry UFSAR.

2.3.3.10.1 Summary of Technical Information in the Application

The NAS 1/2 and SPS 1/2 CC systems consist of the component cooling water, chilled water, and neutron shield tank cooling water subsystems. These subsystems can be used individually or in combination with each other to provide cooling water for the removal of heat from components. The NAS 1/2 and SPS 1/2 CC systems are intermediate cooling systems that transfer heat from plant systems and components to the service water system. Each CC system supports safety-related and non-safety-related systems and components that contain potentially radioactive fluids. The NAS 1/2 and SPS 1/2 CC systems are closed cooling water systems utilizing corrosion inhibitors.

For SPS 1/2, the CC systems are made up of two additional subsystems (in addition to the three subsystems listed above): the chilled component cooling water and the charging pump cooling water systems.

The applicant describes its process for identifying the mechanical components that are within the scope of license renewal in Section 2.1.4, "Scoping Methodology," of the North Anna and Surry LRAs. As described in the scoping methodology, the applicant identified the portions of the NAS 1/2 and SPS 1/2 CC systems that are within the scope of license renewal on the license renewal drawings listed in Section 2.3.3.8 of each LRA. Consistent with the method described in each LRA, Section 2.1.5, "Screening Methodology," the applicant listed the NAS 1/2 and SPS 1/2 CC mechanical component commodity groups that are subject to an AMR in Table 2.3.3-8 of each LRA. These tables also list the intended functions and the LRA sections that contain the AMR for each commodity group.

In each LRA Section 2.3.3.8, the applicant states that the portion of the CC system that is subject to AMR consists of the components that are required to support heat removal function, and the components that perform a containment pressure boundary function. In each LRA Table 2.3.3-8, the applicant listed the following 13 component commodity groups subject to an AMR for NAS 1/2 and SPS 1/2 CC systems: CC heat exchangers, expansion joints, filters/strainers flow elements, flow indicators, instrument valve assemblies, level indicators, piping, pipe penetration cooling coils, pump casings, tanks, thermowells, tubing, and valve bodies. In addition, NAS 1/2 CC systems component commodity groups also include flexible connections and radiation sensors, and SPS 1/2 CC systems component commodity groups also include primary shield penetration cooling coils and restricting orifices. The applicant identified that the intended functions of the SCs that are subject to an AMR for the NAS 1/2 and SPS 1/2 CC systems are maintaining pressure boundary integrity, providing heat transfer, providing filtration, and restricting flow.

2.3.3.10.2 Staff Evaluation

The staff reviewed the North Anna and Surry LRAs, Section 2.3.3.8, to determine whether there is reasonable assurance that the applicant appropriately identified the portions of the NAS 1/2 and SPS 1/2 CC systems that are within the scope of license renewal in accordance with 10 CFR 54.4, and that the applicant appropriately identified the SCs of the CC systems that are subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff reviewed the information provided in Section 2.3.3.8 of each LRA, the applicable license renewal drawings, and the North Anna and Surry UFSARs to determine whether the applicant adequately identified the portions of the NAS 1/2 and SPS 1/2 CC systems that are within the scope of license renewal. The staff verified that those portions of the CC systems that meet the scoping requirements of 10 CFR 54.4 were included within the scope of license renewal and were identified as such by the applicant in Section 2.3.3.8 of each LRA. To verify that the applicant did include the applicable portions of the CC systems within the scope of license renewal, the staff focused its review on those portions of the NAS 1/2 and SPS 1/2 CC systems that were not identified within the scope of license renewal and verified that they did not meet the scoping criteria of 10 CFR 54.4. In addition, the staff reviewed the UFSARs for each facility to identify any additional system functions that were not identified in each LRA and verified that these additional functions did not meet the scoping requirements of 10 CFR 54.4. The staff did not identify any omissions.

The staff then determined whether the applicant had properly identified the SCs of the NAS 1/2 and SPS 1/2 CC systems that are subject to AMR from among those portions of the CC systems that are identified as being within the scope of license renewal. The applicant identified and lists the SCs subject to AMR for the CC systems in Table 2.3.3-8 of each LRA using the screening methodology described in Section 2.1 of each LRA. The staff evaluated the scoping and screening methodology and documented its findings in Section 2.1 of this SER.

In the North Anna LRA, the applicant identified the portions of the CC systems that are within the scope of license renewal in the drawings listed below. The applicant also listed the mechanical component commodity groups that are subject to AMR and their intended functions in Table 2.3.3-8 of the North Anna LRA.

Unit 1	Unit 2
11448-LRM-071B, Sh. 2	11548-LRM-071B, Sh. 2
11448-LRM-072A, Sh. 1	11548-LRM-072A, Sh. 1
11448-LRM-072A, Sh. 2	11548-LRM-072A, Sh. 2
11448-LRM-072A, Sh. 3	11548-LRM-072A, Sh. 3
11448-LRM-072A, Sh. 4	11548-LRM-072A, Sh. 4
11448-LRM-072A, Sh. 5	11548-LRM-072A, Sh. 5
11448-LRM-072A, Sh. 6	11548-LRM-072A, Sh. 6
11448-LRM-072A, Sh. 7	11548-LRM-072A, Sh. 7
11448-LRM-072B, Sh. 1	11548-LRM-072B, Sh. 1
11448-LRM-072B, Sh. 2	11548-LRM-072B, Sh. 2
11448-LRM-072B, Sh. 3	11548-LRM-072B, Sh. 3
11448-LRM-072C, Sh. 1	11548-LRM-072C, Sh. 1
11448-LRM-072C, Sh. 2	11548-LRM-072C, Sh. 2
11448-LRM-072C, Sh. 3	
11448-LRM-072C, Sh. 4	
11448-LRM-072C, Sh. 5	
11448-LRM-072D, Sh. 1	
11448-LRM-072D, Sh. 2	
11448-LRM-072D, Sh. 3	
11448-LRM-072E, Sh. 1	
11448-LRM-072E, Sh. 2	
11448-LRM-072G, Sh. 1	

In the Surry LRA, the applicant identified the portions of the CC systems that are within the scope of license renewal in the drawings listed below. In addition, the applicant listed the mechanical component commodity groups that are subject to AMR and their intended functions in Table 2.3.3-8 of the Surry LRA.

Unit 1	Unit 2
11448-LRM-071B, Sh. 2	11548-LRM-071B, Sh. 2
11448-LRM-072A, Sh. 1	11548-LRM-072A, Sh. 1
11448-LRM-072A, Sh. 2	11548-LRM-072A, Sh. 2
11448-LRM-072A, Sh. 3	11548-LRM-072A, Sh. 3
11448-LRM-072A, Sh. 4	11548-LRM-072A, Sh. 4
11448-LRM-072A, Sh. 5	11548-LRM-072A, Sh. 5
11448-LRM-072A, Sh. 6	11548-LRM-072A, Sh. 6
11448-LRM-072A, Sh. 7	11548-LRM-072A, Sh. 7
11448-LRM-072B, Sh. 1	11548-LRM-072B, Sh. 1
11448-LRM-072B, Sh. 2	11548-LRM-072B, Sh. 2
11448-LRM-072B, Sh. 3	11548-LRM-072B, Sh. 3
11448-LRM-072C, Sh. 1	11548-LRM-072C, Sh. 1
11448-LRM-072C, Sh. 2	11548-LRM-072C, Sh. 2
11448-LRM-072C, Sh. 3	
11448-LRM-072C, Sh. 4	
11448-LRM-072C, Sh. 5	
11448-LRM-072D, Sh. 1	
11448-LRM-072D, Sh. 2	
11448-LRM-072D, Sh. 3	
11448-LRM-072E, Sh. 1	
11448-LRM-072E, Sh. 2	
11448-LRM-072G, Sh. 1	

The license renewal drawings were highlighted by the applicant to identify those portions of the CC systems that meet at least one of the scoping requirements of 10 CFR 54.4. The staff compared the license renewal drawings to the system drawings and the descriptions in the North Anna and Surry UFSARs to ensure they were representative of the CC systems. The staff performed its review by sampling the SCs that the applicant identified as being within the scope of license renewal but not subject to AMR to verify that no structure or component, that performs its 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, was excluded from an AMR. The staff did not identify any omissions.

2.3.3.10.3 Conclusion

On the basis of its review of the information contained in Section 2.3.3.8 of each LRA, the supporting information in the North Anna and Surry UFSARs, and the license renewal drawings, as described above, the staff did not identify any omissions in the scoping and screening of the NAS 1/2 and SPS 1/2 CC systems by the applicant. Therefore, the staff concludes that there is reasonable assurance that the applicant has identified those portions of the NAS 1/2 and SPS 1/2 CC systems that are within the scope of license renewal and the SCs that are subject to an AMR in accordance with 10 CFR 54.4(a) and 10 CFR 54.21(a)(1), respectively.

2.3.3.11 Neutron Shield Tank Cooling

In the North Anna and Surry LRAs, Section 2.3.3.9, "Neutron Shield Tank Cooling," the applicant describes the components of the neutron shield tank cooling (NS) systems that are within the scope of license renewal and subject to an AMR. NAS 1/2 and SPS 1/2 each has an NS system. These systems are identical for the purposes of license renewal for both facilities without any notable differences in system design. The NS structural components that are subject to AMR are presented separately by the applicant in Section 2.4.10 of each LRA, "General Structural Supports," as commodity groups and, therefore, are evaluated separately by the staff in Section 2.4.10 of this SER. The NS systems are further described in Section 9 of the North Anna and Surry UFSARs.

2.3.3.11.1 Summary of Technical Information in the Application

The North Anna and Surry NS systems provide cooling for the neutron shield tank fluid, which is heated by the attenuation of neutron and gamma radiation in the vicinity of the reactor vessel. The neutron shield tank fluid cooling is provided by the component cooling (CC) system.

The applicant describes its process for identifying the mechanical components that are within the scope of license renewal in Section 2.1.4, "Scoping Methodology" of each LRA. As described in the scoping methodology, the applicant identified the portions of the NAS 1/2 and SPS 1/2 NS systems that are within the scope of license renewal on the license renewal drawings listed in Section 2.3.3.9 of each LRA. Consistent with the method described in each LRA Section 2.1.5, "Screening Methodology," the applicant listed the NAS 1/2 and SPS 1/2 NS systems mechanical component commodity groupings that are within the license renewal evaluation boundaries and that are subject to an AMR in Table 2.3.3-9 of each LRA. The table also lists the intended functions, and the LRA section containing the AMR for each commodity grouping.

The portions of the NAS 1/2 and SPS 1/2 NS systems that are subject to AMR include the NS components that provide a pressure boundary function for the component cooling water systems. In each LRA Table 2.3.3-9, the applicant listed the following six component commodity groups subject to an AMR: bolting, neutron shield tank coolers, pipe, pump casings, tanks, and valve bodies. The applicant identified maintaining system pressure boundary integrity as the only intended function for the NS system SCs that are subject to an AMR.

2.3.3.11.2 Staff Evaluation

The staff reviewed Section 2.3.3.9 of each LRA to determine whether there is reasonable assurance that the applicant appropriately identified the portions of the NAS 1/2 and SPS 1/2 NS systems that are within the scope of license renewal in accordance with 10 CFR 54.4 and that the applicant appropriately identified the SCs that are subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff reviewed the information provided by the applicant in Section 2.3.3.9 of each LRA, the applicable license renewal drawings, and the North Anna and Surry UFSARs to determine whether the applicant adequately identified the portions of the NS systems that are within the scope of license renewal. The staff verified that those portions of the NS systems that meet the scoping requirements of 10 CFR 54.4 were included within the scope of license renewal and were identified as such by the applicant in Section 2.3.3.9 of each LRA. To verify that the applicant did include the applicable portions of the NAS 1/2 and SPS 1/2 NS systems within the scope of license renewal, the staff focused its review on those portions of the NS systems that were not identified within the scope of license renewal to verify that they do not meet the scoping requirements of 10 CFR 54.4(a). The staff also reviewed the UFSARs to determine whether there were any additional system functions that were not identified in each LRA and verified that those additional functions did not meet any of the scoping requirements of 10 CFR 54.4. The staff did not identify any omissions.

The staff then determined whether the applicant had properly identified the SCs that are subject to AMR from among those portions of the NAS 1/2 and SPS 1/2 NS systems that are identified as being within the scope of license renewal. The applicant identified and lists the SCs subject to AMR for the NS systems in Table 2.3.3-9 of each LRA using the screening methodology described in Section 2.1 of each LRA. The staff evaluated the scoping and screening methodology and documented its findings in Section 2.1 of this SER.

In the North Anna LRA, the applicant identified the portions of the NS systems that are within the scope of license renewal in the license renewal drawings listed below. The applicant also listed the mechanical component commodity groups that are subject to AMR and their intended functions in Table 2.3.3-9 of the North Anna LRA.

Unit 1	Unit 2
11715-LRM-079B, Sh. 5	11548-LRM-072A, Sh. 7
12050-LRM-079A, Sh. 5	11548-LRM-072B, Sh. 1
	11548-LRM-072B, Sh. 3

In Surry LRA, the applicant identified the portions of the NS system that are within the scope of license renewal in the drawings listed below. In addition, the applicant listed the mechanical component commodity groups that are subject to AMR and its intended functions in Table 2.3.3-9 of the Surry LRA.

Unit 1	Unit 2
11448-LRM-072A, Sh. 7	11548-LRM-072A, Sh. 7
11448-LRM-072B, Sh. 2	11548-LRM-072B, Sh. 1
11448-LRM-072E, Sh. 2	11548-LRM-072B, Sh. 3

The license renewal drawings were highlighted by the applicant to identify those portions of the NS systems that meet at least one of the scoping requirements of 10 CFR 54.4. The staff compared these drawings to the system drawings and the descriptions in both UFSARs to ensure they were representative of the NS systems. The staff performed its review by sampling the SCs that the applicant identified as being within the scope of license renewal but not subject to AMR to verify that no structure or component, that performs its 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, was excluded from an AMR. The staff did not identify any omissions.

2.3.3.11.3 Conclusions

On the basis of its review of the information contained in Section 2.3.3.9 of each LRA the supporting information in the North Anna and Surry UFSARs, and license renewal drawings, as described above, the staff did not identify any omissions in the scoping of the NAS 1/2 and SPS 1/2 NS systems by the applicant. Therefore, the staff concludes that there is reasonable assurance that the applicant has identified those portions of the NAS 1/2 and SPS 1/2 NS systems that are within the scope of license renewal and subject to an AMR in accordance with 10 CFR 54.4(a) and 10 CFR 54.21(a)(1), respectively.

2.3.3.12 Primary Grade Water

In the Surry LRA, Section 2.3.3.10, "Primary Grade Water," the applicant describes the piping and mechanical components of the primary grade water (PG) system that are within the scope of license renewal and subject to an AMR for Surry. The PG structural components that are subject to AMR are presented separately by the applicant in Section 2.4.10 of the SPS LRA "General Structural Supports," as commodity groups and, therefore, are evaluated separately by the staff in Section 2.4.10 of this SER. The PG piping and mechanical components are further described by the applicant in Chapter 9.2 of the Surry UFSAR.

For North Anna, the PG system contains no mechanical components that are within the scope of license renewal. Therefore, the following evaluation only applies to Surry LRA.

2.3.3.12.1 Summary of Technical Information in the Application

The Surry PG system primary function is to provide treated-water to plant systems for makeup, flushing, cooling, and other uses. Although providing treated-water for makeup, flushing, cooling, and other uses does not meet the scoping requirements for license renewal, portions of the Surry PG system also provide a pressure boundary for the chemical and volume control system and the fuel pit cooling system. The PG system piping and components that serve these pressure boundary functions are within the scope of license renewal and are subject to AMR.

The applicant describes its process for identifying the mechanical components that are within the scope of license renewal in Section 2.1.4, "Scoping Methodology," of the Surry LRA. As described in the scoping methodology, the applicant identified the portions of the Surry PG system that are within the scope of license renewal on the license renewal drawings listed in Section 2.3.3.10 of the Surry LRA. Consistent with the method described in the LRA, Section 2.1.5, "Screening Methodology," the applicant listed the Surry PG system mechanical component commodity groups that are subject to an AMR in Table 2.3.3-10 of the Surry LRA. This table also lists the intended functions and the LRA section that contains the AMR for each commodity group.

The portions of the Surry PG system that are subject to an AMR include the components that makeup the pressure boundary for the chemical and volume control system and the fuel pit cooling system. In the LRA Table 2.3.3-10, the applicant listed the following three component commodity groups subject to an AMR: bolting, pipe, and valve bodies. The applicant identified maintaining pressure boundary integrity as the intended function of the SCs that are subject to an AMR for the Surry PG system.

2.3.3.12.2 Staff Evaluation

The staff reviewed the Surry LRA, Section 2.3.3.10, to determine whether there is reasonable assurance that the applicant appropriately identified the portions of the Surry PG system that are within the scope of license renewal in accordance with 10 CFR 54.4, and that the applicant appropriately identified the SCs of the PG systems that are subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff reviewed the information provided in Section 2.3.3.10 of the Surry LRA, the applicable license renewal drawings, and the Surry UFSAR to determine whether the applicant adequately identified the portions of the Surry PG system that are within the scope of license renewal. The staff verified that those portions of the PG system that meet the scoping requirements of 10 CFR 54.4 were included within the scope of license renewal and were identified as such by the applicant in Section 2.3.3.10 of the Surry LRA. To verify that the applicant did include the applicable portions of the PG system within the scope of license renewal, the staff focused its review on those portions of the Surry PG system that were not identified within the scope of license renewal and verified that they did not meet the scoping criteria of 10 CFR 54.4. In addition, the staff reviewed the Surry UFSAR to identify any additional system functions that were not identified in the LRA, and verified that these additional functions did not meet the scoping requirements of 10 CFR 54.4. The staff did not identify any omissions.

In addition, the staff reviewed the North Anna UFSAR to identify any intended functions of the North Anna PG system that met the scoping requirements of 10 CFR 54.4. The staff did not identify any intended function that would require including the North Anna PG system within the scope of license renewal.

The staff then determined whether the applicant had properly identified the SCs of the Surry PG system that are subject to AMR from among those portions of the PG system that are identified as being within the scope of license renewal. The applicant identified and lists the SCs subject to AMR for the PG system in Table 2.3.3-10 of Surry LRA using the screening methodology described in Section 2.1 of each LRA. The staff evaluated the scoping and screening methodology and documented its findings in Section 2.1 of this SER.

In the Surry LRA, the applicant identified the portions of the PG system that are within the scope of license renewal in the drawings listed below. In addition, the applicant listed the mechanical component commodity groups that are subject to AMR and their intended functions in Table 2.3.3-10 of the Surry LRA.

Unit 1	Unit 2
11448-LRM-079C, Sh. 1	Common
11448-LRM-079D, Sh. 1	
11448-LRM-081A, Sh. 1	

The license renewal drawings were highlighted by the applicant to identify those portions of the PG systems that meet at least one of the scoping requirements of 10 CFR 54.4. The staff compared the license renewal drawings to the system drawings and the descriptions in the Surry UFSAR to ensure they were representative of the PG system. The staff performed its review by sampling the SCs that the applicant identified as being within the scope of license renewal but not subject to AMR to verify that no structure or component, that performs its 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, was excluded from an AMR. The staff did not identify any omissions.

2.3.3.12.3 Conclusion

On the basis of its review of the information contained in Section 2.3.3.10 of the Surry LRA, the supporting information in the North Anna and Surry UFSARs, and the license renewal drawings, as described above, the staff did not identify any omissions in the scoping and screening of the North Anna and Surry PG systems by the applicant. Therefore, the staff concludes that there is reasonable assurance that the applicant has identified those portions of the Surry PG system that are within the scope of license renewal and the SCs that are subject to an AMR in accordance with 10 CFR 54.4(a) and 10 CFR 54.21(a)(1), respectively.

2.3.3.13 Alternate AC (AAC) Diesel Generator Systems

In the North Anna LRA, Section 2.3.3.10, and the Surry LRA, Section 2.3.3.11, both entitled "Alternate AC (AAC) Diesel Generator Systems," the applicant describes the piping and mechanical components of the AAC systems that are within the scope of license renewal and subject to an AMR for North Anna and Surry. The AAC systems discussed in the following staff evaluation include the diesel generator and associated support systems. These systems are identical for the purpose of license renewal for both facilities with no notable differences. The AAC systems structural components that are subject to AMR are presented separately by the applicant in Section 2.4.10 of each LRA, "General Structural Supports," as commodity groups and, therefore, are evaluated separately by the staff in Section 2.4.10 of this SER. The AAC system piping and mechanical components are further described by the applicant in Section 9.5.11 of the North Anna UFSAR and Section 8.4.6 of the Surry UFSAR.

2.3.3.13.1 Summary of Technical Information in the Application

The North Anna and Surry AAC systems were installed in response to 10 CFR 50.63, "Loss of all AC power," and provide alternating current (AC) power to an emergency electrical bus during a Station Blackout (SBO) event. The AAC systems consist of the diesel generator and associated support systems. In North Anna LRA, Section 2.3.3.10, and the Surry 2.3.3.11, the applicant states that the diesel engine and electrical generator are within the scope of license renewal but are active components and, therefore, are not subject to AMR. The AAC supporting systems that are within the scope of license renewal include the portions of the AAC diesel cooling water (BCW) system, diesel fuel oil (BFO) system, diesel lubricating oil (BLO) system, and diesel starting air (BSA) system for both North Anna and Surry that are required for the operation of the AAC systems to meet SBO requirements.

The applicant describes its process for identifying the mechanical components that are within the scope of license renewal in Section 2.1.4, "Scoping Methodology," of the North Anna and Surry LRAs. As described in the scoping methodology, the applicant identified the portions of the AAC systems that are within the scope of license renewal on the license renewal drawings listed in the North Anna LRA, Section 2.3.3.10, and the Surry LRA, Section 2.3.3.11. Consistent with the method described in each LRA, Section 2.1.5, "Screening Methodology," the applicant listed the North Anna and Surry AAC systems mechanical component commodity groups that are subject to an AMR in Table 2.3.3-10 and Table 2.3.3.11 of North Anna and Surry LRAs, respectively. These tables also list the intended functions and the LRA sections that contain the AMR for each commodity group.

The portions of the AAC systems that are subject to an AMR for North Anna and Surry include those long-lived, passive SCs that are required for the operation of the AAC systems to meet SBO requirements. In North Anna LRA, Table 2.3.3-10, and the Surry LRA, Table 2.3.3-11, the applicant listed the following 19 component commodity groups subject to an AMR: accumulators, air receivers, diesel aftercoolers, diesel fuel oil coolers, diesel jacket water radiators, diesel lube oil coolers, fan/blower housing, filters/strainers, heaters, instrument valve assemblies, level indicators, oil pans, pipe, pump casings, restricting orifices, tanks, thermowells, tubing, valve bodies. The applicant identified maintaining pressure boundary integrity and restricting flow as the intended functions of the SCs that are subject to an AMR for the North Anna and Surry AAC systems.

2.3.3.13.2 Staff Evaluation

The staff reviewed the North Anna LRA, Section 2.3.3.10, and the Surry LRA, Section 2.3.3.11, to determine whether there is reasonable assurance that the applicant appropriately identified the portions of the North Anna and Surry AAC systems that are within the scope of license renewal in accordance with 10 CFR 54.4, and that the applicant appropriately identified the SCs of the AAC systems that are subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff reviewed the information provided in Sections 2.3.3.10 and 2.3.3.11 of the North Anna and Surry LRAs, respectively, the applicable license renewal drawings, and the North Anna and Surry UFSARs to determine whether the applicant adequately identified the portions of the North Anna and Surry AAC systems that are within the scope of license renewal. The staff verified that those portions of the AAC system that meet the scoping requirements of 10 CFR 54.4 were included within the scope of license renewal and were identified as such by the applicant In the North Anna and Surry LRAs. To verify that the applicant did include the applicable portions of the AAC systems within the scope of license renewal, the staff focused its review on those portions of the North Anna and Surry AAC systems that were not identified within the scope of license renewal and verified that they did not meet the scoping criteria of 10 CFR 54.4. In addition, the staff reviewed the UFSARs for each facility to identify any additional system functions that were not identified in each LRA and verified that these additional functions did not meet the scoping requirements of 10 CFR 54.4. The staff did not identify any omissions.

The staff then determined whether the applicant had properly identified the SCs of the North Anna and Surry AAC systems that are subject to AMR from among those portions of the AAC systems that are identified as being within the scope of license renewal. The applicant identified and lists the SCs subject to AMR for the AAC systems in the North Anna and Surry LRAs, Table 2.3.3-10 and Table 2.3.3.11, respectively, using the screening methodology described in Section 2.1 of each LRA. The staff evaluated the scoping and screening methodology and documented its findings in Section 2.1 of this SER.

In the North Anna LRA, the applicant identified the portions of the AAC systems that are within the scope of license renewal in the drawings listed below. The applicant also listed the mechanical component commodity groups that are subject to AMR and their intended functions in Table 2.3.3-10 of the North Anna LRA.

Unit 1	Unit 2
11715-LRM-113A, Sh. 1	Common
11715-LRM-113B, Sh. 1	
11715-LRM-113C, Sh. 1	
11715-LRM-113D, Sh. 1	
11715-LRM-113E, Sh. 1	

In the Surry LRA, the applicant identified the portions of the AAC systems that are within the scope of license renewal in the drawings listed below. In addition, the applicant listed the mechanical component commodity groups that are subject to AMR and their intended functions in Table 2.3.3-11 of the Surry LRA.

Unit 1	Unit 2
11448-LRB-038B, Sh. 1	Common
11448-LRB-046D, Sh. 1	
11448-LRB-046D, Sh. 2	
11448-LRB-046D, Sh. 3	
11448-LRB-046D, Sh. 4	

The license renewal drawings were highlighted by the applicant to identify those portions of the CH systems that meet at least one of the scoping requirements of 10 CFR 54.4. The staff compared the license renewal drawings to the system drawings and the descriptions in the North Anna and Surry UFSARs to ensure they were representative of the AAC systems. The staff performed its review by sampling the SCs that the applicant identified as being within the scope of license renewal but not subject to AMR to verify that no structure or component, that performs its 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, was excluded from an AMR. The staff did not identify any omissions.

2.3.3.13.3 Conclusion

On the basis of its review of the information contained in the North Anna LRA, Section 2.3.3.10, and the Surry LRA, Section 2.3.3.11, the supporting information in the North Anna and Surry UFSARs, and the license renewal drawings, as described above, the staff did not identify any omissions in the scoping and screening of the North Anna and Surry AAC systems by the applicant. Therefore, the staff concludes that there is reasonable assurance that the applicant has identified those portions of the North Anna and Surry AAC systems that are within the scope of license renewal and the SCs that are subject to an AMR in accordance with 10 CFR 54.4(a) and 10 CFR 54.21(a)(1), respectively.

2.3.3.14 Emergency Diesel Generator Systems

In the North Anna LRA, Section 2.3.3.11, and the Surry LRA, Section 2.3.3.12, both entitled "Emergency Diesel Generator Systems," the applicant describes the piping and mechanical components of the emergency diesel generators (EDGs) that are within the scope of license renewal and subject to an AMR for NAS 1/2 and SPS 1/2. The EDG systems discussed in the following staff evaluation include the diesel generator and associated support systems. Each unit of NAS and SPS has an EDG. The EDG systems are similar for both facilities with some minor differences in system design. Any notable differences are specifically identified and discussed in the staff's evaluation. Unless otherwise specified, the information provided below is applicable to both the NAS 1/2 and SPS 1/2 EDG systems. The EDG structural components that are subject to AMR are presented separately by the applicant in Section 2.4.10 of each LRA, "General Structural Supports," as commodity groups and, therefore, are evaluated separately by the staff in Section 2.4.10 of this SER. The EDG piping and mechanical components are further described by the applicant in Sections 8.3.1, and 9.5.4 to 9.5.8 of the North Anna UFSAR and Section 8.5 of the Surry UFSAR.

2.3.3.14.1 Summary of Technical Information in the Application

For NAS 1/2 and SPS 1/2 the EDGs are a diesel engine driven electrical generator that provides a backup source of electrical power to the emergency electrical bus in the event that the normal supply is unavailable. At North Anna, the EDG systems consist of the diesel generator and the following support systems: emergency diesel generator cooling (EC) systems, emergency generator (EG) system, emergency diesel generator lubrication (EL) systems, emergency diesel generator starting air (EB) systems, fuel oil (FO) system. At Surry, the EDG systems consist of the emergency generator (EG) systems and the emergency electrical power (EE) systems. The Surry EE and EG systems are functionally equivalent to the North Anna emergency diesel generator cooling (EC) systems, emergency diesel generator lubrication (EL) systems, emergency generator (EG) system, emergency diesel generator starting air (EB) systems, and fuel oil (FO) systems. The portion of the EDG support systems that are subject to AMR consists of the components that are required for operation of the EDGs.

The applicant describes its process for identifying the mechanical components that are within the scope of license renewal in Section 2.1.4, "Scoping Methodology," of the North Anna and Surry LRAs. As described in the scoping methodology, the applicant identified the portions of the EDG systems that are within the scope of license renewal on the license renewal drawings listed in the North Anna LRA, Section 2.3.3.11, and the Surry LRA, Section 2.3.3.12. Consistent with the method described in each LRA, Section 2.1.5, "Screening Methodology," the applicant listed the NAS 1/2 and SPS 1/2 mechanical component commodity groups that are subject to an AMR in Tables 2.3.3-11 and 2.3.3-12, respectively, of each LRA. These tables also list the intended functions and the LRA sections that contain the AMR for each commodity group.

The portions of each EDG systems that are subject to an AMR for NAS 1/2 and SPS 1/2 include the following 4 component commodity groups: air receivers, diesel aftercoolers, diesel jacket water radiators, diesel lube oil coolers, fan/blower housings, filters/strainers, flow orifices, heaters, instrument valve assemblies, level indicators, oil pans, pipe, pump casings, tanks, thermowells, tubing, valve bodies. The applicant identified maintaining pressure boundary integrity and flow restriction as the intended functions of the SCs that are subject to an AMR for the NAS 1/2 and SPS 1/2 EDG systems.

2.3.3.14.2 Staff Evaluation

The staff reviewed Section 2.3.3.11 of the North Anna LRA and Section 2.3.3.12 of the Surry LRA to determine whether there is reasonable assurance that the applicant appropriately identified the portions of the NAS 1/2 and SPS 1/2 EDG systems that are within the scope of license renewal in accordance with 10 CFR 54.4, and that the applicant appropriately identified the SCs of the EDG systems that are subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff reviewed the information provided in each LRA, the applicable license renewal drawings, and the North Anna and Surry UFSARs to determine whether the applicant adequately identified the portions of the NAS 1/2 and SPS 1/2 EDG systems that are within the scope of license renewal. The staff verified that those portions of the EDG systems that meet the scoping requirements of 10 CFR 54.4 were included within the scope of license renewal and were identified as such by the applicant in Sections 2.3.3.11 and 2.3.3.12 of the North Anna and Surry LRAs, respectively. To verify that the applicant did include the applicable portions of the EDG systems within the scope of license renewal, the staff focused its review on those portions of the NAS 1/2 and SPS 1/2 EDG systems that were not identified within the scope of license renewal and verified that they did not meet the scoping criteria of 10 CFR 54.4. In addition, the staff reviewed the North Anna and Surry UFSARs to identify any additional system functions that were not identified in each LRA and verified that these additional functions did not meet the scoping requirements of 10 CFR 54.4. The staff did not identify any omissions.

The staff then determined whether the applicant had properly identified the SCs of the NAS 1/2 and SPS 1/2 EDG systems that are subject to AMR from among those portions of the EDG systems that are identified as being within the scope of license renewal. The applicant identified and lists the SCs subject to AMR for the EDG systems in Table 2.3.3-11 of the North Anna LRA and Table 2.3.3-12 of the Surry LRA using the screening methodology described in Section 2.1 of each LRA. The staff evaluated the scoping and screening methodology and documented its findings in Section 2.1 of this SER.

In the North Anna LRA, the applicant identified the portions of the EDG systems that are within the scope of license renewal in the drawings listed below. The applicant also listed the mechanical component commodity groups that are subject to AMR and their intended functions in Table 2.3.3-11 of the North Anna LRA.

Unit 1	Unit 2
11715-LRB-035A, Sh. 1	12050-LRM-107A, Sh. 1
11715-LRB-035A, Sh. 2	12050-LRM-107A, Sh. 2
11715-LRB-035C, Sh. 1	12050-LRM-107A, Sh. 3
11715-LRB-035C, Sh. 2	12050-LRM-107A, Sh. 4
11715-LRB-035C, Sh. 3	12050-LRM-107B, Sh. 1
11715-LRB-035C, Sh. 4	12050-LRM-107B, Sh. 2
11715-LRM-107A, Sh. 1	12050-LRM-107C, Sh. 1
11715-LRM-107A, Sh. 2	12050-LRM-107C, Sh. 2
11715-LRM-107A, Sh. 3	12050-LRM-107D, Sh. 1
11715-LRM-107A, Sh. 4	12050-LRM-107D, Sh. 2
11715-LRM-107B, Sh. 1	
11715-LRM-107B, Sh. 2	
11715-LRM-107C, Sh. 1	
11715-LRM-107C, Sh. 2	
11715-LRM-107D, Sh. 1	
11715-LRM-107D, Sh. 2	

In the Surry LRA, the applicant identified the portions of the EDG systems that are within the scope of license renewal in the drawings listed below. In addition, the applicant listed the mechanical component commodity groups that are subject to AMR and their intended functions in Table 2.3.3-12 of the Surry LRA.

Unit 1	Unit 2
11448-LRB-038B, Sh. 1	Common
11448-LRB-046D, Sh. 1	
11448-LRB-046D, Sh. 2	
11448-LRB-046D, Sh. 3	
11448-LRB-046D, Sh. 4	

The license renewal drawings were highlighted by the applicant to identify those portions of the EDG systems that meet at least one of the scoping requirements of 10 CFR 54.4. The staff compared the license renewal drawings to the system drawings and the descriptions in the North Anna and Surry UFSARs to ensure they were representative of the EDG systems. The staff performed its review by sampling the SCs that the applicant identified as being within the scope of license renewal but not subject to AMR to verify that no structure or component, that performs its 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, was excluded from an AMR. The staff did not identify any omissions.

2.3.3.14.3 Conclusion

On the basis of its review of the information contained in Section 2.3.3.11 of the North Anna LRA and Section 2.3.3.12 of the Surry LRA, the supporting information in the North Anna and Surry UFSARs and the license renewal drawings, as described above, the staff did not identify any omissions in the scoping and screening of the NAS 1/2 and SPS 1/2 EDG systems by the applicant. Therefore, the staff concludes that there is reasonable assurance that the applicant has identified those portions of the NAS 1/2 and SPS 1/2 EDG systems that are within the scope of license renewal and the SCs that are subject to an AMR in accordance with 10 CFR 54.4(a) and 10 CFR 54.21(a)(1), respectively.

2.3.3.15 Security

Both the NAS and SPS LRAs present information regarding yard lighting required to meet 10 CFR Part 50, Appendix R, Section III.J, "emergency lighting" requirements, in sections entitled "Security." The review of these components is covered in the fire protection section of this safety evaluation (Section 2.3.3.37).

2.3.3.16 Compressed Air

In the North Anna LRA, Section 2.3.3.13, "Compressed Air," the applicant describes the piping and mechanical components of the compressed air (CA) system that are within the scope of license renewal and subject to an AMR for North Anna. The CA structural components that are subject to AMR are presented separately by the applicant in Section 2.4.10 of each LRA, "General Structural Supports," as commodity groups and, therefore, are evaluated separately by the staff in Section 2.4.10 of this SER. The CA piping and mechanical components are further described by the applicant in Chapter 9.4.1 of the North Anna UFSAR. The Surry ventilation system (VS), which is functionally equivalent to the North Anna CA system, is evaluated in Section 2.3.3.24 of this SER. Therefore, the following evaluation only applies to North Anna LRA.

2.3.3.16.1 Summary of Technical Information in the Application

The North Anna CA system provides bottled compressed dry air of breathing quality to pressurize the main control room envelope for postulated accidents involving radioactive release. The pressurization ensures outward leakage in order to limit the dose to control room personnel. The bottled air is of sufficient quantity to last a minimum of 1 hour. Emergency supply ventilation systems, taking suction from the turbine building through high-efficiency particulate air (HEPA) and charcoal filters, are provided to continue the supply of breathing and pressurization air indefinitely on depletion of the bottled air supply.

The applicant describes its process for identifying the mechanical components that are within the scope of license renewal in Section 2.1.4, "Scoping Methodology," of the North Anna and Surry LRAs. As described in the scoping methodology, the applicant identified the portions of the North Anna CA system that are within the scope of license renewal on license renewal drawings listed in Section 2.3.3.13 of the North Anna LRA. Consistent with the method described in the LRA, Section 2.1.5, "Screening Methodology," the applicant listed the CA system mechanical component commodity groups that are subject to an AMR in Table 2.3.3-13 of the North Anna LRA. The applicant identified the following component commodity groups for the compressed air system that are subject to AMR: instrument valve assemblies, tubing, valve bodies. The applicant also identifies maintaining pressure boundary integrity as the intended function of the SCs that are subject to an AMR for the North Anna CA system.

2.3.3.16.2 Staff Evaluation

The staff reviewed the CA system scoping and screening results to determine whether there is reasonable assurance that the applicant appropriately identified the portions of the North Anna CA system that are within the scope of license renewal in accordance with 10 CFR 54.4, and that the applicant appropriately identified the SCs of the CA system that are subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff reviewed the information in Section 2.3.3.13 of the North Anna LRA, the applicable license renewal drawings, and the North Anna UFSAR to determine whether the applicant adequately identified the portions of the North Anna CA system that are within the scope of license renewal. The staff verified that the portion of the North Anna CA system that meets the scoping requirements of 10 CFR 54.4 was included within the scope of license renewal and were identified as such by the applicant in Section 2.3.3.13 of the North Anna LRA. To verify that the applicant did include the applicable portion of the North Anna CA system within the scope of license renewal, the staff focused its review on those portions of the CA system that were not identified within the scope of license renewal and verified that they did not meet the scoping criteria of 10 CFR 54.4. In addition, the staff reviewed the North Anna UFSAR to identify any additional system functions that were not identified in each LRA and verified that these additional functions did not meet the scoping requirements of 10 CFR 54.4. The staff did not identify any omissions. The staff also reviewed the Surry UFSAR and verified that the Surry CA function was performed by the Surry ventilation system and did not need to be included within the scope of this review.

The staff then determined whether the applicant had properly identified the SCs of the North Anna CA system that are subject to AMR from the portion of the CA system that is identified as being within the scope of license renewal. The applicant identified and lists the SCs subject to AMR for the CA system in Table 2.3.3-13 of the North Anna LRA using the screening methodology described in Section 2.1 of each LRA. The staff evaluated the scoping and screening methodology and documented its findings in Section 2.1 of this SER.

In the North Anna LRA, the applicant identified the portions of the CA system that are within the scope of license renewal in the drawings listed below. The applicant also listed the mechanical component commodity groups that are subject to AMR and its intended function in Table 2.3.3-13 of the North Anna LRA.

Unit 1	Unit 2
11715-LRB-034F, Sh. 1	Common
11715-LRB-034F, Sh. 2	
11715-LRB-034F, Sh. 3	
11715-LRB-034F, Sh. 4	
11715-LRB-034F, Sh. 5	

The license renewal drawings were highlighted by the applicant to identify the SCs of the North Anna CA system that meet at least one of the scoping requirements of 10 CFR 54.4. The staff compared the license renewal drawings to the system drawings and the descriptions in the North Anna UFSAR to ensure that they were representative of the CA system. The staff performed its review by sampling the SCs that the applicant identified as being within the scope of license renewal but not subject to AMR to verify that no structure or component, that performs its intended functions without moving parts or without a change in configuration or properties and that is not subject to replacement based on qualified life or specified time period, was excluded from an AMR. The staff did not identify any omissions.

2.3.3.16.3 Conclusion

On the basis of its review of the information contained in Section 2.3.3.13 of the North Anna LRA, the supporting information in the North Anna and Surry UFSARs, and the license renewal drawings, as described above, the staff did not identify any omissions in the scoping and screening of the CA system by the applicant. Therefore, the staff concludes that there is reasonable assurance that the applicant has identified the portion of the North Anna CA system that is within the scope of license renewal and the SCs that are subject to an AMR in accordance with 10 CFR 54.4(a) and 10 CFR 54.21(a)(1), respectively.

2.3.3.17 Instrument Air

In the North Anna and Surry LRAs, Section 2.3.3.14, “Instrument Air,” the applicant describes the components of the instrument air (IA) systems that are within the scope of license renewal and subject to an AMR for both North Anna and Surry. Each unit of NAS and SPS has an IA system. These systems are similar for both facilities with some differences in system design. Any notable differences are specifically identified and discussed in the staff’s evaluation. Unless otherwise specified, the information provided below is applicable to both the North Anna and Surry IA systems. The IA structural components that are subject to AMR are presented separately by the applicant in Section 2.4.10 of each LRA, “General Structural Supports,” as commodity groups and, therefore, are evaluated separately by the staff in Section 2.4.10 of this SER. These systems are further described in Section 9.3.1 of North Anna UFSAR and Section 9.8 of the Surry UFSAR.

2.3.3.17.1 Summary of Technical Information in the Application

The IA system is a subsystem of the compressed air system. The compressed air system includes a service air subsystem, an IA subsystem, and a containment instrument air subsystem for each unit. System pressures are dictated by the expected uses of instrument air or service air.

For NAS 1/2, the IA subsystem is fed by the service air subsystem, and is the normal supply to the containment instrument air subsystem. The containment instrument air compressors provide backup capability to the containment instrument air subsystem. The IA compressors, air receivers, piping, valves, and supports for critical instruments and controls are designed to conform with Seismic Class I criteria. The containment instrument air compressors, receivers, and air driers are not designed to Seismic Class I criteria.

For SPS 1/2, the service air compressors are the primary source of compressed air to both the service air and IA subsystems during normal plant operation. The IA compressors provide backup capability to the IA subsystem and the containment instrument air subsystem and are connected to the emergency power system for greater availability of compressed air in the event offsite power is lost. Portions of the IA subsystem which are critical system components and designated containment isolation features are designed to Seismic I criteria.

The applicant describes its process for identifying the mechanical components that are within the scope of license renewal in Section 2.1.4, “Scoping Methodology,” of each LRA. As described in the scoping methodology, the applicant identified the portions of the IA systems that are within the scope of license renewal on the license renewal drawings listed in Section 2.3.3.14 of each LRA. Consistent with the method described in each LRA, Section 2.1.5, “Screening Methodology,” the applicant listed the NAS 1/2 and SPS 1/2 IA system mechanical component commodity groups that are within the license renewal evaluation boundaries and subject to an AMR in Table 2.3.3-14 of each LRA. These tables also list the intended functions and the LRA sections that contain the AMR for each commodity group.

The portions of each IA systems that are subject to an AMR for NAS 1/2 and SPS 1/2 include the portions of the IA systems that perform a containment pressure boundary function as part of the IA system containment penetration, and the backup compressed air subsystem components that provide for operation of critical components. For NAS 1/2, the IA compressor coolers perform a service water system pressure boundary function and are also subject to an AMR. For SPS 1/2, the containment IA compressor heat exchangers perform a component cooling system pressure boundary function and are also subject to an AMR. In each LRA, Table 2.3.3-14, the applicant listed the following component commodity groups subject to an AMR: bolting, instrument valve assemblies, pipe, tubing, valve bodies. In addition, the North Anna LRA identifies gas bottles, hoses, and instrument air compressor coolers, and the Surry LRA identifies containment 1A compressor heat exchanger, filters/strainers, and flexible connections as component commodity groups that are subject to an AMR for that site. The applicant identified maintaining pressure boundary integrity and providing filtration as the intended functions of the SCs that are subject to an AMR for the NAS 1/2 and SPS 1/2 IA systems.

2.3.3.17.2 Staff Evaluation

The staff reviewed each LRA Section 2.3.3.14 to determine whether there is reasonable assurance that the applicant appropriately identified the portions of the NAS 1/2 and SPS 1/2 IA systems that are within the scope of license renewal in accordance with 10 CFR 54.4, and that the applicant appropriately identified the SCs that are subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff reviewed the information provided in Section 2.3.3.14 of each LRA, the applicable license renewal drawings, and the North Anna and Surry UFSARs to determine whether the applicant adequately identified the portions of the IA systems that are within the scope of license renewal. The staff verified that those portions of the IA systems that meet the scoping requirements of 10 CFR 54.4 were included within the scope of license renewal and were identified as such by the applicant in Section 2.3.3.14 of each LRA. To verify that the applicant did include the applicable portions of the IA systems within the scope of license renewal, the staff focused its review on those portions of the IA systems that were not identified within the scope of license renewal and verified that they did not meet the scoping criteria of 10 CFR 54.4. In addition, the staff reviewed the UFSARs for each facility to identify any additional system functions that were not identified in each LRA and verified that these additional functions did not meet the scoping requirements of 10 CFR 54.4. The staff did not identify any omissions.

The staff then determined whether the applicant had properly identified the SCs of the NAS 1/2 and SPS 1/2 IA systems that are subject to AMR from among those portions of the IA systems that are identified as being within the scope of license renewal. The applicant identified and listed the SCs subject to AMR for the IA systems in Table 2.3.3-14 of each LRA using the screening methodology described in Section 2.1 of each LRA. The staff evaluated the scoping and screening methodology and documented its findings in Section 2.1 of this SER.

In the North Anna LRA, the applicant identified the portions of the IA systems that are within the scope of license renewal in the drawings listed below. The applicant also listed the mechanical component commodity groups that are subject to AMR and their intended functions in Table 2.3.3-14 of the North Anna LRA.

Unit 1	Unit 2
11715-LRM-082A, Sh. 1	12050-LRM-082A, Sh. 1
11715-LRM-082A, Sh. 2	12050-LRM-082A, Sh. 2
11715-LRM-082C, Sh. 1	12050-LRM-082B, Sh. 1
11715-LRM-082C, Sh. 2	12050-LRM-082B, Sh. 2
11715-LRM-082D, Sh. 2	12050-LRM-082B, Sh. 3
11715-LRM-082M, Sh. 1	12050-LRM-082C, Sh. 1
11715-LRM-082N, Sh. 1	12050-LRM-082C, Sh. 2
11715-LRM-082N, Sh. 2	12050-LRM-093B, Sh. 1
11715-LRM-082N, Sh. 3	
11715-LRM-093B, Sh. 1	

In the Surry LRA, the applicant identified the portions of the IA systems that are within the scope of license renewal in the drawings listed below. In addition, the applicant listed the mechanical component commodity groups that are subject to AMR and their intended functions in Table 2.3.3-14 of the Surry LRA.

Unit 1	Unit 2
11448-LRM-072A, Sh. 1	11548-LRM-072A, Sh. 1
11448-LRM-075C, Sh. 1	11548-LRM-075B, Sh. 2
11448-LRM-075C, Sh. 3	11548-LRM-075C, Sh. 1
11448-LRM-075E, Sh. 2	11548-LRM-075C, Sh. 2
11448-LRM-075J, Sh. 1	11548-LRM-075D, Sh.1
	11548-LRM-075J, Sh. 1

The license renewal drawings were highlighted by the applicant to identify those portions of the IA systems that meet at least one of the scoping requirements of 10 CFR 54.4. The staff compared the license renewal drawings to the system drawings and the descriptions in the North Anna and Surry UFSARs to ensure they were representative of the IA systems. The staff performed its review by sampling the SCs that the applicant identified as being within the scope of license renewal but not subject to AMR to verify that no structure or component, that performs its 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, was excluded from an AMR. The staff did not identify any omissions.

2.3.3.17.3 Conclusion

On the basis of its review of the information contained in Section 2.3.3.14 of each LRA, the supporting information in the North Anna and Surry UFSARs, and the license renewal drawings, as described above, the staff did not identify any omissions in the scoping and screening of the NAS 1/2 and SPS 1/2 IA systems by the applicant. Therefore, the staff concludes that there is reasonable assurance that the applicant has identified those portions of the NAS 1/2 and SPS 1/2 IA systems that are within the scope of license renewal and the SCs that are subject to an AMR in accordance with 10 CFR 54.4(a) and 10 CFR 54.21(a)(1), respectively.

2.3.3.18 Primary and Secondary Plant Gas Supply

In the North Anna and Surry LRAs, Section 2.3.3.15, "Primary and Secondary Plant Gas Supply," the applicant describes the piping and mechanical components of the primary and secondary plant gas supply (GN) systems that are within the scope of license renewal and subject to an AMR for the NAS 1/2 and SPS 1/2. The NAS 1/2 and SPS 1/2 each has a GN system. These systems are similar for both facilities with some differences in system design. Any notable differences are specifically identified and discussed in the staff's evaluation. Unless otherwise specified, the information provided below is applicable to NAS 1/2 and SPS 1/2. The GN structural components that are subject to AMR are presented separately by the applicant in Section 2.4.10 of each LRA, "General Structural Supports," as commodity groups and, therefore, are evaluated separately by the staff in Section 2.4.10 of this SER. The GN piping and mechanical components are further described by the applicant in Sections 5.5.8.2 and 9.5.10 of the North Anna UFSAR and Sections 6.2.2.2 and 10.3.1 of the Surry UFSAR.

2.3.3.18.1 Summary of Technical Information in the Application

The NAS 1/2 and SPS 1/2 GN systems provide compressed gas for various plant uses. The portions of the NAS 1/2 GN systems that are within the scope of license renewal include those portions that provide compressed gas to the hydrogen analyzer system, the hydrogen recombiner valves, and the pressurizer power-operated relief valves (PORVs). The portion of the SPS 1/2 GN systems that are within the scope of license renewal include those portions that provide compressed gas to the main steam systems and those portions that serve as the containment pressure boundary for the GN system nitrogen supply to the safety injection accumulators and main steam system.

The applicant describes its process for identifying the mechanical components that are within the scope of license renewal in Section 2.1.4, "Scoping Methodology," of each LRA. As described in the scoping methodology, the applicant identified the portions of the GN systems that are within the scope of license renewal on the license renewal drawings listed in Section 2.3.3.15 of each LRA. Consistent with the method described in each LRA, Section 2.1.5, "Screening Methodology," the applicant listed the NAS 1/2 and SPS 1/2 GN system mechanical component commodity groups that are within the license renewal evaluation boundaries and that are subject to an AMR in Table 2.3.3-15 of each LRA. These tables also list the intended functions and the LRA sections that contain the AMR for each commodity group.

The portions of each GN system that is subject to an AMR for NAS 1/2 includes the system components that provide compressed gas for the operational support of the hydrogen analyzer system, that provide a backup pneumatic source for the hydrogen analyzer and hydrogen recombiner valves, and that provide a backup pneumatic source for the pressurizer power-operated relief valves (PORVs) upon a loss of instrument air. The portions of the SPS 1/2 GN systems that are subject to an AMR consist of the system components that provide the GN systems nitrogen supply to the safety injection accumulators containment penetration pressure boundary, and that provide the GN systems supply connection to the main steam lines containment pressure boundary and main steam system pressure boundary. In both LRAs, Table 2.3.3-15, the applicant listed the following component commodity groups subject to an AMR: pipe, valve bodies. In addition, the North Anna LRA identifies bolting, gas bottles, hoses, instrument valve assemblies, and tubing commodity groups. The applicant identified maintaining pressure boundary integrity as the intended function for the SCs that are subject to an AMR for the NAS 1/2 and SPS 1/2 GN systems.

2.3.3.18.2 Staff Evaluation

The staff reviewed each LRA Section 2.3.3.15, to determine whether there is reasonable assurance that the applicant appropriately identified the portions of the NAS 1/2 and SPS 1/2 GN systems that are within the scope of license renewal in accordance with 10 CFR 54.4, and that the applicant appropriately identified the SCs that are subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff reviewed the information provided in Section 2.3.3.15 of each LRA, the applicable license renewal drawings, and the North Anna and Surry UFSARs to determine whether the applicant adequately identified the portions of the GN systems that are within the scope of license renewal. The staff verified that those portions of the GN systems that meet the scoping requirements of 10 CFR 54.4 were included within the scope of license renewal and were identified as such by the applicant in Section 2.3.3.15 of each LRA. To verify that the applicant did include the applicable portions of the GN systems within the scope of license renewal, the staff focused its review on those portions of the GN systems that were not identified within the scope of license renewal and verified that they did not meet the scoping criteria of 10 CFR 54.4. In addition, the staff reviewed the UFSARs for each facility to identify any additional system functions that were not identified in each LRA and verified that these additional functions did not meet the scoping requirements of 10 CFR 54.4. The staff did not identify any omissions.

The staff then determined whether the applicant had properly identified the SCs of the NAS 1/2 and SPS 1/2 GN systems that are subject to AMR from among those portions of the GN systems that are identified as being within the scope of license renewal. The applicant identified and lists the SCs subject to AMR for the GN systems in Table 2.3.3-15 of each LRA using the screening methodology described in Section 2.1 of each LRA. The staff evaluated the scoping and screening methodology and documented its findings in Section 2.1 of this SER.

In the North Anna LRA, the applicant identified the portions of the GN systems that are within the scope of license renewal in the drawings listed below. The applicant also listed the mechanical component commodity groups that are subject to AMR and their intended functions in Table 2.3.3-15 of the North Anna LRA.

Unit 1	Unit 2
11715-LRM-082A, Sh. 2	12050-LRM-082A, Sh. 2
11715-LRM-082C, Sh. 1	12050-LRM-093B, Sh. 1
11715-LRM-093B, Sh. 1	
11715-LRM-105A, Sh. 1	
11715-LRM-105C, Sh. 1	
11715-LRM-106A, Sh. 1	
11715-LRM-106A, Sh. 2	
11715-LRM-106A, Sh. 4	

In the Surry LRA, the applicant identified the portions of the GN systems that are within the scope of license renewal in the drawings listed below. In addition, the applicant listed the mechanical component commodity groups that are subject to AMR and their intended functions in Table 2.3.3-15 of the Surry LRA.

Unit 1	Unit 2
11448-LRM-064A, Sh. 1	11548-LRM-064A, Sh. 1
11448-LRM-064A, Sh. 2	11548-LRM-064A, Sh. 2
11448-LRM-064A, Sh. 3	11548-LRM-064A, Sh. 3
11448-LRM-064B, Sh. 1	11548-LRM-064B, Sh. 1
11448-LRM-089A, Sh. 3	11548-LRM-089A, Sh. 3
11448-LRM-089B, Sh. 1	11548-LRM-089B, Sh. 1

The license renewal drawings were highlighted by the applicant to identify those portions of the GN systems that meet at least one of the scoping requirements of 10 CFR 54.4. The staff compared the license renewal drawings to the system drawings and the descriptions in the North Anna and Surry UFSARs to ensure they were representative of the GN systems. The staff performed its review by sampling the SCs that the applicant identified as being within the scope of license renewal but not subject to AMR to verify that no structure or component, that performs its 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, was excluded from an AMR. The staff did not identify any omissions.

2.3.3.18.3 Conclusion

On the basis of its review of the information contained in Section 2.3.3.15 of each LRA, the supporting information in the North Anna and Surry UFSARs, and the license renewal drawings, as described above, the staff did not identify any omissions in the scoping and screening of the NAS 1/2 and SPS 1/2 GN systems by the applicant. Therefore, the staff concludes that there is reasonable assurance that the applicant has identified those portions of the NAS 1/2 and SPS 1/2 GN systems that are within the scope of license renewal and the SCs that are subject to an AMR in accordance with 10 CFR 54.4(a) and 10 CFR 54.21(a)(1), respectively.

2.3.3.19 Service Air

In the North Anna and Surry LRAs, Section 2.3.3.16, “Service Air,” the applicant describes the components of the service air (SA) systems that are within the scope of license renewal and subject to an AMR for both North Anna and Surry. NAS 1/2 and SPS 1/2 each has a SA system. These systems are identical for both facilities with no notable differences in system design for the purpose of license renewal. Therefore, the information provided below is applicable to both the North Anna and Surry SA systems. The SA structural components that are subject to AMR are presented separately by the applicant in Section 2.4.10 of each LRA, “General Structural Supports,” as commodity groups and, therefore, are evaluated separately by the staff in Section 2.4.10 of this SER. These systems are further described in Section 9.3.1 of North Anna UFSAR and Section 9.8 of the Surry UFSAR.

2.3.3.19.1 Summary of Technical Information in the Application

The SA system provides a source of compressed air to support plant general service compressed air requirements. The SA system can be used as a source of compressed air to the instrument air system. The applicant has stated that the portion of the SA system that is subject to AMR is limited to components that perform a containment pressure boundary function as part of the SA system containment penetration.

The applicant describes its process for identifying the mechanical components that are within the scope of license renewal in Section 2.1.4, “Scoping Methodology,” of each LRA. As described in the scoping methodology, the applicant identified the portions of the SA systems that are within the scope of license renewal on the license renewal drawings listed in Section 2.3.3.16 of each LRA. Consistent with the method described in each LRA, Section 2.1.5, “Screening Methodology,” the applicant listed the NAS 1/2 and SPS 1/2 SA system mechanical component commodity groups that are within the license renewal evaluation boundaries and that are subject to an AMR in Table 2.3.3-16 of each LRA. These tables also list the intended functions and the LRA sections that contain the AMR for each commodity group.

The portion of each SA system that is subject to an AMR for NAS 1/2 and SPS 1/2 is limited to components that perform a Containment pressure boundary function as part of the SA system Containment penetration. In both LRAs, Table 2.3.3-16, the applicant listed the following component commodity groups subject to an AMR: bolting, pipe, valve bodies. The applicant identified maintaining pressure boundary integrity as the only intended function for the SCs that is subject to an AMR for the NAS 1/2 and SPS 1/2 SA systems.

2.3.3.19.2 Staff Evaluation

The staff reviewed each LRA Section 2.3.3.16 to determine whether there is reasonable assurance that the applicant appropriately identified the portions of the NAS 1/2 and SPS 1/2 SA systems that are within the scope of license renewal in accordance with 10 CFR 54.4, and that the applicant appropriately identified the SCs that are subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff reviewed the information provided in Section 2.3.3.16 of each LRA, the applicable license renewal drawings, and the North Anna and Surry UFSARs to determine whether the applicant adequately identified the portions of the SA systems that are within the scope of license renewal. The staff verified that those portions of the SA systems that meet the scoping requirements of 10 CFR 54.4 were included within the scope of license renewal and were identified as such by the applicant in Section 2.3.3.16 of each LRA. To verify that the applicant did include the applicable portions of the SA systems within the scope of license renewal, the staff focused its review on those portions of the SA systems that were not identified within the scope of license renewal and verified that they did not meet the scoping criteria of 10 CFR 54.4. In addition, the staff reviewed the UFSARs for each facility to identify any additional system functions that were not identified in each LRA and verified that this additional functions did not meet the scoping requirements of 10 CFR 54.4. The staff did not identify any omissions.

The staff then determined whether the applicant had properly identified the SCs of the NAS 1/2 and SPS 1/2 SA systems that are subject to AMR from among those portions of the SA systems that are identified as being within the scope of license renewal. The applicant identified and lists the SCs subject to AMR for the SA systems in Table 2.3.3-16 of each LRA using the screening methodology described in Section 2.1 of each LRA. The staff evaluated the scoping and screening methodology and documented its findings in Section 2.1 of this SER.

In the North Anna LRA, the applicant identified the portions of the SA systems that are within the scope of license renewal in the drawings listed below. The applicant also listed the mechanical component commodity groups that are subject to AMR and their intended functions in Table 2.3.3-16 of the North Anna LRA.

Unit 1	Unit 2
11715-LRM-082F, Sh. 1	12050-LRM-082F, Sh. 2

In the Surry LRA, the applicant identified the portions of the SA systems that are within the scope of license renewal in the drawings listed below. In addition, the applicant listed the mechanical component commodity groups that are subject to AMR and their intended functions in Table 2.3.3-16 of the Surry LRA.

Unit 1	Unit 2
11448-LRM-075G, Sh. 1	11548-LRM-075E, Sh. 1

The license renewal drawings were highlighted by the applicant to identify those portions of the SA systems that meet at least one of the scoping requirements of 10 CFR 54.4. The staff compared the license renewal drawings to the system drawings and the descriptions in the North Anna and Surry UFSARs to ensure they were representative of the SA systems. The staff performed its review by sampling the SCs that the applicant identified as being within the scope of license renewal but not subject to AMR to verify that no structure or component, that performs its 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, was excluded from an AMR. The staff did not identify any omissions.

2.3.3.19.3 Conclusion

On the basis of its review of the information contained in Section 2.3.3.16 of each LRA, the supporting information in the North Anna and Surry UFSARs, and the license renewal drawings, as described above, the staff did not identify any omissions in the scoping and screening of the NAS 1/2 and SPS 1/2 SA systems by the applicant. Therefore, the staff concludes that there is reasonable assurance that the applicant has identified those portions of the NAS 1/2 and SPS 1/2 SA systems that are within the scope of license renewal and the SCs that are subject to an AMR in accordance with 10 CFR 54.4(a) and 10 CFR 54.21(a)(1), respectively.

2.3.3.20 Containment Vacuum (CV)

In each LRA Section 2.3.3.17, “Containment Vacuum,” the applicant describes the components of the containment vacuum system that are within the scope of license renewal and subject to an AMR. This system is further described in Section 6.2.6 of the North Anna UFSAR and Section 5.3.4 of the Surry UFSAR.

2.3.3.20.1 Summary of Technical Information in the Application

The containment vacuum (CV) system establishes and maintains the subatmospheric pressure of the containment building in support of plant operation. The CV system also provides a flowpath, via the containment penetration piping, for the containment post-accident hydrogen analyzer system.

For NAS, the CV pump seal water heat exchangers are cooled by the component cooling (CC) system. These components are subject to aging management review for a CC system pressure boundary function.

The applicant describes its process for identifying the mechanical components that are within the scope of license renewal in Section 2.1.4, “Scoping Methodology,” of each LRA. As described in the scoping methodology, the applicant identified the portions of the CV system that are within the scope of license renewal on the piping and instrument drawings listed in Section 2.3.3.17 of each LRA. Consistent with the method described in the LRA, Section 2.1.5, “Screening Methodology,” the applicant listed the CV system mechanical component commodity groups that are within the license renewal evaluation boundaries and that are subject to an AMR in Table 2.3.3-17 of each LRA. The tables also list the intended functions and the LRA sections that contain the AMR for each commodity group.

The portion of the CV system that is subject to aging management review is limited to components that perform a containment pressure boundary function as part of the CV system containment penetrations. In each LRA, Table 2.3.3-17, the applicant listed the following two component commodity groups as subject to an AMR: pipe and valve bodies. In addition, the NAS LRA, Table 2.3.3-17, lists containment vacuum heat exchangers as a component commodity group that is subject to an AMR for NAS. The applicant identified maintaining pressure boundary integrity as the only intended function for the SCs that is subject to an AMR.

2.3.3.20.2 Staff Evaluation

The staff reviewed each LRA Section 2.3.3.17 to determine whether there is reasonable assurance that the applicant appropriately identified the portions of the CV system that are within the scope of license renewal in accordance with 10 CFR 54.4, and that the applicant appropriately identified the SCs that are subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff reviewed the information provided in Section 2.3.3.17 of each LRA, the applicable piping and instrument drawings, and the North Anna and Surry UFSARs to determine whether the applicant adequately identified the portions of the containment vacuum systems that are within the scope of license renewal. The staff verified that those portions of the containment vacuum systems that meet the scoping requirements of 10 CFR 54.4 were included within the scope of license renewal and were identified as such by the applicant in Section 2.3.3.17 of each LRA. To verify that the applicant did include the applicable portions of the CV system within the scope of license renewal, the staff focused its review on those portions of the CV system that were not identified within the scope of license renewal and verified that they did not meet the scoping criteria of 10 CFR 54.4. In addition, the staff reviewed the UFSARs for each facility to identify any additional system functions that were not identified in each LRA and verified that these additional functions did not meet the scoping requirements of 10 CFR Part 54.4. The staff did not identify any omissions.

The staff then determined whether the applicant had properly identified the SCs that are subject to AMR from among those portions of the CV system that were identified as being within the scope of license renewal. The applicant used the screening methodology described in Section 2.1 of each LRA to identify and list the SCs subject to AMR. The staff evaluation of the scoping and screening methodology is documented in Section 2.1 of this SER.

In the NAS LRA, the applicant identified the portions of the CV system that are within the scope of license renewal in the drawings listed below. In Table 2.3.3-17 of the LRA, the applicant listed the mechanical component commodity groups that are subject to AMR and their intended functions.

Unit 1	Unit 2
11715-LRM-079C, Sh. 1	12050-LRM-092A, Sh. 2
11715-LRM-092A, Sh. 2	

In the SPS LRA, the applicant identified the portions of the CV system that are within the scope of license renewal in the drawings listed below. In Table 2.3.3-17 of the LRA, the applicant listed the mechanical component commodity groups that are subject to AMR and their intended functions.

Unit 1	Unit 2
11448-LRM-085A, Sh. 1	11448-LRM-085A, Sh. 1
11448-LRM-085A, Sh. 2	11448-LRM-085A, Sh. 2

The piping and instrumentation drawings were highlighted by the applicant to identify those portions of the CV system that meet at least one of the scoping requirements of 10 CFR 54.4. The staff compared the LRA drawings to the system drawings and the descriptions in the UFSAR to ensure they were representative of the CV system. The staff performed its review by sampling the SCs that the applicant identified as being within the scope of license renewal but not subject to AMR, to verify that no structure or component that performs its intended function without moving parts or without a change in configuration or properties, or is not subject to replacement based on qualified life or specified time period, was excluded from an AMR. The staff did not identify any omissions.

2.3.3.20.3 Conclusions

On the basis of its review of the information contained in Section 2.3.3.17 of each LRA, the supporting information in the UFSARs, and the LRA drawings, as described above, the staff did not identify any omissions in the scoping of the CV system by the applicant. The staff concludes that there is reasonable assurance that the applicant has identified those portions of the CV system that are within the scope of license renewal and the SCs that are subject to an AMR in accordance with 10 CFR 54.4(a) and 10 CFR 54.21(a)(1), respectively.

2.3.3.21 Leakage Monitoring (LM)

In each LRA Section 2.3.3.18, “Leakage Monitoring,” the applicant describes the components of the leakage monitoring system that are within the scope of license renewal and subject to an AMR. This system is further described in Sections 6.2.7 and 7.3.1.3.2 of the North Anna UFSAR and Sections 5.3.2 and 7.5.1.2 of the Surry UFSAR.

2.3.3.21.1 Summary of Technical Information in the Application

The leakage monitoring (LM) system provides containment pressure signals to the engineered safety features (ESF) actuation system. The system is also designed to provide pressure sensing during containment leakage rate testing.

The applicant describes its process for identifying the mechanical components that are within the scope of license renewal in Section 2.1.4, “Scoping Methodology,” of each LRA. As described in the scoping methodology, the applicant identified the portions of the LM system that are within the scope of license renewal on the piping and instrument drawings listed in Section 2.3.3.18 of each LRA. Consistent with the method described in each LRA, Section 2.1.5, “Screening Methodology,” the applicant listed the LM system mechanical component commodity groups that are within the license renewal evaluation boundaries and that are subject to an AMR in Table 2.3.3-21 of each LRA. The tables also list the intended functions, and the LRA section containing the AMR, for each commodity group.

The portion of the LM system that is subject to aging management review is limited to components that perform a containment pressure boundary function as part of the LM system containment penetrations. In each LRA, Table 2.3.3-18, the applicant listed the following four component commodity groups as subject to an AMR: bolting, pipe, tubing, and valve bodies. The applicant identified maintaining pressure boundary integrity as the only intended function for the SCs that is subject to an AMR.

2.3.3.21.2 Staff Evaluation

The staff reviewed each LRA Section 2.3.3.18, to determine whether there is reasonable assurance that the applicant appropriately identified the portions of the LM system that are within the scope of license renewal in accordance with 10 CFR 54.4, and that the applicant appropriately identified the SCs that are subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff reviewed the information provided in Section 2.3.3.18 of each LRA the applicable piping and instrument drawings, and the North Anna and Surry UFSARs to determine whether the applicant adequately identified the portions of the leakage monitoring system that are within the scope of license renewal. The staff verified that those portions of the leakage monitoring system that meet the scoping requirements of 10 CFR 54.4 were included within the scope of license renewal and were identified as such by the applicant in Section 2.3.3.18 of each LRA. To verify that the applicant did include the applicable portions of the LM system within the scope of license renewal, the staff focused its review on those portions of the LM system that were not identified within the scope of license renewal and verified that they did not meet the scoping criteria of 10 CFR 54.4. In addition, the staff reviewed the UFSARs for each facility to identify any additional system functions that were not identified in each LRA and verified that these additional functions did not meet the scoping requirements of 10 CFR 54.4. The staff did not identify any omissions.

The staff then determined whether the applicant had properly identified the SCs that are subject to AMR from among those portions of the LM system that were identified as being within the scope of license renewal. The applicant used the screening methodology described in Section 2.1 of each LRA to identify and list the SCs subject to AMR. The staff evaluation of the scoping and screening methodology is documented in Section 2.1 of this SER.

In the NAS LRA, the applicant identified the portions of the LM system that are within the scope of license renewal in the drawings listed below. The applicant also listed the mechanical component commodity groups that are subject to AMR and their intended functions in Table 2.3.3-18 of the LRA.

Unit 1	Unit 2
11715-LRM-092A, Sh. 1	12050-LRM-092A, Sh. 1

In the SPS LRA, the applicant identified the portions of the LM system that are within the scope of license renewal in the drawings listed below. In addition, the applicant listed the mechanical component commodity groups that are subject to AMR and its intended functions in Table 2.3.3-18 of the LRA.

Unit 1	Unit 2
11448-LRM-085A, Sh. 1	11548-LRM-085A, Sh. 1

The piping and instrumentation drawings were highlighted by the applicant to identify those portions of the LM system that meet at least one of the scoping requirements of 10 CFR 54.4.

The staff compared the LRA drawings to the system drawings and the descriptions in the UFSAR to ensure they were representative of the LM system. The staff performed its review by sampling the SCs that the applicant identified as being within the scope of license renewal but not subject to AMR, to verify that no structure or component that performs its intended function without moving parts or without a change in configuration or properties, or is not subject to replacement based on qualified life or specified time period, was excluded from an AMR. The staff did not identify any omissions.

2.3.3.21.3 Conclusions

On the basis of its review of the information contained in Section 2.3.3.18 of each LRA, the supporting information in the UFSARs, and the LRA drawings, as described above, the staff did not identify any omissions in the scoping of the LM system by the applicant. The staff concludes that there is reasonable assurance that the applicant has identified those portions of the LM system that are within the scope of license renewal and the SCs that are subject to an AMR in accordance with 10 CFR 54.4(a) and 10 CFR 54.21(a)(1), respectively.

2.3.3.22 Secondary Vents (SV)

In each LRA Section 2.3.3.19, "Secondary Vents," the applicant describes the components of the secondary vents system that are within the scope of license renewal and subject to an AMR. This system is further described in Section 10 of the NAS and SPS UFSARs.

2.3.3.22.1 Summary of Technical Information in the Application

The secondary vents (SV) system provides a vent path for noncondensable gases discharged by the main condenser air ejectors.

The applicant describes its process for identifying the mechanical components that are within the scope of license renewal in Section 2.1.4, "Scoping Methodology," of each LRA. As described in the scoping methodology, the applicant identified the portions of the SV system that are within the scope of license renewal on the piping and instrument drawings listed in Section 2.3.3.19 of each LRA. Consistent with the method described in the LRA, Section 2.1.5, "Screening Methodology," the applicant listed the SV system mechanical component commodity groups that are within the license renewal evaluation boundaries and that are subject to an AMR in Table 2.3.3-19 of each LRA. The tables also list the intended functions and the LRA sections that contain the AMR for each commodity group.

The portion of the SV system that is subject to aging management review is limited to components that perform a containment pressure boundary function as part of the SV system containment penetrations. In each LRA, Table 2.3.3-19, the applicant listed valve bodies as the only component commodity group subject to an AMR, although the table notes that the piping associated with these components is included in the vacuum priming (VP) system (section 2.3.3.23 of this SER). The applicant identified maintaining pressure boundary integrity as the only intended function for the SCs that is subject to an AMR.

2.3.3.22.2 Staff Evaluation

The staff reviewed Section 2.3.3.19 of each LRA to determine whether there is reasonable assurance that the applicant appropriately identified the portions of the SV system that are within the scope of license renewal in accordance with 10 CFR 54.4, and that the applicant appropriately identified the SCs that are subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff reviewed the information provided in Section 2.3.3.19 of each LRA, the applicable piping and instrument drawings, and the North Anna and Surry UFSARs to determine whether the applicant adequately identified the portions of the secondary vents system that are within the scope of license renewal. The staff verified that those portions of the secondary vents system that meet the scoping requirements of 10 CFR 54.4 were included within the scope of license renewal and were identified as such by the applicant in Section 2.3.3.19 of each LRA. To verify that the applicant did include the applicable portions of the SV system within the scope of license renewal, the staff focused its review on those portions of the SV system that were not identified within the scope of license renewal and verified that they did not meet the scoping criteria of 10 CFR 54.4. In addition, the staff reviewed the UFSARs for each facility to identify any additional system functions that were not identified in each LRA and verified that these additional functions did not meet the scoping requirements of 10 CFR 54.4. The staff did not identify any omissions.

The staff then determined whether the applicant had properly identified the SCs that are subject to AMR from among those portions of the SV system that were identified as being within the scope of license renewal. The applicant used the screening methodology described in Section 2.1 of each LRA to identify and list the SCs subject to AMR. The staff evaluation of the scoping and screening methodology is documented in Section 2.1 of this SER.

In the NAS LRA, the applicant identified the portions of the SV system that are within the scope of license renewal in the drawings listed below. The applicant also listed the mechanical component commodity groups that are subject to AMR and their intended functions in Table 2.3.3-19 of the LRA.

Unit 1	Unit 2
11715-LRM-072A, Sh. 2	12050-LRM-072A, Sh. 2

In the SPS LRA, the applicant identified the portions of the SV system that are within the scope of license renewal in the drawings listed below. In addition, the applicant listed the mechanical component commodity groups that are subject to AMR and its intended functions in Table 2.3.3-19 of the LRA.

Unit 1	Unit 2
11448-LRM-066A, Sh. 2	11548-LRM-066A, Sh. 2

The piping and instrumentation drawings were highlighted by the applicant to identify those portions of the SV system that meet at least one of the scoping requirements of 10 CFR 54.4.

The staff compared the LRA drawings to the system drawings and the descriptions in the UFSAR to ensure they were representative of the SV system. The staff performed its review by sampling the SCs that the applicant identified as being within the scope of license renewal but not subject to AMR, to verify that no structure or component that performs its intended function without moving parts or without a change in configuration or properties, or is not subject to replacement based on qualified life or specified time period, was excluded from an AMR. The staff did not identify any omissions.

2.3.3.22.3 Conclusions

On the basis of its review of the information contained in Section 2.3.3.19 of each LRA, the supporting information in the UFSARs, and LRA drawings, as described above, the staff did not identify any omissions in the scoping of the SV system by the applicant. The staff concludes that there is reasonable assurance that the applicant has identified those portions of the SV system that are within the scope of license renewal and the SCs that are subject to an AMR in accordance with 10 CFR 54.4(a) and 10 CFR 54.21(a)(1), respectively.

2.3.3.23 Vacuum Priming (VP)

In each LRA Section 2.3.3.20, “Vacuum Priming,” the applicant describes the components of the vacuum priming system that are within the scope of license renewal and subject to an AMR. This system is further described in Section 10 of the North Anna and Surry UFSARs.

2.3.3.23.1 Summary of Technical Information in the Application

The vacuum priming (VP) system removes noncondensable gases from various plant systems. In addition, at SPS, the VP system also provides a circulating water (CW) system pressure boundary function at the VP tank drain connection to the main condenser outlet CW pipe. The applicant describes its process for identifying the mechanical components that are within the scope of license renewal in Section 2.1.4, “Scoping Methodology,” of the LRA. As described in the scoping methodology, the applicant identified the portions of the VP system that are within the scope of license renewal on the piping and instrument drawings listed in Section 2.3.3.20 of each LRA. Consistent with the method described in the LRA, Section 2.1.5, “Screening Methodology,” the applicant listed the VP system mechanical component commodity groups that are within the license renewal evaluation boundaries and that are subject to an AMR in Table 2.3.3-20 of each LRA. The tables also list the intended functions, and the LRA section containing the AMR, for each commodity group.

The portion of the VP system that is subject to aging management review includes the components that perform a containment pressure boundary function as part of the VP system containment penetrations. In addition, at SPS, the additional portions of the VP system that are subject to aging management review consist of the components that form the CW system pressure boundary, and the components that provide a vent path for gases from the component cooling (CC) system heat exchangers that form a service water (SW) system pressure boundary. In each LRA, Table 2.3.3-20, the applicant listed the following two component commodity groups as subject to an AMR: pipes and valve bodies. The applicant identified maintaining pressure boundary integrity as the only intended function for the SCs that is subject to an AMR.

2.3.3.23.2 Staff Evaluation

The staff reviewed each LRA Section 2.3.3.20, to determine whether there is reasonable assurance that the applicant appropriately identified the portions of the VP system that are within the scope of license renewal in accordance with 10 CFR 54.4, and that the applicant appropriately identified the SCs that are subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff reviewed the information provided in Section 2.3.3.20 of each LRA the applicable piping and instrument drawings, and the North Anna and Surry UFSARs to determine whether the applicant adequately identified the portions of the vacuum priming system that are within the scope of license renewal. The staff verified that those portions of the vacuum priming system that meet the scoping requirements of 10 CFR 54.4 were included within the scope of license renewal and were identified as such by the applicant in Section 2.3.3.20 of each LRA. To verify that the applicant did include the applicable portions of the VP system within the scope of license renewal, the staff focused its review on those portions of the VP system that were not identified within the scope of license renewal and verified that they did not meet the scoping criteria of 10 CFR 54.4. In addition, the staff reviewed the UFSARs for each facility to identify any additional system functions that were not identified in each LRA and verified that these additional functions did not meet the scoping requirements of 10 CFR 54.4. The staff did not identify any omissions.

The staff then determined whether the applicant had properly identified the SCs that are subject to AMR from among those portions of the VP system that were identified as being within the scope of license renewal. The applicant used the screening methodology described in Section 2.1 of each LRA to identify and list the SCs subject to AMR. The staff evaluation of the scoping and screening methodology is documented in Section 2.1 of this SER.

In the NAS LRA, the applicant identified the portions of the VP system that are within the scope of license renewal in the drawings listed below. The applicant also listed the mechanical component commodity groups that are subject to AMR and their intended functions in Table 2.3.3-20 of the LRA.

Unit 1	Unit 2
11715-LRM-072A, Sh. 2	12050-LRM-072A, Sh. 2

In the SPS LRA, the applicant identified the portions of the VP system that are within the scope of license renewal in the drawings listed below. In addition, the applicant listed the mechanical component commodity groups that are subject to AMR and its intended functions in Table 2.3.3-20 of the LRA.

Unit 1	Unit 2
11448-LRM-066A, Sh. 2	11548-LRM-066A, Sh. 2
11448-LRM-071A, Sh. 2	11548-LRM-071A, Sh. 2
11448-LRM-074A, Sh. 1	11548-LRM-074A, Sh. 1

The piping and instrumentation drawings were highlighted by the applicant to identify those portions of the VP system that meet at least one of the scoping requirements of 10 CFR 54.4. The staff compared the LRA drawings to the system drawings and the descriptions in the UFSAR to ensure they were representative of the VP system. The staff performed its review by sampling the SCs that the applicant identified as being within the scope of license renewal but not subject to AMR, to verify that no structure or component that performs its intended function without moving parts or without a change in configuration or properties, or is not subject to replacement based on qualified life or specified time period, was excluded from an AMR. The staff did not identify any omissions.

2.3.3.23.3 Conclusions

On the basis of its review of the information contained in Section 2.3.3.20 of each LRA, the supporting information in the UFSARs, and LRA drawings, as described above, the staff did not identify any omissions in the scoping of the VP system by the applicant. The staff concludes that there is reasonable assurance that the applicant has identified those portions of the VP system that are within the scope of license renewal and the SCs that are subject to an AMR in accordance with 10 CFR 54.4(a) and 10 CFR 54.21(a)(1), respectively.

2.3.3.24 Heating and Ventilation

In Section 2.3.3.21 of both North Anna and Surry LRAs, the applicant describes the components of the heating and ventilation (HV) systems that are within the scope of license renewal and subject to an AMR. For North Anna, Section 2.3.3.21 is titled “Heating and Ventilation” while for Surry, this section is titled “Ventilation.” However, the North Anna HV system is functionally equivalent to the Surry system. This system is further described in Sections 9.4 and 6.4.1 of the North Anna UFSAR and in Sections 5.3.1 and 9.13 of the Surry UFSAR.

2.3.3.24.1 Summary of Technical Information in the Application

The HV system comprises several ventilation subsystems with the general function of providing the space and equipment cooling. Certain subsystems also provide radiological controls (e.g., emergency ventilation subsystem takes suction from the turbine building through particulate filters and charcoal absorber to remove airborne radioactivity during accident conditions). The HV subsystems within the scope of license renewal are those that perform essential cooling and those that maintain onsite and offsite radiological doses within limits for postulated accident conditions.

The auxiliary ventilation subsystem comprises fresh air supply and exhaust ventilation for the auxiliary building, fuel building, decontamination building, safeguards building, and common filtration units. The auxiliary ventilation subsystem also includes the exhaust ventilation filters, fans, dampers, and ductwork for engineered safety features (ESF) equipment areas (emergency system).

The containment ventilation subsystem consists of containment air recirculation, control rod drive mechanism (CRDM) ventilation, and containment purge ventilation. The containment air recirculation ventilation supplies containment heat removal during normal and shutdown operations. The CRDM ventilation cools the ventilation air drawn from the CRDM area of the reactor vessel head in order to remove heat generated in the head region. The containment purge supplies containment atmosphere air changes to maintain radiological control and personnel habitability levels during plant shutdown conditions.

The main control room and emergency switchgear room (MCR/ESGR) ventilation subsystem comprises air-conditioning ventilation components and MCR envelope pressurization components. The air-conditioning system consists of supply and exhaust-ventilation and a recirculation system. The supply and exhaust system is secured in an emergency in order to isolate the MCR envelope. The recirculation air-conditioning system, including water chillers and associated equipment, air handling units, dampers, and ductwork, supplies cooling during normal and emergency conditions.

The pressurization of the MCR envelope is required for postulated accidents involving radioactive releases in order to limit the dose to control room personnel. Pressurization is performed by the MCR/ESGR bottled air system initially and by the MCR/ESGR emergency ventilation system for the long term. The bottled air system consists of compressed breathing air bottles, piping, and valves. The MCR/ESGR emergency ventilation system consists of fans, filters, dampers, and ductwork.

For Surry, the cable-spreading room ventilation subsystem supplies cooling to the cable-spreading area in the service building. This subsystem is relied upon for certain severe fire scenarios. For North Anna, ventilation subsystem components supply cooling for critical areas of the auxiliary building and the fuel building in the event that a severe fire disables the normal ventilation system, rod drive room, and cable vault ventilation subsystem includes emergency supply ventilation fans and ductwork that supply cooling to safety-related motor control centers if normal ventilation is lost.

The applicant describes its process for identifying the mechanical components that are within the scope of license renewal in Section 2.1.4, “Scoping Methodology,” of each LRA. As described in the scoping methodology, the applicant identified portions of the HV system that are within the scope of license renewal on the piping and instrumentation diagrams (P&IDs) listed in Section 2.3.3.21 of each LRA. Consistent with the method described in Section 2.1.5, “Screening Methodology,” of each LRA, the applicant listed the mechanical component commodity groupings that are within the license renewal evaluation boundaries and that are subject to an AMR in Table 2.3.3-21 of each LRA. The tables also list the intended functions and the LRA section containing the AMR for each commodity grouping.

The portions of the HV system subject to an AMR consists of the following: components of the auxiliary ventilation subsystem that supply required post-accident ESF equipment cooling and control of radiological conditions, including portions of the normal supply and exhaust that provide a pressure boundary for the ESF equipment areas (emergency system); cooling coils of the containment air recirculation ventilation and CRDM ventilation that provide pressure boundary for the chilled water system; components of the containment purge that provide containment pressure boundary as part of the HV system containment penetrations and that provide a pressure boundary for the ESF areas exhaust ventilation; components of the air-conditioning system that supply isolation and cooling of the MCR envelope; components of the MCR/ESGR bottled air system and MCR/ESGR emergency ventilation system that supply pressurization of the MCR envelope; for Surry, components of the cable-spreading room ventilation subsystem that supply cooling for the cable-spreading area; for North Anna, components of ventilation subsystems that supply cooling for critical areas of the auxiliary building and the fuel building, and components of the rod drive room and cable vault ventilation subsystem that supply cooling to safety-related motor control centers.

In Table 2.3.3-21 of each LRA, the applicant listed the following component commodity groups as subject to an AMR: cooling coils, damper and fan/blower housings, expansion joints, filter/strainers, flow elements, gas bottles, valve assemblies, chiller condensers and evaporators, flexible connections, heaters, in-line instrumentation, level indicators, thermowells, valve bodies, ductwork, pipes, pump casings, restricting orifices, tanks, tubing. The applicant identified restricting flow and maintaining pressure boundary, filtration, and heat transfer as the intended functions for the HV system SCs that are subject to an AMR.

2.3.3.24.2 Staff Evaluation

The staff reviewed Section 2.3.3.21 of each LRA to determine whether there is reasonable assurance that the applicant appropriately identified the portions of the HV system that are within the scope of license renewal in accordance with 10 CFR 54.4, and that the applicant appropriately identified the SCs that are subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff reviewed the information provided in Section 2.3.3.21 of each LRA, the applicable piping and instrumentation diagrams (P&IDs), and the North Anna and Surry UFSARs to determine whether the applicant adequately identified the portions of the HV system that are within the scope of license renewal. The staff verified that those portions of the HV system that meet the scoping requirements of 10 CFR 54.4 were included within the scope of license renewal and were identified as such by the applicant in Section 2.3.3.21 of each LRA. To verify that the applicant did include the applicable portions of the HV system within the scope of license renewal, the staff focused its review on those portions of the HV system that were not identified within the scope of license renewal and verified that they did not meet the scoping criteria of 10 CFR 54.4. In addition, the staff reviewed the UFSAR for each facility to identify any additional system functions that were not identified in each LRA and verified that these additional functions did not meet the scoping requirements of 10 CFR 54.4.

The staff then determined whether the applicant had properly identified the SCs that are subject to an AMR from among those portions of the HV system that are identified as being within the scope of license renewal. The applicant identified and lists the SCs subject to an AMR for the HV system in Table 2.3.3-21 of each LRA using the screening methodology described in Section 2.1 of each LRA. The staff evaluated the scoping and screening methodology and documented its findings in Section 2.1 of this SER. The staff performed its review by sampling the SCs that the applicant determined within the scope of license renewal but not subject to an AMR to verify that these SCs do not performed their intended functions without moving parts or without a change in configuration or properties or are subject to replacement based on qualified life or specified time period.

The staff then determined whether the applicant had properly identified the SCs that are subject to an AMR from among those portions of the HV system that were identified as being within the scope of license renewal. The applicant used the screening methodology described in Section 2.1 of each LRA to identify and list the SCs subject to an AMR. The staff evaluation of the scoping and screening methodology is documented in Section 2.1 of this SER.

In a telecommunication summary dated November 21, 2001, the NRC staff requested specific information from the applicant concerning the exclusion of the following components from the scope of license renewal and/or an AMR:

- exhaust fan housings
- bird screen or wire mesh
- building sealant materials
- radiation, chlorine, and smoke detection monitors
- control room air bottles

In an electronic communication dated November 21, 2001, the applicant provided the following responses:

- The North Anna and Surry exhaust fans, fan housings, and respective dampers, identified by the NRC staff, do not perform any intended function consistent with scoping criteria under 10 CFR 54.4(a) and, therefore, are not within the scope of license renewal.

- There is no bird wire or wire mesh used as a protective cover for the vent stack.

- For both Surry and North Anna, sealant material is not used in the auxiliary building HVAC system. Surry and North Anna auxiliary building ventilation systems use welded and interlocking joints. Structural sealants are used in the auxiliary building and are addressed under structural scoping.

- Sealants used in the main control room pressure boundary are within the scope of license renewal. The sealants are covered under Sections 2.4.11 and 3.5.11 of each LRA, "Miscellaneous Structural Commodities." The sealants are identified as "fire barrier penetration seals" in Tables 2.4.11-1 and 3.5.11-1.

- Chlorine detectors are not installed at either Surry or North Anna. Smoke detectors are within the scope of license renewal for Surry and North Anna; however, the smoke detectors are local, self-contained units. The detectors themselves are active and, therefore, there are no smoke detector components that are subject to an AMR. With the exception of the containment high-range radiation monitors (CHRRM) at Surry and, North Anna, there are no radiation monitors that are within the scope of license renewal. The CHRRM are local, self-contained units. The detectors themselves are active and therefore, there are no CHRRM components subject to an AMR.

- The Surry ventilation (VS) system contains gas bottles that are included within the scope of license renewal. The corresponding gas bottles for North Anna, however, are contained in systems other than the HV system as clarified below.

  The control room air bottles for both stations are within the scope of license renewal and perform a passive pressure boundary function and as such are highlighted on the license renewal drawings. However, the bottles are periodically replaced and, therefore, do not require an AMR and are not shown on LRA screening summary tables. The control room air bottles are contained within the VS system for Surry and the compressed air (CA) system for North Anna.

> The Surry VS system also contains an in-scope long-lived air bottle which performs an intended function for air-operated dampers within the VS system. This air bottle is represented by the component group “gas bottles” in Table 2.3.3-21 of the Surry LRA. The corresponding gas bottles for North Anna are also within the scope and are long-lived, but are contained within the instrument air (IA) system (Table 2.3.3-14 of the North Anna LRA).

With regard to the North Anna LRA, the NRC staff also requested that the applicant define “Future HEPA Charcoal,” and briefly explain its relationship to the scope of the auxiliary building. In an electronic communication dated November 21, 2001, the applicant presented clarification that the filter unit is a three-element housing where two of three element compartments are being used as “HEPA” and “Charcoal” filtering functions. The third compartment has nothing installed and is labeled as “Future.”

With regard to Table 2.3.3-21 of the North Anna LRA, the NRC staff requested that the applicant describe the components that make up the commodity group “Instrumentation,” and discuss why Table 2.3.3-21 of the Surry LRA does not identify a similar commodity group. In an electronic communication dated November 21, 2001, the applicant stated that as indicated in a footnote to Table 2.3.3-21 of the LRA for North Anna, the component group “instrumentation” includes miscellaneous in-line instrumentation that performs a pressure boundary function. The Surry VS system does not have similar components that were included in a similar component group; therefore, an instrumentation component group is not included in Table 2.3.3-21 of the LRA for Surry.

For each LRA the NRC staff observed that although the evaluation boundary of the main control room and different switchgear rooms is identified, the applicant did not define the areas that constitute the main control room envelope. In a letter dated November 26, 2001, the NRC staff issued RAI 2.3.3.21-1 and requested that the applicant to (1) describe the main control room envelope in terms of systems, subsystems, and spaces, and its intended functions for both North Anna and Surry in sufficient detail that the NRC staff can perform its review consistent with the information provided in each LRA, (2) ensure that the discussion includes sufficient correlation with the scoping and AMR activities contained in each LRA to allow the NRC staff to utilize the information already provided, and (3) identify any SCs that need to be added to the already identified scope of license renewal and include all the applicable scoping and AMR information.

In a letter dated February 5, 2002, the applicant responded to RAI 2.3.3.21-1 and stated that the control room envelope for both Surry and North Anna is located within the service building, which is described in Section 2.4.5, “Miscellaneous Structures,” of each LRA. For Surry, the control room envelope consists of the control room (including the control room annex area), emergency switchgear and relay rooms, battery rooms, associated stairwell, and mechanical equipment room (MER) 3. For North Anna, the control room envelope consists of the control room, emergency switchgear and relay rooms, battery rooms, and the associated stairwell. As indicated in Table 2.4.5-2, “Miscellaneous Structures - Service Building,” of the North Anna LRA, the floor slabs and walls associated with the control room envelope perform a pressure boundary function for the envelope. In addition, fire barrier penetration seals and fire doors and/or EQ barrier doors associated with the control room envelope also perform a pressure boundary function in support of the envelope. Systems associated with the Surry control room envelope are described, along with the associated functions, in Section 2.3.3.21, “Ventilation,” and consist of the air-conditioning system, the bottled air pressurization system, and the emergency ventilation system. Components that are subject to an AMR are identified in Table 2.3.3-21 of the Surry LRA. This table also identifies the section within the Surry LRA that contains the AMR results. Systems associated with the North Anna control room envelope are described, along with the associated functions, in Sections 2.3.3.21, “Heating and Ventilation,” and 2.3.3.13, “Compressed Air,” of the North Anna LRA, and consist of the air-conditioning system, bottled air pressurization system, and emergency ventilation system. Components that are subject to an AMR are identified in Tables 2.3.3-21 and 2.3.3-13 of the North Anna LRA. These tables also identify the section within the LRA that contains the AMR results. The SCs that comprise the control room envelope and that support the envelope functions are included within the scope of license renewal and subject to an AMR as described in each LRA. The applicant further stated that no new SCs need to be added to the scope of license renewal as a result of the response to RAI 2.3.3.21-1.

The NRC staff reviewed the applicant’s responses to the staff’s RAIs and determined that the applicant properly identified portions of the HV system that are within the scope of license renewal and subject to an AMR. The staff did not identify any omissions.

In the LRA for North Anna, the applicant identified the portions of the HV system that are within the scope of license renewal in the P&IDs listed below. The applicant also listed the mechanical component commodity groups that are subject to an AMR and their intended functions in Table 2.3.3-21 of the North Anna LRA.

Unit 1	Unit 2
11715-LRB-006A, Sh. 1	12050-LRM-079A, Sh. 2
11715-LRB-006A, Sh. 2	12050-LRM-079A, Sh. 3
11715-LRB-006A, Sh. 3	12050-LRM-079A, Sh. 4
11715-LRB-023A, Sh. 1	12050-LRM-079B, Sh. 3
11715-LRB-034F, Sh. 1	
11715-LRB-034F, Sh. 2	
11715-LRB-034F, Sh. 3	
11715-LRB-034F, Sh. 4	
11715-LRB-034F, Sh. 5	
11715-LRB-040C, Sh. 1	
11715-LRB-040C, Sh. 2	
11715-LRB-040D, Sh. 2	
11715-LRB-040D, Sh. 2	
11715-LRB-040E, Sh. 1	
11715-LRB-040E, Sh. 2	
11715-LRM-079B, Sh. 2	
11715-LRM-079B, Sh. 3	
11715-LRM-079B, Sh. 4	
11715-LRM-079D, Sh. 4	
11715-LRM-106A, Sh. 4	

In the LRA for Surry, the applicant identified the portions of the HV system that are within the scope of license renewal in the P&IDs listed below. In addition, the applicant listed the mechanical component commodity groups that are subject to an AMR and its intended functions in Table 2.3.3-21 of the Surry LRA.

Unit 1	Unit 2
11448-LRB-006A, Sh. 1	11548-LRB-006A, Sh. 1
11448-LRB-006D, Sh. 1	11548-LRM-072A, Sh. 2
11448-LRB-006D, Sh. 2	11548-LRM-072A, Sh. 3
11448-LRB-006D, Sh. 3	11548-LRM-072A, Sh. 4
11448-LRB-006D, Sh. 4	11548-LRM-072B, Sh. 1
11448-LRB-024A, Sh. 1	
11448-LRB-041A, Sh. 1	
11448-LRB-041A, Sh. 2	
11448-LRB-041A, Sh. 3	
11448-LRB-041B, Sh. 1	
11448-LRB-041B, Sh. 2	
11448-LRB-041B, Sh. 3	
11448-LRM-071D, Sh. 1	
11448-LRM-071D, Sh. 2	
11448-LRM-072A, Sh. 2	
11448-LRM-072A, Sh. 3	
11448-LRM-072A, Sh. 4	
11448-LRM-072B, Sh. 2	

The P&IDs were highlighted by the applicant to identify those portions of the HV system that meet at least one of the scoping requirements of 10 CFR 54.4. The staff compared these P&IDs to the P&IDs and descriptions in the UFSARs to ensure they were representative of the HV system. The staff performed its review by sampling the SCs that the applicant determined within the scope of license renewal but not subject to an AMR to verify that no structure or component, that performs its 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, was excluded from an AMR. The staff did not identify any omissions.

2.3.3.24.3 Conclusions

On the basis of the staff's review of the information contained in Section 2.3.3.21 of both North Anna and Surry LRAs, the supporting information in the UFSARs and P&IDs, and the applicant's responses to the staff's RAIs as described above, the staff did not identify any omissions in the scoping and screening of the HV system. Therefore, the staff concludes that there is reasonable assurance that the applicant has identified those portions of the HV system that are within the scope of license renewal and the SCs that are subject to an AMR in accordance with 10 CFR 54.4(a), and 10 CFR 54.21 (a)(1), respectively.

2.3.3.25 Boron Recovery

In the North Anna and Surry LRAs, Section 2.3.3.22, "Boron Recovery," the applicant describes the piping and mechanical components of the boron recovery (BR) systems that are within the scope of license renewal and subject to an AMR. North Anna and Surry both have a BR system. These systems are identical with no notable differences in system design for the purpose of license renewal. Therefore, the information provided below is applicable to the North Anna and Surry BR systems. The BR structural components that are subject to AMR are presented separately by the applicant in Section 2.4.10 of each LRA, “General Structural Supports,” as commodity groups and, therefore, are evaluated separately by the staff in Section 2.4.10 of this SER. The BR piping and mechanical components are further described by the applicant in Chapter 9.3.5 of the North Anna UFSAR and Chapter 9.2 of the Surry UFSAR.

2.3.3.25.1 Summary of Technical Information in the Application

North Anna and Surry both have a single BR system common to Unit 1 and Unit 2. The North Ann and Surry BR systems are used to degasify and store borated radioactive water letdown by the chemical and volume control systems or gaseous drain water transferred by the drains-gaseous systems. The portions of the BR systems that are subject to AMR consist of the components that provide the system pressure boundary for the BR and other interconnected systems.

The applicant describes its process for identifying the mechanical components that are within the scope of license renewal in Section 2.1.4, “Scoping Methodology,” of the North Anna and Surry LRAs. As described in the scoping methodology, the applicant identified the portions of the BR systems that are within the scope of license renewal on the license renewal drawings listed in the North Anna and Surry LRAs, Section 2.3.3.22. Consistent with the method described in each LRA, Section 2.1.5, “Screening Methodology,” the applicant listed the NAS 1/2 and SPS 1/2 mechanical component commodity groups that are subject to an AMR in Tables 2.3.3-22 of each LRA. These tables also list the intended functions and the LRA sections that contain the AMR for each commodity group.

The portions of NAS 1/2 and SPS 1/2 BR systems that are subject to an AMR include the following 12 component commodity groups subject to an AMR: bellows, bolting, distillate coolers and stripper trim cooler, filters/strainers, heaters, overhead condensers, pipe, primary drain transfer tank vent chiller condenser, pump casings, stripper vent chillers, stripper vent condensers, and valve bodies. The applicant identified maintaining pressure-boundary integrity and providing filtration as the intended functions of the SCs that are subject to an AMR for the North Anna and Surry BR systems.

2.3.3.25.2 Staff Evaluation

The staff reviewed Sections 2.3.3.22 of both the North Anna and Surry LRAs to determine whether there is reasonable assurance that the applicant appropriately identified the portions of the North Anna and Surry BR systems that are within the scope of license renewal in accordance with 10 CFR 54.4, and that the applicant appropriately identified the SCs of the BR systems that are subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff reviewed the information provided in each LRA, the applicable license renewal drawings, and the North Anna and Surry UFSARs to determine whether the applicant adequately identified the portions of the North Anna and Surry BR systems that are within the scope of license renewal. The staff verified that those portions of the BR systems that meet the scoping requirements of 10 CFR 54.4 were included within the scope of license renewal and were identified as such by the applicant in Sections 2.3.3.22 of both North Anna and Surry LRAs. To verify that the applicant did include the applicable portions of the BR systems within the scope of license renewal, the staff focused its review on those portions of the North Anna and Surry BR systems that were not identified within the scope of license renewal and verified that they did not meet the scoping criteria of 10 CFR 54.4. In addition, the staff reviewed the UFSARs for each facility to identify any additional system functions that were not identified in each LRA and verified that these additional functions did not meet the scoping requirements of 10 CFR 54.4. The staff did not identify any omissions.

The staff then determined whether the applicant had properly identified the SCs of the North Anna and Surry BR systems that are subject to AMR from among those portions of the BR systems that are identified as being within the scope of license renewal. The applicant identified and lists the SCs subject to AMR for the BR systems in Table 2.3.3-22 of each LRA using the screening methodology described in Section 2.1 of each LRA. The staff evaluated the scoping and screening methodology and documented its findings in Section 2.1 of this SER.

In the North Anna LRA, the applicant identified the portions of the BR system that are within the scope of license renewal in the drawings listed below. The applicant also listed the mechanical component commodity groups that are subject to AMR and their intended functions in Table 2.3.3-22 of the North Anna LRA.

Unit 1	Unit 2
11715-LRM-079C, Sh. 1	Common
11715-LRM-079C, Sh. 4	
11715-LRM-079C, Sh. 5	
11715-LRM-086B, Sh. 3	

In the Surry LRA, the applicant identified the portions of the BR systems that are within the scope of license renewal in the drawings listed below. In addition, the applicant listed the mechanical component commodity groups that are subject to AMR and their intended functions in Table 2.3.3-22 of the Surry LRA.

Unit 1	Unit 2
11448-LRM-072C, Sh. 2	Common
11448-LRM-072D, Sh. 3	
11448-LRM-079A, Sh. 2	
11448-LRM-079C, Sh. 1	

The license renewal drawings were highlighted by the applicant to identify those portions of the BR systems that meet at least one of the scoping requirements of 10 CFR 54.4. The staff compared the license renewal drawings to the system drawings and the descriptions in the North Anna and Surry UFSARs to ensure they were representative of the BR systems. The staff performed its review by sampling the SCs that the applicant identified as being within the scope of license renewal but not subject to AMR to verify that no structure or component, that performs its 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, was excluded from an AMR. The staff did not identify any omissions.

2.3.3.25.3 Conclusion

On the basis of its review of the information contained in Sections 2.3.3.22 of each LRA the supporting information in the North Anna and Surry UFSARs, and the license renewal drawings, as described above, the staff did not identify any omissions in the scoping and screening of the North Anna and Surry BR systems by the applicant. Therefore, the staff concludes that there is reasonable assurance that the applicant has identified those portions of the North Anna and Surry BR systems that are within the scope of license renewal and the SCs that are subject to an AMR in accordance with 10 CFR 54.4(a) and 10 CFR 54.21(a)(1), respectively.

2.3.3.26 Drains-Aerated

In each LRA Section 2.3.3.23, “Drains-Aerated,” the applicant describes the components of the aerated drain (DA) systems that are within the scope of license renewal and subject to an AMR. NAS 1/2 and SPS 1/2 each has a DA system. These systems are identical for the purposes of license renewal for both facilities without any notable differences in system design. The DA structural components that are subject to AMR are presented separately by the applicant in Section 2.4.10 of each LRA, “General Structural Supports,” as commodity groups and, therefore, are evaluated separately by the staff in Section 2.4.10 of this SER. The DA systems are further described in Section 9.3.5 of the North Anna UFSAR and Section 9.7 of the Surry UFSAR.

2.3.3.26.1 Summary of Technical Information in the Application

The DA system collects potentially radioactive fluids in building sumps and discharges the sump fluids to the waste disposal system for processing and disposal. The waste disposal function in itself is not within the scope of license renewal in accordance with 10 CFR 54.4(a). However, the containment penetration portion of the NAS 1/2 and SPS 1/2 DA system that serves as part of the containment pressure boundary is subject to AMR.

The applicant describes its process for identifying the mechanical components that are within the scope of license renewal in Section 2.1.4, “Scoping Methodology,” of each LRA. As described in the scoping methodology, the applicant identified portions of the DA system that are within the scope of license renewal on the license renewal drawings that are listed in Section 2.3.3.23 of each LRA. Consistent with the method described in each LRA, Section 2.1.5, “Screening Methodology,” the applicant listed the DA system mechanical component commodity groups that are subject to an AMR in Table 2.3.3-23 of each LRA. These tables also list the intended functions, and the LRA section containing the AMR for each commodity group. Specifically, the applicant identified the following component commodity groups as subject to an AMR: pipe, valve bodies, and bolting. The applicant states that maintaining pressure boundary integrity is the only intended function subject to an AMR for these components.

2.3.3.26.2 Staff Evaluation

The staff reviewed Section 2.3.3.23 of the North Anna and Surry LRAs to determine whether there is reasonable assurance that the applicant appropriately identified the portions of the NAS 1/2 and SPS 1/2 DA systems that are within the scope of license renewal in accordance with 10 CFR 54.4, and that the applicant appropriately identified the SCs that are subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff reviewed the information provided in Section 2.3.3.23 of each LRA, the applicable license renewal drawings, and the North Anna and Surry UFSARs to determine whether the applicant adequately identified the portions of the DA systems that are within the scope of license renewal. The staff verified that those portions of the NAS 1/2 and SPS 1/2 DA system that meet the scoping requirements of 10 CFR 54.4(a) were included within the scope of license renewal and were identified as such by the applicant in Section 2.3.3.23 of each LRA.

In the North Anna and Surry LRAs, Section 2.3.3.23, the applicant listed nine detailed drawings for the DA system. The detailed drawings were highlighted to identify those portions of the system that are within the scope of license renewal. The staff compared the license renewal drawings to the system drawings and descriptions in the North Anna and Surry UFSARs to ensure that they were representative of the DA systems. To verify that the applicant did include the applicable portions of the NAS 1/2 and SPS 1/2 DA systems within the scope of license renewal, the staff focused its review on those portions of the DA system that were not identified within the scope of license renewal and verified that they did not meet the scoping criteria of 10 CFR 54.4(a). In addition, the staff reviewed the UFSARs for each facility to identify any additional system functions that were not identified in each LRA and verified that these additional functions did not meet the scoping requirements of 10 CFR 54.4(a). The staff did not identify any omissions.

The staff then determined whether the applicant had properly identified the SCs that are subject to AMR from among those portions of the NAS 1/2 and SPS 1/2 DA systems that were identified as being within the scope of license renewal. The applicant used the screening methodology described in Section 2.1 of each LRA to identify and list the SCs subject to AMR. The staff evaluation of the scoping and screening methodology is documented in Section 2.1 of this SER.

In the North Anna LRA, the applicant identified the portions of the DA system that are within the scope of license renewal and lists the mechanical component commodity groups that are subject to AMR and their intended functions in Table 2.3.3-23 of the LRA.

In the Surry LRA, the applicant identified the portions of the DA systems that are within the scope of license renewal and lists the mechanical component commodity groups that are subject to AMR and their intended functions in Table 2.3.3-23 of the LRA.

The staff then sampled the SCs that were within the scope of license renewal but not subject to an AMR to verify that the intended functions of these SCs were not performed without moving parts or without a change in configuration or properties, or were subject to replacement based on qualified life or specified time period. The staff did not identify any omissions.

2.3.3.26.3 Conclusions

On the basis of the staff's review of the information contained in Section 2.2.3.23 of each LRA and the supporting information in the license renewal drawings and the North Anna and Surry UFSARs, as described above, the staff did not identify any omissions in the scoping and screening results of the NAS 1/2 and SPS 1/2 DA systems by the applicant. Therefore, the staff finds that there is reasonable assurance that the applicant has adequately identified those portions of the NAS 1/2 and SPS 1/2 DA systems that are within the scope of license renewal and the associated SCs that are subject to an AMR, in accordance with the requirements of 10 CFR 54.4(a) and 54.21(a)(1), respectively.

2.3.3.27 North Anna Drains-Building Services System/Surry Plumbing System

In the North Anna LRA, Section 2.3.3.24 "Drains-Building Services Systems," the applicant describes the components of the drains-building services (DB) systems that are within the scope of license renewal and subject to an AMR for NAS 1/2. This system is further described in Section 9.3.3 of the North Anna UFSAR. In the Surry LRA, Section 2.3.3.25, "Plumbing," the applicant describes the components of the plumbing (PL) systems that are within the scope of license renewal and subject to an AMR for SPS 1/2. The PL is further described in the SPS UFSAR, Appendix 9C. The DB system and PL system structural components that are subject to AMR are presented separately by the applicant in Section 2.4.10 of each LRA, "General Structural Supports," as commodity groups and, therefore, are evaluated separately by the staff in Section 2.4.10 of this SER. Both the DB and PL systems are evaluated below in this section of the SER. Unless otherwise specified, the information provided below is applicable to the NAS 1/2 DB systems and to the SPS 1/2 PL systems.

2.3.3.27.1 Summary of Technical Information in the Application

The safety function of the North Anna DB systems and Surry PL systems is to prevent or mitigate plant flooding for its perspective unit. The applicant describes its process for identifying the mechanical components that are within the scope of license renewal in Section 2.1.4, "Scoping Methodology" of each LRA. As described in the scoping methodology, the applicant identified the portions of the DB and PL systems that are within the scope of license renewal on the license renewal drawings listed in Section 2.3.3.24 and Section 2.3.3.25 of the respective LRA. Consistent with the methodology described in Section 2.1.5, "Screening Methodology," of each LRA the applicant listed the DB and PL systems mechanical component commodity groupings in Tables 2.3.3-24 and 2.3.3-25, respectively, that are within the license renewal evaluation boundaries and that are subject to an AMR. The portions of the DB and PL systems that are subject to AMR include the main control room and emergency switchgear room, chiller rooms, sump discharge path components that prevent flooding of the chiller rooms for NAS 1/2 turbine building sump pumps, and discharge piping for SPS 1/2. In the NAS LRA, Table 2.3.3-24, and the SPS LRA, Table 2.3.3-2 5, the applicant listed the following three component commodity groups as subject to an AMR: pipe, pump casings, and valve bodies. The applicant identified maintaining system pressure boundary integrity as the only intended function of the SCs subject to an AMR for the DB and PL systems.

2.3.3.27.2 Staff Evaluation

The staff reviewed the North Anna LRA, Section 2.3.3.24, and the Surry LRA, Section 2.3.3.25, to determine whether there is reasonable assurance that the applicant appropriately identified the portions of the DB systems and PL systems that are within the scope of license renewal and the SCs that are subject to an AMR in accordance with the requirements of 10 CFR 54.4(a) and 10 CFR 54.21(a)(1), respectively.

The staff reviewed the information provided by the applicant in each LRA, the applicable license renewal drawings, and the North Anna and Surry UFSARs to determine whether the applicant adequately identified the SSCs of the DB and PL systems that are within the scope of license renewal. The staff verified that those portions of the DB and PL systems that meet the scoping requirements of 10 CFR 54.4(a) were included within the scope of license renewal and were identified as such by the applicant in Sections 2.3.3.24 and 2.3.3.25 of each LRA, respectively. To verify that the applicant did include the applicable portions of the DB and PL systems within the scope of license renewal, the staff focused its review on those portions of the DB and PL systems that were not identified within the scope of license renewal to verify that they do not meet the scoping requirements of 10 CFR 54.4(a). The staff also reviewed the applicable portions of the North Anna and Surry UFSARs to determine whether there were any additional system functions that were not identified in either LRA, and verified that those additional functions did not meet the scoping requirements of 10 CFR 54.4. The staff did not identify any omissions.

The staff then determined whether the applicant had properly identified the SCs that are subject to AMR from among those portions of the DB and PL systems that are identified as being within the scope of license renewal. The applicant identified and lists the SCs subject to AMR for the DB and PL systems in Tables 2.3.3-24 and 2.3.3.25 (respectively) using the screening methodology described in each LRA Section 2.1. The staff evaluated the scoping and screening methodology and documented its findings in Section 2.1 of this SER.

In the NAS LRA, the applicant identified the portions of the DB system that are within the scope of license renewal on the license renewal drawings listed below. The applicant also listed the mechanical component commodity groups that are subject to AMR and their intended functions in Table 2.3.3-24 of the NAS LRA.

Unit 1	Unit 2
11715-LRB-201A, Sh. 1	Common
11715-LRB-201A, Sh. 2	

In the SPS LRA, the applicant identified the portions of the PL system that are within the scope of license renewal in the drawings listed below. The applicant also listed the mechanical component commodity groups that are subject to AMR and their intended functions in Table 2.3.3-25 of the SPS LRA.

Unit 1	Unit 2
11448-LRB-15B, Sh. 1	11548-LRB-15B, Sh. 1

The license renewal drawings were highlighted by the applicant to identify those portions of the DB and PL systems that perform at least one of the scoping requirements of 10 CFR 54.4(a). The staff compared the license renewal drawings to the system drawings and the verbal descriptions in the North Anna and Surry UFSARs to ensure they were representative of the DB and PL systems. The staff performed its review by sampling the SCs that the applicant identified as being within the scope of license renewal but not subject to AMR to verify that no structure or component, that performs its 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, was excluded from an AMR. The staff did not identify any omissions.

2.3.3.27.3 Conclusions

On the basis of its review of the information contained in Section 2.3.3.24 of the NAS LRA and Section 2.3.3.25 of the SPS LRA, the supporting information from both UFSARs, and applicable license renewal drawings, as described above, the staff did not identify any omissions in the scoping and screening of the North Anna DB systems and Surry PL systems by the applicant. The staff concludes that there is reasonable assurance that the applicant has identified those portions of the NAS 1/2 DB systems and SPS 1/2 PL systems that are within the scope of license renewal and subject to an AMR in accordance with 10 CFR 54.4(a) and 10 CFR 54.21(a)(1), respectively.

2.3.3.28 Drains - Gaseous

In the North Anna LRA, Section 2.3.3.25, and Surry LRA, Section 2.3.3.24, both entitled “Drains - Gaseous,” the applicant describes the components of the gaseous drain (DG) systems that are within the scope of license renewal and subject to an AMR. Each unit of NAS and SPS has a DG system. These systems are identical with no notable differences in system design for the purpose of license renewal. Therefore, the information provided below is applicable to the NAS 1/2 and SPS 1/2 DG systems. The DG structural components that are subject to AMR are presented separately by the applicant in Section 2.4.10 of each LRA, “General Structural Supports,” as commodity groups and, therefore, are evaluated separately by the staff in Section 2.4.10 of this SER. The DG systems are further described in Section 9.3.3 of the North Anna UFSAR and Section 9.7 of the Surry UFSAR.

2.3.3.28.1 Summary of Technical Information in the Application

The DG system collects potentially radioactive fluids and discharges the fluids to the boron recovery system. DG system drainage collected from the primary systems is processed through the primary drains transfer tank and cooler. The function of collecting primary system drainage performed by the DG system is not in itself within the scope of license renewal in accordance with 10 CFR 54.4(a). However, the containment penetration portion of the DG system that serves as part of the containment pressure boundary and the portion of the DG system (the primary drains transfer tank cooler) that serves as part of the component cooling system pressure boundary are subject to AMR.

In addition, the portions of the Surry DG system that serve as part of the safety injection (SI) system and neutron shield tank cooling (NS) system pressure boundaries are subject to an AMR. This includes the DG drain isolation valves from the safety injection (SI) system piping and the DG drain isolation valves from the NS system coolers.

The applicant describes its process for identifying the mechanical components that are within the scope of license renewal in Section 2.1.4, "Scoping Methodology," of each LRA. As described in the scoping methodology, the applicant identified portions of the DG system that are within the scope of license renewal on license renewal drawings that are listed in Section 2.3.3.25 of North Anna LRA and Section 2.3.3.24 of Surry LRA. Consistent with the method described in each LRA, Section 2.1.5, "Screening Methodology," the applicant listed the DG system mechanical component commodity groups that are subject to an AMR in Table 2.3.3-25 of the North Anna LRA and Table 2.3.3-24 of the Surry LRA. These tables also list the intended functions, and the LRA section containing the AMR for each commodity group. Specifically, the applicant identified the following component commodity groups as subject to an AMR: pipe, valve bodies, bolting, and primary drain transfer tank coolers. The applicant states that maintaining pressure boundary integrity is the only intended function subject to an AMR for these components.

2.3.3.28.2 Staff Evaluation

The staff reviewed the Surry and North Anna LRAs, Sections 2.3.3.24 and 2.3.3.25, respectively, to determine whether there is reasonable assurance that the applicant has appropriately identified the DG system SCs that are within the scope of license renewal in accordance with 10 CFR 54.4(a) and subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff reviewed the information provided in each LRA, the applicable license renewal drawings, and the North Anna and Surry UFSARs to determine whether the applicant adequately identified the portions of the NAS 1/2 and SPS 1/2 DG systems that are within the scope of license renewal. The staff verified that those portions of the DG systems that meet the scoping requirements of 10 CFR 54.4 were included within the scope of license renewal and were identified as such by the applicant in Sections 2.3.3.25 and 2.3.3.24 of the North Anna and Surry LRAs, respectively. To verify that the applicant did include the applicable portions of the DG systems within the scope of license renewal, the staff focused its review on those portions of the NAS 1/2 and SPS 1/2 DG systems that were not identified within the scope of license renewal and verified that they did not meet the scoping criteria of 10 CFR 54.4. In addition, the staff reviewed the UFSARs for each facility to identify any additional system functions that were not identified in each LRA and verified that these additional functions did not meet the scoping requirements of 10 CFR 54.4. The staff did not identify any omissions.

The staff then determined whether the applicant had properly identified the SCs that are subject to AMR from among those portions of the DG systems that were identified as being within the scope of license renewal. The applicant used the screening methodology described in Section 2.1 of each LRA to identify and list the SCs subject to AMR. The staff evaluation of the scoping and screening methodology is documented in Section 2.1 of this SER.

In the North Anna LRA, the applicant identified the portions of the DG system that are within the scope of license renewal in the license renewal drawings. The applicant also listed the mechanical component commodity groups that are subject to AMR and their intended functions in Table 2.3.3-25 of the North Anna LRA.

In the Surry LRA, the applicant identified the portions of the DG systems that are within the scope of license renewal in the drawings listed below. In addition, the applicant listed the mechanical component commodity groups that are subject to AMR and their intended functions in Table 2.3.3-24 of the Surry LRA.

The license renewal drawings were highlighted by the applicant to identify those portions of the DG systems that meet at least one of the scoping requirements of 10 CFR 54.4. The staff compared the license renewal drawings to the system drawings and the descriptions in the North Anna and Surry UFSARs to ensure they were representative of the DG systems. The staff performed its review by sampling the SCs that the applicant identified as being within the scope of license renewal but not subject to AMR to verify that no structure or component, that performs its 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, was excluded from an AMR. The staff did not identify any omissions.

2.3.3.28.3 Conclusions

On the basis of its review of the information contained in Section 2.3.3.25 of the North Anna LRA and Section 2.3.3.24 of the Surry LRA, the supporting information in the North Anna and Surry UFSARs, and the license renewal drawings, as described above, the staff did not identify any omissions in the scoping and screening of the NAS 1/2 and SPS 1/2 DG systems by the applicant. Therefore, the staff concludes that there is reasonable assurance that the applicant has identified those portions of the NAS 1/2 and SPS 1/2 DG systems that are within the scope of license renewal and the SCs that are subject to an AMR in accordance with 10 CFR 54.4(a) and 10 CFR 54.21(a)(1), respectively.

2.3.3.29 Liquid and Solid Waste

In the North Anna LRA, Section 2.3.3.26, “Liquid and Solid Waste,” the applicant describes the components of the liquid and solid waste (LW) systems that are within the scope of license renewal and subject to an AMR. The system is further described in Section 11.2 of the North Anna UFSAR. The following staff evaluation only applies to the North Anna LRA because the SPS does not have an LW system that is within the scope of license renewal.

2.3.3.29.1 Summary of Technical Information in the Application

The LW system processes potentially radioactive liquid and solid wastes produced by the operation of the plant. The waste processing function is not in itself within the scope of license renewal in accordance with 10 CFR 54.4(a). However, the portions of the LW system that provide the pressure boundary for the chemical and volume control (CH) and component cooling (CC) systems are subject to AMR.

The applicant describes its process for identifying the mechanical components that are within the scope of license renewal in Section 2.1.4, “Scoping Methodology,” of each LRA. As described in the scoping methodology, the applicant identified portions of the LW system that are within the scope of license renewal on the license renewal drawings that are listed in Section 2.3.3.26 of the North Anna LRA. Consistent with the method described in the LRA, Section 2.1.5, “Screening Methodology,” the applicant listed the LW system mechanical component commodity groups that are subject to an AMR in Table 2.3.3-26 of the North Anna LRA. These tables also list the intended functions, and the LRA section containing the AMR for each commodity group. Specifically, the applicant identified the following component commodity groups as subject to an AMR: valve bodies and the steam generator blowdown heat exchangers. The applicant noted that the piping associated with these components is included in the radwaste (RW) system (Section 2.3.3.32 of this SER). The applicant states that maintaining pressure boundary integrity is the only intended function that is subject to an AMR for these components.

2.3.3.29.2 Staff Evaluation

The staff reviewed the North Anna LRA, Section 2.3.3.26, to determine whether there is reasonable assurance that the applicant appropriately identified the portions of the LW system that are within the scope of license renewal in accordance with 10 CFR 54.4 (a), and that the applicant appropriately identified the SCs that are subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff reviewed the scoping and screening results provided in Section 2.3.3.26 of the LRA, the applicable license renewal drawings, and the North Anna UFSAR to determine whether the applicant adequately identified the portions of the LW system that are within the scope of license renewal. The staff verified that those portions of the LW system that meet the scoping requirements of 10 CFR 54.4(a) were included within the scope of license renewal and were identified as such by the applicant in Section 2.3.3.26 of the North Anna LRA.

In the North Anna LRA, Section 2.3.3.26, the applicant listed three license renewal drawings for the LW system. The detailed drawings were highlighted to identify those portions of the system that are within the scope of license renewal. The staff compared the LRA drawings to the system drawings and descriptions in the UFSARs to ensure that they were representative of the LW system. The staff sampled portions of the drawings that were not highlighted to verify that these components did not meet any of the intended functions associated with the scoping criteria of 10 CFR 54.4(a). The staff also reviewed the UFSARs to determine whether there were any additional system functions that were not identified in the LRA and verified that those additional functions did not meet the scoping requirements of 10 CFR 54.4(a). In addition, the staff specifically confirmed that the LW system does not penetrate the containment, and that there is no containment isolation function associated with this system.

Furthermore, the staff reviewed the SPS LW system to verify that it was appropriately excluded from the scope of license renewal in accordance with 10 CFR 54.4(a). The applicant determined that North Anna and Surry use different system boundary nomenclature. At NAS, the CH ion exchanger drain valves are identified as liquid waste (LW) valves. At SPS, the drain valves on the CH ion exchangers are identified as CH valves. The design of the blowdown systems at North Anna and Surry differ as well. The NAS blowdown system uses a flash tank design and discharges the blowdown to waste. The steam generator blowdown heat exchangers at North Anna cool the flash tank effluent and are within the boundary of the liquid waste system. The cooling water is from the CC system and the portion of the heat exchanger that provides a pressure boundary for the CC system is the portion in scope and subject to AMR. The heat exchanger provides no other intended function than CC system pressure boundary. Additionally, the temperature control valve on the component cooling water outlet piping of these heat exchangers has an LW mark number and was appropriately included in the scope of license renewal per 10 CFR 54.4(a)(1). The SPS blowdown systems design has a blowdown recovery system and uses condensate as the cooling medium. The blowdown interface with condensate is at a non-safety-related portion of the condensate system and was appropriately determined not to be within the scope of license renewal consistent with the requirements of 10 CFR 54.4.

The staff did not identify any omissions in the scoping of the North Anna and the exclusion of the Surry LW systems.

The staff then determined whether the applicant had properly identified the SCs that are subject to an AMR from among those portions of the North Anna LW system that were identified within the scope of license renewal. The applicant used the screening methodology described in Section 2.1 of each LRA to identify and list the SCs subject to AMR. The staff evaluation of the scoping and screening methodology is documented in Section 2.1 of this SER. In the North Anna LRA, the applicant identified the portions of the LW system that are within the scope of license renewal and lists the mechanical component commodity groups that are subject to AMR and their intended functions in Table 2.3.3-26 of the LRA. The staff then sampled the SCs that were within the scope of license renewal but not subject to an AMR to verify that the intended functions of these SCs were not performed without moving parts or without a change in configuration or properties, or were subject to replacement based on qualified life or specified time period. The staff did not identify any omissions.

2.3.3.29.3 Conclusions

On the basis of the staff's review of the information contained in Section 2.2.3.26 of the North Anna LRA and the supporting information in the license renewal drawings and the North Anna UFSAR, as described above, the staff did not identify any omissions in the scoping and screening results of the LW system by the applicant. Therefore, the staff finds that there is reasonable assurance that the applicant has adequately identified those portions of the North Anna LW system that are within the scope of license renewal and the associated SCs that are subject to an AMR, in accordance with the requirements of 10 CFR 54.4(a) and 54.21(a)(1), respectively. The staff also confirmed that the Surry LW system need not be included within the scope of license renewal in accordance with 10 CFR 54.4.

2.3.3.30 Plumbing

This Section has been combined with, and discussed in Section 2.3.3.27, "North Anna Drains-Building Services System/Surry Plumbing System" of this SER.

2.3.3.31 Gaseous Waste

In the SPS LRA Section 2.3.3.26, "Gaseous Waste," the applicant describes the components of the gaseous waste (GW) system that are within the scope of license renewal and subject to an AMR. The system is further described in Section 11.2.5 of the SPS UFSAR. The in-scope portion of the GW system at Surry is functionally equivalent to the North Anna post-accident hydrogen control (HC) system which is evaluated in Sections 2.3.3.33 of this SER. Therefore, the following staff evaluation only applies to the Surry LRA.

2.3.3.31.1 Summary of Technical Information in the Application

The GW system provides holding capability and processing for potential radioactive gases collected from various plant systems. The GW system also provides the capability to monitor and control the post-accident containment atmosphere hydrogen concentration via hydrogen analyzer and recombiner units. The portions of the GW system that are associated with containment hydrogen monitoring and control, and that perform a containment pressure boundary function as part of the GW system containment penetration, are subject to an AMR.

The applicant describes its process for identifying the mechanical components that are within the scope of license renewal in Section 2.1.4, “Scoping Methodology,” of the LRAs. As described in the scoping methodology, the applicant identified portions of the GW system that are within the scope of license renewal on the license renewal drawings that are listed in Section 2.3.3.26 of the Surry LRA. Consistent with the method described in the LRA, Section 2.1.5, “Screening Methodology,” the applicant listed the GW system mechanical component commodity groups that are subject to an AMR in Table 2.3.3-26 of the Surry LRA. This table also lists the intended functions, and the LRA section containing the AMR for each commodity group. Specifically, the applicant identified the following component commodity groups as subject to an AMR: valve bodies, pipe, tubing, instrument valve assemblies, recombiner, and flexible connections. The applicant states that maintaining pressure boundary integrity is the only intended function that is subject to an AMR for these components.

2.3.3.31.2 Staff Evaluation

The staff reviewed the Surry LRA, Section 2.3.3.26, to determine whether there is reasonable assurance that the applicant has appropriately identified the portions of the GW system that are within the scope of license renewal in accordance with 10 CFR 54.4 (a), and that the applicant has appropriately identified the SCs that are subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff reviewed the scoping and screening results provided in Section 2.3.3.26 of the SPS LRA, the applicable license renewal drawings, and the Surry UFSAR to determine if the applicant has adequately identified the portions of the GW system that are in the scope of license renewal. The staff verified that those portions of the GW system that meet the scoping requirements of 10 CFR 54.4(a) were included within the scope of license renewal, and were identified as such by the applicant in Section 2.3.3.26 of the Surry LRA.

In the SPS LRA, Section 2.3.3.26, the applicant listed three license renewal drawings for the GW system. The detailed drawings are highlighted to identify those portions of the system that are within the scope of license renewal. The staff compared the LRA drawings to the system drawings and descriptions in the UFSARs to ensure they were representative of the GW system. The staff sampled portions of the drawings that were not highlighted to verify that these components did not meet any of the intended functions associated with the scoping criteria of 10 CFR 54.4(a). The staff also reviewed the UFSARs to determine if there were any additional system functions that were not identified in the LRA and verified that those additional functions did not meet the scoping requirements of 10 CFR 54.4(a).

In the conference call dated October 3, 2001, the staff asked the applicant to clarify its determination of certain components of the GW system being not in the scope of license renewal. Specifically, as shown in NAS UFSAR Section 3.2.2 and Table 3.2-1, the GW components, such as gas waste decay tanks, waste gas recombiner, compressors, filter, blowers, piping and valves, and supports from stripper to dilution air, and surge drum, are identified as Seismic Category I, and therefore, the staff believes that these components are safety-related in the current design basis. Similarly, SPS UFSAR Table15.2-1 identifies the components such as gas waste decay tanks, waste gas recombiner, compressors, filter, and blowers being Seismic Category I, and therefore, these components are safety-related. However, the staff could not find those GW components being included in the scope of license renewal.

The applicant clarified that those GW components, questioned by the staff, are classified as safety-related in the equipment data system (EDS). However, based on the results of the waste gas decay tank rupture accident analysis, the failure of these portions of the GW systems would result in dose consequences well below the guidelines of 10 CFR, Part 100. Therefore, these portions of the NAS and SPS GW systems have no intended functions [as defined in 10 CFR 54.4(a)(1)(iii)], and were determined to be not within the scope. During the scoping process on the other hand, the SPS GW system was determined to be within the scope of license renewal, because portions of the SPS GW system, including the components associated with the containment hydrogen analyzer system and containment atmosphere sample penetration, are within the scope of license renewal for their function of supporting the containment pressure boundary. The in-scope portion of the SPS GW system is functionally equivalent to the NAS post-accident hydrogen control (HC) system, which is also determined to be within the scope under HC system boundary in the NAS LRA. The staff did not identify any omissions in the scoping of mechanical components according to 10 CFR 54.4(a).

The staff then determined whether the applicant had properly identified the SCs that are subject to an AMR from among those portions of the Surry GW system that were identified as being within the scope of license renewal. The applicant used the screening methodology described in Section 2.1 of the LRAs to identify and list the SCs subject to an AMR. The staff evaluation of the scoping and screening methodology is documented in Section 2.1 of this SER. In the Surry LRA, the applicant listed the mechanical component commodity groups that are subject to an AMR and its intended functions in Table 2.3.3-26 of the Surry LRA. The staff then sampled the SCs that the applicant determined as being within the scope of license renewal but not subject to an AMR to verify that no structure or component, that performs its intended functions without moving parts or without a change in configuration or properties (passive) or that is not subject to replacement based on qualified life or specified time period (long-lived), was excluded from an AMR. The staff did not identify any omissions.

2.3.3.31.3 Conclusions

On the basis of the staff's review of the information contained in Section 2.3.3.26 of the Surry LRA, the supporting information in the license renewal drawings, and the Surry UFSAR, as described above, the staff did not identify any omissions in the scoping and screening results of the GW system by the applicant. Therefore, the staff finds that there is reasonable assurance that the applicant has adequately identified those portions of the GW system that are within the scope of license renewal, and the associated SCs that are subject to an AMR, in accordance with the requirements of 10 CFR 54.4(a) and 54.21(a)(1), respectively.

2.3.3.32 Radwaste

In the NAS LRA Section 2.3.3.27, "Radwaste," the applicant describes the components of the radwaste (RW) system that are within the scope of license renewal and subject to an AMR. The system is further described in Section 11.2 of the NAS UFSAR. Because of the design differences between NAS and SPS, the following staff evaluation only applies to the North Anna LRA.

2.3.3.32.1 Summary of Technical Information in the Application

The RW system processes potentially radioactive radwaste produced by the operation of the plant. The portion of the RW system that provides the pressure boundary for the chemical and volume control (CH) system is subject to an AMR.

The applicant describes its process for identifying the mechanical components that are within the scope of license renewal in Section 2.1.4, "Scoping Methodology," of the LRAs. As described in the scoping methodology, the applicant identified portions of the RW system that are within the scope of license renewal on the license renewal drawings that are listed in Section 2.3.3.27 of the NAS LRA. Consistent with the method described in the LRA, Section 2.1.5, "Screening Methodology," the applicant listed the RW system mechanical component commodity groups that are subject to an AMR in Table 2.3.3-27 of the North Anna LRA. This table also lists the intended functions, and the LRA section containing the AMR for each commodity group. Specifically, the applicant identified the following component commodity groups as subject to an AMR: pipe, and valve bodies. The applicant noted that the valves associated with these components are included in the LW system (Section 2.3.3.29 of this SER). The applicant states that maintaining pressure boundary integrity is the only intended function that is subject to an AMR for these components.

2.3.3.32.2 Staff Evaluation

The staff reviewed the North Anna LRA, Section 2.3.3.27, to determine whether there is reasonable assurance that the applicant has appropriately identified the portions of the RW system that are within the scope of license renewal in accordance with 10 CFR 54.4 (a), and that the applicant has appropriately identified the SCs that are subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff reviewed the scoping and screening results provided in Section 2.3.3.27 of the LRA, the applicable license renewal drawings, and the North Anna UFSAR to determine if the applicant has adequately identified the portions of the RW system that are in the scope of license renewal. The staff verified that those portions of the RW system that meet the scoping requirements of 10 CFR 54.4(a) were included within the scope of license renewal, and were identified as such by the applicant in Section 2.3.3.27 of the North Anna LRA.

In the North Anna LRA, Section 2.3.3.27, the applicant listed six license renewal drawings for the RW system. The detailed drawings are highlighted to identify those portions of the system that are within the scope of license renewal. The staff compared the LRA drawings to the system drawings and descriptions in the UFSARs to ensure that they were representative of the RW system. The staff sampled portions of the drawings that were not highlighted to verify that these components did not meet any of the intended functions associated with the scoping criteria of 10 CFR 54.4(a). The staff also reviewed the UFSARs to determine if there were any additional system functions that were not identified in the LRA and verified that those additional functions did not meet the scoping requirements of 10 CFR 54.4(a). The staff did not identify any omissions in the scoping of the North Anna RW system.

The staff then determined whether the applicant had properly identified the SCs that are subject to an AMR from among those portions of the North Anna RW system that were identified as being within the scope of license renewal. The applicant used the screening methodology described in Section 2.1 of the LRAs to identify and list the SCs subject to an AMR. The staff evaluation of the scoping and screening methodology is documented in Section 2.1 of this SER. In the North Anna LRA, the applicant listed the mechanical component commodity groups that are subject to an AMR and its intended functions in Table 2.3.3-27 of the North Anna LRA. The staff then sampled the SCs that the applicant determined as being within the scope of license renewal but not subject to an AMR to verify that no structure or component, that performs its intended functions without moving parts or without a change in configuration or properties (passive) or that is not subject to replacement based on qualified life or specified time period (long-lived), was excluded from an AMR. The staff did not identify any omissions.

2.3.3.32.3 Conclusions

On the basis of the staff's review of the information contained in Section 2.3.3.27 of the North Anna LRA, the supporting information in the license renewal drawings, and the North Anna UFSAR, as described above, the staff did not identify any omissions in the scoping and screening results of the RW system by the applicant. Therefore, the staff finds that there is reasonable assurance that the applicant has adequately identified those portions of the RW system that are within the scope of license renewal, and the associated SCs that are subject to an AMR, in accordance with the requirements of 10 CFR 54.4(a) and 54.21(a)(1), respectively.

2.3.3.33 Post-Accident Hydrogen Removal

In the NAS LRA Section 2.3.3.28 "Post-Accident Hydrogen Removal," the applicant describes the components of the post-accident hydrogen removal (HC) system that are within the scope of license renewal and subject to an AMR. The system is further described in Section 6.2.5 of the NAS UFSAR. The in-scope portion of the HC system at North Anna is functionally equivalent to the Surry gaseous waste (GW) system which is evaluated in Section 2.3.3.31. Therefore, the following staff evaluation only applies to the North Anna LRA.

2.3.3.33.1 Summary of Technical Information in the Application

The HC system provides the capability to monitor and control the post-accident containment atmosphere hydrogen concentration. The HC system is comprised of hydrogen recombiner units, hydrogen analyzers, and associated components. The portion of the HC system that are associated with containment hydrogen monitoring and control, and that perform a containment pressure boundary function as part of the HC system containment penetration is subject to an AMR.

The applicant describes its process for identifying the mechanical components that are within the scope of license renewal in Section 2.1.4, "Scoping Methodology," of the LRAs. As described in the scoping methodology, the applicant identified portions of the HC system that are within the scope of license renewal on the license renewal drawings that are listed in Section 2.3.3.28 of the NAS LRA. Consistent with the method described in the LRA, Section 2.1.5, “Screening Methodology,” the applicant listed the HC system mechanical component commodity groups that are subject to an AMR in Table 2.3.3-28 of the NAS LRA. This table also lists the intended functions, and the LRA section containing the AMR for each commodity group. Specifically, the applicant identified the following component commodity groups as subject to an AMR: pipe, valve bodies, tubing, instrument valve assemblies, recombiner, flexible connections, expansion joints, fan/blower housings, filters/strainers, flow element, and tanks. The applicant states that maintaining pressure boundary integrity is the only intended function that is subject to an AMR for all the above components except two. The flow element has both the flow restriction and pressure boundary functions. The filters/strainers have the filtration function.

2.3.3.33.2 Staff Evaluation

The staff reviewed the NAS LRA, Section 2.3.3.28, to determine whether there is reasonable assurance that the applicant has appropriately identified the portions of the HC system that are within the scope of license renewal in accordance with 10 CFR 54.4 (a), and that the applicant has appropriately identified the SCs that are subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff reviewed the scoping and screening results provided in Section 2.3.3.28 of the NAS LRA, the applicable license renewal drawings, and the North Anna UFSAR to determine if the applicant has adequately identified the portions of the HC system that are in the scope of license renewal. The staff verified that those portions of the HC system that meet the scoping requirements of 10 CFR 54.4(a) were included within the scope of license renewal, and were identified as such by the applicant in Section 2.3.3.28 of the North Anna LRA.

In the NAS LRA, Section 2.3.3.28, the applicant listed six license renewal drawings for the HC system. The detailed drawings are highlighted to identify those portions of the system that are within the scope of license renewal. The staff compared the LRA drawings to the system drawings and descriptions in the UFSARs to ensure they were representative of the HC system. The staff sampled portions of the drawings that were not highlighted to verify that these components did not meet any of the intended functions associated with the scoping criteria of 10 CFR 54.4(a). The staff also reviewed the UFSARs to determine if there were any additional system functions that were not identified in the LRA and verified that those additional functions did not meet the scoping requirements of 10 CFR 54.4(a). The staff did not identify any omissions in the scoping of mechanical components according to 10 CFR 54.4(a).

The staff then determined whether the applicant had properly identified the SCs that are subject to an AMR from among those portions of the North Anna HC system that were identified as being within the scope of license renewal. The applicant used the screening methodology described in Section 2.1 of the LRAs to identify and list the SCs subject to an AMR. The staff evaluation of the scoping and screening methodology is documented in Section 2.1 of this SER. In the North Anna LRA, the applicant listed the mechanical component commodity groups that are subject to an AMR and its intended functions in Table 2.3.3-28 of the North Anna LRA. The staff then sampled the SCs that the applicant determined as being within the scope of license renewal but not subject to an AMR to verify that no structure or component, that performs its intended functions without moving parts or without a change in configuration or properties (passive) or that is not subject to replacement based on qualified life or specified time period (long-lived), was excluded from an AMR. The staff did not identify any omissions.

2.3.3.33.3 Conclusions

On the basis of the staff's review of the information contained in Section 2.3.3.28 of the North Anna LRA, the supporting information in the license renewal drawings, and the North Anna UFSAR, as described above, the staff did not identify any omissions in the scoping and screening results of the HC system by the applicant. Therefore, the staff finds that there is reasonable assurance that the applicant has adequately identified those portions of the HC system that are within the scope of license renewal, and the associated SCs that are subject to an AMR, in accordance with the requirements of 10 CFR 54.4(a) and 54.21(a)(1), respectively.

2.3.3.34 Radiation Monitoring

In the NAS LRA, Section 2.3.3.29, and SPS LRA, Section 2.3.3.27, "Radiation Monitoring," the applicant describes the components of the radiation monitoring (RM) system that are within the scope of license renewal and subject to an AMR. The system is further described in Section 11.4 of the NAS UFSAR and Section 11.3 of the SPS UFSAR.

2.3.3.34.1 Summary of Technical Information in the Application

The RM system provides indication of radiation conditions in various plant areas and within potentially radioactive plant systems. The portion of the RM system that perform a containment pressure boundary function as part of the RM system containment penetration is subject to an AMR.

The applicant describes its process for identifying the mechanical components that are within the scope of license renewal in Section 2.1.4, "Scoping Methodology," of the LRAs. As described in the scoping methodology, the applicant identified portions of the RM system that are within the scope of license renewal on the license renewal drawings that are listed in Section 2.3.3.29 of NAS LRA and Section 2.3.3.27 of SPS LRA. Consistent with the method described in the LRAs Section 2.1.5, "Screening Methodology," the applicant listed the RM system mechanical component commodity groups that are subject to an AMR in Table 2.3.3-29 of NAS LRA and Table 2.3.3-27 of SPS LRA. These tables also list the intended functions, and the LRA section containing the AMR for each commodity group. Specifically, the applicant identified the following component commodity groups as subject to an AMR: pipe, and valve bodies. The applicant states that maintaining pressure boundary integrity is the only intended function that is subject to an AMR for these components.

2.3.3.34.2 Staff Evaluation

The staff reviewed the NAS LRA Section 2.3.3.29, and the SPS LRA Section 2.3.3.27 to determine whether there is reasonable assurance that the applicant has appropriately identified the portions of the RM system that are within the scope of license renewal in accordance with 10 CFR 54.4(a), and that the applicant has appropriately identified the SCs that are subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff reviewed the scoping and screening results provided in Section 2.3.3.29 of the NAS LRA, Section 2.3.3.27 of the SPS LRA, the applicable license renewal drawings, and the NAS and SPS UFSARs to determine if the applicant has adequately identified the portions of the RM system that are within the scope of license renewal. The staff verified those portions of the RM system that meet the scoping requirements of 10 CFR 54.4(a) were included in the scope of license renewal, and were identified as such by the applicant in Section 2.3.3.29 of the NAS LRA and Section 2.3.3.27 of the SPS LRA.

In the NAS LRA, Section 2.3.3.29, and SPS LRA Section 2.3.3.27, the applicant listed four license renewal drawings for the RM system. The detailed drawings are highlighted to identify those portions of the system that are within the scope of license renewal. The staff compared the LRA drawings to the system drawings and descriptions in the UFSARs to ensure that they were representative of the RM system. The staff sampled portions of the drawings that were not highlighted to verify that these components did not meet any of the intended functions associated with the scoping criteria of 10 CFR 54.4(a). The staff also reviewed the UFSARs to determine if there were any additional system functions that were not identified in the LRA and verified that those additional functions did not meet the scoping requirements of 10 CFR 54.4(a).
Furthermore, the staff reviewed the NAS and SPS systems to verify that the components associated with the radiation monitoring function such as post-accident radiation monitors, containment high-range radiation monitor system, containment gaseous and particulate monitors were properly excluded from the scope of license renewal in accordance with 10 CFR 54.4(a). The applicant determined that with the exception of the containment high range radiation monitors (CHRRMS) at SPS and NAS, the radiation monitoring function do not perform the intended function as specified in 10 CFR 54.4(a). The CHRRMS monitor is in the scope of license renewal, but the monitor has no passive components subject to an AMR. The portion of the RM system that is subject to an AMR consists of the components that perform a containment pressure boundary function as part of the RM system containment penetration. The staff did not identify any omissions by the applicant in scoping of mechanical components according to 10 CFR 54.4(a).

The staff then determined whether the applicant had properly identified the SCs that are subject to an AMR from among those portions of the RM system that were identified as being within the scope of license renewal. The applicant used the screening methodology described in Section 2.1 of the LRAs to identify and list the SCs subject to an AMR. The staff evaluation of the scoping and screening methodology is documented in Section 2.1 of the SER. In both the NAS and SPS LRAs, the applicant identified the portions of the RM system that are within the scope of license renewal in the license renewal drawings, and lists the mechanical component commodity groups that are subject to an AMR and its intended functions in Table 2.3.3-29 of the NAS LRA and Table 2.3.3-27 of the SPS LRA. The staff then sampled the SCs that the applicant determined as being within the scope of license renewal but not subject to an AMR to verify that no structure or component, that performs its intended functions without moving parts or without a change in configuration or properties (passive) or that is not subject to replacement based on qualified life or specified time period (long-lived), was excluded from an AMR. The staff did not identify any omissions.

2.3.3.34.3 Conclusions

On the basis of the staff's review of the information contained in Section 2.3.3.29 of the NAS LRA and Section 2.3.3.27 of the SPS LRA, the supporting information in the license renewal drawings, and the NAS and SPS UFSARs, as described above, the staff did not identify any omissions in the scoping and screening results of the RM system by the applicant. Therefore, the staff finds that there is reasonable assurance that the applicant has adequately identified those portions of the RM systems that are within the scope of license renewal, and the associated SCs that are subject to an AMR, in accordance with the requirements of 10 CFR 54.4(a) and 54.21(a)(1), respectively.

2.3.3.35 Vent - Aerated

In the SPS LRA Section 2.3.3.28 "Vent - Aerated," the applicant describes the components of the vent-aerated (VA) gaseous waste system that are within the scope of license renewal and subject to an AMR. The system is further described in Section 9.7 of the SPS UFSAR. The Surry VA system is equivalent to the function of the North Anna drains-aerated (DA) system which is evaluated in Section 2.3.3.26. The following staff evaluation applies to SPS VA system only.

2.3.3.35.1 Summary of Technical Information in the Application

The Surry VA system collects and processes gases vented from various potentially radioactive systems. The portions of the VA system that perform a containment pressure boundary function as part of the VA system containment penetration is subject to an AMR.

The applicant describes its process for identifying the mechanical components that are within the scope of license renewal in Section 2.1.4, "Scoping Methodology," of the LRAs. As described in the scoping methodology, the applicant identified portions of the VA system that are within the scope of license renewal on the license renewal drawings that are listed in Section 2.3.3.28 of the Surry LRA. Consistent with the method described in the LRA, Section 2.1.5, "Screening Methodology," the applicant listed the VA system mechanical component commodity groups that are subject to an AMR in Table 2.3.3-28 of the Surry LRA. This table also lists the intended functions, and the LRA section containing the AMR for each commodity group. Specifically, the applicant identified the following component commodity groups as subject to an AMR: valve bodies, and pipe. The applicant states that maintaining pressure boundary integrity is the only intended function that is subject to an AMR for these components.

2.3.3.35.2 Staff Evaluation

The staff reviewed Surry LRA, Section 2.3.3.28 to determine whether there is reasonable assurance that the applicant has appropriately identified the portions of the VA system that are within the scope of license renewal in accordance with 10 CFR 54.4(a), and that the applicant has appropriately identified the SCs that are subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff reviewed the scoping and screening results provided in Section 2.3.3.28 of the Surry LRA, the applicable license renewal drawings, and the Surry UFSAR to determine if the applicant has adequately identified the portions of the VA system that are in the scope of license renewal. The staff verified that those portions of the VA system that meet the scoping requirements of 10 CFR 54.4(a) were included within the scope of license renewal, and were identified as such by the applicant in Section 2.3.3.28 of the Surry LRA.

In the Surry LRA, Section 2.3.3.28, the applicant listed three license renewal drawings for the VA system. The detailed drawings are highlighted to identify those portions of the system that are within the scope of license renewal. The staff compared the LRA drawings to the system drawings and descriptions in the UFSARs to ensure that they were representative of the VA system. The staff sampled portions of the drawings that were not highlighted to verify that these components did not meet any of the intended functions associated with the scoping criteria of 10 CFR 54.4(a). The staff also reviewed the UFSAR to determine if there were any additional system functions that were not identified in the LRA and verified that those additional functions did not meet the scoping requirements of 10 CFR 54.4(a). The staff did not identify any omissions in the scoping of the Surry VA system.

The staff then determined whether the applicant had properly identified the SCs that are subject to an AMR from among those portions of the Surry VA system identified as being within the scope of license renewal. The applicant used the screening methodology described in Section 2.1 of the LRAs to identify and list the SCs subject to an AMR. The staff evaluation of the scoping and screening methodology is documented in Section 2.1 of this SER. In the Surry LRA, the applicant identified the portions of the VA system that are within the scope of license renewal in the license renewal drawings and lists the mechanical component commodity groups that are subject to an AMR and its intended functions in Table 2.3.3-28 of the Surry LRA. The staff then sampled the SCs that the applicant determined as being within the scope of license renewal but not subject to an AMR to verify that no structure or component, that performs its intended functions without moving parts or without a change in configuration or properties (passive) or that is not subject to replacement based on qualified life or specified time period (long-lived), was excluded from an AMR. The staff did not identify any omissions.

2.3.3.35.3 Conclusions

On the basis of the staff's review of the information contained in Section 2.3.3.28 of the Surry LRA, the supporting information in the license renewal drawings, and the Surry UFSAR, as described above, the staff did not identify any omissions in the scoping and screening results of the VA system by the applicant. Therefore, the staff finds that there is reasonable assurance that the applicant has adequately identified those portions of the VA system that are within the scope of license renewal, and the associated SCs that are subject to an AMR, in accordance with the requirements of 10 CFR 54.4(a) and 54.21(a)(1), respectively.

2.3.3.36 Vent - Gaseous

In the NAS LRA, Section 2.3.3.30, and SPS LRA, Section 2.3.3.29, "Vent - Gaseous," the applicant describes the components of the vent - gaseous (VG) system that are within the scope of license renewal and subject to an AMR. The system is further described in Section 9.3.3 of the NAS UFSAR and Section 9.7 of the SPS UFSAR.

2.3.3.36.1 Summary of Technical Information in the Application

The VG system collects and processes potentially radioactive gases vented from various plant systems. The portion of the VG system that performs a containment pressure boundary function as part of the VG system containment penetration is subject to an AMR. For Surry specific, its VG system vent isolation valves from the neutron shield tank and cooling (NS) system perform a NS pressure boundary function and are also subject to an AMR.

The applicant describes its process for identifying the mechanical components that are within the scope of license renewal in Section 2.1.4, "Scoping Methodology," of the LRAs. As described in the scoping methodology, the applicant identified portions of the VG system that are within the scope of license renewal on the license renewal drawings that are listed in Section 2.3.3.30 of the NAS LRA and Section 2.3.3.29 of the SPS LRA. Consistent with the method described in the LRA, Section 2.1.5, "Screening Methodology," the applicant listed the VG system mechanical component commodity groups that are subject to an AMR in Table 2.3.3-30 of the NAS LRA and Table 2.3.3-29 of the SPS LRA. These tables also list the intended functions, and the LRA section containing the AMR for each commodity group. Specifically, the applicant identified the following component commodity groups as subject to an AMR: pipe, and valve bodies. The applicant states that maintaining pressure boundary integrity is the only intended function that is subject to an AMR for these components.

2.3.3.36.2 Staff Evaluation

The staff reviewed NAS LRA, Section 2.3.3.30, and SPS LRA, Section 2.3.3.29 to determine whether there is reasonable assurance that the applicant has appropriately identified the VG system that are within the scope of license renewal in accordance with 10 CFR 54.4(a), and that the applicant has appropriately identified the SCs that are subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff reviewed the scoping and screening results provided in Section 2.3.3.30 of the NAS LRA, Section 2.3.3.29 of the SPS LRA, the applicable license renewal drawings, and the North Anna and Surry UFSARs to determine if the applicant has adequately identified the portions of the VG system that are in the scope of license renewal. The staff verified that those portions of the VG system that meet the scoping requirements of 10 CFR 54.4(a) were included within the scope of license renewal, and were identified by the applicant in Section 2.3.3.30 of the NAS LRA and Section 2.3.3.29 of the SPS LRA.

In the North Anna LRA Section 2.3.3.30, and Surry LRA Section 2.3.3.29, the applicant listed eight license renewal drawings for the VG system. The detailed drawings are highlighted to identify those portions of the system that are within the scope of license renewal. The staff compared the LRA drawings to the system drawings and descriptions in the UFSARs to ensure that they were representative of the VG system. The staff sampled portions of the drawings that were not highlighted to verify that these components did not meet any of the intended functions associated with the scoping criteria of 10 CFR 54.4(a). The staff also reviewed the UFSARs to determine if there were any additional system functions that were not identified in the LRA and verified that those additional functions did not meet the scoping requirements of 10 CFR 54.4(a). The staff did not identify any omissions.

The staff then determined whether the applicant had properly identified the SCs that are subject to an AMR from among those portions of the North Anna VG system that were identified as being within the scope of license renewal. The applicant used the screening methodology described in Section 2.1 of the LRAs to identify and list the SCs subject to an AMR. The staff evaluation of the scoping and screening methodology is documented in Section 2.1 of this SER. In both LRAs, the applicant identified the portions of the VG system that are within the scope of license renewal in the license renewal drawings, and lists the mechanical component commodity groups that are subject to an AMR and its intended functions in Table 2.3.3-30 of the NAS LRA and Table 2.3.3-29 of the SPS LRA. The staff then sampled the SCs that the applicant determined as being within the scope of license renewal but not subject to an AMR to verify that no structure or component, that performs its intended functions without moving parts or without a change in configuration or properties (passive) or that is not subject to replacement based on qualified life or specified time period (long-lived), was excluded from an AMR. The staff did not identify any omissions.

2.3.3.36.3 Conclusions

On the basis of the staff's review of the information contained in Section 2.3.3.30 of the NAS LRA and Section 2.3.3.29 of the SPS LRA, the supporting information in the license renewal drawings, and the North Anna and Surry UFSARs, as described above, the staff did not identify any omissions in the scoping and screening results of the VG system by the applicant. Therefore, the staff finds that there is reasonable assurance that the applicant has adequately identified those portions of the VG systems that are within the scope of license renewal, and the associated SCs that are subject to an AMR, in accordance with the requirements of 10 CFR 54.4(a) and 54.21(a)(1), respectively.

2.3.3.37 Fire Protection

In the North Anna LRA, Section 2.3.3.31, and the Surry LRA, Section 2.3.3.30, both entitled "Fire Protection," the applicant describes the SSCs of the fire protection (FP) systems that are within the scope of license renewal and the SCs subject to an AMR. North Anna and Surry both have a variety of FP systems. For both North Anna and Surry, the applicant follows criteria set forth in Appendix A of the Branch Technical Position, APCSB 9.5-1 and Appendix R, Sections III.G, III.J, and III.O, to satisfy the requirements of 10 CFR 50.48. Therefore, these systems are similar for both facilities for the purpose of license renewal with some differences in system design. Any notable differences are specifically identified and discussed in the staff's evaluation. Unless otherwise specified, the information provided below is applicable to both the North Anna and Surry FP systems. These systems are further described throughout the North Anna or Surry UFSAR. As part of its scoping and screening process, the applicant also utilizes Regulated Event Reports as discussed below.

2.3.3.37.1 Summary of Technical Information in the Application

Consistent with 10 CFR 54.4(a)(3), the applicant prepared Fire Protection Regulated Events Reports for North Anna and Surry to identify the FP systems relied on for compliance with 10 CFR 50.48. These reports discuss the history of each facility's fire protection program (FPP) and identify analysis, documents, and correspondence which constitute the CLB. As part of the applicant's scoping and screening process, the applicant has utilized Regulated Event Reports and each facility's UFSAR.

The applicant describes its process for identifying the mechanical components that are within the scope of license renewal and subject to an AMR in Section 2.1.4, "Scoping Methodology," of each LRA. As described in the scoping methodology, the applicant identified the portions of the FP systems that are within the scope of license renewal on the drawings listed in Section 2.3.3.2 of each LRA. Consistent with the method described in the North Anna and Surry, Section 2.1.5, "Screening Methodology," the applicant listed the NAS 1/2 and SPS 1/2 FP systems' mechanical component commodity groups that are within the license renewal evaluation boundaries and are subject to an AMR in Table 2.3.2-2 of each LRA. These tables also list the intended functions and the LRA sections that contain the AMR for each commodity group.

In each LRA, FP system information is located in various sections. The North Anna LRA has the reactor coolant pump (RCP) oil collection system in Section 2.3.1.1, "Reactor Coolant," emergency yard lighting in Section 2.3.3.12, "Security," fire detection and suppression in Section 2.3.3.31, "Fire Protection," and fire barrier requirements in Section 2.4.11, "Miscellaneous Structural Commodities." In Surry LRA, RCP oil collection system is included with fire detection and suppression in Section 2.3.3.30, "Fire Protection," emergency yard lighting is in Section 2.3.3.13, "Security," and fire barrier requirements are in Section 2.4.11, "Miscellaneous Structural Commodities."

Section III.O of Appendix R requires each RCP to be equipped with an oil collection system to prevent an oil fire from spreading to other components within containment. The NAS LRA, Table 2.3.1-1 and drawings 11715-LRM-093E and 12050-LRM-093E, indicate the SCs subject to an AMR. The Surry LRA, Table 2.3.3-30 and drawings 11448-LRB-047F and 11548-LRB-047F, indicate the SCs subject to an AMR. At both facilities, RCP oil collection system drip pans, drip pan enclosures, flame arrestors, flexible connections/hoses, pipe, tanks, and valve bodies are subject to an AMR.

In the North Anna LRA, Section 2.3.3.12, and Surry LRA, Section 2.3.3.13, it is noted that the backup diesel generator, cabling, and yard lighting are required to meet Appendix R emergency lighting requirements. Table 2.3.3-12 in the North Anna LRA and Table 2.3.3-13 in the Surry LRA, list the passive diesel generator components and the yard lighting poles as SCs subject to an AMR.

The North Anna LRA, Section 2.3.3.31, and the Surry LRA, Section 2.3.3.30, contain the fire detection and suppression systems scoping review. Fire detection devices are required in areas that contain safe shutdown equipment and/or safety-related equipment. In each LRA the applicant considers fire detection devices to be active SCs, not subject to an AMR.

Fixed fire suppression can be divided into water-based and gaseous type systems. Water-based systems include sprinkler, deluge, and foam system, along with the water supply, pumps, distribution piping, valves and hose racks for those systems. At North Anna, fire suppression water is obtained from either Lake Anna or the service reservoir, each having at least 300,000 gallons. A diesel and an electric fire pump are installed and each can deliver 3,000 gpm. LRA drawing 11715-LRB-41B indicates that the fire pumps, jockey pump, valves, and piping are subject to an AMR. Table 2.3.3-31 lists piping, pump casings, diesel fire pump radiator, and valve bodies as SCs subject to an AMR.

At Surry, two 300,000 gallon tanks are provided, the top 50,000 gallons for domestic water and the bottom 250,000 gallons reserved for FP. A diesel and an electric fire pump are provided, each capable of delivering 2,500 gpm. Drawing 11448-LRB-47A indicates the water tanks, fire pumps, jockey pump, valves, and piping are subject to an AMR, while the tank fill and domestic water systems are not. Table 2.3.3-30 includes the following SCs subject to an AMR: water tanks, pump casings, diesel fire pump radiator, piping, and valve bodies.

At both North Anna and Surry, 12-inch fire mains and hydrants were installed around the facility and each hydrant is provided with a hose house for fire hose and fire fighting equipment. The fire hose and equipment are routinely inspected and considered consumables not subject to an AMR. The fire main provides water to branch-lines for hose stations and sprinkler, deluge, and foam systems. North Anna drawings 11715-LRB-101A/B/E and Surry drawing 11448-LRB-047B identify branch lines to facilities with FP systems that are in scope of the license renewal. At both North Anna and Surry, the training center, AAC building, fuel oil storage tank, technical support center, security building, and warehouses were excluded from license renewal. At Surry, drawing 11448-LRB-047C identifies additional facilities excluded from license renewal: fuel oil foam house, gravel neck control building, nuclear information center, south annex, fab and paint shops, radwaste facility, and the local emergency ops facility (LEOF). Tables 2.3.3-31 in both LRAs list piping, hydrants, and valve bodies as SCs that are subject to an AMR.

Manual fire hose stations are located in areas containing safety-related equipment. North Anna drawings 11715-LRB-102A/B and 12050-LRB-104A identified the following areas the stations are within the scope of license renewal: fuel building, service water pump house, auxiliary building, service building, turbine building, and containment buildings. Surry drawings 11448-LRB-047B, Sheets 1 thru 3, identified the following areas the stations are within the scope of license renewal: turbine building, service building, auxiliary building, fuel building, cable tunnels, clean change building, condensate polishing building, auxiliary boiler room, machine shops, and containment buildings. The drawings indicate the station piping and valves are subject to an AMR.

The North Anna Regulated Event Report lists CLB sprinkler systems that protect the following: turbine building, turbine oil storage room, N-16 enclosures, auxiliary boiler room, CCW pump area, service building cable vault and tunnel, service building warehouse, AAC building, on-line chemistry monitoring computer room, service water chemistry addition system building, records building, warehouse No. 2, security building, training center, and machine shop. Drawings 11715-LRB-103A/E and 12050-LRB-105A identify the turbine building, turbine oil storage room, and auxiliary boiler room sprinkler systems as being within the scope of license renewal. The drawings show valves and piping are included in the AMR, with the exception of test and drainage piping, alarm components (pressure switch, retard chamber, and associated piping) and the N-16 enclosure sprinkler system, Table 2.3.3-31 identifies the pipe, sprinkler heads, and valve bodies as SCs subject to an AMR.

The Surry Regulated Event Report lists CLB sprinkler systems that protect the following: Turbine building, turbine oil storage room, auxiliary boiler room, service building, service building cable vault and tunnel, condensate polishing, machine shop, laundry, warehouses, construction clean change building, training center, LEOF, on-line chemistry monitoring computer room, and the ACC building. Drawings 11448-LRB-047B, sheets 1 through 5, identify the following sprinkler systems as being within the scope of license renewal: Turbine building, turbine oil storage room, auxiliary boiler room, service building, service building cable vault and tunnel, condensate polishing, machine shop, and laundry. The drawings show valves and piping are subject to an AMR, with the exception of test and drainage system. Table 2.3.3-30 lists pipe, sprinkler heads, and valve bodies as SCs subject to an AMR.

The North Anna Regulated Event Report identified CLB deluge systems that protect the following: bearing cooling towers, turbine-oil reservoir, hydrogen seal-oil unit, oil purifier unit, and main power and station service transformers. Drawings 11715-LRB-103A and 12050-LRB-105A show these deluge systems with the exception of the cooling towers as being within the scope of license renewal. Table 2.3.3-31 lists pipe, sprinkler heads, and valve bodies as SCs subject to an AMR.

The Surry Regulated Event Report identified CLB deluge systems that protect the following: service building cable vault and tunnel, lube oil reservoir coolers, hydrogen seal-oil unit, turbine lube oil conditioners, main power and station service transformers, and auxiliary building charcoal filters. The drawings 11448-LRB-047B, sheets 1, 4, and 5, identify these deluge systems within the scope of license renewal. Table 2.3.3-30 lists pipe, sprinkler heads, and valve bodies as SCs subject to an AMR.

Both UFSARs include a foam system in the CLB to protect the bulk fuel oil storage tank. Neither Regulated Event Reports mentions these systems and the Surry drawing 11448-LRB-047C excludes the system from the scope of license renewal.

The North Anna Regulated Event Report identifies the following as protected by Carbon Dioxide (CO_2) fire suppression systems: primary and service building cable vault and tunnel, normal switchgear rooms, cable tray spreading room, turbine and generator bearing and exciter enclosures, emergency diesel generator rooms, auxiliary building charcoal filters, fuel oil pump rooms, and technical support center (TSC) charcoal filters. The report notes the TSC system is not required for safe shutdown. Drawing 11715-LRB-104A/B/C identifies the systems above except for the service building cable vault and tunnel and TSC charcoal filters as being within the scope of license renewal. Table 2.3.3-31 lists the CO_2 tank cooling coils, compressor casings, nozzle, and piping as the SCs subject to an AMR.

The Surry Regulated Event Report identifies the following are protected by low-pressure CO_2: switchgear rooms, service building and containment cable vaults, cable tray spreading rooms, auxiliary building charcoal filters, turbine and generator bearing enclosures, emergency diesel generator rooms, and motor control center rooms. The drawings 11448-LRB-047E, Sheets 1 through 5, identify the above systems within the scope of license renewal. Table 2.3.3-30 lists the CO_2 cooling coils, compressor casings, nozzle, and piping as SCs subject to an AMR.

The Surry Regulated Event Report does not identify any areas protected by high-pressure CO_2. The Surry UFSAR identified three areas in the CLB protected by high-pressure CO_2: fuel oil pump rooms, emergency service water pump house diesel tank, and the TSC charcoal filters. The UFSAR notes the TSC system is not required for safe shutdown. Drawings 11448-LRB-047G and H identifies the CO_2 systems protecting the fuel oil pump rooms and emergency service water pump house to be within the scope of license renewal. Table 2.3.3-30 lists gas bottles, piping, and nozzles as SCs subject to an AMR.

The North Anna Regulated Event Report identifies the following as protected by halon: emergency switchgear and main control room, security building control room and cable vaults, training center simulator, and the LEOF. Drawings 11715-LRB-104D and 104E identifies the emergency switchgear and the main control room halon systems are within the scope of license renewal. Table 2.3.3-31 lists gas bottles, piping and nozzles as SCs subject to an AMR.

The Surry Regulated Event Report identifies the following as protected by halon: emergency switchgear and relay rooms, training center simulator, LEOF, and the security building control room. Drawing 11448-LRM-27K identifies the emergency switchgear and relay rooms as being within the scope of license renewal. Table 2.3.3-30 lists gas bottles, piping, and nozzles as SCs subject to an AMR.

In each LRA, Section 2.4 indicates the facility fire barriers that are within the scope of license renewal. Table 2.4.11-1 lists penetration seals, fire doors, fire stops, fire wrap, fire wrap bands, fire stop supports, cable tray covers, gypsum boards, radiant energy shields, and seismic-gap covers as SCs subject to an AMR. Table 2.3.3-21 lists fire damper housings as an SC subject to an AMR.

In each LRA Appendix C, Section C2.3, "Identification of Short Lived Components and Consumables," identifies portable fire extinguishers, fire hoses, and air packs for self-contained breathing apparatuses as consumables, not subject to an AMR.

2.3.3.37.2 Staff Evaluation

In accordance with 10 CFR 54.4(a)(3), all SSCs in safety analysis or plant evaluations that demonstrate compliance with the Commission's regulation for FP (10 CFR 50.48) are within the scope of license renewal. The FP license condition defines the CLB as the FPP as described in the applicants UFSAR and various NRC approved SERs. Therefore, the FP systems included in the FPP should be within the scope of license renewal.

The staff reviewed the UFSARs and applicable SERs to determine the FP systems that define the applicant's CLB. A comparison of the FPP with the information provided in each LRA has identified FP systems that were excluded from license renewal. For NAS, the following were excluded: cooling tower deluge system, fuel oil storage tank foam system, service building cable vault and tunnel CO_2 and sprinkler systems, training center and security building halon and sprinkler systems, and sprinkler systems protecting the following: CCW pump area, service building warehouse, on-line chemistry monitoring system computer room, N-16 enclosure, AAC building, service water chemical addition system building, records storage building, and warehouse No. 2. For Surry, the following were excluded: security building halon, training center halon and sprinkler systems, fuel oil storage tank foam system, and the following sprinkler systems for the turbine oil storage room, AAC building, station and chemical warehouses, construction clean change building. The Surry radwaste facility sprinkler system was not included in the UFSAR, but its inclusion is suggested by the guidance in Appendix A of the BTP.

As described in the UFSARs and SERs, the applicant identified the approved FPP as a mix of systems, some required to meet the CLB and others installed for industrial safety purposes. The UFSARs noted this distinction for the TSC charcoal filter CO_2 system, but not the numerous systems that were excluded in each LRA. In a request for additional information, the applicant was asked to justify excluding FP systems needed for the CLB from the scope of license renewal. In a letter to the NRC dated February 5, 2002, the applicant states that after reviewing the appropriate documentation, it decided to clarify the CLB in the UFSAR. On January 22, 2002, the applicant revised the UFSARs to identify those FP systems that are not required for the CLB. The FP license condition for both facilities allows such changes without prior NRC approval only if those changes would not adversely affect the ability to achieve and maintain safe shutdown. The applicant justified removal of FP systems from the CLB because a fire in these locations would not adversely affect safety-related SSCs or safe shutdown.

The applicant identified the following North Anna FP systems not required for the CLB: cooling tower deluge, fuel oil storage tank foam system; training center, security building, LEOF halon and sprinkler systems, and the sprinkler systems protecting the following: nuclear information center, records storage building, service water chemical addition system building, site construction office building, and warehouses. Some FP systems were added to license renewal: service building cable vault and tunnel CO_2 and sprinkler systems, and sprinkler systems protecting the N-16 enclosures, CCW pump area, AAC building, and the on-line chemistry monitoring computer room.

The Surry UFSAR was revised to note the following FP systems are not required for the CLB: fuel oil storage tank foam system, training center halon and sprinkler systems, security building halon, and the sprinkler systems protecting the administration buildings, construction clean change building, fabrication shop, gravel neck combustion turbine facility, LEOF, paint shop, records vault, south annex, station and chemical warehouse, nuclear information center, and warehouses 1, 2, 7, and 8. The following sprinkler systems were added to the scope of the license renewal: turbine oil storage room, AAC building, on-line chemistry monitoring computer room, and radwaste facility.

After determining which FP systems were within the scope of license renewal the staff reviewed each LRA to verify that the applicant determined those SCs that should be subject to an AMR. The applicant has included most components within scope; the low-pressure CO_2 refrigeration components (compressor and associated piping) and the sprinkler system alarm components (retard chamber, orifice, pressures switch, associated piping) were excluded. The staff considered the refrigeration components active, not requiring an AMR. However, the staff requested additional information justifying the exclusion of the alarm components from license renewal. On February 5, 2002, in a letter to the NRC, the applicant added the sprinkler system alarm components to the SCs that are subject to an AMR.

2.3.3.37.3 Conclusions

On the basis of its review of the information contained in the North Anna LRA, Section 2.3.3.31, and the Surry LRA, Section 2.3.3.30, the supporting information in the Regulated Event Reports, the North Anna and Surry UFSARs, and the LRA drawings, as described above, the staff did not identify any additional omissions in the scoping and screening of the SCs of the North Anna and Surry FP systems by the applicant. Therefore, the staff concludes that there is reasonable assurance that the applicant has identified those portions of the North Anna and Surry FP systems that are within the scope of license renewal and the SCs that are subject to an AMR in accordance with 10 CFR 54.4(a) and 10 CFR 54.21(a)(1), respectively.

2.3.3.38 Hydrogen Gas

In the SPS LRA, Section 2.3.3.31 “Hydrogen Gas,” the applicant describes the components of the hydrogen gas (HG) system that are within the scope of license renewal and subject to an AMR. The system is further described in Section 10.3.3.2 of the SPS UFSAR. The HG system is specific to SPS 1/2 and staff’s evaluation only applies to SPS 1/2. The NAS 1/2 does not have HG system.

2.3.3.38.1 Summary of Technical Information in the Application

The HG system provides hydrogen and carbon dioxide gas for main electrical generator service. The portion of the HG system that consists of the isolation valve located at the fire protection (FP) system low-pressure carbon dioxide tank that isolates the flowpath to the main generator is subject to an AMR.

The applicant describes its process for identifying the mechanical components that are within the scope of license renewal in Section 2.1.4, “Scoping Methodology,” of the LRAs. As described in the scoping methodology, the applicant identified portions of the HG system that are within the scope of license renewal on the license renewal drawings that are listed in Section 2.3.3.31 of the Surry LRA. Consistent with the method described in the LRA, Section 2.1.5, “Screening Methodology,” the applicant listed the HG system mechanical component commodity groups that are subject to an AMR in Table 2.3.3-31 of the Surry LRA. This table also lists the intended functions, and the LRA section containing the AMR for each commodity group. Specifically, the applicant identified the following component commodity groups as subject to an AMR: valve bodies, and pipe. The applicant noted that the in-scope piping associated with the component is included in the fire protection (FP) system. The applicant states that maintaining pressure boundary integrity is the only intended function that is subject to an AMR for these components.

2.3.3.38.2 Staff Evaluation

The staff reviewed Section 2.3.3.31 of the SPS LRA to determine whether there is reasonable assurance that the applicant has appropriately identified the portions of HG system that are within the scope of license renewal in accordance with 10 CFR 54.4(a), and that the applicant has appropriately identified SCs that are subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff reviewed the scoping and screening results provided in Section 2.3.3.31 of the SPS LRA, the applicable license renewal drawings, and the SPS UFSAR to determine if the applicant has adequately identified the portions of the HG system that are in the scope of license renewal. The staff verified that those portions of the HG system that meet the scoping requirements of 10 CFR 54.4(a) were included within the scope of license renewal, and were identified as such by the applicant in Section 2.3.3.31 of the Surry LRA.

In the Surry LRA, Section 2.3.3.31, the applicant listed one license renewal drawing for the HG system. The detailed drawing is highlighted to identify those portions of the system that are within the scope of license renewal. The staff compared the LRA drawings to the system drawings and descriptions in the UFSAR to ensure that they were representative of the HG system. The staff sampled portions of the drawings that were not highlighted to verify that these components did not meet any of the intended functions associated with the scoping criteria of 10 CFR 54.4(a). The staff also reviewed the UFSAR to determine if there were any additional system functions that were not identified in the LRA and verified that those additional functions did not meet the scoping requirements of 10 CFR 54.4(a). The staff did not identify any omissions.

The staff then determined whether the applicant had properly identified the SCs that are subject to an AMR from among those portions of the Surry HG system that were identified as being within the scope of license renewal. The applicant used the screening methodology described in Section 2.1 of the LRAs to identify and list the SCs subject to an AMR. The staff evaluation of the scoping and screening methodology is documented in Section 2.1 of this SER. In the Surry LRA, the applicant identified the portions of the HG system that are within the scope of license renewal in the license renewal drawing and lists the mechanical component commodity groups that are subject to an AMR and its intended functions in Table 2.3.3-31 of the Surry LRA. The staff then sampled the SCs that the applicant determined as being within the scope of license renewal but not subject to an AMR to verify that no structure or component, that performs its intended functions without moving parts or without a change in configuration or properties (passive) or that is not subject to replacement based on qualified life or specified time period (long-lived), was excluded from an AMR. The staff did not identify any omissions.

2.3.3.38.3 Conclusions

On the basis of the staff's review of the information contained in Section 2.3.3.31 of the Surry LRA, the supporting information in the license renewal drawings, and the Surry UFSAR, as described above, the staff did not identify any omissions in the scoping and screening results of the HG system by the applicant. Therefore, the staff finds that there is reasonable assurance that the applicant has adequately identified those portions of the HG systems that are within the scope of license renewal, and the associated SCs that are subject to an AMR, in accordance with the requirements of 10 CFR 54.4(a) and 54.21(a)(1), respectively.

2.3.4 Steam and Power Conversion Systems

In both the North Anna and Surry LRAs, Section 2.3.4, "Steam and Power Conversion Systems," the applicant describes the SSCs of the steam and power conversion systems (SPCSs) that are within the scope of license renewal and subject to an AMR. The following staff evaluation applies to the SPCSs of NAS 1/2 and SPS 1/2 for the purpose of license renewal. Any differences in any of the SSCs that make up the SPCSs for each of the four units or unique information that applies to a specific unit or site will be clearly identified as to which unit or site the information applies. Other than what is specifically stated, the following evaluations are applicable to the SPCSs for NAS 1/2 and SPS 1/2.

2.3.4.1 Auxiliary Steam

In the North Anna and Surry LRAs, Section 2.3.4.1, "Auxiliary Steam," the applicant describes the components of the auxiliary steam (AS) system that are within the scope of license renewal and subject to an AMR. The auxiliary steam system is further described in Section 10.4.1 of the North Anna UFSAR and Section 10.3.2 of the Surry UFSAR.

2.3.4.1.1 Summary of Technical Information in the Application

The auxiliary steam (AS) system supplies low-pressure, saturated steam to various plant systems.

The applicant describes its process for identifying the mechanical components that are within the scope of license renewal in Section 2.1.4, “Scoping Methodology,” of each LRA. As described in the scoping methodology, the applicant identified the portions of the AS system that are within the scope of license renewal on the piping and instrument drawings listed in Section 2.3.4.1 of each LRA. Consistent with the methodology described in Section 2.1.5, “Screening Methodology,” of each LRA, the applicant listed the AS system mechanical component commodity groups that are within the license renewal evaluation boundaries and that are subject to an AMR in Table 2.3.4-1 of each LRA.

The portion of the AS system subject to aging management review includes the steam pressure regulating valve and associated bypass and isolation valves that are credited with providing a main steam system pressure boundary intended function in the event of a station blackout event or severe fire (Appendix R) event. Table 2.3.4-1 of the SPS and NAS LRAs lists valve bodies as the only component commodity group subject to an AMR. The piping associated with these components is noted to be included in the main steam (MS) systems. The tables also list the intended functions, and the LRA sections containing the AMR for the valves commodity group. The applicant identified maintaining system pressure boundary integrity as the only intended function of the SCs subject to an AMR for the AS system.

2.3.4.1.2 Staff Evaluation

The staff reviewed each LRA Section 2.3.4.1 to determine whether there is reasonable assurance that the applicant appropriately identified the portions of the AS system that are within the scope of license renewal in accordance with 10 CFR 54.4, and that the applicant appropriately identified the SCs that are subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff reviewed the information presented in Section 2.3.4.1 of the LRA, the applicable piping and instrument drawings, and the North Anna and Surry UFSARs to determine whether the applicant adequately identified the portions of the AS system that are within the scope of license renewal. The staff verified that those portions of the AS system that meet the scoping requirements of 10 CFR 54.4 were included within the scope of license renewal and were identified as such by the applicant in Section 2.3.4.1 of each LRA. To verify that the applicant did include the applicable portions of the AS system within the scope of license renewal, the staff focused its review on those portions of the AS systems that were not identified within the scope of license renewal to verify that they did not meet the scoping criteria of 10 CFR 54.4. In addition, the staff reviewed the UFSARs to identify any additional system intended functions that were not identified in each LRA and verified that these additional intended functions did not meet the scoping requirements of 10 CFR 54.4. The staff did not identify any omissions.

The staff determined whether the applicant had properly identified the SCs that are subject to AMR from among those portions of the AS system that are identified within the scope of license renewal. The applicant identified and lists the SCs subject to AMR for the AS system in Table 2.3.4-1 of the LRA using the screening methodology described in Section 2.1 of each

LRA. The staff evaluated the scoping and screening methodology and documented its findings in Section 2.1 of this SER.

In the NAS LRA, the applicant identified the portions of the AS system that are within the scope of license renewal in the drawings listed below. In addition, the applicant listed the valve mechanical component commodity group that is subject to AMR and its intended function in Table 2.3.4-1 of the LRA:

Unit 1	Unit 2
12050-LRM-072A, Sh. 1	11715-LRM-072A, Sh. 1

In the SPS LRA, the applicant identified the portions of the AS system that are within the scope of license renewal in the drawings listed below. In addition, the applicant listed the valve mechanical component commodity group that is subject to AMR and its intended function in Table 2.3.4-1 of the LRA:

Unit 1	Unit 2
11548-LRM-066A, Sh. 1	11448-LRM-066A, Sh. 1

The piping and instrumentation drawings were highlighted by the applicant to identify those portions of the AS system that meet at least one of the scoping requirements of 10 CFR 54.4. The staff compared the LRA drawings to the descriptions in the UFSARs to ensure they were representative of the AS system. The staff performed its review by sampling the SCs that the applicant identified as being within the scope of license renewal but not subject to AMR to verify that no structure or component that performs its intended function without moving parts or without a change in configuration or properties and that are not subject to replacement on the basis of qualified life or specified time period, was excluded from an AMR.

The staff did not identify any omissions, but asked why the small-bore lines leading to several steam traps were not included in the AS system scope for the pressure boundary intended function. In a telecommunication dated November 21, 2001, the applicant clarified that the intended function of the AS system is to prevent excessive reactor cooldown in the event the main steam trip valves cannot be shut due to an Appendix R fire or SBO event. Only large-bore pipe could provide the capacity to cause excessive cooldown; therefore, smaller lines such as those leading to the steam traps are not in scope for Appendix R or SBO intended functions.

2.3.4.1.3 Conclusions

On the basis of its review of the information contained in Section 2.3.4.1 of each LRA, the supporting information in the UFSARs, and LRA drawings, as described above, the staff did not identify any omissions in the scoping of the AS system by the applicant. The staff concludes that there is reasonable assurance that the applicant has identified those portions of the AS system that are within the scope of license renewal and the SCs that are subject to an AMR in accordance with 10 CFR 54.4(a) and 10 CFR 54.21(a)(1), respectively.

2.3.4.2 Blowdown

In the North Anna and Surry LRAs, Section 2.3.4.2, "Blowdown," the applicant describes the components of the blowdown (BD) system that are within the scope of license renewal and subject to an AMR. The blowdown system is further described in Section 10.4.6 of the North Anna UFSAR and Section 10.3.1 of the Surry UFSAR.

2.3.4.2.1 Summary of Technical Information in the Application

The BD system provides a flowpath for the continuous blowdown flow from the steam generator secondary side to maintain acceptable steam generator water chemistry. The BD system isolates flow for containment isolation, maintains steam generator inventory during transients and in the event of a high-energy line break.

The applicant describes its process for identifying the mechanical components that are within the scope of license renewal in Section 2.1.4, "Scoping Methodology," of each LRA. As described in the scoping methodology, the applicant identified the portions of the BD system that are within the scope of license renewal on the piping and instrument drawings listed in Section 2.3.4.2 of each LRA. Consistent with the methodology described in Section 2.1.5, "Screening Methodology," of each LRA, the applicant listed the BD system mechanical component commodity groups that are within the license renewal evaluation boundaries and that are subject to an AMR in Table 2.3.4-2 of each LRA. The tables also list the intended functions, and the LRA sections containing the AMR for the commodity groups.

The portion of the BD system subject to aging management review consists of the components from the steam generator to the first manual isolation valve downstream of the outboard containment isolation valves. For NAS only, the portion of the BD system that provides the component cooling system pressure boundary at the BD system vent condenser is also subject to aging management review. For SPS only, the portion of the BD system that provides the circulating water system pressure boundary at the connection to the circulating water outlet from the main condenser is also subject to aging management review. In the LRA, Table 2.3.4-2, the applicant listed the following five component commodity groups as subject to an AMR: flow elements, instrument valve assemblies, pipe, tubing, and valve bodies. In addition, the NAS LRA Table 2.3.4-2, also lists steam generator blowdown vent condensers as a component commodity group that is subject to an AMR. The applicant identified maintaining pressure boundary integrity and restricting flow (flow elements only) as intended functions for the SCs that are subject to an AMR for the NAS and SPS BD systems.

2.3.4.2.2 Staff Evaluation

The staff reviewed Section 2.3.4-2 of the NAS and SPS LRAs to determine whether there is reasonable assurance that the applicant appropriately identified the portions of the BD system that are within the scope of license renewal in accordance with 10 CFR 54.4, and that the applicant appropriately identified the SCs that are subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff reviewed the information presented in Section 2.3.4-2 of each LRA, the applicable piping and instrument drawings, and the North Anna and Surry UFSARs to determine whether the applicant adequately identified the portions of the BD system that are within the scope of license renewal. The staff verified that those portions of the BD system that meet the scoping requirements of 10 CFR 54.4 were included within the scope of license renewal and were identified as such by the applicant in Section 2.3.4-2 of each LRA. To verify that the applicant did include the applicable portions of the BD system within the scope of license renewal, the staff focused its review on those portions of the BD systems that were not identified within the scope of license renewal to verify that they did not meet the scoping criteria of 10 CFR 54.4. In addition, the staff reviewed the UFSARs to identify any additional system intended functions that were not identified in each LRA and verified that these additional intended functions did not meet the scoping requirements of 10 CFR 54.4.

In a telecommunication with the applicant dated November 21, 2001, the staff asked whether any of the BD piping, which should be classified as high-energy piping, was considered as class II/I, i.e., although the piping that is not safety-related and has no seismic or tornado design requirements, its failure must not cause a functional loss of any safety-related equipment. The staff asked why this interaction of Class II/I systems was not identified as an intended function of the blowdown system, with parts of the BD system within the scope of license renewal for Class II/I considerations. In its response to RAI 2.1-2, the applicant stated that this issue was being reevaluated generically. The applicant in a letter dated February 1, 2002, responded to RAIs related to the scoping of non-safety-related systems that have a spatial relationship with safety-related systems. The applicant's response to RAI 2.1-1, in that letter, specifically addressed how high-energy lines such as those in the BD system were scoped for license renewal. Table 2.1-3-4 for North Anna, and Table 2.1-3-5 for Surry, include the AMR results for the specific BD system material groups that were determined to be within the expanded scope of license renewal.

The staff did not identify any other omissions during its scoping review of the BD system. The staff determined whether the applicant had properly identified the SCs that are subject to AMR from among those portions of the BD system that are identified within the scope of license renewal. The applicant identified and listed the SCs subject to AMR for the BD system in Table 2.3.4-2 of the LRAs using the screening methodology described in Section 2.1 of each LRA. The staff evaluated the scoping and screening methodology and documented its findings in Section 2.1 of this SER.

In the NAS LRA, the applicant identified the portions of the BD system that are within the scope of license renewal in the drawings listed below. The applicant also listed the mechanical component commodity groups that are subject to AMR and their intended functions in Table 2.3.4-2 of the LRA:

Unit 1	Unit 2
11715-LRM-079A, Sh. 3	12050-LRM-098A, Sh. 2
11715-LRM-098A, Sh. 2	12050-LRM-098A, Sh. 3
11715-LRM-098A, Sh. 3	12050-LRM-098A, Sh. 4
11715-LRM-098A, Sh. 4	12050-LRM-102B, Sh. 1
13075-LRM-102C, Sh. 1	

In the SPS LRA, the applicant identified the portions of the BD system that are within the scope of license renewal in the drawings listed below. The applicant also listed the mechanical component commodity groups that are subject to AMR and their intended functions in Table 2.3.4-2 of the LRA:

Unit 1	Unit 2
11448-LRM-071A, Sh. 2	11548-LRM-071A, Sh. 2
11448-LRM-124A, Sh. 1	11548-LRM-124A, Sh. 1
11448-LRM-124A, Sh. 2	11548-LRM-124A, Sh. 2
11448-LRM-124A, Sh. 3	11548-LRM-124A, Sh. 3
11448-LRM-124A, Sh. 4	11548-LRM-124A, Sh. 4

The piping and instrumentation drawings were highlighted by the applicant to identify those portions of the BD system that meet at least one of the scoping requirements of 10 CFR 54.4. The staff compared the LRA drawings to the descriptions in the UFSARs to ensure they were representative of the BD system. The staff performed its review by sampling the SCs that the applicant identified as being within the scope of license renewal but not subject to AMR, to verify that no structure or component that performs its intended function without moving parts or without a change in configuration or properties and that are not subject to replacement on the basis of qualified life or specified time period, was excluded from an AMR.

2.3.4.2.3 Conclusions

On the basis of its review of the information contained in Section 2.3.4.2 of each LRA, the supporting information in the UFSARs and LRA drawings, and the applicant's responses to RAIs, as described above, the staff did not identify any additional omissions in the scoping of the BD system by the applicant. The staff concludes that there is reasonable assurance that the applicant has identified those portions of the BD system that are within the scope of license renewal and the SCs that are subject to an AMR in accordance with 10 CFR 54.4(a) and 10 CFR 54.21(a)(1), respectively.

2.3.4.3 Condensate

In the North Anna and Surry LRAs, Section 2.3.4.3, "Condensate," the applicant describes the components of the condensate (CN) system that are within the scope of license renewal and subject to an AMR. The condensate system is further described in Section 9.2.4, Section 10.4.3, and Section 10.4.4 of the North Anna UFSAR and in Section 10.3.5 of the Surry UFSAR.

2.3.4.3.1 Summary of Technical Information in the Application

The primary purpose of the condensate (CN) system is to provide chemically treated-water to the suction of the main feedwater pumps at sufficient pressure to support main feedwater pump operation. The CN system also provides the piping, valves, water storage, and makeup supply for auxiliary feedwater. An emergency condensate storage tank is provided for each unit. Each tank supplies water to the three auxiliary feedwater pumps through individual lines.

The applicant describes its process for identifying the mechanical components that are within the scope of license renewal in Section 2.1.4, “Scoping Methodology,” of each LRA. As described in the scoping methodology, the applicant identified the portions of the CN system that are within the scope of license renewal on the piping and instrument drawings listed in Section 2.3.4.3 of each LRA. Consistent with the methodology described in Section 2.1.5, “Screening Methodology,” of each LRA, the applicant listed the CN system mechanical component commodity groups that are within the license renewal evaluation boundaries and that are subject to an AMR in Table 2.3.4-3 of each LRA. The tables also list the intended functions, and the LRA sections containing the AMR for the commodity groups.

The portion of the CN system subject to aging management review includes the emergency condensate storage tanks and the associated components up to the suction of the pumps. For SPS only, a portion of the CN system provides the component cooling system pressure boundary at the makeup connection to the component cooling surge tank. The components that support this intended function are also subject to aging management review. In the LRA, Table 2.3.4-3, the applicant listed the following four component commodity groups as subject to an AMR: instrument valve assemblies, pipe, tanks, and tubing. In addition, the SPS LRA, Table 2.3.4-3, also lists valve bodies as a component commodity group subject to an AMR. The applicant identified maintaining pressure boundary integrity as the only intended function for the SCs that is subject to an AMR for the NAS and SPS CN systems.

2.3.4.3.2 Staff Evaluation

The staff reviewed Section 2.3.4-3 of the NAS and SPS LRAs to determine whether there is reasonable assurance that the applicant appropriately identified the portions of the CN system that are within the scope of license renewal in accordance with 10 CFR 54.4, and that the applicant appropriately identified the SCs that are subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff reviewed the information presented in Section 2.3.4-3 of the LRA, the applicable piping and instrument drawings, and the North Anna and Surry UFSARs to determine whether the applicant adequately identified the portions of the CN system that are within the scope of license renewal. The staff verified that those portions of the CN system that meet the scoping requirements of 10 CFR 54.4 were included within the scope of license renewal and were identified as such by the applicant in Section 2.3.4-3 of each LRA. To verify that the applicant did include the applicable portions of the CN system within the scope of license renewal, the staff focused its review on those portions of the CN systems that were not identified within the scope of license renewal to verify that they did not meet the scoping criteria of 10 CFR 54.4. In addition, the staff reviewed the UFSARs to identify any additional system intended functions that were not identified in each LRA and verified that these additional intended functions did not meet the scoping requirements of 10 CFR 54.4.

As a result of this review, the NRC staff requested additional information in a letter to the applicant dated November 26, 2001. The staff asked why the 6" line up to and including the vacuum breaker on NAS condensate storage tank 1-CN-TK-1 and the similar 4" line to the vacuum breaker on NAS condensate storage tank 2-CN-TK-1 were not identified within license renewal scope due to the potential for failure of these lines and/or the vacuum breaker to cause the failure of the associated tank. In the response, dated February 5, 2002, the applicant stated that both tanks are vented to atmosphere through an open 6"-diameter vent line. Therefore, the vacuum breakers and the associated piping do not perform a license renewal intended function and are not included in scope. In the RAI, the staff also requested the applicant to confirm that there is an open 6" vent line on condensate storage tank 2-CN-TK-1, along with a parallel nitrogen pressurization system and a vacuum breaker, and to describe the intended function for each of the components identified. The applicant's letter dated February 5, 2002, confirmed the vent line (open to atmosphere) in addition to the vacuum breaker and nitrogen line penetrating the top of 2-CN-TK-1, noting an identical configuration exists for 1-CN-TK-1. The 6" diameter vent line prevents adverse pressure conditions within the tank during filling and drawdown. The applicant stated that this line (which is not highlighted for 2-CN-TK-2 on the LRA drawing) is within the scope of license renewal. The applicant stated that the nitrogen line is no longer used and is isolated from the tank by closed manual isolation valves so its failure cannot affect tank function. Therefore, the nitrogen line is not within the scope of license renewal. The license renewal drawings for 1-CN-TK-1 do not depict the 6" vent line. Therefore, the applicant was requested to confirm that the nitrogen line to 1-CN-TK-1 is isolated from the tank similar to 2-CN-TK-2 and that the vent on tank 1-CN-TK-1 is similarly within the scope of license renewal. The applicant provided a draft RAI response via an e-mail on May 10, 2002. The applicant's e-mail response to staff's questions is docketed and available to public. In its response, the applicant stated that NAS condensate storage tanks 1-CN-TK-1 and 2-CN-TK-1 each has a 6"diameter open vent line, a 4" line with a vacuum breaker installed, and a nitrogen line penetrating the top of the tank in an identical configuration. For both tanks, the open vent line is within the scope of license renewal. The nitrogen line on each tank is not used and isolated, and the vacuum breaker for each tank is not required for the tank function, and these components are not within the scope of license renewal. The applicant further stated that the license renewal drawing configuration errors noted by the staff were being corrected. The staff did not identify any other omissions

The staff determined whether the applicant had properly identified the SCs that are subject to AMR from among those portions of the CN system that are identified within the scope of license renewal. The applicant identified and lists the SCs subject to AMR for the CN system in Table 2.3.4-3 of the LRA using the screening methodology described in Section 2.1 of each LRA. The staff evaluated the scoping and screening methodology and documented its findings in Section 2.1 of this SER.

In the NAS LRA, the applicant identified the portions of the CN system that are within the scope of license renewal in the drawings listed below. The applicant also listed the mechanical component commodity groups that are subject to AMR and their intended functions in Table 2.3.4-3 of the LRA:

Unit 1	Unit 2
11715-LRM-074A, Sh. 3	12050-LRM-074A, Sh. 3
11715-LRM-078B, Sh. 1	
11715-LRM-078B, Sh. 3	

In the SPS LRA, the applicant identified the portions of the CN system that are within the scope of license renewal in the drawings listed below. The applicant also listed the mechanical component commodity groups that are subject to AMR and their intended functions in Table 2.3.4-3 of the LRA:

Unit 1	Unit 2
11448-LRM-064B, Sh. 1	11548-LRM-067A, Sh. 2
11448-LRM-067A, Sh. 1	11548-LRM-068A, Sh. 3
11448-LRM-067A, Sh. 2	11548-LRM-068A, Sh. 4
11448-LRM-068A, Sh. 3	11548-LRM-071A, Sh. 2
11448-LRM-068A, Sh. 4	
11448-LRM-071A, Sh. 2	
11448-LRM-072D, Sh. 1	

The piping and instrumentation drawings were highlighted by the applicant to identify those portions of the CN system that meet at least one of the scoping requirements of 10 CFR 54.4. The staff compared the LRA drawings to the descriptions in the UFSARs to ensure they were representative of the CN system. The staff performed its review by sampling the SCs that the applicant identified as being within the scope of license renewal but not subject to AMR, to verify that no structure or component that performs its intended function without moving parts or without a change in configuration or properties and that are not subject to replacement on the basis of qualified life or specified time period, was excluded from an AMR.

The staff did not identify any omissions. However, in a November 21, 2001, telecommunication with the applicant, the staff asked why valve bodies were not listed as a component group on NAS Table 2.3.4-3. The applicant clarified that the valves within the highlighted sections of the LRA drawings for the CN system are designated as feedwater (FW) on the basis of mark number designation and are evaluated accordingly in Section 2.3.4.4 of each LRA. During the same telecommunication, the staff asked whether the diversion of the condenser air ejector discharge on high radioactivity was an intended function. The applicant clarified that the diversion is not credited in the safety analyses nor otherwise safety-related for both NAS and SPS. The staff further asked whether the SPS main condenser served an intended function and whether the shell should be included in Table 2.3.4-3. The applicant clarified that the condenser shell is not in-scope; however, the condenser water boxes are in-scope for pressure boundary of the circulating water system as indicated in Table 2.3.3-5.

2.3.4.3.3 Conclusions

On the basis of its review of the information contained in Section 2.3.4.3 of each LRA, the supporting information in the UFSARs, and LRA drawings, and the applicant's responses to RAIs, as described above, the staff did not identify any omissions in the scoping of the CN system by the applicant. The staff concludes that there is reasonable assurance that the applicant has identified those portions of the CN system that are within the scope of license renewal and the SCs that are subject to an AMR in accordance with 10 CFR 54.4(a), and 10 CFR 54.21(a)(1).

2.3.4.4 Feedwater

In the North Anna and Surry LRAs, Section 2.3.4.4, "Feedwater," the applicant describes the components of the feedwater (FW) system that are within the scope of license renewal and subject to an AMR. The feedwater system is further described in Section 10.4.3 of the North Anna UFSAR and Section 10.3.5 of the Surry UFSAR.

2.3.4.4.1 Summary of Technical Information in the Application

The feedwater (FW) system comprises main feedwater and auxiliary feedwater. Main feedwater provides treated-water to maintain inventory in the steam generators for the production of steam and to provide a heat sink for the reactor coolant system. Main feedwater components provide a flow path for auxiliary feedwater flow to the steam generator and provide isolation of main feedwater flow in response to plant transients. Auxiliary feedwater provides an emergency source of water to the steam generator for reactor heat removal. Auxiliary feedwater provides a heat sink during design basis accidents, including loss of power conditions. The system consists of three auxiliary feedwater pumps and associated components. The source of water is from the emergency condensate storage tank in the condensate system.

The applicant describes its process for identifying the mechanical components that are within the scope of license renewal in Section 2.1.4, "Scoping Methodology," of each LRA. As described in the scoping methodology, the applicant identified the portions of the FW systems that are within the scope of license renewal on the piping and instrument drawings listed in Section 2.3.4.4 of each LRA. Consistent with the methodology described in Section 2.1.5, "Screening Methodology," of each LRA, the applicant listed the FW system mechanical component commodity groups that are within the license renewal evaluation boundaries and that are subject to an AMR in Table 2.3.4-4 of each LRA. The tables also list the intended functions, and the LRA sections containing the AMR for the commodity groups.

The portion of the FW system subject to aging management review includes the components from the high-energy line break analysis boundary outside of the containment downstream to the steam generator feedwater nozzle, and the auxiliary feedwater pumps and discharge line components up to the feedwater piping connection. The auxiliary feedwater pumps lubricating oil and seal cooling components support the function of the pump and are also subject to aging management review. Additionally, backup compressed air components required for the function of selected feedwater isolation valves are subject to an aging management review. In the LRAs, Table 2.3.4-4, the applicant listed the following 11 component commodity groups as subject to an AMR: filters/strainers, flow elements, instrument valve assemblies, pipe, pump casings, pump lube oil coolers, restricting orifices, tanks, tubing, turbine casings, and valve bodies. In Table 2.3.4-4 of the NAS LRA, the applicant listed gas bottles and instrumentation as component commodity groups subject to an AMR for the applicable facility. The applicant identified maintaining pressure boundary integrity, filtration (filters/strainers only), and restricting flow (restricting orifices and flow elements) as intended functions for the SCs that are subject to an AMR for the NAS and SPS FW systems.

2.3.4.4.2 Staff Evaluation

The staff reviewed Section 2.3.4.4 of the NAS and SPS LRAs to determine whether there is reasonable assurance that the applicant appropriately identified the portions of the FW system that are within the scope of license renewal in accordance with 10 CFR 54.4, and that the applicant appropriately identified the SCs that are subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff reviewed the information presented in Section 2.3.4.4 of the LRA, the applicable piping and instrument drawings, and the North Anna and Surry UFSARs to determine whether the applicant adequately identified the portions of the FW system that are within the scope of license renewal. The staff verified that those portions of the FW system that meet the scoping requirements of 10 CFR 54.4 were included within the scope of license renewal and were identified as such by the applicant in Section 2.3.4.4 of each LRA. To verify that the applicant did include the applicable portions of the FW systems within the scope of license renewal, the staff focused its review on those portions of the FW systems that were not identified within the scope of license renewal to verify that they did not meet the scoping criteria of 10 CFR 54.4. In addition, the staff reviewed the UFSARs to identify any additional system intended functions that were not identified in each LRA and verified that these additional intended functions did not meet the scoping requirements of 10 CFR 54.4.

As a result of this review, the NRC staff requested additional information in a letter to the applicant dated November 26, 2001. The applicant responded to the NRC staff's RAIs in a letter to the NRC dated February 5, 2002, as discussed below:

- The NRC staff requested that the applicant explain the exclusion of SPS flow elements 1-FW-FE-1476, -1486, and -1496 and 2-FW-FE-2476, -2486, contained in 14-inch main feedwater lines, from the scope of license renewal. The applicant was requested to address the safety-related sensing intended function (flow restriction for measurement purposes - reactor power measurement; feedwater flow for various actuations) and any other license renewal intended function, and the need to subject the flow elements to an AMR. The applicant responded that the non-safety-related feedwater flow elements are used to develop safety-related flow signals as inputs to the reactor protection system. These components have the intended function to restrict flow, which includes the flow detection intended function. The applicant added these flow elements to the scope of license renewal and performed an aging management review. The aging management review results are consistent with those presented in Table 3.4-4 of the Surry application for the Flow Elements component group. The applicant also stated that the piping adjacent to these flow elements is not required to remain intact to support the intended function of the flow elements since the safety signal is generated on low flow. However, the applicant has modified the scope of license renewal for Surry and North Anna to include non-safety-related SSCs that have a spatial relationship with safety-related SSCs and whose failure could impact the performance of an intended safety function. Therefore, the piping and components adjacent to these flow elements are included in this expanded scope of license renewal.

- The staff also asked why the exhaust lines from the auxiliary feedwater pump turbine casings, which vent to atmosphere, and any bolting attaching these lines are not also within the scope and subject to an AMR in each LRA. The applicant responded that although these non-safety-related exhaust lines do not directly support any safety-related functions, the scope of license renewal for Surry and North Anna was modified to include non-safety-related SSCs that have a spatial relationship with safety-related SSCs, and whose failure could impact the performance of an intended safety function. This modified scope includes the 6-inch turbine exhaust lines attached to the auxiliary turbine feedwater pump turbine casings. The exhaust lines will be managed for loss of material using the Work Control Process aging management activity. In its initial response, dated February 5, 2002, the applicant did not indicate whether or not bolting in these exhaust lines was being within the scope of license renewal. The applicant provided a draft RAI response via e-mail on May 10, 2002. The applicant's e-mail response to staff's questions is docketed. In its response, the applicant stated that the bolting associated with the auxiliary feedwater pump turbine exhaust lines are within the scope of license renewal along with the piping. The applicant also noted that bolting is not uniquely identified as a component when the bolting material is the same as the piping/component material as described in the LRA in Appendix C, Section C2.2. The staff did not identify any additional omissions.

The staff determined that the applicant had properly identified the SCs that are subject to AMR from among those portions of the FW system that are identified within the scope of license renewal. The applicant identified and lists the SCs subject to AMR for the FW system in Table 2.3.4-4 of the LRA using the screening methodology described in Section 2.1 of each LRA. The staff evaluated the scoping and screening methodology and documented its findings in Section 2.1 of this SER.

In the NAS LRA, the applicant identified the portions of the FW system that are within the scope of license renewal in the drawings listed below. The applicant also listed the mechanical component commodity groups that are subject to AMR and their intended functions in Table 2.3.4-4 of the LRA:

Unit 1	Unit 2
11715-LRM-070A, Sh. 3	12050-LRM-070A, Sh. 3
11715-LRM-074A, Sh. 1	12050-LRM-074A, Sh. 1
11715-LRM-074A, Sh. 3	12050-LRM-074A, Sh. 3
11715-LRM-074A, Sh. 4	12050-LRM-074A, Sh. 4
11715-LRM-074B, Sh. 1	12050-LRM-074B, Sh. 1

In the SPS LRA, the applicant identified the portions of the FW system that are within the scope of license renewal in the drawings listed below. The applicant also listed the mechanical component commodity groups that are subject to AMR and their intended functions in Table 2.3.4-4 of the LRA:

Unit 1	Unit 2
11448-LRM-064A, Sh. 4	11548-LRM-064A, Sh. 4
11448-LRM-068A, Sh. 1	11548-LRM-068A, Sh. 1
11448-LRM-068A, Sh. 3	11548-LRM-068A, Sh. 3
11448-LRM-068A, Sh. 4	11548-LRM-068A, Sh. 4

The piping and instrumentation drawings were highlighted by the applicant to identify those portions of the FW system that meet at least one of the scoping requirements of 10 CFR 54.4. The staff compared the LRA drawings to the descriptions in the UFSARs to ensure they were representative of the FW system. The staff performed its review by sampling the SCs that the applicant identified as being within the scope of license renewal but not subject to AMR, to verify that no structure or component that performs its intended function without moving parts or without a change in configuration or properties, and are not subject to replacement on the basis of qualified life or specified time period, was excluded from an AMR.

As a result of this review, the NRC staff requested additional information in a letter to the applicant dated November 26, 2001. The staff asked whether the non-safety-related feedwater flow elements (1-FW-FE-1476, -1486, -1496 and 2-FW- FE-2476, -2486, and –2496) used to develop safety-related flow signals as inputs to the reactor protection system at NAS were in-scope for license renewal for the “restricts flow” intended function and pressure boundary. In a letter to the NRC dated February 5, 2002, the applicant confirmed that Table 2.3.4-4 includes this flow detection intended function for these particular flow elements.

The staff also asked why accumulators were not identified as a commodity group in Table 2.3.4-4 of the NAS LRA. In its response to the RAI, dated February 5, 2002, the applicant confirmed that the subject accumulators are within the scope of license renewal and are identified as “Gas Bottles” in Table 2.3.4-4 of the application. The accumulators were evaluated for the effects of aging in Section 3.3.5, “Air and Gas Systems,” of each LRA.

The staff observed that the SPS LRA identifies cavitating venturis that were installed in the 3-inch auxiliary feedwater lines leading to each steam generator. The staff asked the applicant to clarify the intended function of these components and identify where the AMR was documented in the LRA; and asked that the applicant address fatigue as an applicable aging effect for these cavitating venturis. In its February 5, 2002, response to the RAI, the applicant stated that the cavitating venturis limit auxiliary feedwater flow to a depressurized steam generator in the event of a feedwater or main steam line rupture in order to ensure adequate flow to the intact steam generators and prevent auxiliary feedwater pump runout, with the license renewal intended functions of restricting flow and pressure boundary. Auxiliary feedwater flow through the cavitating venturis normally only occurs during surveillance testing prior to plant startup and during certain plant transients. On the basis of this limited usage, fatigue due to cavitation-induced dynamic loading was considered to be insignificant and not result in aging effects requiring management. Additionally, the applicant stated a review of operating experience has not identified aging effects on these venturis due to fatigue effects. The staff had no further questions regarding AMR for these components.

The staff did not identify any omissions, but did receive a clarification in a telecommunication on November 21, 2001. The staff requested that the applicant address the Surry LRA, Section 2.3.4.4, “Feedwater System,” statement that backup compressed air components are required for the function of selected feedwater isolation valves. Although similar components were depicted on North Anna LRA drawings as within scope, such components do not appear on the FW system drawings contained in the Surry application. The applicant stated that because less detail is presented in the Surry LRA drawings, the components are not shown on the drawings. However, components similar to the NAS components are in scope at SPS. The valves and instrument tubing are shown in the SPS LRA Table 2.3.4-4. The applicant stated that the associated nitrogen bottles are replaced on a set frequency and were deemed short-lived, thus not requiring aging management review.

2.3.4.4.3 Conclusions

On the basis of its review of the information contained in Section 2.3.4.4 of each LRA, the supporting information in the UFSARs, LRA drawings, and the applicant’s responses to RAIs, as described above, the staff did not identify any other omissions in the scoping of the FW system by the applicant. The staff concludes that there is reasonable assurance that the applicant has identified those portions of the FW system that are within the scope of license renewal and the SCs that are subject to an AMR in accordance with 10 CFR 54.4(a), and 10 CFR 54.21(a)(1), respectively.

2.3.4.5 Main Steam

In the North Anna and Surry LRAs, Section 2.3.4.5, "Main Steam," the applicant describes the components of the main steam (MS) systems that are within the scope of license renewal and subject to an AMR. The main steam system is further described in Section 10.3 of the North Anna UFSAR and Section 10.3.1 of the Surry UFSAR.

2.3.4.5.1 Summary of Technical Information in the Application

The main steam (MS) system transports steam produced in the steam generators to the main turbine for the production of electricity. Additionally, the MS system:

- provides motive steam to the turbine-driven auxiliary feed pump
- removes heat from the reactor coolant system via the Code safety valves, steam generator power-operated relief valves, and/or condenser steam dump valves
- isolates steam flow to the main turbine following a reactor trip or during accident conditions to prevent an excessive cooldown that could have an adverse effect on the reactor

The applicant describes its process for identifying the mechanical components that are within the scope of license renewal in Section 2.1.4, "Scoping Methodology," of each LRA. As described in the scoping methodology, the applicant identified the portions of the MS system that are within the scope of license renewal on the piping and instrument drawings listed in Section 2.3.4.5 of each LRA. Consistent with the methodology described in Section 2.1.5, "Screening Methodology," of each LRA, the applicant listed the MS system mechanical component commodity groups that are within the license renewal evaluation boundaries and that are subject to an AMR in Table 2.3.4-5 of each LRA. The tables also list the intended functions, and the LRA sections containing the AMR for the commodity groups.

The portion of the MS system subject to aging management review includes the major flowpaths from the steam generator outlet nozzle to the turbine stop valves and the condenser steam dump valves. The evaluation boundary extends beyond the safety-related boundary of the system on the basis of high-energy line break analysis and the station blackout and Appendix R requirements. In each LRA, Table 2.3.4-5, the applicant listed the following six component commodity groups as subject to an AMR: flow elements, instrument valve assemblies, pipe, steam traps, tubing, and valve bodies. The applicant identified maintaining pressure boundary integrity and restricting flow (flow elements only) as intended functions for the SCs that are subject to an AMR for the NAS and SPS MS systems.

2.3.4.5.2 Staff Evaluation

The staff reviewed Section 2.3.4.5 of the NAS and SPS LRAs to determine whether there is reasonable assurance that the applicant appropriately identified the portions of the MS system that are within the scope of license renewal in accordance with 10 CFR 54.4, and that the applicant appropriately identified the SCs that are subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff reviewed the information presented in Section 2.3.4.5 of the LRA, the applicable piping and instrument drawings, and the North Anna and Surry UFSARs to determine whether the applicant adequately identified the portions of the MS system that are within the scope of license renewal. The staff verified that those portions of the MS systems that meet the scoping requirements of 10 CFR 54.4 were included within the scope of license renewal and were identified as such by the applicant in Section 2.3.4.5 of each LRA. To verify that the applicant did include the applicable portions of the MS system within the scope of license renewal, the staff focused its review on those portions of the MS system that were not identified within the scope of license renewal to verify that they did not meet the scoping criteria of 10 CFR 54.4. In addition, the staff reviewed the UFSARs to identify any additional system intended functions that were not identified in each LRA and verified that these additional intended functions did not meet the scoping requirements of 10 CFR 54.4.

As a result of this review, the NRC staff requested additional information in a letter to the applicant dated November 26, 2001. The applicant responded to the NRC staff's RAIs in a letter to the NRC dated February 5, 2002, as discussed below:

The staff asked the applicant to provide a technical justification as to why the piping from the exhausts of the main steam safety valves and main steam power-operated relief valves to atmosphere was not included within the scope of license renewal. The applicant responded that although these non-safety-related exhaust lines do not directly support any safety-related functions, the scope of license renewal for Surry and North Anna was modified to include non-safety-related SSCs that have a spatial relationship with safety-related SSCs and whose failure could impact the performance of an intended safety function. This modified scope includes the piping from the exhausts of the main steam safety valves and main steam power-operated relief valves. The piping from the exhausts of the main steam safety valves and main steam power-operated relief valves will be managed for loss of material using the Work Control Process aging management activity.

In the NAS LRA, the staff asked why the main steam system (MS) evaluation boundary ended at a manual valve immediately upstream of the pneumatically controlled decay heat release valve. The UFSAR notes that the decay heat release valve is a Seismic Class I, Quality Assurance Category I valve located in the main steam valve house. The applicant responded that these valves are safety-related, consistent with the UFSAR statements, and perform a system pressure boundary function for the main steam system. The valves and upstream piping were added to the scope of license renewal. The applicant additionally stated that, consistent with the treatment of the main steam safety and power-operated relief valves discussed above, they have modified the scope of license renewal for North Anna to include non-safety-related SSCs that have a spatial relationship with safety-related SSCs and whose failure could impact the performance of an intended safety function. This modified scope includes the decay heat release valve outlet piping. The decay heat release valves and associated outlet piping will be managed for loss of material using the Work Control Process aging management activity. The applicant's response fully addressed staff's questions, therefore, the staff found the applicant's response acceptable. The staff did not identify any additional omissions.

The staff determined whether the applicant had properly identified the SCs that are subject to AMR from among those portions of the MS system that are identified within the scope of license renewal. The applicant identified and lists the SCs subject to AMR for the MS system in Table 2.3.4-5 of the LRA using the screening methodology described in Section 2.1 of each LRA. The staff evaluated the scoping and screening methodology and documented its findings in Section 2.1 of this SER.

In the NAS LRA, the applicant identified the portions of the MS system that are within the scope of license renewal in the drawings listed below. The applicant also listed the mechanical component commodity groups that are subject to AMR and their intended functions in Table 2.3.4-5 of the LRA:

Unit 1	Unit 2
11715-LRM-070A, Sh. 1	12050-LRM-070A, Sh. 1
11715-LRM-070A, Sh. 2	12050-LRM-070A, Sh. 2
11715-LRM-070A, Sh. 3	12050-LRM-070A, Sh. 3
11715-LRM-070B, Sh. 1	12050-LRM-070B, Sh. 1
11715-LRM-070B, Sh. 2	12050-LRM-070B, Sh. 2
11715-LRM-070B, Sh. 3	12050-LRM-070B, Sh. 3
11715-LRM-072A, Sh. 1	12050-LRM-072A, Sh. 1

In the SPS LRA, the applicant identified the portions of the MS system that are within the scope of license renewal in the drawings listed below. The applicant also listed the mechanical component commodity groups that are subject to AMR and their intended functions in Table 2.3.4-5 of the LRA:

Unit 1	Unit 2
11448-LRM-064A, Sh. 1	11548-LRM-064A, Sh. 1
11448-LRM-064A, Sh. 2	11548-LRM-064A, Sh. 2
11448-LRM-064A, Sh. 3	11548-LRM-064A, Sh. 3
11448-LRM-064A, Sh. 4	11548-LRM-064A, Sh. 4
11448-LRM-064A, Sh. 5	11548-LRM-064A, Sh. 5
11448-LRM-064A, Sh. 6	11548-LRM-064A, Sh. 6
11448-LRM-066A, Sh. 1	11548-LRM-066A, Sh. 1

The piping and instrumentation drawings were highlighted by the applicant to identify those portions of the MS system that meet at least one of the scoping requirements of 10 CFR 54.4. The staff compared the LRA drawings to the descriptions in the UFSARs to ensure they were representative of the MS system. The staff performed its review by sampling the SCs that the applicant identified as being within the scope of license renewal but not subject to AMR, to verify that no structure or component that performs its intended function without moving parts or without a change in configuration or properties, and that is not subject to replacement on the basis of qualified life or specified time period, was excluded from an AMR.

The staff did not identify any omissions, but received a clarification during a telecommunication on November 21, 2001. The staff asked why the small-bore lines downstream of the main steam trip valves, such as those leading to steam traps, were not included in the MS system scope for the pressure boundary intended function. The applicant clarified that the intended function of the MS system is to prevent excessive reactor cooldown in the event the main steam trip valves cannot be shut due to an Appendix R fire or SBO event. Only large-bore pipe could provide the capacity to cause excessive cooldown as the cooldown analyses for these events was on the basis of a 6-inch opening in the main steam system; therefore smaller lines such as those leading to the steam traps are not in scope for Appendix R or SBO intended functions.

2.3.4.5.3 Conclusions

On the basis of its review of the information contained in Section 2.3.4.5 of each LRA, the supporting information in the UFSARs, the LRA drawings, and the applicant's responses to RAIs, as described above, the staff did not identify any omissions in the scoping of the MS system by the applicant. The staff concludes that there is reasonable assurance that the applicant has identified those portions of the MS system that are within the scope of license renewal and the SCs that are subject to an AMR in accordance with 10 CFR 54.4(a) and 10 CFR 54.21(a)(1), respectively.

2.3.4.6 Steam Drains

In the North Anna LRA, Section 2.3.4.6, "Steam Drains," the applicant describes the components of the steam drain (SD) system that are within the scope of license renewal and subject to an AMR. This system is further described in Section 10.4.6 of the NAS UFSAR. The SPS does not have an SD system but its main steam system has a functionally equivalent steam trap drain piping. Therefore, the following staff evaluation only applies to the NAS LRA.

2.3.4.6.1 Summary of Technical Information in the Application

The steam drains (SD) system provides a flow path for returning condensate drips from various steam sources to the condensate system.

The applicant describes its process for identifying the mechanical components that are within the scope of license renewal in Section 2.1.4, "Scoping Methodology" of the LRA. As described in the scoping methodology, the applicant identified portions of the SD system that are within the scope of license renewal on the piping and instrument drawings listed in Section 2.3.4.6 of the LRA. Consistent with the methodology described in the LRA, Section 2.1.5, "Screening Methodology," the applicant listed SD system mechanical component commodity groupings that are within the license renewal evaluation boundaries and that are subject to an AMR in Table 2.3.4-6 of the LRA. The table also lists the intended functions, and the LRA section containing the AMR for each commodity group.

The portions of the SD system that are subject to aging management review are steam trap drain line piping sections that form the main steam system pressure boundary upstream of the main steam trip valves. In the LRA, Table 2.3.4-6, the applicant listed pipe as the only component commodity group subject to an AMR. The applicant identified maintaining pressure boundary integrity as the only intended function of the SCs subject to an AMR.

2.3.4.6.2 Staff Evaluation

The staff reviewed Section 2.3.4.6 of the NAS LRA to determine whether there is reasonable assurance that the applicant appropriately identified the portions of the SD system that are within the scope of license renewal in accordance with 10 CFR 54.4, and that the applicant appropriately identified the SCs that are subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff reviewed the information presented in Section 2.3.4.6 of the LRA, the applicable piping and instrument drawings, and the North Anna UFSAR to determine whether the applicant adequately identified the portions of the SD system that are within the scope of license renewal. The staff verified that those portions of the SD system that meet the scoping requirements of 10 CFR 54.4 were included within the scope of license renewal and were identified as such by the applicant in Section 2.3.4.6 of the NAS LRA. To verify that the applicant did include the applicable portions of the SD system within the scope of license renewal, the staff focused its review on those portions of the SD system that were not identified within the scope of license renewal to verify that they did not meet the scoping criteria of 10 CFR 54.4. In addition, the staff reviewed the NAS UFSAR to identify any additional system intended functions that were not identified in the LRA, and verified that these additional intended functions did not meet the scoping requirements of 10 CFR 54.4. The staff did not identify any omissions.

The staff determined whether the applicant had properly identified the SCs that are subject to AMR from among those portions of the SD system that are identified within the scope of license renewal. The applicant identified and lists the SCs subject to AMR for the SD system in Table 2.3.4-6 of the LRA using the screening methodology described in Section 2.1 of each LRA. The staff evaluated the scoping and screening methodology and documented its findings in Section 2.1 of this SER.

In the NAS LRA, the applicant identified the portions of the SD system that are within the scope of license renewal in the drawings listed below. In addition, the applicant listed pipe as the mechanical component commodity group that is subject to AMR and its intended function in Table 2.3.4-6 of the LRA:

Unit 1	Unit 2
11715-LRM-070A, Sh. 3	12050-LRM-070A, Sh. 3
11715-LRM-070B, Sh. 1	12050-LRM-070B, Sh. 1
11715-LRM-070B, Sh. 2	12050-LRM-070B, Sh. 2
11715-LRM-070B, Sh. 3	12050-LRM-070B, Sh. 3

The piping and instrumentation drawings were highlighted by the applicant to identify those portions of the SD system that meet at least one of the scoping requirements of 10 CFR 54.4. The staff compared the LRA drawings to the descriptions in the UFSAR to ensure they were representative of the SD system. The staff performed its review by sampling the SCs that the applicant identified as being within the scope of license renewal but not subject to AMR to verify that no structure or component that performs its intended function without moving parts or without a change in configuration or properties and that are not subject to replacement on the basis of qualified life or specified time period, was excluded from an AMR.

The staff did not identify any omissions, but received several clarifications during a telecommunication on November 21, 2001. The staff asked the applicant why it had only included a single isolation valve for the main steam pressure boundary. The applicant clarified that the SD system valves were normally closed, and that this meets the boundary convention of extending to the first normally closed manual valve, check valve, or automatic valve that gets a signal to go closed. Because piping was the only commodity group listed in Table 2.3.4.6-1, the staff also received confirmation from the applicant that the valves depicted as within scope on the SD drawings, which all had MS designations, are included within the component group “valves” for the MS system Table 2.3.4-5.

2.3.4.6.3 Conclusions

On the basis of its review of the information contained in Section 2.3.4.6 of the NAS LRA, the supporting information in the UFSAR, and LRA drawings, the staff did not identify any omissions in the scoping of the steam drain system by the applicant. The staff concludes that there is reasonable assurance that the applicant has identified those portions of the SD system that are within the scope of license renewal and the SCs that are subject to an AMR in accordance with 10 CFR 54.4(a) and 10 CFR 54.21(a)(1), respectively.

2.3.4.7 Steam Generator Water Treatment/Steam Generator Recirculation and Transfer

In the North Anna LRA, Section 2.3.4.7, “Steam Generator Water Treatment System,” the applicant describes the components of the steam generator water treatment (WT) system that are within the scope of license renewal and subject to an AMR. This system is further described in Section 10.4.3 of the North Anna UFSAR. The functionally equivalent system at Surry is described in Section 2.3.4.6 of the SPS LRA, “Steam Generator Recirculation and Transfer.” The steam generator recirculation and transfer (RT) system is further described in the SPS UFSAR, Section 10.3.1. Both the WT and RT systems are evaluated in this section of the SER.

2.3.4.7.1 Summary of Technical Information in the Application

The WT and RT systems provide a means of recirculating water in the steam generator during periods of wet layup to help maintain steam generator water chemistry within limits and to provide the capability for water transfer from the steam generators.

The applicant describes its process for identifying the mechanical components that are within the scope of license renewal in Section 2.1.4, “Scoping Methodology,” of each LRA. As described in the scoping methodology, the applicant identified portions of the WT and RT systems that are within the scope of license renewal on the piping and instrumentation drawings listed in Section 2.3.4.7 and Section 2.3.3.6 of the respective LRA. Consistent with the methodology described in Section 2.1.5, “Screening Methodology,” of each LRA, the applicant listed the WT and RT systems mechanical component commodity groupings that are within the license renewal evaluation boundaries and that are subject to an AMR in Tables 2.3.4-7, “Steam Generator Water Treatment” and 2.3.4-6, “Steam Generator Recirculation and Transfer,” respectively. The portions of the WT and RT systems that are subject to aging management review provide the steam generator pressure boundary and the containment pressure boundary. In the SPS LRA, Table 2.3.4-6, the applicant listed the following two component commodity groups as subject to an AMR: pipe and valve bodies. In the NAS LRA,

Table 2.3.4-7, the applicant listed bolting in addition to the pipe and valve component commodity groups subject to an AMR at SPS. The applicant identified maintaining system pressure boundary integrity as the only intended function of the SCs subject to an AMR for the WT and RT systems.

2.3.4.7.2 Staff Evaluation

The staff reviewed the NAS LRA, Section 2.3.4.7, and the SPS LRA, Section 2.3.4.6, to determine whether there is reasonable assurance that the applicant appropriately identified the portions of the WT and RT systems that are within the scope of license renewal in accordance with 10 CFR 54.4 and that the applicant appropriately identified the SCs that are subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff reviewed the information presented by the applicant in each LRA, the applicable piping and instrumentation drawings, and the North Anna and Surry UFSARs to determine whether the applicant adequately identified the SSCs of the WT and RT systems that are within the scope of license renewal. The staff verified that those portions of the WT and RT systems that meet the scoping requirements of 10 CFR 54.4 were included within the scope of license renewal and were identified as such by the applicant in Sections 2.3.4.7 and 2.3.4.6 of each LRA, respectively. To verify that the applicant did include the applicable portions of the SSs within the scope of license renewal, the staff focused its review on those portions of the WT and RT systems that were not identified within the scope of license renewal to verify that they do not meet the scoping requirements of 10 CFR 54.4. The staff also reviewed the UFSARs to determine whether there were any additional system intended functions that were not identified in the LRA, and verified that those additional intended functions did not meet the scoping requirements of 10 CFR 54.4. The staff did not identify any omissions.

The staff determined whether the applicant had properly identified the SCs that are subject to AMR from among those portions of the WT and RT systems that are identified as being within the scope of license renewal. The applicant identified and lists the SCs subject to AMR for the WT and RT systems in Tables 2.3.4-7 and 2.3.4-6 (respectively) of the LRA using the screening methodology described in each LRA, Section 2.1. The staff evaluated the scoping and screening methodology and documented its findings in Section 2.1 of this SER.

In the NAS LRA, the applicant identified the portions of the WT system that are within the scope of license renewal in the drawings listed below. The applicant also listed the mechanical component commodity groups that are subject to AMR and their intended functions in Table 2.3.4-7 of the NAS LRA:

Unit 1	Unit 2
11715-LRM-074A, Sh. 1	12050-LRM-074A, Sh. 1
11715-LRM-102A, Sh. 2	12050-LRM-102A, Sh. 2
13075-LRM-102C, Sh. 1	12050-LRM-102B, Sh. 1

In the SPS LRA, the applicant identified the portions of the RT system that are within the scope of license renewal in the drawings listed below. The applicant also listed the mechanical component commodity groups that are subject to AMR and their intended functions in Table 2.3.4-6 of the SPS LRA:

Unit 1	Unit 2
11448-LRM-124A, Sh. 1	11548-LRM-124A, Sh. 1
11448-LRM-124A, Sh. 2	11548-LRM-124A, Sh. 2
11448-LRM-124A, Sh. 3	11548-LRM-124A, Sh. 3

The piping and instrumentation drawings were highlighted by the applicant to identify those portions of the WT and RT systems that meet at least one of the scoping requirements of 10 CFR 54.4. The staff compared the LRA drawings to the descriptions in the UFSARs to ensure they were representative of the WT and RT systems. The staff performed its review by sampling the SCs that the applicant identified as being within the scope of license renewal but not subject to AMR to verify that no structure or component, that performs its intended function without moving parts or without a change in configuration or properties and that are not subject to replacement on the basis of qualified life or specified time period, was excluded from an AMR.

The staff did not identify any omissions, but did receive a clarification in a November 21, 2001, telecommunication. The staff asked the applicant why it had only included a single isolation valve for the pressure boundary for the WT system. The applicant clarified that the WT system valves were normally closed, and that this meets the boundary convention of extending to the first normally closed manual valve, check valve, or automatic valve that gets a signal to go closed.

2.3.4.7.3 Conclusions

On the basis of its review of the information contained in Section 2.3.4.7 of the NAS LRA and Section 2.3.4.6 of the SPS LRA, the supporting information in the UFSARs, and LRA drawings, as described above, the staff did not identify any omissions in the scoping of the WT and RT systems by the applicant. The staff concludes that there is reasonable assurance that the applicant has identified those portions of the WT and RT systems that are within the scope of license renewal and the SCs that are subject to an AMR in accordance with 10 CFR 54.4(a) and 10 CFR 54.21(a)(1), respectively.

2.3.5 Expanded SSCs For Criterion 2 Scoping

Section 54.4(a)(2) of 10 CFR requires that all non-safety-related systems and structures whose failure could prevent satisfactory accomplishment of any of the safety-related functions identified in 10 CFR 54.4(a)(1) be included within the scope of license renewal.

2.3.5.1 Technical Information in the Application

In Sections 2.1.2.2 and 2.1.3.6 of each LRA, the applicant described its scoping and screening methodology for identifying SSCs that are within the scope of license renewal in accordance with the requirements of 10 CFR 54.4(a)(2). In Sections 2.3 and 2.4 of each LRA, the applicant provided its scoping and screening results and identified in-scope systems, components, and structures in LRA drawings.

Section 2.1.3.6 of each LRA indicates that flooding, high-energy-line-break outside containment, and seismic supports are considered for Criterion 2 scoping of non-safety-related mechanical components. Based on its review of the information provided in Sections 2.1.2.2 and 2.1.3.6 of each LRA, the staff requested additional information in RAIs 2.1-1 through 2.1-4, dated October 22, 2001. In these RAIs, the staff identified the areas of inadequacy in each LRA relating to the requirements of 10 CFR 54.4(a)(2). Specifically, the staff stated that the applicant should consider two configurations of non-safety-related piping systems that could potentially meet the section 54.4(a)(2) criterion based on industry operating experience involving age-related pipe failures. The first configuration includes non-safety-related piping systems (including piping segments and supports) that are connected to safety-related piping. The staff stated that these non-safety-related piping systems should be included within the scope of license renewal up to and including the first seismic support past the safety-related/non-safety-related interface. The second configuration involves non-safety-related piping systems, that are not connected to safety-related piping but are located such that their failure could adversely impact the performance of an intended safety function. The above staff position as described in the RAIs is consistent with the Interim Staff Guidance, dated December 3, 2001, and March 15, 2002, regarding 10 CFR 54.4(a)(2) and the Seismic II/I issue.

By letter dated February 1, 2002, the applicant responded to the staff's RAIs. In its response to RAI 2.1-2, the applicant stated that non-safety-related piping that is attached to safety-related piping and that is seismically designed and supported up to the first equivalent anchor point beyond the safety-related/non-safety-related boundary is included within the scope of license renewal. Although these non-safety-related piping segments were not identified or highlighted on each LRA drawing, the applicant expanded the scoping and screening results in the RAI response such that applicable aging effects on these piping segments are managed along with the adjoining safety-related piping. The supports for the non-safety-related piping segments are also included within the scope of license renewal, as stated in Section 2.1.3.6 of each LRA.

In response to RAIs 2.1-3 and 2.1-4, the applicant stated that the methodology in each LRA for scoping of systems, structures, and components did not include any non-safety-related mechanical components for the second configuration described above. Furthermore, in response to the staff's RAIs, the applicant stated that the scope of license renewal for Surry and North Anna was modified to include these non-safety-related piping systems with the second configuration. In addition, the applicant indicated that the details of this scoping process and results are described in its technical report, LR-1921/LR-2921, "Aging Management of Criterion 2 (Non-safety-related/Safety-related) Component Groups not Addressed in AMR Reports." The expanded piping-systems considered for inclusion within the scope of license renewal in this report are piping, valves, tanks, pumps, and other mechanical system equipment.

2.3.5.2 Staff Evaluation

The staff's evaluation of the scoping methodology is in Section 2.1.3.1 of this SER. The evaluation of the associated SSCs initially identified in each LRA is in Sections 2.3 and 2.4 of this SER, not including the expanded SSCs identified in the RAI responses dated February 1,

2002. The staff's evaluation of the non-safety-related piping systems with the first configuration is in Section 2.1.3.1 of this SER. The staff concluded that the applicant's response to RAI 2.1-2 as described above is acceptable based on the staff's confirmation that these non-safety-related piping segments and supports were included in the scope.

The following staff evaluation focuses on the non-safety-related piping systems with the second configuration, which are located close to safety-related components such that their failure could adversely impact the performance of an intended safety function. Specifically, the staff reviewed the applicant's scoping method and results for identifying the expanded piping systems as described in the applicant's technical report, LR-1921/LR-2921.

The scoping method described in LR-1921/LR-2921 involves several steps to identify the non-safety-related piping systems with the second configuration. In the first step, the applicant identified the following structures that contain both safety-related and non-safety-related SSCs (listed in Attachment 1 to LR-1921/LR-2921):

North Anna

auxiliary building
auxiliary feedwater pump house
casing cooling pump house
containment
fuel building
fuel oil pump house
intake structure
main steam valve house
quench spray pump house
service building
safeguards building
service water pump house
service water valve house
turbine building

Surry

auxiliary building
containment
containment spray pump building
fuel building
fuel oil pump house
high level intake structure
low level intake structure
main steam valve house
service building
safeguards building
turbine building

Section 2.1.3.6 of the LRAs (Criterion 2 scoping) states that the structural components such as component supports, building subcompartment block walls, supports and structural members for load handling cranes and devices, certain load handling cranes and devices important to plant operations have been included within the scope of license renewal for the structures housing the expanded systems.

In the second step, the applicant reviewed the equipment database to identify the mechanical systems containing non-safety-related components within these structures. The systems are listed in Attachments 2 and 3 to LR-1921/LR-2921. Attachment 2 lists the following systems, which are included in Section 2.3 of each LRA. These systems have expanded license renewal boundaries as a result of the expanded scoping to consider effects identified in RAI 2.1-3.

North Anna

- auxiliary steam (AS)
- boron recovery (BR)
- component cooling (CC)
- chilled water (CD)
- chemical and volume control (CH)
- condensate (CN)
- containment vacuum (CV)
- circulating water (CW)
- drains aerated (DA)
- drains - building services (DB)
- drains gaseous (DG)
- fuel pit cooling (FC)
- feedwater (FW)
- high radiation sampling (HRS)
- liquid waste (LW)
- main steam (MS)
- primary grade water (PG)
- quench spray (QS)
- reactor coolant (RC)
- residual heat removal (RH)
- radwaste (RW)
- steam drains (SD)
- safety injection (SI)
- sampling (SS)
- secondary vents (SV)
- service water (SW)
- vents gaseous (VG)
- vacuum priming (VP)
- water treatment (WT)

Surry

- auxiliary steam (AS)
- bearing cooling (BC)
- boron recovery (BR)
- component cooling (CC)
- chemical and volume control (CH)
- condensate (CN)
- containment spray (CS)

containment vacuum (CV)
circulating water (CW)
drains aerated (DA)
drains gaseous (DG)
fuel pit cooling (FC)
feedwater (FW)
gaseous waste (GW)
heating (HS)
main steam (MS)
primary grade water (PG)
plumbing (PL)
reactor coolant (RC)
residual heat removal (RH)
recirculation and transfer (RT)
steam drains (SD)
safety injection (SI)
sampling (SS)
secondary vents (SV)
service water (SW)
vents aerated (VA)
vents gaseous(VG)
vacuum priming (VP)
ventilation (VS)

Attachment 3 to LR-1921/LR-2921 lists the following added systems, which are not included in Section 2.3 of each LRA. These systems are included within the scope only because of the effects identified in RAI 2.1-3.

North Anna

Bearing cooling
decontamination
extraction steam
gaseous waste

Surry

chilled water
decontamination
extraction steam
liquid waste
water treatment

The staff reviewed the systems and structures listed above and did not identify any omissions.

In the third step, the applicant excluded the non-fluid-containing component groups. In Section 2.1.3.1 of this SER, the staff reviewed and found the applicant's exclusion of non-fluid-containing components acceptable, based on the applicant's review of the industry operating experience and plant-specific operating experience.

Finally, the applicant evaluated the fluid-containing components of the above-listed systems, and identified each component group that may be excluded from the effects identified in RAI 2.1-3. Assuming a failure of the component group, the applicant examined whether the failure could impact the performance of an intended safety function of any in-scope safety-related SSCs. If not, the component group was excluded. The applicant listed the excluded component groups in Attachments 4 and 5 to LR-1921/LR-2921. The failure modes considered in this exclusion evaluation were pipe whip and jet impingement fluid spray, and physical contact for the component groups of all systems in the structures, listed above.

The staff reviewed the list of excluded component groups along with the justifications for exclusion in Attachments 4 and 5 to LR-1921/LR-2921. The applicant indicated that the non-safety-related component groups that were not near safety-related components were excluded from the scope of license renewal. The staff requested the applicant to clarify the criteria used for this determination. In a letter dated May 22, 2002, the applicant provided clarification for each component group that was excluded.

The following component groups were excluded because they are in cubicles isolated from any safety-related components:

- tanks and pumps in the LW and DC systems
- tanks, heat exchangers, and pumps in the PG system
- filters in the BR, SS, and HRS systems
- pumps and filters in the FC system
- tanks, filters, and concrete-encased piping in the PL and DB systems
- tanks and filters in the GW system

The following two component groups were excluded because they are located in an area remote from any safety-related components:

- tanks, filters, and pumps in the WT system
- tanks, piping, valves, and filters in the FW oil system

In addition, the pumps in the RT system were excluded because these pumps are located in the auxiliary building basement and are secured and isolated when the temperature of the reactor coolant system is higher than 200 °F.

The staff reviewed the above justifications and found them acceptable because the excluded component groups are not located near safety-related components, and their failure cannot impact the performance of an intended safety function.

For the fluid-containing components, following the scoping method described above, the applicant identified mechanical components of the systems that are listed in Attachments 2 and 3 to technical report LR-1921/LR-2921 and that reside in the structures listed in Attachment 1 of the report, except the component groups excluded in Attachments 4 and 5 of the report. The in-scope mechanical components that are passive were screened for an AMR in accordance with 10 CFR 54.21(a)(1).

The results of this expanded scoping were also reviewed by the NRC regional inspection team during an inspection on February 4-8, 2002. The inspection team determined that the applicant's scoping and screening activities were performed in accordance with the prescribed methodology and were adequate. In an inspection report dated March 25, 2002, the inspection team confirmed that additional portions of the system not originally included in scope were to be added as a result of RAI 2.1-3.

In a request supplemental to RAI 2.1-3, the staff asked the applicant how the applicant will modify LRA information to include the additional systems and components identified in Technical Report LR-1921/LR-2921 but not included in LRA boundary drawings. Furthermore, the staff noted that technical report LR-1921/LR-2921 is used as the supplement to each LRA in defining additional components subject to an AMR and should have the same level of document control and record keeping as each LRA and the associated boundary drawings. In its response, dated May 22, 2002, the applicant stated that it would make a note on drawings to indicate that non-safety-related in-scope components due to location near safety-related SSCs are not highlighted and to direct users to the report, LR-1921/LR-2921, for additional guidance.

The staff reviewed the applicant's responses to the RAIs, the scoping method described in technical report LR-1921/LR-2921, the list of systems and structures, the justifications for exclusion, and the findings of the NRC inspection team. Based on the above, the staff finds the expanded scoping and additional SSCs identified in technical report LR-1921/LR-2921 to be acceptable because the applicant has included all the non-safety-related SSCs with the configurations that meet the 10 CFR 54.4(a)(2) scoping criterion as discussed in the staff's RAIs. The expanded scoping is consistent with the staff position stated in the RAIs and the Interim Staff Guidance, dated December 3, 2001, and March 15, 2002, regarding section 54.4(a)(2) and the Seismic II/I issue.

2.3.5.3 Conclusion

On the basis of its review of the information contained in technical report LR-1921/LR-2921 and its attachments, the RAI responses, and the inspection, the staff did not identify any omissions in the scoping and screening of SSCs under section 54.4(a)(2). Therefore, the staff concludes that there is a reasonable assurance that the applicant has identified those portions of the NAS and SPS 54.4(a)(2) SSCs that are within the scope of license renewal and the SCs that are subject to an AMR in accordance with 10 CFR 54.4(a)(2) and 10 CFR 54.21(a)(1), respectively.

2.4 Scoping and Screening Results: Structures

2.4.1 Containment

In the North Anna and Surry LRAs, Section 2.4.1, "Containment," the applicant describes the containment structures for all four units of both plants, and identifies the structural components that are within the scope of license renewal and subject to an AMR. The design of the SPS 1/2 containments structure is described in SPS Updated Final Safety Analysis Report (UFSAR), Sections 5.2 and 15.5. The design of the NAS 1/2 containment structures is described in NAS UFSAR Sections 3.7 and 3.8.2. Additional information for the NAS 1/2 containments is provided in NAS UFSAR, Sections 3.1.12 and 6.2, Table 6.2-37, and drawings 11715-FM-1A through 1G. The staff reviewed this information to determine whether the applicant has adequately demonstrated that the requirements of 10 CFR 54.4 and 54.21 were met for the containment structures and their structural components. The containment structures of the two nuclear power stations are similar in design, and therefore, the staff's safety evaluation (SE) is applicable to both plants unless specified otherwise.

2.4.1.1 Summary of Technical Information in the Application

In each LRA, Section 2.4.1, "Containment," the applicant states that the containment is a seismic Class I structure that houses the reactor and other nuclear steam supply system (NSSS) components for the respective plant. Seismic Class I structures are designed to prevent the uncontrolled release of radioactive material as a result of a specified seismic event, and to withstand all applicable loads without loss of function. The applicant has determined that seismic Class I structures meet the intent of 10 CFR 54.4(a)(1) and are within the scope of license renewal.

The containment structure for each plant consists of a reinforced-concrete cylindrical wall, a hemispherical dome roof, and a 10-foot-thick reinforced-concrete mat foundation. For the NAS 1/2 containments, the mat foundation is supported on fresh, crystalline, metamorphic rock. For the SPS 1/2 containments, the mat foundation is supported on highly consolidated Miocene clay. There is a waterproof membrane under the foundation mat of each containment that extends up to the containment below-ground wall. The internal surfaces of the cylindrical wall and dome roof are lined with a carbon steel liner of varying thickness to maintain a high degree of leak tightness. The liner at the bottom of the containment is covered with a thick reinforced-concrete slab. The containment is divided by the crane wall into an outer annulus section and a central section that supports the polar crane. The central section is subdivided into equipment cubicles. A seismic Class I drainage sump with a stainless steel liner is provided in the containment basement.

The boundary of the containment structure includes all the penetration assemblies that penetrate the containment wall, such as mechanical penetrations, electrical penetrations, and the equipment and personnel hatches. These penetrations are welded to the containment liner to maintain an essentially leak-tight-barrier that prevents uncontrolled release of radioactivity. The equipment hatch is bolted in place to the interior of the containment wall. A two-door emergency escape air lock is provided through the equipment hatch for emergency access to the containment. The personnel hatch has an inner and an outer door. The doors are maintained in a closed position by interlocking tooth closure mechanisms. A fuel transfer tube penetrates the containment to link the refueling canal in the containment and the spent fuel pool in the fuel building. The fuel transfer tube also forms part of the containment pressure boundary.

The applicant has determined that all the structural components and commodities of the containment structure meet the intent of 10 CFR 54.4(a) for license renewal because they perform one or more of the following passive functions:

- provide a pressure boundary
- provide structural and/or functional support for safety-related equipment
- provide enclosure, shelter, or protection for in-scope equipment (including radiation shielding and pipe whip restraint)
- provide a rated fire barrier to confine or retard a fire
- provide a missile (internal or external) barrier
- provide structural and/or functional support to equipment meeting license renewal Criterion 2 (non-safety affecting safety-related) and/or Criterion 3 (the five regulated events)
- provide a protective barrier for internal/external flood events
- provide jet impingement shielding for high-energy line breaks
- provide an environmental qualification (EQ) barrier

In Table 2.4.1-1 of each LRA, the applicant listed the structural components and commodities of the containment structure that are subject to an AMR. The applicant grouped them into 44 structural component groups or unique commodities for the NAS 1/2 containments and 43 for SPS 1/2 containments. The one extra component in the NAS 1/2 containments is the spare penetration, which does not exist in SPS 1/2 containments. These components and commodities meet the criteria of 10 CFR 54.21(a)(1), because applicable intended functions are performed without moving parts or without a change of configuration or properties and they are not replaced based on a qualified life or specified time period.

2.4.1.2 Staff Evaluation

The staff reviewed Section 2.4.1, “Containment,” of each LRA and the UFSARs to determine whether the applicant has adequately implemented its methodologies as described in Section 2.1 of each LRA, such that there is reasonable assurance that the structural components and commodities of the containment were properly identified within the scope of license renewal and subject to an AMR, in accordance with the requirements of 10 CFR 54.4 and 10 CFR 54.21. After completing its initial review, the staff requested additional information from the applicant by e-mail on September 24, 2001. The applicant responded to the staff’s questions via e-mail on October 4, 2001. The applicant’s e-mail response to staff’s questions is docketed and available to public.

The staff reviewed the additional information and drawings submitted by the applicant in response to the staff's questions to determine whether there are any structure or component within the containment boundary that the applicant did not bring into the scope of license renewal or did not determine to be subject to an AMR. On the basis of this review, the staff has identified the findings as described below:

In each LRA Section 2.4.1, "Containment," the applicant states that the containment is divided by the crane wall that support the polar crane. However, the polar crane and the crane wall are not listed in LRA Table 2.4.1-1 as components subject to an AMR. The staff asked that the applicant verify the table to ensure its completeness. In its response, the applicant stated that both the polar crane and its supporting structures are within the scope of license renewal and subject to an AMR. In each LRA, the polar crane is included in Table 2.4.12-1 under the commodity group "crane", and the crane wall is included in Table 2.4.1-1 under the structural component group "walls." The staff found the applicant's response acceptable in addressing this concern.

In each LRA Section 2.4.1, "Containment," the applicant states that the personnel access hatch has an inner and an outer door and that the doors are maintained in "closed" position by interlocking-tooth closure mechanisms. The staff asked whether the operating mechanisms of the hatch that perform a passive function associated with maintaining the hatch in a closed position (e.g., gears, latches, hinges, and equalizing valves) are subject to an AMR. In its response, the applicant stated that the interlocking-tooth closure mechanism aligns the hatch and holds it in place, performing the intended function of the containment pressure boundary. The latches and hinges do not perform an intended function and are not within the scope of license renewal because the personnel hatch has no gears. However, the equalizing valve body is within the scope and subject to an AMR for license renewal. The staff found that the applicant has included these components in the AMR tables.

In each LRA, Table 2.4.1-1 also lists the fuel transfer tube and its protection shield and the gate valve as being subject to an AMR. However, the table does not list some of the attachments of the fuel transfer tube, such as sleeves that are welded to the liner plate and blind flanges that cover the tube when the transfer tube is not in use. In addition, neither LRA Section 2.4.1 provides any information for these attachments. Since these components perform an intended function to maintain the containment pressure boundary, the staff asked why they are not included in either LRA Table 2.4.1-1. In its response, the applicant stated that the transfer tube sleeves and blind flanges are within the scope of license renewal and subject to an AMR. The fuel transfer tube sleeves and blind flanges are included in the commodity group "penetrations" in each LRA Table 2.4.1-1. The staff confirmed that these components are within the scope of license renewal.

Based on the above review, the staff did not find any omissions as to the scoping and screening of the containment structure. The staff's review also found that all the passive structural components identified within the scope of license renewal were subject to an AMR.

2.4.1.3 Conclusions

The staff reviewed the information presented in each LRA, Section 2.4.1, Table 2.4.1-1, the UFSAR, the additional information submitted by the applicant in response to the staff's RAIs, and the drawings submitted by the applicant for this review. On the basis of this review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the containment structures of both plants and the associated structural components within the scope of license renewal and subject to an AMR, in accordance with the requirements of 10 CFR 54.4(a) and 10 CFR 54.21(a)(1), respectively.

2.4.2 Auxiliary Building Structure

In each LRA Section 2.4.2, "Auxiliary Building Structure," the applicant describes the structures of the auxiliary building and identifies their structural components that are within the scope of license renewal and subject to an AMR. The design of the structures within the auxiliary building boundary is described in NAS UFSAR Section 3.8.1 and SPS UFSAR Section 9.10.4.

2.4.2.1 Summary of Technical Information in the Application

In Section 2.4.2 of each LRA, the applicant states that the term "auxiliary building structure" include:

- auxiliary building
- Units 1 and 2 cable vaults
- cable tunnels
- pipe tunnels
- hydrogen recombiner vault (NAS 1/2)
- NAS 1/2 rod drive room and the functionally equivalent to motor control center rooms at SPS 1/2

The auxiliary building, which houses the systems and equipment serving both units, is a four-story seismic Class I structure located between the two reactor containment buildings. The structure consists of a reinforced-concrete substructure (with concrete walls partially below grade), a structural steel framed superstructure, and a reinforced-concrete mat foundation (with monolithic finish). The membrane roofing system is supported by steel framing covered with an insulated metal-roof deck. Flood protection barriers, fire and EQ doors, fire barrier penetrations, and fire barrier seals are provided to protect safety-related equipment.

The cable vault, cable tunnel, motor control center room, and pipe tunnel for each unit are the reinforced-concrete structures within the auxiliary building. The pipe tunnel is in the bottom story, the cable vault and cable tunnel are in the middle story, and the rod drive room is in the top story. The cable vault is the reinforced-concrete portion of the auxiliary building adjacent to the exterior side of the containment wall around the major electric penetrations above the pipe tunnel. The cable tunnel extends from the cable vault through the auxiliary building to the electric control area below the main control room. The hydrogen recombiner vault for the NAS is a single-story reinforced-concrete structure that contains the hydrogen recombiners for NAS 1/2. The hydrogen recombiner vault shares a reinforced-concrete mat foundation with the auxiliary building structure and is attached to the east side of the Unit 2 rod drive room. The reinforced-concrete walls and slabs for these structures are designed with biological shielding and missile protection.

The applicant has determined that all the structural components and commodities within the auxiliary building boundary are within the scope of license renewal because they perform one or more of the following intended functions which meet the 10 CFR 54.4 criteria:

- provide structural and/or functional support for safety-related equipment
- provide structural and/or functional support to equipment meeting license renewal Criterion 2 (non-safety-related affecting safety-related) and/or Criterion 3 (the five regulated events)
- provide enclosure, shelter, or protection for in-scope equipment
- provide a rated fire barrier to confine or retard a fire from spreading to or from adjacent areas of the plant
- provide a missile (internal or external) barrier
- provide a protective barrier for internal/external flood events
- provide an environmental qualification barrier

In Table 2.4.2-1 of each LRA, the applicant listed the structural components and commodities and their intended functions for the auxiliary building structures that are subject to an AMR. These structural components are similar in design and materials. Some of the components are common to many structures and are addressed in the LRA as the commodities for the entire plant. The applicant grouped all the components of the auxiliary building structure into 28 structural component groups and unique commodities for the NAS 1/2 and 26 for SPS 1/2. Two component groups were not listed for the SPS 1/2 because the auxiliary buildings in SPS 1/2 do not have access doors and flood barriers. These components and commodities meet the criteria of 10 CFR 54.21(a)(1) because applicable intended functions are performed without moving parts or without a change of configuration or properties, and they are not replaced on a qualified life or specified time period.

2.4.2.2 Staff Evaluation

The staff reviewed Section 2.4.2 of each LRA and the supporting information in the UFSAR to determine whether there is reasonable assurance that the structural components and commodities within the boundary of the auxiliary building structures were properly identified within the scope of license renewal and subject to an AMR.

In Section 2.4.2 of each LRA, the applicant describes the structures and structural components in the auxiliary building; cable vaults, cable tunnels, etc. However, the staff found that the following structural components, which are described in this section, are not listed in Table 2.4.2-1 of either LRA: fire and EQ doors, fire barrier penetrations, fire barrier seals, and the membrane roofing system. The staff asked the applicant to verify that the Table 2.4.2-1 contains the complete listing of structures and structural components in the auxiliary building. In its response, the applicant stated that the fire and EQ doors and fire barrier penetration seals are included within the scope of license renewal in each LRA Section 2.4.11, and in LRA Table 2.4.11-1 as miscellaneous structural commodities. The membrane roofing is not included in LRA Table 2.4.2-1 and is not subject to an AMR because it is not required to perform any intended function. The staff found the applicant’s response acceptable in addressing this concern.

In Section 2.4.2 of each LRA, the applicant states that the auxiliary building consists of a reinforced-concrete foundation mat and below-grade reinforced-concrete walls (substructure), etc. However, the applicant did not explain whether the foundation mat and the lower portion of walls have expansion joints, water stops or waterproofing membranes. The staff was concerned that water stops are important in maintaining the integrity of the concrete components to which they connect. The groundwater in-leakage into the concrete construction joints could occur as a result of degradation of the water stops. The staff asked that the applicant provide information on structural sealants for the below-grade construction joints. In its response, the applicant stated that the water-stops are within the scope of license renewal. As stated in each LRA, Appendix C, Section C2.4, water-stops are considered as part of the components that they are integral to and are not identified as a separate component within each LRA. The staff found the applicant's response acceptable.

Based on the above review, the staff did not find any omissions by the applicant related to scoping and screening of the auxiliary building structures. The staff's review also found that all the passive structural components identified within the scope of license renewal were subject to an AMR.

2.4.2.3 Conclusions

On the basis of this review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the structural components and commodities of the auxiliary building structure within the scope of license renewal and subject to an AMR, in accordance with the requirements of 10 CFR 54.4(a) and 10 CFR 54.21(a)(1), respectively.

2.4.3 Other Class 1 Structures

In the North Anna and Surry LRAs, Section 2.4.3, "Other Class 1 Structures," the applicant describes the other Class 1 structures and identifies their structural components that are within the scope of license renewal and subject to an AMR. The applicant has determined that the following Class 1 structures are within the boundary of the other structures that are within the scope of license renewal in either the NAS or the SPS:

- safeguard building (both plants)
- main steam valve house (both plants)
- fuel oil pump house (both plants)
- quench spray pump house (NAS only)
- containment spray pump building (SPS only)
- auxiliary feed water pump house (NAS only)
- auxiliary feed water tunnel (NAS only)
- casing cooling pump house (NAS only)
- service water pump house (NAS only)
- service water pipe expansion joint enclosure (NAS only)
- service water valve house (NAS only)
- service water tie-in vault (NAS only)
- fire pump house (SPS only)

The staff reviewed the information submitted by the applicant to determine whether the applicant has demonstrated that the requirements of 10 CFR 54.4 and 10 CFR 54.21 were met for the above structures and the associated components. The design of these Class 1 structures is addressed in Sections 3.8.1.1, 9.2.1.2, 9.5.1.3, and Section 3C.5.4.9 of the NAS UFSAR, and Sections 9.10.4 and 9.13.3.4 of the SPS UFSAR.

2.4.3.1 Summary of Technical Information in the Application

Safeguards Building

In Section 2.4.3 of each LRA, the applicant states that the safeguards building is a seismic Class 1 structure that houses the safeguards equipment, including the outside recirculating spray pumps, the low-head safety injection pumps, and the associated pipe tunnels. The safeguards building is a reinforced-concrete structure supported on a reinforced-concrete mat foundation adjacent to the reactor containment. The building has three external side wall of reinforced-concrete; the fourth side wall is a common wall with the containment. The structure has a reinforced-concrete roof with hatches for the removal of equipment. For the North Anna plant, the exterior walls and roof are specially designed for missile protection. The Unit 2's 24-inch service water lines that run in a separate cubicle are part of the safeguard building. For the Surry plant, the safeguards building concrete structure is partially below grade. A pipe chase located on the missile barrier roof extends along the entire length of the roof. A concrete wall and a steel-framed metal deck on top enclose the pipe chase. The structural components of the safeguards building that require an AMR are listed in Table 2.4.3-1 of each LRA.

Main Steam Valve House

The main steam valve house provides shelter for the main steam isolation valves and auxiliary feedwater pumps. It is a seismic Class 1, reinforced-concrete structure supported by a reinforced-concrete mat foundation adjacent to the containment and cable vault. The mat foundation is founded on soil (for the North Anna plant) or on concrete-filled steel pipe piles (for the Surry plant). The valve house has a roof slab and an intermediate floor slab. Both slabs are reinforced-concrete structures supported by structural steel framing and are cast against permanent metal deck formwork. The openings of the roof slab, which are used for the removal of equipment, have concrete hatches (for the North Anna plant) or missile screens (for the Surry plant). The structural components subject to an AMR are listed in Table 2.4.3-2 of each LRA.

Quench Spray Pump House (NAS)/Containment Spray Pump Building (SPS)

The quench spray pump house of the North Anna plant is functionally equivalent to the containment spray pump building of the Surry plant. Each performs the same function, which is to house the containment spray pumps (or quench spray pumps) and their accessories.

For the North Anna plant, the quench spray pump house for each unit consists of a quench spray area and a refueling water recirculating pump area; both the areas are open to the cylindrical containment wall. The pump house is a reinforced-concrete structure with its exterior walls supported on a reinforced-concrete mat foundation. It has a metal deck roof and an intermediate reinforced-concrete floor slab which are supported by structural steel framing. The structural components of the quench spray pump house that require an AMR are listed in Table 2.4.3-3 of the NAS LRA.

For the Surry plant, the containment spray pump building for each unit consists of a containment spray area and a refueling water recirculating pump area. The building is adjacent to the main steam valve house and safeguard building and is open to the containment exterior wall. It is a reinforced-concrete structure supported on a reinforced-concrete mat foundation.

The building has a metal deck roof and a reinforced-concrete intermediate floor slab which are supported by structural steel framing. The 24-inch service water lines for Unit 1 run in an area below grade, which is part of the main steam valve house, and the Unit 1 containment spray pump building. The 24-inch service water lines for Unit 2 run in a separate area below grade level, which is part of the containment spray pump building. This area has a reinforced-concrete roof slab with several hatches. The structural components for the containment spray pump building that require an AMR are listed in Table 2.4.3-3 of the SPS LRA.

Fuel Oil Pump House

The fuel oil pump house (common to both units), which shelters the diesel generator fuel oil supply pumps, is divided into two cubicles with a reinforced-concrete interior wall (one for each unit). For the North Anna plant, the fuel oil pump house is built at the grade level and the motor control center room is part of the pump house. For the Surry plant, the two cubicles are below grade and the roof slab is at the ground level. There is a concrete missile shield at the ground level to protect the fuel oil lines. A concrete missile-protected manhole adjacent to the fuel oil pump house is an integral part of the pump house. The structural components that require an AMR are listed in Table 2.4.3-4 of each LRA.

Auxiliary Feed-water Pump House (NAS 1/2)

The auxiliary feed-water pump house for each unit is a single-story reinforced-concrete building founded at grade level. The building is divided into two cubicles by a reinforced-concrete wall. One cubicle houses the two motor-driven auxiliary feed-water pumps and the other cubicle houses one turbine-driven auxiliary feed-water pump. The auxiliary feed-water pump house is a tornado missile-protected structure. The roof openings are provided with missile-protected concrete hatches. The structural components that require an AMR are listed in Table 2.4.3-5 of the NAS LRA.

Auxiliary Feed-water Tunnel (NAS 1/2)

The auxiliary feed-water tunnel located below grade runs between the auxiliary feed-water pump house and the quench spray pump house. The tunnel carries the auxiliary feed-water pump piping and other safeguards piping. The tunnel is a reinforced-concrete structure that is designed for seismic and tornado missile protection. There are missile-protected manholes along the tunnel at the grade level. The structural components subject to an AMR are listed in Table 2.4.3-6 of the NAS LRA.

Casing Cooling Pump House (NAS 1/2)

The casing cooling pump house provides a weather-protected enclosure for the casing cooling systems, motors, and other equipment. The pump house is a reinforced-concrete structure supported by a common mat foundation on bedrock. The roof of the pump house is a concrete slab built on metal decking that is supported by a structural steel frame. The structural components subject to an AMR are listed in Table 2.4.3-7 of the NAS LRA.

Service Water Pump House (NAS 1/2)

The service water pump house, located at the edge of the service water reservoir, provides shelter for the service water system equipment for both units. The pump house is a reinforced-concrete structure founded on a mat foundation. The structure has missile-protected concrete roof openings and missile barriers between the service water pumps. The structural components subject to an AMR are listed in Table 2.4.3-8 of the NAS LRA.

Service Water Pipe Expansion Joint Enclosure (NAS 1/2)

The service water expansion joint enclosure is a single-story reinforced-concrete building attached to the service water pump house. The reinforced-concrete floor slab is built on grade level and the walls are supported by concrete footing. The reinforced-concrete roof slab and walls are designed for missile protection. There is a manhole on the roof for access to the building. The manhole is covered with a missile-protected steel cover. The structural components subject to AMR are listed in Table 2.4.3-9 of the NAS LRA.

Service Water Valve House (NAS 1/2)

The service water valve house provides shelter and protection for the service water valves and related equipment for both units. The valve house is a reinforced-concrete structure with missile-protected concrete roof openings. A reinforced-concrete access pit to the expansion joint is located along the north side of the service water valve house. The pit encloses and provides access to the two 36-inch pressure balance expansion joints in the service water return headers entering the valve house. The structural components subject to an AMR are listed in Table 2.4.3-10 of the NAS LRA.

Service Water Tie-in Vault (NAS 1/2)

The service water tie-in vault houses the four pressure-balanced expansion joints, pipe access hatches, and the associated cathodic protection equipment. This vault is provided at the tie-in to the original buried service water lines to protect from the adverse effects of tornado-generated missiles and effects due to earthquake-induced ground motion for the four service water headers, four new service line expansion joints, and two new access ports. The tie-in vault is a reinforced-concrete structure founded on a reinforced mat foundation. The roof is a reinforced-concrete slab on steel decking and has a manhole opening with a steel cover for personnel access into the vault. Various platforms are provided for access to the pipe access hatches. The structural components subject to an AMR are listed in Table 2.4.3-11 of the NAS LRA.

Fire Pump House (SPS 1/2)

The fire pump house is a free-standing, reinforced-concrete structure in the southwest area of the yard. The pump house is divided into two separate cubicles by a reinforced-concrete wall with a metal door. One cubicle is a seismic Class 1 reinforced-concrete structure that houses the diesel-engine-driven fire pump. It has openings in the exterior wall that are protected with missile screens. The other cubicle which houses the electric-motor-driven fire pump, motor control center, surge tank, and two small water booster pumps, is not a seismic Class 1 structure. This cubicle is enclosed with a built-up metal deck roof and masonry block walls and is supported on spread footing. The applicant determined that the cubicle that houses the diesel-engine-driven fire pump is within the scope of license renewal. For the cubicle that houses the electric-motor-driven fire pump, only the equipment pad, the floor, and the common concrete wall between the two cubicles are in scope. The structural components subject to an AMR are listed in Table 2.4.3-5 of the SPS LRA.

2.4.3.2 Staff Evaluation

The staff reviewed Section 2.4.3 of each LRA and the UFSARs for each plant to determine whether there is reasonable assurance that the applicant has properly identified the structures and components of the other Class 1 structures that are within the scope of license renewal and subject to an AMR in accordance with 10 CFR 54.4 and 10 CFR 54.21, respectively. After completing its initial review, the staff requested additional information from the applicant by an e-mail on September 24, 2001. The applicant responded to the staff's questions via e-mail on October 4, 2001.

The applicant identified the structural components and commodities and their intended functions, in the following tables for each of the buildings and structures that are within the scope of license renewal. The methodology used to identify these generic component groups is evaluated in Section 2.1 of this report. For NAS, the generic component groups for each Class 1 structure are listed in the following tables:

Table 2.4.3-1 lists 17 components for the safeguards building
Table 2.4.3-2 lists 20 components for the main steam valve house
Table 2.4.3-3 lists 17 components for the quench spray pump house
Table 2.4.3-4 lists 7 components for the fuel pump house
Table 2.4.3-5 lists 9 components for the auxiliary feed-water pump house
Table 2.4.3-6 lists 7 components for the auxiliary feed-water tunnel
Table 2.4.3-7 lists 10 components for the casing cooling pump house
Table 2.4.3-8 lists 17 components for the service water pump house
Table 2.4.3-9 lists 4 components for the service water pipe expansion joint enclosure
Table 2.4.3-10 lists 16 components for the service water valve house
Table 2.4.3-11 lists 12 components for the service water tie-in vault

For SPS, the generic component groups for each Class 1 structure are listed in the following tables:

Table 2.4.3-1 lists 15 components for the safeguards building
Table 2.4.3-2 lists 21 components for the main steam valve house
Table 2.4.3-3 lists 17 components for the containment spray pump building
Table 2.4.3-4 lists 10 components for the fuel oil pump house
Table 2.4.3-5 lists 12 components for the fire pump house

The applicant determined that components and commodities listed in above tables are subject to an AMR because the intended functions are performed without moving parts or without a change in configuration or properties and because they are not replaced based on qualified life or specified time period. The staff reviewed each of the above tables and compared the descriptions in each LRA and the UFSARs for both plants to determine whether there were any components or commodities within the boundary of the other Class 1 structures that the applicant did not identify within the scope of license renewal or did not identify in the tables subject to an AMR. On the basis of this review, the staff has made the following findings:

In Section 2.4.3 of the NAS LRA, the applicant describes the auxiliary feed-water pump house, auxiliary feed-water tunnel, casing cooling pump house, service water pump house, service water pipe expansion joint enclosure, service water valve house, and service water tie-in vault that are Class 1 structures within the scope of license renewal. However, Section 2.4.3 of the SPS LRA does not address any equivalent structures that perform similar functions for the Surry plant. The staff asked that the applicant to verify whether there are any structures at the Surry plant that house and protect the equipment of the auxiliary feed-water systems, or the service water systems that should be included in the scope of license renewal.

In its response, the applicant stated that the Surry plant does not have these specific structures. The auxiliary feedwater systems are located in the main steam valve house along with their piping (part of the piping is buried in the yard). The part of the service water system that includes the emergency service water pumps is located in the low-level intake structure, which is addressed in Section 2.4.6 of the SPS LRA. The casing cooling pump system is not required at the Surry plant, because the net positive suction head for the recirculating spray system pumps is not needed for the Surry plant. Based on the applicant's response, the staff found that the applicant did not omit any Class 1 structures in the Surry plant that should be within the scope of license renewal.

In Section 2.4.3 of the NAS LRA, the applicant states that the floor of the service water pipe expansion joint enclosure is a reinforced-concrete slab on grade and the reinforced-concrete walls are supported on concrete footings. However, the concrete footings are not listed in Table 2.4.3-9 of the NAS LRA as a component group subject to an AMR. The staff asked the applicant to verify the table for completeness. In its response, the applicant stated that the on-grade slab is monolithic with the footing. The footings are evaluated as part of the on-grade slab and are not listed as a separate item. The staff confirmed that the footings are subject to an AMR.

In Section 2.4.3 of the NAS LRA, the applicant states that the structures of the service water pump house and service water valve house have missile-protected reinforced-concrete roof openings. However, Tables 2.4.3-8 and 2.4.3-10 of the NAS LRA did not list these missile-protected roof openings as components subject to an AMR. The applicant explained that these roof openings are identified as "concrete hatches" in the tables and one of their intended functions listed in the tables is "missile barrier." The staff confirmed that these roof openings are subject to an AMR.

Section 3.8.1.1.7 of the NAS UFSAR states that the service water pump house contains among other things, screen wells, traveling screens, basket, pump missile barriers, pump house footing, and wing walls. However, these structural components are not discussed in Section 2.4.3 of the NAS LRA nor listed in Table 2.4.3-8 of the NAS LRA. The staff asked that the applicant explain why these components were not included in the scope of license renewal.

In its response, the applicant stated that the screen wells, which have concrete walls and floors, are addressed as part of the structural walls and floors of the service water pump house. The traveling screens are identified in Table 2.3.3-6 of the NAS LRA as "filters/strainers" in the service water system. The baskets do not perform any intended function and are not included in scope. The pump missile barriers are addressed as part of internal and external walls of the service water pump house. The footing for the service water pump house is identified in Table 2.4.3-8 of the NAS LRA as the foundation mat slab. The wing walls are addressed as part of the external walls of the service water pump house. The staff found that components of concern were included in the scope and subject to an AMR for license renewal.

In Section 2.4.3 of the SPS LRA, the applicant states that the fire pump house is divided by a wall with a metal door forming two separate rooms. Section 9.10.4.23 of the SPS UFSAR states that the door in this wall is fire rated in excess of 3 hours. However, this interior fire door is not listed in Table 2.4.3-5 of the SPS LRA as a component subject to an AMR. The staff asked that the applicant verify the table to ensure its completeness. In its response, the applicant stated that the fire door in question is listed in Table 2.4.3-5 of the SPS LRA as "missile protection door" with the intended functions of both missile barrier and fire barrier. The staff confirmed that the fire door is subject to an AMR.

In Section 2.4.3 of the SPS LRA, the applicant states that the containment spray pump building consists of containment spray and refueling water recirculating pump areas that are within the scope of license renewal. Section 9.10.4.13 of the SPS UFSAR states that the containment spray pump building and auxiliary feed-water pump building for each unit are essentially identical structures, each located adjacent to the containment of its unit. However, the auxiliary feed-water pump building is not addressed in Section 2.4.3 of the SPS LRA. The staff asked why the auxiliary feed-water pump building is not within the scope of license renewal.

In its response, the applicant stated that the buildings which are described in Section 9.10.4.13 of the SPS UFSAR that house the containment spray pumps and the auxiliary feed-water pumps, are physically two structures, i.e., the containment spray pump building and the main steam valve house. Actually, the auxiliary feed-water pumps are located in the main steam valve house, which is included in the scope of license renewal as described in Section 2.4.3 of the SPS LRA. The staff found the applicant's response acceptable.

The staff has completed its review of the information presented in Section 2.4.3 of each LRA, the UFSAR for each plant, and additional information provided by the applicant in response to the staff's questions. As a result of the above review, the staff did not find any omissions by the applicant related to scoping the structures for license renewal as defined under 10 CFR 54.4(a). The staff also found no omissions in screening the components of the Class 1 structures that require an AMR.

2.4.3.3 Conclusions

On the basis of this review, the staff concludes that there is reasonable assurance that the applicant has adequately identified those structures in the boundary of other Class 1 structures that are within the scope of license renewal and the associated components and commodities that are subject to an AMR, in accordance with the requirements of 10 CFR 54.4(a) and 10 CFR 54.21(a)(1), respectively.

2.4.4 Fuel Building

In the North Anna and Surry LRAs, Section 2.4.4, "Fuel Building," the applicant describes the structures of the fuel building and identifies its structural components that are within the scope of license renewal and subject to an AMR. The fuel building consists of the following major structures in each plant:

- fuel building structure
- new fuel storage area
- fuel pool (including transfer canals)
- spent fuel storage racks

The design of the fuel building structures is described in Sections 3.8.1.1.4 and 9.4.5 of the NAS UFSAR, and Section 9.10.4.14 of the SPS UFSAR. The staff reviewed this information provided by the applicant to determine whether the applicant has demonstrated that the requirements of 10 CFR 54.4 and 10 CFR 54.21 were met for the structures of the fuel building.

2.4.4.1 Summary of Technical Information in the Application

Fuel Building Structure

In Section 2.4.4 of each LRA, the applicant states that the fuel building, located between the two reactor containment buildings, is a seismic Class 1 structure that is common to both units. The fuel pool and exterior reinforced-concrete walls of the fuel building substructure are supported by a reinforced-concrete mat foundation. For the North Anna plant, the mat foundation is founded on bedrock. For the Surry plant, the mat foundation is founded on concrete-filled steel pipe piles. The substructure of the fuel building consists of an intermediate reinforced-concrete floor slab, beams, interior walls, and masonry walls. A reinforced-concrete pipe tunnel is built on the top of the foundation mat. The superstructure of the fuel building extends from the top of the reinforced-concrete walls to the roof which is supported by structural steel framing and enclosed with insulated metal siding (blow-off metal panel). The roof is covered with insulated metal decking and a single-ply, mechanically attached membrane roofing system.

New Fuel Storage Area

The new fuel storage area in the fuel building is provided to hold new fuel assemblies for one-third of a replacement core. The new fuel assemblies are stored in the specially designed seismic Class 1 array racks. These racks consist of 126 stainless steel square guide tubes, which are supported by a structural steel network at the top and horizontally restrained at the bottom. The fuel assemblies are inserted in these guide tubes on the racks that are supported by concrete floor of the new fuel storage area.

Spent Fuel Pool and Fuel Transfer Canals

The spent fuel pool provides storage for the spent fuel received from the containment through the fuel transfer tubes, which enter the fuel transfer canals on the east and west ends of the fuel building. The spent fuel pool and fuel transfer canals are seismic Class 1 reinforced-concrete structures lined inside with stainless steel plates. During normal operation of both Units, the fuel transfer tube is isolated with a blind flange on the reactor cavity side and a gate valve on the pool side. The fuel transfer canal can be isolated from the pool with movable stainless steel gates. For the North Anna plant, the spent fuel pool has a stainless-steel-lined reinforced-concrete wall, which separates the spent fuel cask area from the spent fuel storage racks. For the Surry plant, fuel cask impact pads are provided in the pool to protect the floor from damage in the event of a spent fuel pool cask dropping accident.

Spent Fuel Storage Racks

The spent fuel storage racks in the spent fuel pool are high-density racks submerged in borated water. These racks, which hold the spent fuel assemblies, are seismic Class 1 structures erected on the pool floor. The racks are free-standing on the floor support pads, and are integrally connected to embedded plates.

2.4.4.2 Staff Evaluation

The staff reviewed Section 2.4.4 of each LRA and the UFSARs of each plant to determine whether the applicant has identified the structures of each of the fuel buildings that are within the scope of license renewal in accordance with 10 CFR 54.4(a), and the components and commodities that require an AMR in accordance with 10 CFR 54.21(a)(1). After completing its initial review, the staff requested additional information from the applicant by an E-mail on September 24, 2001. The applicant responses are documented in a telecommunication summary dated October 25, 2001, and its letter submitted on May 22, 2002.

The applicant identified 20 generic component groups in the fuel building for the North Anna plant and 22 for the Surry plant and their intended functions in Table 2.4.4-1 of the respective LRA. These components and commodities in scope are subject to an AMR because the specified intended functions, as indicated in the tables, are performed without moving parts or without change in configuration or properties, and are not subject to replacement based on qualified life or specified time period as specified under 10 CFR 54.21(a)(1). The staff examined these components in the LRA tables and compared them with the descriptions in the LRA and UFSAR. The staff did not find any omissions except two.

In Section 2.4.4 of each LRA, the applicant describes the reinforced-concrete pipe tunnel for the fuel building, and the fuel transfer canals for the spent fuel pool. The applicant did not list the structural components for these structures in Table 2.4.4-1 of neither LRA. In an RAI, the staff requested the applicant to clarify whether these components were within the scope of license renewal. In its response, the applicant stated that the fuel pool, including fuel transfer canals, consists of reinforced-concrete walls above the mat foundation. The mat foundation and all walls are included in Table 2.4.4-1 of each LRA. The “walls” and “floor slabs” listed in the tables envelop the structural components of the concrete pipe tunnel for the fuel building structure. Therefore, the pipe tunnel was not listed separately. The staff found the applicant’s response acceptable and confirmed that all the components of the pipe tunnel and fuel transfer canals are subject to an AMR.

Section 9.1.2 of the NAS UFSAR describes the spent fuel storage and indicates that a movable platform crane is used to move the three spent fuel gates. However, the platform crane is not described in Section 2.4.4 or identified in Table 2.4.4-1 of the NAS LRA. The staff asked that the applicant to verify whether the crane is within the scope of license renewal. The applicant stated that the movable platform crane is within the scope of license renewal and is identified as the fuel handling bridge crane in Section 2.4.12 of the NAS LRA. The staff found the applicant’s response acceptable.

The staff has completed its review of the structures within the boundary of the fuel building and did not find any omissions by the applicant related to scoping and screening of the structures and components.

2.4.4.3 Conclusions

On the basis of the review described above, the staff concludes that there is reasonable assurance that the applicant has adequately identified the structures and components associated with the fuel building that are within the scope of license renewal and subject to an AMR, in accordance with the requirements of 10 CFR 54.4(a) and 54.21(a)(1), respectively.

2.4.5 Miscellaneous Structures

In the North Anna and Surry LRAs, Section 2.4.5, "Miscellaneous Structures," the applicant described the miscellaneous structures. The applicant has determined that the following buildings at either NAS or the SPS plant or both are the structures that are within the scope of license renewal:

- turbine building
- service building
- station blackout (SBO) building
- security diesel building
- condensate polishing building (Surry plant)
- black battery building (Surry plant)
- radwaste facility (Surry plant)
- maintenance building (North Anna plant)

The staff reviewed the information submitted by the applicant to determine whether the applicant has adequately demonstrated that the requirements of 10 CFR 54.4 and 10 CFR 54.21 were met for the above miscellaneous structures and their structural components. The design of these buildings is described in Sections 3.8.1.1, 7.8, 9.4.1, and 13.3 of the NAS UFSAR, and Sections 8.4.6, 9.10.4, 9.9.2.1, 9.13.3 of the SPS UFSAR.

2.4.5.1 Summary of Technical Information in the Application

Turbine Building

In Section 2.4.5 of each LRA, the applicant identified the turbine building as being within the scope of license renewal because failure of the structure could impact the adjacent safety-related structures. Two turbine buildings in each plant (one for each unit) house the turbine generators, condensers, feed-water heaters, pumps, and associated components and equipment. The turbine building is a non-safety-related structure that is constructed with a reinforced-concrete substructure and a steel framing superstructure. The substructure consists of below-grade reinforced-concrete walls, footings, and grade beams. The above-grade superstructure is a structural steel building enclosed with metal sidings. The roof is made of metal decking covered with a membrane roofing system.

In NAS, the portion of the turbine building adjacent to the main control room was designed for tornado wind loads to prevent its collapse on the main control room. In SPS, the turbine building contains several seismic Class 1 structures, including the battery room 2B, component cooling water heat exchangers floor slab (missile barrier), and mechanical equipment room No.4. These rooms have reinforced-concrete walls that protect the safety-related equipment. In SPS, Unit 2, the turbine building also houses portions of the equipment and components of the station blackout system. Therefore, the turbine buildings in SPS 1/2 were designed for seismic and tornado wind loads so that a seismic event will not impact the Class 1 structures within the turbine building.

Service Building

The service building, located between the auxiliary building and the turbine building, is a multistory reinforced-concrete structure that serves both Units. The building is founded on reinforced-concrete piers, spread footings, and grade beams. Thick reinforced-concrete walls around the cubicles are provided in the service building for tornado missile and radiation protection. The following cubicles and rooms in the service building at either the NAS or the SPS or both plants are within the scope of license renewal because they protect safety-related equipment or non-safety-related equipment which can affect the safety-related equipment function:

- emergency switchgear and relay rooms
- control room
- emergency diesel generator rooms
- battery rooms
- cable tray rooms
- cable vault (at column line E)
- normal switchgear rooms
- stairwell
- technical support center
- mechanical equipment room 3 (Surry-specific name, MER-3)
- AC chiller rooms (North Anna-specific name, functionally equivalent to MER-3))
- mechanical equipment rooms 1 and 2 (Surry-specific name, MER-1, MER-2)
- mechanical equipment rooms (North Anna-specific name, functionally equivalent to MER-1 and MER-2)
- instrument repair shop (NAS 1/2)

In the above cubicles, the emergency switchgear and relay rooms, battery rooms, cable vault, emergency diesel generator rooms, AC chiller rooms, and the control room are the seismic Class 1 structures. The cable tray rooms, normal switchgear rooms, technical support center, mechanical equipment rooms, instrument repair shop, and stairwell are the non-safety structures. Each of four diesel generator rooms contains one emergency diesel generator and its auxiliary equipment. The cable tray rooms and normal switchgear rooms house the station blackout (SBO) equipment and components. The technical support center houses the essential fire-protection-related equipment and the stairwell provides access to the fire protection equipment. The instrument repair shop houses the essential fire protection components. The control room that serves both units is designed to provide fire, biological, and tornado missile protection.

Station Blackout Building

The station blackout building is a single story non-seismic structure that houses the AAC diesel generator and its associated auxiliaries. The diesel generator and its components in the SBO building are non-safety-related. However, the SBO building is within the scope of license renewal because the diesel generator provides alternate power to the safe shutdown equipment in the event of a station blackout. The upper portion of the SBO building is a steel frame structure enclosed with metal siding. The lower portion of the SBO building has exterior reinforced-concrete walls founded on reinforced-concrete piers and spread footings. The roof is covered with metal decking and a membrane roofing system.

Security Diesel Building

The security diesel building is a non-seismic single story building that houses the security diesel generator. It is a reinforced-concrete structure supported on a mat foundation. The roof is a reinforced-concrete slab.

Condensate Polishing Building (SPS)

The condensate polishing building is a non-safety and non-seismic structure that houses the SBO system cables and raceways. The applicant determined that the portion of the building that support the SBO system cables and raceways, is within the scope of license renewal.

Black Battery Building (SPS)

The black battery building houses numerous DC loads, including the power supply equipment (batteries and associated accessories) for the actuation circuitry panel of the anticipated transient without scram (ATWS) mitigation system located in the service building. The building is a non-safety, non-seismic structure. Since the batteries and accessory equipment are supported by the reinforced-concrete on-grade floor slab, the applicant determined that only the floor slab on grade is within the scope of license renewal.

2.4.5.2 Staff Evaluation

The staff reviewed Section 2.4.5 of each LRA and the UFSARs to determine whether the applicant has adequately identified the structural components and commodities of the miscellaneous structures specified in each LRA that are within the scope of license renewal and subject to an AMR. After completing the initial review, the staff requested additional information to clarify some of these structures (E-mail to the applicant on September 24, 2001). The applicant responded to the staff's questions via E-mail on October 4, 2001. The staff's evaluation of these structures is described below:

Turbine Building

The applicant listed 20 generic component groups and their intended functions in Table 2.4.5-1 of the NAS LRA for the turbine building of the North Anna plant and lists 24 in Table 2.4.5-1 of the SPS LRA for the turbine building of the Surry plant. The components listed in both tables are essentially identical except the Surry turbine building has more components than the North Anna turbine building because of building design differences. The staff reviewed the LRA and

UFSAR of each plant and examined the components listed in the table. The staff did not find any significant omissions except the following components which are addressed in each LRA and are not listed in Table 2.4.5-1 of each LRA as being subject to an AMR: metal siding, sliding fire-rated steel doors, fire barrier penetrations, and fire barrier seals. In addition, Section 9.10.4.18 of the SPS UFSAR states that cable trays are located at all elevations of the turbine building. These cable trays and their supports are not addressed in Section 2.4.5 or listed in Table 2.4.5-1 of the SPS LRA. The staff asked that the applicant provide additional information for these components.

In its response, the applicant stated that the metal siding is not included in the table because it does not perform any intended function. All types of fire-rated doors and fire barrier penetration seals are addressed generically in Section 2.4.11 and listed in Table 2.4.11-1 of each LRA as "miscellaneous structural commodities." The cable trays and supports are addressed in Section 2.5.4.10 of each LRA as "the general structural supports." The staff's review found that the applicant did not omit any of these components that require an AMR.

Service Building

The applicant listed 28 generic component groups and their intended functions for the service building in Table 2.4.5-2 of the NAS LRA for the North Anna plant, and listed 31 of them in Table 2.4.5-2 of the SPS LRA for the Surry plant. The staff reviewed these tables and compared the components described in each LRA and UFSARs for each plant. The staff did not find any omissions, except the following components, which are not listed in Table 2.4.5-2 of either LRA as being subject to an AMR: reinforced-concrete piers, structural steel framing that supports floor slabs, flood protection barriers, fire-rated doors and fire barriers. The staff asked that the applicant verify the LRA tables to ensure their completeness.

In its response, the applicant stated that the concrete piers are included in the commodity group "footing and grade beam." Structural steel framing that supports floor slabs is included in the commodity group "concrete floor support framing and decking." Flood protection barriers are included in the component commodity group "flood barrier." The fire-rated doors and fire barriers are covered in Section 2.4.11 of each LRA as "miscellaneous structural commodities." The staff confirmed that these components, which require an AMR, were included in each LRA table.

Station Blackout Building

The applicant listed 10 generic component groups and their intended functions in Table 2.4.5-3 of each LRA. The staff reviewed the information in each LRA and UFSARs and did not find any omissions.

Security Diesel Building

The applicant listed the foundation mat slabs, roof slabs, and external walls in Table 2.4.5-4 of the NAS LRA as the structural components of the security diesel building for the North Anna plant. The applicant also listed the foundation mat slabs, masonry block walls, roof framing and decking, and steel beams in Table 2.4.5-4 of the SPS LRA as the structural components of the security diesel building for the Surry plant. The different listing in the different tables is due to the building design of the two plants. The staff reviewed the applicant's submittals and did not find any omissions.

Condensate Polishing Building (SPS)

The applicant listed seven generic component groups with their intended functions in Table 2.4.5-5 of the SPS LRA for the condensate polishing building of the Surry plant. The North Anna plant does not have such a building. In Section 2.4.5 of the SPS LRA, the applicant addresses the function of the building but does not describe its structures. The staff asked the applicant to provide additional information on the portion of the structure that supports the SBO system cables and raceways, which are in scope for license renewal.

In its response, the applicant stated that the cables and raceways of the SBO system are located in the west of column line B.8 of the condensate polishing building. The structural steel between column lines B.6 and B.8, and column line 17.2 through 20 supports the cables and raceways for the SBO system. The portion of the foundation mat that supports the columns meets license renewal Criterion 3. These structures that support the cables and raceways are the only portions of the building that are in scope and subject to an AMR for license renewal. The staff reviewed Table 2.4.5-5 of the SPS LRA and did not found any omissions.

Black Battery Building (SPS)

The applicant listed "slabs on grade" and "grout" in Table 2.4.5-6 of the SPS LRA as the components of the black battery building subject to an AMR. The staff reviewed this information in the LRA and UFSAR and did not find any omissions.

2.4.5.3 Conclusions

On the basis of this review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the structures and components associated with each of the miscellaneous structures in each LRA that are within the scope of license renewal and subject to an AMR, in accordance with the requirements of 10 CFR 54.4(a) and 10 CFR 54.21(a)(1), respectively.

2.4.6 Intake Structures

In the North Anna and Surry LRAs, Section 2.4.6, "Intake Structures", the applicant describes the intake structures and identifies their components and commodities that are within the scope of license renewal and subject to an AMR. The intake structures of the North Anna and the Surry plants have different design except the discharge tunnels and seal pit are similar in design. The intake structure of each plant includes the following structures.

North Anna Intake Structure

- intake structure, including circulating water intake tunnel header, auxiliary service water pump house, fire pump house, and intake structure control house
- discharge tunnel and seal pit

Surry Intake Structure

- low-level intake structure, including the emergency service water pump house
- high-level intake structure
- concrete circulating water pipe
- discharge tunnel and seal pit

The design of the intake structures is described in Section 3.8.1.1.9 of the NAS UFSAR for the North Anna plant, and in Section 9.10.4.16 of the SPS UFSAR for the Surry plant. The staff reviewed the information submitted by the applicant to determine whether the applicant has adequately demonstrated that the requirements of 10 CFR 54.4 and 10 CFR 54.21 were met for the intake structures.

2.4.6.1 Summary of Technical Information in the Application

North Anna Intake Structure

The North Anna intake structure, located on the shore of the North Anna reservoir is an eight-bay (four bays serve each unit) reinforced-concrete structure supported by a reinforced-concrete mat foundation on soil. The intake structure draws water from the reservoir and provides cooling water to the main condensers for both units. There are two reinforced-concrete wing walls on the waterside corners of the intake structure to direct water into the bay. The interior walls of the intake structure separate the eight bays. Each bay has an associated circulating water pump and two of the bays have a motor-driven auxiliary service water pump. The auxiliary service water pump house and fire pump house are located on the exposed deck of the intake structure. The safety-related auxiliary service water pump house, fire pump house, and the intake structure control house at the west side of the intake structure are within the scope of license renewal. The electrical cable that runs from the intake structure control house to the auxiliary fire pump is routed in a concrete duck bank (in the area of yard structures) which is supported by the intake tunnel header. Therefore, the intake tunnel header is also within the scope of license renewal.

The outlet water from the main condensers is directed to a reinforced-concrete discharge tunnel (one for each unit). The Unit 2 discharge tunnel combines with the Unit 1 discharge tunnel (opposite to Unit 1 condensers) to form a common tunnel which shares an inner wall. The two tunnels terminate at a seal pit, which is a reinforced-concrete outlet structure. The discharge tunnels and the seal pit are within the scope of license renewal.

Surry Intake Structure

The Surry intake structure consists of a low-level intake structure and a high-level intake structure. The low-level intake structure draws water from the James River and pumped the water into an intake canal to provide the cooling water for the main condensers and the service water system. The low-level intake structure is an eight-bay (four bays serve each unit) reinforced-concrete structure supported by a reinforced-concrete mat foundation on soil. Before entering the intake structure, the inlet water passes through a trash rack and traveling screen located at the mouth of each bay or screen well to remove the debris from water. The trash racks are supported by the steel beams between the mat foundation and the top slab of the intake structure.

Each bay has an associated circulating water pump, and three of the eight bays have an emergency diesel-driven service water pump. The emergency service water pump house and the electrical equipment room are located on the exposed deck of the intake structure. The emergency service water pump house is a reinforced-concrete structure that is divided into two rooms, i.e., service water pump room and diesel fuel-oil storage room. The entrances to the service water pump room and the diesel fuel-oil storage room are missile-protected and have flood barriers.

The safety-related high-level intake structure for each unit is located at the station end of the intake canal that provides conduits for water flow from the intake canal to the 96-inch-diameter reinforced-concrete circulating water pipe located at the end of each bay area. The high-level intake structure is a four-bay reinforced-concrete structure supported by a reinforced-concrete mat foundation that is founded on natural soil. The four bays are separated by reinforced-concrete interior walls and an exposed deck is built on top of the walls. Each of the four bays directs water from the intake canal to the 96-inch-diameter pipe that provides the cooling water for the safety-related plant shutdown systems. Circulating water flows from the high-level intake structure through the four pipes to the main condenser and then returns through four separate pipes to a safety-related discharge tunnel.

A separate discharge tunnel for each unit continues to the discharge canal. Each discharge tunnel ends at a seal pit at the edge of the discharge canal. The discharge tunnel is a reinforced-concrete structure supported on soil. The seal pit has a reinforced-concrete weir wall across the mouth of the discharge tunnel. The weir forms a dead end that maintains the water level at an elevation so that flow through the system is slow enough to keep the condenser discharge water box full.

2.4.6.2 Staff Evaluation

The staff reviewed Section 2.4.6 of both the NAS LRA and SPA LRA and the UFSARs to determine whether there is reasonable assurance that the applicant has properly identified and listed those structures and components of the intake structures for each plant to meet the requirements stated in 10 CFR 54.21(a)(1). After completing its initial review, the staff requested additional information from the applicant by an E-mail on September 24, 2001. The applicant responded to the staff’s questions via an E-mail, dated October 4, 2001. The staff’s evaluation of each of the intake structures is described below.

<u>North Anna Intake Structure</u>

The applicant identified the intake structure, intake tunnel header, auxiliary service water pump house, fire pump house and the intake structure control house as the structures within the boundary of the intake structure that are within the scope of license renewal. The staff reviewed Section 2.4.6 of the NAS LRA and found that some of the structures of the intake structure were not clearly described. The staff asked that the applicant provides information on the structural components of the exposed deck and the pump house on top of the deck. The applicant’s response was summarized in Section 2.4.6.1 of this report as the technical information.

The North Anna intake structure has eight bays and each bay has a trash rack and traveling screen at the mouth of the bay that prevents debris entering into the intake tunnel. The applicant determined that only two of the eight trash racks associated with the safety-related auxiliary service water system and one trash rack associated with the auxiliary fire pump are within the scope of license renewal. Due to fire protection regulations, the intake structure control house at the west side of the intake structure is also in-scope. The staff's review found the applicant's determination for the structures in scope acceptable because these structures perform the intended functions as defined in 10 CFR 54.4(a). The intake structure of the North Anna plant comprises various structural components and commodities that are within the scope of license renewal. The applicant listed 20 generic component groups and their intended functions in Table 2.4.6-1 of the NAS LRA that are subject to an AMR. Some of the structural components do not contribute to any of the intended functions defined in 10 CFR 54.4(a), the applicant has justified not to include them in the table.

The staff has examined the components and commodities listed in Table 2.4.6-1 of the NAS LRA and did not identify any omissions by the applicant in the structures within the boundary of the intake structure that were included within the scope of license renewal as defined in 10 CFR 54.4(a). The staff also found no omissions in the components of the intake structure included in the applicant's AMR that perform their intended functions without moving parts or without a change in configuration or properties, or that are not replaced based on a qualified life or specified time period.

Surry Intake Structure

The staff reviewed the information provided in Section 2.4.6 and Table 2.4.6-1 of the SPS LRA and found that the design of the Surry intake structure is different from the North Ann intake structure. The low-level intake structure for the Surry plant is similar to the North Anna intake structure. However, North Anna plant does not have the high-level intake structure. The Surry low-level intake structure has eight bays with a trash rack in each bay. The applicant determined that three of the eight bays and their trash racks associated with the emergency service water pumps are within the scope of license renewal. The safety-related emergency service water pump house is in scope, but the electric equipment room is not in scope. The staff's review finds that the scoping of the low-level intake structure meets the requirements of 10 CFR 54.4.

The Surry plant has a safety-related high-level intake structure for each unit at the station end of the intake canal. Each high-level intake structure has four bays separated by reinforced-concrete interior walls and a exposed deck that is built on top of the walls. Trash racks are provided at the mouth of each bay. The applicant determined that all four of the Unit 1 trash racks associated with the emergency service water system are in scope. Two of the Unit 2 trash racks are within the scope of license renewal because they are associated with the emergency service water system. Each of the four bays directs water from the intake canal into the 96-inch-diameter concrete circulating water pipe. The outlet water from the condensers is directed to a single concrete discharge tunnel. A safety-related discharge tunnel is provided for each unit that ends at a seal pit. The applicant determined that the concrete circulating water pipe, the discharge tunnel and seal pit are within the scope of license renewal. The staff's review found that including these structures within the scope of license renewal meets the intent of 10 CFR 54.4.

The applicant listed 17 generic component and commodity groups and their intended functions in Table 2.4.6-1 of the SPS LRA for the low-level intake structure and listed 11 of them in

Table 2.4.6-2 of the SPS LRA for the high-level intake structure. The applicant listed 3 components and their intended functions in Table 2.4.6-3 of the SPS LRA for the concrete circulating water pipe and listed concrete tunnels, seal pits, and weirs in Table 2.4.6-4 of the SPS LRA for the discharge tunnels and seal pits. The component groups in these tables are subject to an AMR because applicable intended functions are performed without moving parts or without a change of configuration or properties, and they are not replaced on a qualified life or specified time period. The staff reviewed Tables 2.4.6-1 through 2.4.6-4 of the SPS LRA and the information in Section 2.4.6 of the LRA and the UFSAR for the Surry plant, and the additional information submitted by the applicant in response to the staff's questions. Based on this review, the staff did not find any omissions by the applicant related to scoping and screening the Surry intake structures. The staff's review also found that all the long-live and passive structures and components identified within the scope of license renewal were subject to an AMR.

2.4.6.3 Conclusions

On the basis of this review, the staff concludes that there is reasonable assurance the applicant has adequately identified those portions of the structures and components within the boundary of the intake structures for both the North Anna plant and the Surry plant that are within the scope of license renewal and the associated components and commodities that are subject to an AMR, in accordance with the requirements of 10 CFR 54.4(A) and 10 CFR 54.21(A)(1), respectively.

2.4.7 Yard Structures

In the North Anna and Surry LRAs, Section 2.4.7, "Yard Structures," the applicant described the yard structures and identified their structural components at each plant site that are within the scope of license renewal and subject to an AMR. As described in Section 2.4.7 of each LRA, the applicant has identified the following yard structures at the North Anna or the Surry plant or both that are within the scope of license renewal:

- buried fuel oil tank missile barrier
- chemical addition tank foundation
- emergency condensate storage tank foundation and missile barrier
- refueling water storage tank foundation
- casing cooling tank foundation (NAS 1/2)
- fire protection/domestic water tank foundation (SPS 1/2)
- fuel oil lines missile barrier (SPS 1/2)
- manholes
- fuel oil storage tank dike
- transformer fire walls and dikes
- duct banks
- security lighting poles
- domestic water treatment building (NAS 1/2)
- auxiliary service water expansion joint enclosure (NAS 1/2)
- yard valve pit (NAS 1/2)
- containment mat sub-surface pump access shaft

The design of the yard structures is addressed in Sections 6.2.2.2, 9.5.1.3, 9.5.1.4, 9.5.4.3, and 10.4.3.3 of the NAS UFSAR for the North Anna plant and Sections 6.3.1.3, 8.4, 8.5, 9.10.2., 9.10.4, and 10.3.5 of the SPS UFSAR for the Surry plant.

2.4.7.1 Summary of Technical Information in the Application

Buried Fuel Oil Tank Missile Barrier

There are two underground fuel oil tanks which provide fuel oil to the three emergency diesel generators. A 2-foot-thick reinforced-concrete slab is provided on top of the tanks for missile protection. The applicant determined that the slab on grade is within the scope of license renewal.

Chemical Addition Tank Foundation

The chemical addition tanks for the North Anna plant are tied with anchor bolts to the reinforced-concrete mat foundations. The chemical addition tanks for the Surry plant are supported by reinforced-concrete spread footings on soil approximately 9 feet below grade. The tank is attached to an octagon-shaped pedestal with anchor bolts. The pedestal is keyed and integral to the spread footing. The applicant determined that the mat foundation, spread footing, and pedestal are within the scope of license renewal.

Emergency Condensate Storage Tank Foundation and Missile Barrier

The emergency condensate storage tanks are tied with anchor bolts to the 4-foot-thick reinforced-concrete mat foundations on soil and are encapsulated by 2-foot-thick walls and roof for missile protection. For the North Anna plant, the roof has a 20-inch opening which is covered with a carbon steel blind flange for access and missile protection. For the Surry plant, a 2-foot reinforced-concrete hatch is provided on the roof for access and missile protection. The applicant determined that the mat foundations, tank enclosures, and missile shields are in scope for the license renewal.

Refueling Water Storage Tank Foundation

The refueling water storage tanks are tied with anchor bolts to a reinforced-concrete mat foundation. For the North Anna plant, the mat foundation is built on sound rock. For the Surry plant, the mat foundation is supported by concrete-filled steel pipe piles. The mat foundations and steel pipe piles are within the scope of license renewal.

Manholes

The concrete manholes within the scope of license renewal are the small reinforced-concrete structures that are cast in place and soil supported. These manholes are located underground with access openings at grade level. The openings of the safety-related manhole are protected with steel manway covers for missile protection. For the North Anna plant, some of the manholes for cable installation and removal have concrete hatches with missile barriers. For the Surry plant, the electrical concrete manhole No.1 is divided into two sections and its roof is covered with a carbon steel plate as a missile-resistant shield. The manholes and their accessaries are within the scope of license renewal.

Fuel Oil Storage Tank Dike

The fuel oil storage tank dike is a 12-inch-thick reinforced-concrete wall supported on a spread footing on soil. The dike is sized to contain the entire 210,000 gallons of fuel oil in the tank. The walls and spread footings are in scope.

Transformer firewalls/dikes

The main and station service transformers for Units 1 and 2 are protected from fire. They are separated from each other by a 12-inch concrete fire wall that is supported on a soil-supported spread footing. The transformers sit on a bed of crushed stone with a 6-inch-high dike surrounding each transformer to prevent oil spreading. The dike walls and crushed stone pits are sized to contain the full volume of the oil from a transformer. The dikes, fire walls, and crushed stone pits are in scope.

Duct Banks

The duct banks, which protect or support the cable duct, are the reinforced-concrete structures founded on soil. For the Surry plant, the reinforced-concrete transition box, pull box, and cable trench are installed on the duct banks between the station blackout building and the condensate polishing building. The duct banks are buried with a portion above ground. The duct banks, pull box, transition boxes, and trenches are in scope.

Security Lighting Poles

The security lighting poles are required for Appendix R safe shutdown. The poles at NAS and SPS are different in design. At the North Anna plant, 17 security lighting poles installed in the yard area provide security lighting for operator access to various components in other buildings or structures. The NAS poles are galvanized steel poles supported on a 3-foot-square reinforced-concrete foundation tied with anchor bolts to the base plate which is welded to the base of the pole. For the Surry plant, eight security lighting poles in the yard area provide illumination for operator access to various components in other building or structures. These are the reinforced-concrete poles which are buried directly into ground soil. The lighting poles and foundations are within the scope of license renewal.

North Anna Casing Cooling Tank Foundation

Each unit of the North Anna plant has a 26-foot-diameter casing cooling tank that is supported on a common reinforced-concrete mat foundation. The tank is located adjacent to corresponding casing cooling pump house. The tank is tied with anchor bolts to a mat foundation that is supported on rock. The mat foundation is within the scope of license renewal.

North Anna Domestic Water Treatment Building

The domestic water treatment building of the North Anna plant is a one-story building enclosed with masonry block walls and built-up roofing. The building houses the 475-gallon hydropneumatic tank associated with the fire protection system and is supported by a reinforced-concrete mat foundation. The applicant determined that only the mat foundation is within the scope of license renewal.

North Anna Auxiliary Service Water Expansion Joint Enclosure

The auxiliary service water expansion joint enclosure, located adjacent to the intake structure, is an underground reinforced-concrete structure on soil. The enclosure protects and provides access to the expansion joints, which accommodate movement in the 24-inch auxiliary service water lines and the 8-inch service water makeup line. The top of the structure is missile-protected with a reinforced-concrete roof and a manhole access opening on top of the roof is protected with a missile-resistant cover. There are two reinforced-concrete hatches on the top of the structure for equipment installation and removal. The enclosure and its associated components are within the scope of license renewal.

North Anna yard valve pit

The yard valve pit is an underground reinforced-concrete structure that is installed in line with the expansion joint enclosure structure. The valve pit encloses, protects, and provides access for the two 24-inch safety-related auxiliary service water lines and the 8-inch service water makeup line. The reinforced-concrete roof and its three reinforced hatches are missile-protected. A steel platform inside the structure provides access to the valves and associated equipment. The structural components subject to an AMR are listed in Table 2.4.7-8 of the NAS LRA.

Surry Fire Protection/domestic Water Tank Foundation

There are two 300,000-gallon fire protection/domestic water tanks in the Surry plant adjacent to the fire pump house. The tanks are supported on well-tamped sand and gravel with a 2-inch oiled-sand cushion on top that is confined within a 2½-foot-deep reinforced-concrete ring wall at grade level just outside the perimeter of the tank. The foundation ring wall is in-scope for license renewal.

Surry Fuel Oil Lines Missile Barriers

The fuel oil lines in the Surry plant are buried sufficiently deep that the covering soil provides an adequate missile barrier. The fuel oil lines at outside of the fuel oil pump house are protected with a 10-foot long reinforced-concrete slab on soil (as a missile barrier). A bridge missile barrier, consisting of a reinforced-concrete slab resting on steel plate, protects the fuel oil lines where they are routed over the top of the enclosed concrete liquid waste trench on their way to the emergency diesel generator room. The 25-ft long bridge for missile protection rests on spread footings. The missile shields, slabs on soil, and spread footings are in-scope for license renewal.

2.4.7.2 Staff Evaluation

The staff reviewed Section 2.4.7 and Tables 2.4.7-1 through 2.4.7-8 of the NAS LRA and Section 2.4.7 and Table 2.4.7-1 through 2.4.7-5 of the SPS LRA and the UFSARs to determine whether the applicant has adequately implemented its methodologies such that there is reasonable assurance that the structures and components comprising the yard structures in each plant were properly identified within the scope of license renewal and subject to an AMR, in accordance with the requirements of 10 CFR 54.4 and 10 CFR 54.21(a)(1). After completing the initial review, the staff requested additional information from the applicant by E-mail on September 24, 2001. The applicant responded to the staff's questions via an E-mail, dated October 4, 2001. The staff reviewed the additional information and drawings submitted by the applicant in response to the staff's questions to determine whether there were any structures or components within the boundary of the yard structures that the applicant did not identify subject to an AMR. On the basis of this review, the staff identified the findings as described below:

In Section 2.4.7 of the NAS LRA, the applicant describes the yard structures for the North Anna plant. The staff's review found that the following structural components for the tank foundations are not listed in Table 2.4.7-1 of the NAS LRA subject to an AMR: carbon steel blind flange cover for the emergency condensate storage tank, anchor bolts for the refueling water storage tank foundation and the casing cooling tank foundation. Also, it is not clear whether there are any concrete pits or foundations to support the two underground fuel oil tanks. The staff asked that the applicant verify the table to ensure its completeness.

In its response, the applicant stated that the carbon steel blind flange cover for the emergency condensate storage tank is listed in Table 2.4.7-1 under "missile shields." In Table 3.5.7-1, the missile shields are listed as carbon steel. Anchor bolts are not uniquely identified in the table. The embedded portion of anchor bolts is considered steel embedded in concrete (like a reinforcing bar) and evaluated with concrete. The portion of the anchor bolts that is not embedded in concrete is evaluated as part of the general structural supports. As discussed in Section C2.2 of the LRA, bolting (including anchor bolts) was not uniquely identified, and is typically evaluated as part of the larger host component. There is no concrete pit or foundation to support the two underground tanks. The tanks are directly buried and supported by compacted fill with 4 inches of oil-sand placed around the tanks. The staff's review found that the components of concern were identified in the table.

In Section 2.4.7 of the SPS LRA, the applicant describes the yard structures for the Surry plant. The staff found that the following structural components are not identified in Table 2.4.7-1 of SPS LRA subject to an AMR: anchor bolts and steel skirt for the chemical addition tank foundation, anchor bolts and missile walls for the emergency condensate storage tank foundation, concrete bridge for the fuel oil lines missile barriers. The staff asked that the applicant verify the table to ensure its completeness.

In its response, the applicant stated that anchor bolts are not uniquely identified in Table 2.4.7-1. The embedded portions of the anchor bolts are evaluated as part of yard structures. The scoping of anchor bolts is the same as for the North Anna plant. The steel skirt is welded to the chemical addition tank and is considered part of the tank as described in LRA, Section 2.3.2. The missile walls for the emergency condensate storage tanks are listed in Table 2.4.7-1 as "walls" with a missile barrier intended function. The staff found no omissions by the applicant.

In Section 2.2-4 of the NAS LRA, the applicant listed 22 structures in the North Anna plant that are not within the scope of license renewal. The staff agrees with respect to most of these structures because they do not perform the intended function required by 10 CFR 54.21 and, therefore, do not require an AMR. However, the following structures in the table needed to be verified to determine whether they perform any intended functions and should be included in the scope of license renewal: (1) concrete foundations for the main transformers and station service transformers, (2) fire pump house embankment, (3) independent spent fuel storage facility, (4) spent fuel cask handling structure, and (5) transmission line towers. The staff requested that the applicant provide additional information on these structures.

In its response, the applicant stated that the main transformers and station service transformers are not within the scope of license renewal and their foundations are not in scope. However, the dikes and firewalls associated with these transformers are in scope as indicated in Section 2.4.7 of the NAS LRA. The dike and firewalls prevent a fire from spreading from the transformer area. The fire pump house embankment surrounds and supports a fabric tank. The fabric tank supplies water to the fire protection system for warehouse No.5. The warehouse No.5 fire protection system is not in scope. Therefore, the fabric tank and the embankment are not within the scope of license renewal. The independent spent fuel storage facility is not licensed under 10 CFR Part 50 and is not included in each LRA. The independent spent fuel pool is licensed separately under 10 CFR Part 72. The cable that is supported by the transmission line towers is not in scope and, therefore, the transmission towers are not within the scope of license renewal. The staff finds that the applicant's response fully addressed staff's questions, therefore, the applicant 's response is acceptable.

As a result of the above review, the staff did not find any omissions by the applicant in the structures and components of the yard structures that were included within the scope of license renewal. The staff also found no omissions in the components of the yard structures identified in the LRA tables that require an AMR.

2.4.7.3 Conclusions

On the basis of this review, the staff concludes that there is reasonable assurance that the applicant has properly identified the structures and components in the boundary of the yard structures that are within the scope the scope of license renewal and subject to an AMR, in accordance with the requirements of 10 CFR 54.4(a) and 10 CFR 54.21(a)(1), respectively.

2.4.8 Earthen Structures

In the North Anna and Surry LRAs, the applicant described the components of the earthen structures for the NAS and SPS that are within the scope of license renewal and subject to an AMR. The earthen structures are further described in Section 3.8.4 and Section 9.2.1 of the NAS UFSAR and in Section 10.3.4 and Section 15.6 of the SPS UFSAR. The staff reviewed the earthen structures to determine whether there is reasonable assurance that the applicant has identified and listed structures and components subject to AMR in accordance with the requirements stated in 10 CFR 54.21(a)(1).

2.4.8.1 Summary of Technical Information in the Application

The applicant describes its methodology for identifying the components that are within the scope of license renewal in Section 2.0 of the applications, "Scoping and Screening Methodology for Identifying Structures and Components Subject to Aging Management Review, and Implementation Results." In Table 2.2-3 of each LRA, the applicant listed structures within the scope of license renewal and lists structures not within the scope of license renewal in Table 2.2-4. These tables link the reader to the appropriate section in the LRA to view the “screening results.” Based on the scoping methodology, the applicant, in Table 2.2-3 of each LRA, identifies the earthen structures within the scope of license renewal and describes the results of its scoping methodology in Section 2.4.8 in the North Anna and Surry LRAs.

North Anna Power Station

The earthen structures at NAS consist of the service water reservoir and the floodwall west of the turbine building. The service water reservoir (SWR) supports normal operations of safety-related equipment and provides cooling water for plant shutdown. Technical specification requirements ensure that a minimum 30-day supply of service water is available in the SWR for each of the two reactors operating at the site, in the event of the design basis accident. The SWR is the ultimate heat sink for both units.

The applicant identified SWR “component groups” that require AMRs in Table 2.4.8-1 in each LRA. This table lists the component groups with their passive function identified and a link to their AMR results. The applicant has identified the following component groups for the SWR that are subject to AMR: clay liner, concrete liners, earthen dike and embankment, spread footing.

The purpose of the floodwall west of the turbine building is to provide protection from the probable maximum flood. The earthen floodwall dike is located just west of the Unit 2 end of the Turbine Building and the Heating Boiler Room Service Building in the Unit 3 and 4 restoration area. Because the dike provides protection from the probable maximum flood, it will protect the station from flood waters entering the restoration area from Lake Anna through the abandon Unit 3 and 4 intake tunnel.

The applicant identified “component groups” for the floodwall west of the Turbine Building that require AMR. These are presented in Table 2.4.8-2 in each LRA. This table lists the component groups with their passive function identified and a link to their AMR results. The applicant has identified the following component groups for the floodwall west of the Turbine Building that are subject to AMR: culverts, earthen dike and embankment.

Surry Power Station

The earthen structures at SPS consist of the intake and discharge canals. The primary purpose of the intake canal is to provide a source of cooling water from the James River to the station. The intake canal is located south of the station, between the low-level intake structure at the river and the high-level intake structure at the station. The canal is part of the flowpaths for both the circulating water system and the service water system, and it acts as a reservoir for the service water system. In the event of a loss of station power at the low-level intake, three diesel-driven, vertical emergency service water pumps are provided for both units at the low-level intake structure to supply makeup water to the intake canal. The emergency service water lines leaving the low-level intake structure are buried underground and encased in reinforced-concrete (missile barrier) from the beginning of the intake canal embankment to the discharge point into the canal.

The applicant identified component groups for the intake canal that require AMR in Table 2.4.8-1 of each LRA. This table lists the component groups with their passive function identified and a link to their AMR results. The applicant has identified the following component groups for the intake that are subject to AMR: concrete liner sealant, concrete culverts, concrete liners, earthen dike and embankment, concrete culvert gaskets, missile barrier.

The primary purpose of the discharge canal is to convey discharge cooling water to the James River. The discharge canal is located north of the station. Its centerline is approximately 380 feet from the containment structures. The discharge canal begins at the discharge structure's seal pits and extends to the James River. The James River is the ultimate heat sink for both units.

The applicant identified component groups for the discharge canal that require AMR in Table 2.4.8-2 of each LRA. This table lists the component groups with their passive function identified and a link to their AMR results. The applicant has identified the following component groups for the discharge canal that are subject to AMR: concrete liners, earthen dike and embankment.

In Tables 2.4.8-1 and 2.4.8-2 the applicant listed the SCs of the NAS and SPS earthen structures that are within the scope of license renewal because they fulfill one or more of the following intended functions: (1) provide a protective barrier for internal/external flood events; (2) provide a missile (internal or external) barrier; (3) provide a heat sink during SBO or design basis accidents; (4) provides a source of cooling water for plant shutdown; (5) provide structural and/or functional support to equipment meeting license renewal Criterion 2 (non-safety affecting safety-related) and/or to Criterion 3 (the five regulated events); and (6) provides structural and/or functional support for safety-related equipment.

As stated by the applicant, SCs of the earthen structures are subject to an AMR because they support safety-related equipment or equipment meeting license renewal Criterion 2 and/or 3 in a passive manner. As a result, they perform their intended functions without moving parts or without change in configuration or properties and are not subject to periodic replacement based on a qualified life or specified time limit.

2.4.8.2 Staff Evaluation

The NRC staff reviewed Section 2.4.8 in the North Anna and Surry LRA and the supporting information in the various sections of the NAS and SPS UFSARs to determine whether there is reasonable assurance that the SCs of the earthen structures were adequately identified within the scope of license renewal and subject to an AMR in accordance with 10 CFR 54.21(a)(1).

The staff reviewed the structural members in Tables 2.4.8-1 and 2.4.8-2 for NAS and SPS to determine whether any other structures associated with the earthen structures meet the scoping criteria of 10 CFR 54.4(a), but were not included within the scope of license renewal. The staff then reviewed portions of the UFSAR descriptions to ensure that all SCs of the earthen structures had been adequately identified and that they were passive, long-lived and performed their intended functions without moving parts or with a change in configuration or properties and were subject to replacement based on qualified life or specified time period. The staff found that the service water reservoir, floodwall, intake canal, and discharge canal are part of safety-related SSCs and meet 10 CFR 54.4(a), as identified in each LRA. On the basis of the above review the staff did not find any omissions by the applicant.

SPS identified underdrains and pressure relief valves associated with the intake canal within the scope of license renewal but not subject to an AMR. In a teleconference with the applicant in

November 2001, the staff asked whether the drain piping and valves should require an AMR. The applicant stated that the underdrains and pressure relief valves were provided to prevent uplift of the concrete liner by hydrostatic pressure experienced during construction. Since there is no potential for uplifting on the intake canal concrete liner with water maintained in the canal, the drain piping and valves perform no intended function. Therefore, the uderdrain piping and pressure relief valves are not subject to an AMR. The staff found the applicant response to be acceptable.

2.4.8.3 Conclusions

On the basis of the staff's review of the information submitted by the applicant in each LRA and supporting information in the NAS and SPS UFSAR as described above, the staff did not identify any omissions by the applicant. Therefore, the staff finds that there is reasonable assurance that the applicant has adequately identified the earthen structures that are within the scope of license renewal and the associated SC's that are subject to an AMR, in accordance with the requirements of 10 CFR 54.4(a) and 54.21(a)(1), respectively.

2.4.9 Nuclear Steam Supply System (NSSS) Equipment Supports

In the North Anna and Surry LRAs, Section 2.4.9, "NSSS Equipment Supports," the applicant describes the support structures for the NSSS equipment that are within the scope of license renewal and subject to an AMR. The NSSS equipment supports include the supports for the reactor vessel (RV), reactor coolant pumps (RCPs), steam generators (SGs), and the pressurizer (PZR). The design of the NSSS equipment supports is described in Section 5.5.9 of the NAS UFSAR for the North Anna plant and Section 15.6.2 of the SPS UFSAR for the Surry plant. The boundary for each of the NSSS equipment supports lies between the integral attachment being supported and its concrete supporting structure. The staff reviewed this information submitted by the applicant to determine whether the applicant has adequately demonstrated that the requirements of 10 CFR 54.4 and 10 CFR 54.21 were met for the NSSS equipment supports.

2.4.9.1 Summary of Technical Information in the Application

Reactor Vessel Support

The reactor vessel is supported by six sliding-foot assemblies that are mounted to the neutron shield tank (NST) assembly. The NST assembly is a skirt-mounted steel tank that transfers loads from the support ring of the NST to the containment mat foundation. The tank is filled with water, which circulates through an external heat exchanger to limit heat transfer to the concrete shield wall and cool the sliding-foot assemblies. The sliding-foot assemblies support the RV on bearing pads that are integral to and located beneath each of the six RV primary loop nozzles. The sliding-foot assembly consists of a ball-and-socket joint mounted on a foot, which is permitted to slide only radially along the RV centerline. The connection hardware for the RV support structure includes threaded bolting components, nuts, washers, and anchorage components.

Reactor Coolant Pump Support

The North Anna and the Surry reactor coolant pump (RCP) supports have different designs. The North Anna plant RCP support assembly restrains the RCP for all the design loading conditions. The support assembly consists of a lower support frame that is supported from the cubicle floor by three pin-ended support columns. Lateral seismic restraint for the pump is provided by hydraulic snubbers. The design of the support frame permits low friction radial thermal expansion between the RCP feet and the lower support frame. The Surry RCP support assembly is a pin-jointed frame suspended from the building structure, which is attached to the four feet of the RCP at the approximate elevation of the pump discharge line (cold leg). The RCP is supported laterally from the SG with horizontal struts.

The RCP support for each plant has spherical bearing assemblies at the connections to allow for unrestrained rotational movement. Each bearing assembly consists of a high-grade steel ball encased within a high-grade stainless steel socket. Bolting and pin-connection hardware used in the RCP support structure include threaded bolting components, pins, nuts, washers, and anchorage components.

Steam Generator Support

For the North Anna plant, the steam generator support assembly consists of a lower support frame and an upper support ring. The lower support frame is a rigid frame structure that carries the weight of the SG and is anchored to the concrete support structure. The upper SG support consists of a pair of snubbers and a pair of rigid restraints attached to the upper support ring. A bronze alloy plate, impregnated with lubricant, provides low-friction thermal expansion between the SG and its lower support frame.

For the Surry plant, the steam generator support assembly consists of two (upper and lower) steel cast rings with vertical support arrangements. Lateral restraint in the radial direction is provided by snubbers and traverse direction is provided by the upper and lower support rings. The lower ring steel casting, which is located under the four SG support pads, carries the weight of the SG and is suspended by three vertical support rods attached to the concrete structure. Thermal expansion between the SG and the lower support ring is accommodated by the support foot assemblies.

Spherical bearing assemblies are provided for each plant at the connections to allow for unrestrained rotational movement. The bolting and pin-connection hardware used for the SG support structures include threaded bolting components, pins, nuts, washers, and anchorage components.

Pressurizer Support

The pressurizer in each plant is supported by a rigid ring girder bolted to the PZR skirt. The ring girder is suspended from the building with rods. At the upper PZR casing lugs, lateral restraint against dynamic loads is provided by gapped rigid restraints. Bolting and pin-connection hardware used in the PZR support assembly include threaded bolting components, pins, nuts, washers, and visible anchorage components.

2.4.9.2 Staff Evaluation

The staff reviewed Section 2.4.9 of LRAs and the UFSARs to determine whether the applicant has adequately identified the structural components of the NSSS equipment supports that are within the scope of license renewal and subject to an AMR, in accordance with the requirements of 10 CFR 54.4 and 10 CFR 54.21. After completing its initial review, the staff requested additional information of the applicant by an E-mail on September 24, 2001. The applicant responded to the staff's questions via an E-mail, dated October 4, 2001. The staff's evaluation of the applicant's submittals is summarized below.

In Section 2.4.9 of each LRA, the applicant describes the NSSS equipment supports for the reactor vessel, reactor coolant pump, steam generator, and the pressurizer. Table 2.4.9-1 of each LRA lists the RCP, SG, and PZR support structures as all the components of the NSSS equipment supports subject to an AMR. However, the reactor vessel support is not included in the table. The staff believes that the support structure for each of the NSSS equipment supports is designed differently as a specific support assembly that is not a typical design for all the supports. The staff asked that which LRA table lists the RV support and whether the NSSS equipment supports should be itemized in the table (e.g., the RCP support assembly, SG support assembly, and the PZR support assembly).

In its response, the applicant stated that the components of the RV support structure are identified in Table 2.4.9-1 of each LRA. As discussed in Section 2.4.9 of each LRA, support for the RV is provided by six sliding-foot assemblies that are mounted on the neutron shield tank. The sliding-foot assembly, neutron shield tank, and neutron shield tank support structure are listed in Table 2.4.9-1 of each LRA. The support structures for the RCP, SG, and PZR were not listed separately in the table because the materials and the environments are similar (carbon and low-alloy steel in an air and borated water leakage environment). The remaining structural components listed in the table are general support elements associated with the NSSS equipment supports. The staff's review found that all the components of the NSSS equipment supports were included in scope and subject to an AMR for license renewal.

Based on the above review, the staff did not find any omissions by the applicant related to scoping and screening of the structures for the NSSS equipment supports. The staff's review also found that all the structural components within the NSSS equipment supports were identified subject to an AMR.

2.4.9.3 Conclusions

On the basis of this review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the structures and components associated with the NSSS equipment supports that are within the scope of license renewal and subject to an AMR, in accordance with the requirements of 10 CFR 54.4(a) and 54.21(a)(1), respectively.

2.4.10 General Structural Supports

In the North Anna and Surry LRAs, Section 2.4.10, "General Structural Supports," the applicant describes the general structural supports for mechanical and electrical components, and identified the structures within the scope of license renewal that make up the evaluation boundary for the general structural supports. The staff reviewed the general structural supports to determine whether there is reasonable assurance that the applicant has identified and listed all supports subject to AMR in accordance with the requirements stated in 10 CFR 54.21(a)(1).

2.4.10.1 Summary of Technical Information in the Application

The general structural supports are the SCs that support mechanical, electrical, and miscellaneous equipment that are common to plant systems and have similar characteristics (design, materials of construction, environments, and anticipated stressors). The applicant identified that the general structural supports within the scope of license renewal are in Table 2.2-3, "Structures Within the Scope of License renewal" and include structures such as the auxiliary building, discharge canal, fire pump house, fuel building, fuel oil pump house, chemical addition tank foundation, and the emergency condensate storage tank foundation and missile barrier. In Table 2.4.10-1 of each LRA the applicant listed the general structural supports that are within the scope of license renewal because they fulfill one or more of the following intended functions:

- provide enclosure, shelter, or protection for in-scope equipment (including radiation shielding and pipe whip restraint)

- provide structural and/or functional support to equipment meeting license renewal Criterion 2 (non-safety affecting safety-related) and/or Criterion 3 (the five regulated events)

- provide structural and/or functional support for safety-related equipment

In each LRA, Table 2.4.10-1, the applicant assigns the general structural supports to six component groups based on design, material construction, anticipated stressors, and environment. These groups are battery racks, control rod drive mechanism restraints, electrical conduit and cable trays, bearing plate, structural support subcomponents such as plate and structural shapes, and vendor-supplied specialty items such as spring hangers and struts.

As stated by the applicant, SCs of the general structural supports are subject to an AMR because they support safety-related equipment or equipment meeting license renewal Criterion 2 and/or 3 in a passive manner. As a result, they perform their intended functions without moving parts or without change in configuration or properties and are not subject to periodic replacement based on a qualified life or specified time limit.

2.4.10.2 Staff Evaluation

The staff reviewed Section 2.4.10, Table 2.2-3, and Table 2.4.10-1 of the NAS and SPS LRAs to determine whether the applicant has adequately identified the general structural supports in the structures that are within the scope of license renewal in accordance with 10 CFR 54.4. The staff previously reviewed a sample of the structures in Table 2.2-3 of the LRA to verify whether the listed general structural supports were located within or part of the SCs in Table 2.2-3. The staff found that these general structural supports are part of the safety-related, non-safety-related, and regulated-event SSCs that are similar to most nuclear power plants. The staff did not identify any omissions in the general structural supports identified by the applicant subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1). On the basis of the above review the staff did not find any omissions by the applicant.

In the NAS and SPS LRAs, the applicant indicates that there are structural supports included within the evaluation boundary that, upon detailed review, would not be within the scope of license renewal. In a telecommunication with the applicant in November 2001, the staff asked how these structural supports were evaluated, and to provide examples justifying the exclusion of structural supports within the evaluation boundary that had been reviewed. The applicant stated that it did not exclude structural supports in the areas of the plant with mechanical and electrical components. The applicant stated that it evaluated all structural supports within these areas as part of the AMR process. The staff found the applicant response to be acceptable.

2.4.10.3 Conclusions

On the basis of the review described above, the staff finds that there is reasonable assurance that the applicant has adequately identified the general structural supports that are within the scope of license renewal and subject to an AMR in accordance with the requirements of 10 CFR 54.4(a) and 10 CFR 54.21(a)(1), respectively.

2.4.11 Miscellaneous Structural Commodities

In the North Anna and Surry LRAs, Section 2.4.11, “Miscellaneous Structural Commodities,” the applicant describes the miscellaneous structural commodities, and identifies the commodity groupings which protect safety-related equipment and equipment meeting license renewal Criterion 2 and 3. Miscellaneous structural commodities are further described in Section 9.5.1.2.4.2, Section 9.5.1.3.1.1 and Section 7.1.2 of the North Anna updated final safety analysis report (UFSAR). Also, Section 2.4.8 and Section 9.10.2.9 of the Surry UFSAR provide a description of miscellaneous structural commodities. The staff reviewed the miscellaneous structural commodities to determine whether there is reasonable assurance that the applicant has identified and listed structures and components subject to aging management review (AMR) in accordance with the requirements stated in 10 CFR 54.21(a)(1)

2.4.11.1 Summary of Technical Information in the Application

The applicant describes its methodology for identifying the SCs within the scope of license renewal in Section 2.1 of each LRA. Based on its scoping methodology, the applicant, in Table 2.2-3 of each LRA, identifies the miscellaneous structures within the scope of license renewal and describes the results of its scoping methodology in Section 2.4.11 of the North Anna and Surry LRA.

The miscellaneous structural commodities are the SCs that support or protect various SSCs that are safety-related or meet 10 CFR 54.4(a)(2) or (3). The applicant in Table 2.2-3, “Structures Within the Scope of License renewal” defines those areas where miscellaneous structural commodities are within the scope of license renewal (e.g., security diesel building, SBO building, service building, turbine building, and condensate polishing building). The applicant listed the miscellaneous structural commodities in Table 2.4.11-1 that are within the scope of license renewal because they fulfill one or more of the following intended functions:

- provide enclosure, shelter, or protection for in-scope equipment (including radiation shielding and pipe whip restraint)

- provide an environmental qualification (EQ) barrier

- provide a rated fire barrier to confine or retard a fire from spreading to or from adjacent areas of the plant
- provide a protective barrier for internal/external flood events
- provide a pressure boundary
- provide structural and/or functional support to equipment meeting license renewal Criterion 2 (non-safety affecting safety-related) and/or Criterion 3 (the five regulated events)
- provide structural and/or functional support for safety-related equipment

In each LRA, Table 2.4.11-1, the applicant identified the “structural members” for the miscellaneous structural commodities that require an AMR. This table lists the structural members with their passive function identified and a link to their AMR results. The applicant has identified the following structural members for the miscellaneous structures that are subject to an AMR, bus duct enclosure, cable tray cover, electrical component supports (within panels and cabinets), fire barrier penetration seals, fire doors and/or EQ barrier doors, firestops, fire wraps, fire wrap bands, firestop supports, gaskets (in junction, terminal, and pull boxes), gypsum boards, panels and cabinets, radiant energy shield, seismic gap materials, seismic gap covers, and switchgear enclosures.

On the basis of the above-described methodology, the applicant identified both the SCs and the structural members that are part of the miscellaneous structural commodities and identified the intended functions of the structural members that are subject to an AMR in Table 2.4.11-1 in each LRA. As stated by the applicant, SCs of the miscellaneous structural commodities are subject to AMR because they protect or support safety-related equipment or equipment meeting 10 CFR 54.4(a)(2) or (3) in a passive manner. As a result, they perform their intended functions without moving parts or without change in configuration or properties, and are not subject to periodic replacement based on a qualified life or specified time limit.

2.4.11.2 Staff Evaluation

The NRC staff reviewed Section 2.4.11 in the LRA and the supporting information in Sections 9.5.1.2.4.2, 9.5.1.3.1.1, and 7.1.2 of the North Anna UFSAR and Sections 2.4.8 and 9.10.2.9 of the Surry UFSAR to determine whether there is reasonable assurance that the SCs of the miscellaneous structural commodities were adequately identified within the scope of license renewal and subject to an AMR in accordance with 10 CFR 54.21(a)(1).

The staff reviewed the structural members in Table 2.4.11-1 to determine whether there were any other components associated with the miscellaneous structural commodities that meet the scoping criteria of 10 CFR 54.4(a) but were not included within the scope of license renewal. The staff previously reviewed and sampled sections of Table 2.2-3 which identify structures within the scope of license renewal that included structures having miscellaneous structural commodities within the scope of license renewal. The staff found that these miscellaneous structural commodities are part of safety-related SSCs and meet 10 CFR 54.4(a)(2) and (3) as identified in each LRA. In addition, the staff reviewed the various sections of the North Anna and Surry UFSARs. The staff examined the structural members in Table 2.4.11-1 of each LRA to determine whether they are the only SCs that are subject to an AMR in accordance with 10 CFR 54.21(a)(1). On the basis of the above review, the staff did not find any omissions by the applicant.

2.4.11.3 Conclusions

On the basis of the review described above, the staff found that there is reasonable assurance that the applicant has appropriately identified the miscellaneous structural commodities components that are within the scope of license renewal and subject to an AMR in accordance with 10 CFR 54.4(a) and 10 CFR 54.21(a)(1), respectively.

2.4.12 Load-handling Cranes and Devices

In the North Anna and Surry LRAs, Section 2.4.12, “Load-handling Cranes and Devices,” the applicant describes the structural components of the load-handling cranes and devices that are within the scope of license renewal and subject to an AMR. The load-handling cranes and devices are further described in the Section 9.1 and 9.6 of the North Anna updated final safety analysis report (UFSAR) and Section 9.12.4 of the Surry UFSAR. The staff reviewed the load-handling cranes and devices to determine whether there is reasonable assurance that the applicant has identified and listed structures and components subject to AMR in accordance with the requirements stated in 10 CFR 54.21(a)(1).

2.4.12.1 Summary of Technical Information in the Application

The applicant describes its methodology for identifying the SCs within the scope of license renewal in Section 2.1 of each LRA. Based on its scoping methodology, the applicant identifies the load-handling cranes and devices within the scope of license renewal and describes the results of its scoping methodology in Section 2.4.12 in the North Anna and Surry LRAs.

As stated in the North Anna UFSAR Section 9.6, “Control of Heavy Loads,” the load-handling systems are classified into two groups: (1) Group I includes handling systems that conform to the guidelines of NUREG-0612, “Control of Heavy Loads at Nuclear Power Plants,” because a load drop may result in damage to system required for plant shutdown or decay heat removal, and (2) Group II includes handling systems (excluded from Group I) that do not conform to the guidelines of NUREG-0612 because a load drop from these systems would not impact plant operations and safety due to the physical separation between the handling system and systems needed for plant shutdown or decay heat removal.

Surry UFSAR Section 9.12.4, “Refueling Equipment,” states that equipment (i.e., containment polar crane, refueling manipulator cranes, fuel-handling bridge crane, new fuel transfer elevator, etc.) are designed to be Class I structures. Section 15.2, “Structural Design Criteria,” of the Surry UFSAR states that Class I structures of the facility are essential to the prevention of accidents that could affect public health and safety or to the mitigation of their consequences. As such, Class I structures are designed to resist seismic loadings in accordance with Section 15.2.4 of the Surry UFSAR.

The load-handling cranes and devices and the associated components meet the intent of 10 CFR 54.4(a) for license renewal because they perform the following functions:

- provide structural and/or functional support to equipment meeting license renewal Criterion 2 (non-safety affecting safety-related) and/or Criterion 3 (the five regulated events)

- provides structural and/or functional support for safety-related equipment

On the basis of the above described methodology, the applicant identified both the SCs and the component groups that are part of the load-handling cranes and devices, and identified the intended functions of the structural components that are subject to an AMR in Table 2.4.12-1 in each LRA. As stated by the applicant, SCs and components of the load-handling cranes and devices are subject to AMR because they are limited to load-bearing elements that support the lifting of loads in a passive manner. As a result, they perform their intended functions without moving parts or without change in configuration or properties, and are not subject to periodic replacement based on a qualified life or specified time limit.

2.4.12.2 Staff Evaluation

The NRC staff reviewed Section 2.4.12 in the LRA and the supporting information in Section 9.1 and 9.6 of the NAS UFSAR and Sections 9.12.4 and 15.2 of the SPS UFSAR to determine whether there is reasonable assurance that the SCs of the load-handling cranes and devices were adequately identified within the scope of license renewal and subject to an AMR in accordance with 10 CFR 54.21(a)(1).

The staff reviewed the structural component groups in Table 2.4.12-1 (i.e., fuel elevator structural beams, columns, rails, baseplates and anchors for attachment to structures, structural crane components such as structural beams, girders, columns, trolley rails, baseplates and anchors for attachment to structures, and retaining clips) to determine whether there were any other components associated with the load-handling cranes and devices that meet the scoping criteria of 10 CFR 54.4(a), but were not included within the scope of license renewal. The staff has reviewed Section 2.4.12 of each LRA and NAS and SPS UFSARs. The staff also examined the component groupings listed in Table 2.4.12-1 in the LRA to determine whether they are the only SCs that are subject to an AMR in accordance with 10 CFR 54.21(a)(1). On the basis of the above review the staff did not find any omissions by the applicant.

2.4.12.3 Conclusions

On the basis of the review described above, the staff found that there is reasonable assurance that the applicant has appropriately identified the components of the load-handling cranes and devices that are within the scope of license renewal and subject to an AMR in accordance with 10 CFR 54.4(a) and 10 CFR 54.21(a)(1), respectively.

2.5 Screening Results: Electrical and Instrumentation and Controls Systems

In the North Anna and Surry LRAs, Section 2.5, “Screening Results: Electrical and Instrumentation and Controls Systems,” the applicant describes the electrical components that are within the scope of license renewal and subject to an AMR. The staff reviewed this section of each LRA to determine whether there is reasonable assurance that all SCCs within the scope of license renewal were identified, as required by 10 CFR 54.4(a), and that all structures and components subject to an AMR were identified, as required by 10 CFR 54.21(a)(1).

On the basis of this review the staff requested additional information in a letter to the applicant dated August 8, 2001 (Ref. 2.5-1). The applicant responded to this request for additional information in letters to the staff dated September 27, 2001 (Ref. 2.5-2), and July 11, 2002 (Ref. 2.5-8).

The applicant screened and evaluated the electrical and I&C components as commodities on a plant-wide basis rather than on a system basis. The following electrical and I&C component groups are identified in Section 2.5 as performing their intended functions without moving parts and without a change in configuration or properties:

1. bus ducts

2. cables and connectors

3. electrical penetrations

The applicant states in Section 2.5 that all electrical penetration assemblies are within the scope of the environmental qualification program and are also the subject of a TLAA. The electrical penetrations, therefore, are addressed in Section 4.4, “Environmental Qualification (EQ) of Electrical Equipment,” of this SER. The bus duct and non-EQ cables and connectors are evaluated below.

Although the applicant screened and evaluated the electrical and I&C components on a plant-wide basis rather than on a system basis, Table 2.2 -2 of each LRA identifies systems not within the scope of license renewal. In Table 2.2-2 of both the North Anna and Surry applications the AAC diesel service air (BSR) is listed as a system that is not within the scope of license renewal. In Table 2.2-1 of both applications, however, various AAC diesel systems are listed as systems that are within the scope of license renewal. In a conference call with the applicant on July 31, 2001 (Ref 2.5-3), the staff asked the applicant to clarify why the AAC diesel service air system is not included within the scope of license renewal.

The applicant stated that the AAC diesel service air system is primarily used for maintenance purposes and does not provide a support function to the EDG or any other safety-related component. The AAC diesel starting air system supports the EDG safety-related function, and is in the scope of license renewal. The staff finds this response acceptable.

In Table 2.2-2 of the North Anna LRA, 4kV and above electrical equipment (PH) is listed as a system that is not within the scope of license renewal. In Table 2.2-1 of the North Anna and Surry applications, however, electrical power (EP) is listed as a system that is within the scope of license renewal. In the July 31, 2001 conference call (Ref. 2.5-3), the staff requested a clarification of whether the PH system has any safety-related or support functions.

The applicant stated that the PH system is unique to North Anna. Its primary function is to support the main generator output breaker, which is non-safety-related. It has no other safety-related or support functions. The staff finds this response acceptable.

Offsite Power System Scoping

The screening results in Section 2.5 of each LRA do not include any electrical components listed in NEI 95-10 (Appendix B) and the Standard Review Plan (Table 2.1-5) for the offsite power system. These are components such as switchyard bus, transmission conductors, switchyard insulators, and transmission line insulators. The regulation in 10 CFR 54.4(a)(3) requires that all systems, structures, and components relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for station blackout (10 CFR 50.63) be included within the scope of Part 54. A requirement of 10 CFR 50.63 is that each light-water-cooled power plant licensed to operate be able to withstand and recover from a station blackout of a specified duration that is based upon factors that include the expected frequency of loss of offsite power and the probable time needed to recover offsite power. At North Anna and Surry the specified duration was determined based upon evaluations that followed the guidance in NRC Regulatory Guide 1.155 and NUMARC 87-00 and included the plants' offsite power characteristics. These characteristics helped determine the probable time needed to recover offsite power (coping duration). The resulting 4-hour coping duration at North Anna and Surry is therefore based on the likelihood of recovering offsite power within 4 hours.

In a conference call with the applicant on July 31, 2001 (Ref. 2.5-3), the staff requested that the applicant explain the exclusion of offsite power systems from the scope of license renewal (10 CFR 54.4(a)(3)) with regard to station blackout (10 CFR 50.63). The applicant stated that the North Anna and Surry station blackout analysis relied primarily on the recovery of the emergency diesel generators.

The staff disagreed with the applicant and stated that, for North Anna and Surry, the specified duration for recovery was based on Regulatory Guide 1.155 and NUMARC 87-00 and included the recovery of offsite power. In addition, 10 CFR 50.63(a) states that the station blackout duration shall be based on "[t]he expected frequency of loss of offsite power" and "[t]he probable-time needed to restore offsite power." Based on this information, the staff determined that applicable offsite power structures and components are included within the scope of license renewal and are subject to an aging management review or additional justification for their exclusion must be provided. The staff forwarded to the applicant an RAI on August 8, 2001, as a followup to this concern. The applicant responded, in its letter dated September 27, 2001 (Ref 2.5-2), that the alternate AC (AAC) power sources (diesel generators) and emergency diesel generators are relied on to recover from an SBO event at North Anna and Surry. They indicated that the AAC diesel generators can be run past the 4-hour coping period to restore power. The applicant concluded that neither North Anna nor Surry relies on offsite power to recover from an SBO event and that offsite power is not within the scope of license renewal because it is not required to perform the intended functions for compliance with 10 CFR 50.63.

The AAC power sources were accepted under the SBO rule as an alternate means of withstanding an SBO. The definition of an AAC power source is contained in 10 CFR 50.2. The definition addresses the capability of these power sources to cope with an SBO but not to recover from an SBO. While a very small number of AAC sources may have capabilities beyond those required for coping, the staff nevertheless finds that they were only reviewed as a means of coping with an SBO for the plant-specific coping duration. Reference to AAC power sources as a means of recovering from an SBO is therefore not intended within the context of the SBO rule. According to the rule, only offsite power and onsite power are credited as means of recovering from an SBO event and, therefore, both must be included within the scope of license renewal.

An example of an AAC power source coping discussion during an SBO review exists in the North Anna SBO documentation. The applicant indicated in a February 10, 1992 letter (Ref. 2.5-4), that the capacity of the AAC power source fuel (day) tank required for a 4-hour coping duration at North Anna was about 1200 gallons and that the size of the day tank that would be required for an 8-hour coping duration might be larger than acceptable based on insurance and other considerations. The staff accepted the 4-hour coping duration and use of the smaller (1200 gallon) day tank in its supplemental evaluation for North Anna sent to the applicant in a letter dated June 8, 1992 (Ref. 2.5-5). Examples of AAC power source coping discussions also exist at the Surry plant. An applicant letter dated May 10,1993 (Ref. 2.5-6), and the subsequent NRC staff supplemental SBO evaluation on Surry, dated June 25, 1993 (Ref. 2.5-7), speak of an AAC power source capability to carry only the loads required for coping with an SBO for the required coping duration.

The staff has pursued license renewal scoping of offsite power generically with the Nuclear Energy Institute (NEI) and held several public meetings on the subject. The following NRC staff position is the result of industry and public input gathered during these meetings.

Staff Position

Consistent with the requirements specified in 10 CFR 54.4(a)(3) and 10 CFR 50.63(a)(1), the plant system portion of the offsite power system should be included within the scope of license renewal. The reasons for this position follow.

Rationale

The license renewal rule, 10 CFR 54.4(a)(3), requires that “all systems, structures, and components relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission’s regulations for ... station blackout (10 CFR 50.63)” be included within the scope of license renewal. The SBO rule, 10 CFR 50.63(a)(1), requires that each light-water-cooled nuclear power plant licensed to operate be able to withstand and recover from a station blackout of a specified duration that is based upon factors that include: “(iii) The expected frequency of loss of offsite power; and (iv) The probable time needed to restore offsite power.” The SBO rule in this regard is consistent with the staff findings identified in the statement of considerations and NUREG-1032, “Evaluation of Station Blackout Accidents at Nuclear Power Plants.” In particular, with regard to factor (iv), the staff found that offsite power is more likely to be restored (0.6 hour median time to restore) than are the emergency diesel generators (eight hours median time to repair) in terminating an SBO event.

Station blackout is the loss of offsite and onsite AC electric power to the essential and non essential switchgear buses in a nuclear power plant. It does not include the loss of AC power fed from inverters powered by station batteries or loss of AC power from an SBO defined AAC power source. The SBO rule was added to the regulations in 10 CFR Part 50 because, as operating experience accumulated, concern arose that the reliability of both the offsite and onsite AC power systems might be less than originally anticipated, even for designs that met the requirements of General Design Criteria 17 and 18. As a result, the SBO rule required that nuclear power plants have the capability to withstand and recover from the loss of offsite and onsite AC power of a specified duration (the coping duration).

Licensees' plant evaluations followed the guidance specified in NRC Regulatory Guide (RG) 1.155 and NUMARC 87-00 to determine the required plant-specific coping duration. The criteria specified in RG 1.155 to calculate a plant-specific coping duration were based upon the expected frequency of loss of offsite power *and* the probable time needed to restore offsite power, as well as on the other two factors (onsite emergency AC power source redundancy and reliability) specified in 10 CFR 50.63(a)(1). In requiring that a plant's coping duration be based in part on the probable time needed to restore offsite power, 10 CFR 50.63(a)(1) specifies that the offsite power system be an assumed method of recovering from an SBO. Disregarding the offsite power system as a means of recovering from an SBO would not meet the requirements of the rule and would result in a longer required coping duration.

The reference to the offsite power system in 10 CFR 50.63(a)(1) as a means of recovering from an SBO should not be construed to mean that it is the only acceptable means of recovering from an SBO. A licensee could, for example, recover offsite power or emergency (onsite) power. It is not possible to determine prior to an actual SBO event which source of power can be returned first. As a result, 10 CFR 50.63(c)(1)(ii) and the associated guidance in RG 1.155, Section 1.3 and Section 2, provide for procedures to recover from an SBO that include restoration of offsite and onsite power.

Based on the above, both the offsite and onsite power systems are relied upon to meet the requirements of the SBO rule. Elements of both offsite and onsite power are necessary to determine the required coping duration under 10 CFR 50.63(a)(1), and the procedures required by 10 CFR 50.63(c)(1)(ii) must address both offsite power and onsite power restoration. It follows, therefore, that both systems are used to demonstrate compliance with the SBO rule and must be included within the scope of license renewal consistent with the requirements of 10 CFR 54.4(a)(3). License renewal applicants are presently including the onsite power system within the scope of license renewal on the basis of the requirements under 10 CFR 54.4(a)(1) (safety-related systems). They are also including equipment that is relied upon to cope with an SBO (e.g., AAC power sources) on the basis of the requirements under 10 CFR 54.4(a)(3). Therefore, only the addition of the offsite power system is necessary to complete the required scope of the electrical power systems for license renewal.

The offsite power systems of U.S. nuclear power plants consist of a transmission system, the grid, which provides a source of power, and a plant system that connects that power source to a plant's onsite electrical distribution system, which powers safety equipment. Historically, the staff has relied upon the well-distributed, redundant, and interconnected nature of the grid to provide the necessary level of reliability to support nuclear power plant operations. For purposes of the license renewal rule, the staff has determined that the plant system portion of the offsite power system that is used to connect the plant to the offsite power source should be included within the scope of the rule. This path typically includes the switchyard circuit breakers that connect to the offsite system power transformers (startup transformers), the transformers themselves, the intervening overhead or underground circuits between circuit breaker and transformer and the onsite electrical distribution system, and the associated control circuits and structures. Ensuring that the appropriate offsite power system long-lived passive structures and components that are part of this circuit path are subject to an aging management review will assure that the bases underlying the SBO requirements are maintained over the period of the extended license. This is consistent with the Commission's expectation that the SBO regulated-event be included under 10 CFR 54.4(a)(3) of the license renewal rule.

Consistent with the above position, the plant system portion of the offsite power system at North Anna and Surry should be included within the scope of license renewal. In a letter dated July 11, 2002 (Ref. 2.5-8), the applicant responded to the staff position with a revised response to the staff's original request for additional information on this matter. In the revised response, the applicant identified portions of the offsite power system at North Anna and Surry that will be included within the scope of license renewal, consistent with the staff position and the SBO scoping criterion in 10 CFR 54.4(a)(3). The power path identified for both plants includes the 34.5 kV circuit breakers in the station's switchyard, which supply power to the reserve station service transformers (RSSTs), and extends through the transfer buses at each station. The additional electrical components included within the scope of license renewal for the Surry plant are as follows (note: this list does not include structural components associated with the offsite circuits, which are addressed separately in this report):

- 34.5 kV circuit breakers with associated control components (including cables) and disconnect switches to connect the RSST circuits to the grid

- 34.5 kV power conductors (insulated cable, bare overhead cable, tubular bus, and connectors) from the switchyard to the RSSTs

- Power cables and connectors for sump pumps located in manholes associated with underground 34.5 kV cable

- Ceramic insulators used with disconnect switches, overhead bare cable, and tubular bus for 34.5 kV and 4160 V circuits

- RSSTs, 4160 V power conductors (tubular bus, insulated cable, and connectors) that supply transfer buses D, E, and F, the 4160 V breakers connecting to the transfer buses, and transfer buses D, E, and F

The applicant stated that, based on the guidance in NEI 95-10, the circuit breakers, disconnect switches, and RSSTs do not require an aging management review because they are considered active components. The staff agrees with the applicant. In addition, the applicant currently includes the RSST A and RSST B 4160 V circuit breakers and their controls within the SBO scope of license renewal, as well as transfer buses D and E. Transfer bus F is newly added to the scope. The staff evaluation of the newly added electrical components requiring an AMR is contained in Section 3.9 of this report.

The additional SBO-related offsite power electrical components included within the scope of license renewal for North Anna are as follows:

- 34.5 kV disconnect switches, ceramic insulators, and circuit breakers with associated controls (including cables) to connect RSST circuits to the grid

- insulated cables, connectors, and aluminum bus bars connecting the 34.5 kV circuit breakers to the RSSTs

- RSSTs, insulated cables, and connectors to connect to the line side of the 4160 V circuit breakers which power transfer buses D, E, and F

- aluminum tube bus, insulated cables, and connectors to connect to the 4160 V circuit breakers which power normal station service buses A, B, C, and G of each unit

The applicant stated that, based on the guidance in NEI 95-10, the circuit breakers, disconnect switches, and RSSTs do not require an aging management review because they are considered active components. The staff agrees with the applicant. In addition, the applicant currently includes the 4160 V circuit breakers to transfer buses D, E, and F and their controls within the SBO scope of license renewal, as well as the transfer buses themselves. The staff evaluation of the newly added electrical components requiring an AMR is contained in Section 3.9 of this report.

2.5.1 Bus Duct

Section 2.5.1, “Bus Duct,” in the North Anna and Surry LRAs identifies bus ducts as a component group that performs its intended functions without moving parts and without a change in configuration or properties.

2.5.1.1 Summary of Technical Information in the Application

In the North Anna and Surry LRAs, the applicant describes the bus duct as a component assembly conducting electrical power between equipment using a preassembled raceway (enclosure) design, with conductors installed on insulated supports.

In the North Anna LRA, Section 2.5.1, “Bus Duct,” the following nonsegregated bus ducts are identified as within the scope of license renewal for the reasons indicated in parentheses:

- the three 3,000-ampacity bus ducts of transfer buses D, E, and F (related to station blackout, 10 CFR 50.63)
- the four 1,200-ampacity bus ducts of the H and J buses for each of the two units (safety-related)

In the Surry LRA, Section 2.5.1, “Bus Duct,” the following nonsegregated bus ducts are identified as within the scope of license renewal for reasons indicated in parentheses:

- the three 3,000-ampacity, 4160-volt bus ducts of transfer buses D, E. and F (related to station blackout, 10 CFR 50.63)
- the two 1,200-ampacity, 4,160-volt SBO bus ducts (related to station blackout, 10 CFR 50.63)
- the four 1,200-ampacity, 4,160-volt bus ducts of the H and J buses for each of the two units (safety-related)

- the one 1,600-ampacity, 480-volt bus duct connecting transformer 1A2 to switchgear 1A2 (related to fire protection, 10 CFR 50.48)

The North Anna and Surry LRAs both state that the non-segregated bus ducts at the site in the scope of license renewal are the totally enclosed, non-ventilated type and that these bus ducts are located above the switchgear and are connected to the top of entry cubicles.

2.5.1.2 Staff Evaluation

The staff reviewed Section 2.5.1 of the North Anna and Surry LRAs to determine whether there is reasonable assurance that the applicant has identified the bus ducts within the scope of license renewal. This is in accordance with 10 CFR 54.4. The staff also reviewed this section of each LRA to determine whether there is reasonable assurance that the applicant has identified the bus ducts subject to an AMR. This is in accordance with 10 CFR 54.21(a)(1).

The bus ducts identified by the applicant are safety-related, station-blackout-related, and fire-protection-related bus ducts. The staff reviewed these component categories against the requirements in 10 CFR 54.4(a)(1) and 10 CFR 54.4(b) and found that those categories are included in the requirements. The staff reviewed the information in the North Anna and Surry UFSARs and found that there is reasonable assurance that the applicant has identified the bus ducts within the scope of license renewal.

The North Anna and Surry LRAs state that the boundary of a nonsegregated bus duct which is evaluated for aging management is the point at which the nonsegregated passive bus duct connects with active switchgear (i.e., the bolted connections of the bus assembly to the active switchgear bus and the bolted connection of the enclosure assembly to the switchgear housing). In Table 2.5.1-1 of the North Anna and Surry LRAs, the applicant indicates that the bus assembly portion of the bus duct is the electrical portion of the duct that requires an AMR. Its passive function is to conduct electricity. The staff agrees that the applicant has properly identified the electrical portion of the bus duct because it performs its function without moving parts or a change in configuration or properties (is passive and long-lived) and is therefore subject to an AMR.

2.5.1.3 Conclusions

On the basis of the staff’s review of the bus duct information presented in Section 2.5.1 of the North Anna and Surry LRAs and the supporting information in the UFSARs, the staff did not find any omissions by the applicant. The staff therefore concludes that there is reasonable assurance that the applicant has identified those bus ducts that are within the scope of license renewal, as required by 10 CFR 54.4(a), and are subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.5.2 Cables and Connectors

Section 2.5.2, “Cables and Connectors,” in the North Anna and Surry LRAs identifies cable and connectors as component groups that perform their intended functions without moving parts and without a change in configuration or properties.

2.5.2.1 Summary of Technical Information in the Application

Section 2.5.2 in the North Anna and Surry LRAs states that cables and associated connectors provide electrical connections to specified sections of an electrical circuit to deliver system voltage and current. It states that the insulation resistance, which precludes shorts, grounds, and unacceptable leakage currents, maintains circuit integrity.

The applicant has evaluated the North Anna and Surry cables and connectors as commodities across system boundaries. This is termed the “spaces approach” in Section 2.5.3.1 of the NRC Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants (NUREG-1800). Table 2.2-3 of the North Anna and Surry LRAs defines those buildings and structures (areas) containing components that perform 10 CFR 54.4(a) intended functions. Each LRA states that these same areas contain the cables and connectors needed to support component intended functions. The application states that these cables and connectors are within the scope of license renewal and are subject to aging management review.

Section 2.5.2 in the North Anna and Surry LRAs lists the following cable types that require evaluation for aging management:

- power cables
  medium-voltage power (2.0 kV to 15 kV)
  low-voltage power (below 2.0 kV)

- instrumentation and control
  control
  instrumentation
  thermocouple
  communication

2.5.2.2 Staff Evaluation

The staff reviewed Section 2.5.2 of the North Anna and Surry LRAs to determine whether there is reasonable assurance that the applicant has identified the cables and connectors within the scope of license renewal. This is in accordance with 10 CFR 54.4. The staff also reviewed this section of each LRA to determine whether there is reasonable assurance that the applicant has identified the cables and connectors subject to an AMR. This is in accordance with 10 CFR 54.21(a)(1).

The applicant evaluated the cables and connectors as commodities across system boundaries using the spaces approach. In Section 2.5.2 of the North Anna and Surry LRAs it is stated that the evaluation boundary generally includes all cables and connectors in these areas to provide complete coverage of cables and connectors in the scope of license renewal. In its July 31, 2001, telecommunication with the applicant (Ref. 2.5-3), the staff requested a clarification of the use of the term “generally” in this statement.

The applicant stated that the word “generally” was used because the evaluation boundaries included all cables and connectors with the exception of those supplying the control rod drive mechanisms (CRDMs) and the bare grounding conductors. The applicant explained that the CRDMs are included within the scope of license renewal because they serve a safety-related pressure boundary function. However, the rod movement function is not safety-related and is not within the scope of license renewal. Therefore, the associated cables and connectors are also not within the scope of license renewal. The bare grounding conductors were found to be outside the scope of license renewal in several past license renewal applications. In a letter dated August 8, 2001 (Ref. 2.5-1), the staff requested additional information relating to this concern and asked the applicant to formally document the information provided during this telecommunication.

In a letter dated September 27, 2001 (Ref. 2.5-2), the applicant verified that loss of the CRDM cables would neither impede nor prevent the performance of the control rod safety function, and they are not required to support intended functions meeting the criteria in 10 CFR 54.4(a). With regard to the bare grounding conductors, the applicant explained that they provide personnel safety protection by interconnecting plant areas and equipment to minimize potential gradients (voltage differences) between these areas during electrical power system ground fault conditions. They are not required to support the intended functions meeting the 10 CFR 54.4(a) criteria. Accordingly, the staff finds these responses resolve the staff's concerns on this issue. This item is closed.

The staff reviewed the spaces (buildings and structures) in Table 2.2-3 of the North Anna and Surry LRAs that the applicant has identified as containing cables and connectors that are within the scope of license renewal and subject to an aging management review. The staff also reviewed Table 2.2-4 of each LRA, which identifies buildings and structures that are not within the scope of license renewal.

In the Surry LRA, Table 2.2-3, the applicant states that the high-level and low-level intake structures are within the scope of license renewal. However, in Table 2.2-4 of the Surry LRA, the applicant states that the high-level intake structure control house and the low-level intake structure switchgear building are not within the scope of license renewal. The staff requested a clarification as to the function of the high-level intake structure control house and the low-level intake structure switchgear building, and verified that the structures in questions do not contain any safety-related or support equipment.

The applicant stated (Ref. 2.5-3) that the high-level intake structure control house and the low-level intake structure switchgear building are unique to Surry because of its natural circulation service water and circulating water systems. The high-level intake structure control house contains such components as screen drive motors, screen wash pumps, and hotel loads. The low-level intake structure switchgear building primarily houses the switchgear for the 4160-volt, 480-volt, and 120-volt power supplies, switchgear, and transformers to the non-safety-related circulating water systems. It has no other safety-related or support function. The staff finds this response acceptable.

In the Surry LRA, Table 2.2-4, the applicant states that the local emergency operating facility is not within the scope of license renewal. The staff requested a clarification of the function of the local emergency operating facility and any safety-related or support functions.

The applicant states (Ref. 2.5-3) that the local emergency operating facility was originally built to support an emergency response. These functions have since been transferred to the applicant's headquarters in Richmond, VA, and other onsite locations. The only emergency response function of this facility is that it serves as a gathering place for State and local officials during an emergency, as appropriate. This structure has no other safety-related or support functions and, therefore, is not within the scope of license renewal. The staff finds this response acceptable.

In Table 2.5.2-1 of the North Anna and Surry LRAs, the applicant indicates that the passive function of the cables and connectors is to conduct electricity and that the cable and connectors are subject to an AMR. The staff agrees that the applicant has correctly identified the cables and connectors as passive and long-lived components that perform their function without moving parts or a change in configuration or properties and are therefore subject to an AMR.

2.5.2.3 Conclusions

On the basis of the staff's review of the cable and connector information presented in Section 2.5.1 of the North Anna and Surry LRAs and the supporting information in the UFSARs, the staff did not find any omissions by the applicant. The staff therefore concludes that there is reasonable assurance that the applicant has identified those cables and connectors that are within the scope of license renewal, as required by 10 CFR 54.4(a), and are subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.5.3 Staff Position on Screening of Electrical Fuse Holders

In a letter dated May 16, 2002, the NRC forwarded to the Nuclear Energy Institute (NEI) and Union of Concerned Scientists, a proposed staff position on screening of electrical fuse holders. The staff position indicated that fuse holders should be scoped, screened, and included in the aging management review (AMR) in the same manner as terminal blocks and other types of electrical connections that are currently being treated in the process. NUREG-1760 (Aging Assessment of Safety-Related Fuses Used in Low- and Medium-Voltage Applications in Nuclear Power Plants) found that aging stressors such as vibration, thermal cycling, electrical transients, mechanical stress, fatigue, corrosion, chemical contamination, or oxidation of the connecting surfaces can result in fuse holder failure. The final staff position on this issue is under development. In a letter dated November 4, 2002 (ADAMS Accession Number ML023080355), the applicant committed to implement, at North Anna and Surry, the final staff guidance on this subject.

2.5.4 References for Section 2.5

2.5-1 NRC Letter to Virginia Electric and Power Company, dated August 8, 2001, Adams No. ML012260171

2.5-2 Virginia Electric and Power Company letter (Serial No. 01-514) to the NRC, dated September 27, 2001

2.5-3 NRC Telecommunication with Virginia Electric Power Company, dated August 8, 2001, Adams No. ML012260187

2.5-4 Virginia Electric and Power Company letter (Serial No. 91-738A) to the NRC, dated February 10, 1992

2.5-5 NRC (Leon B. Engle) letter to Virginia Electric and Power Company (W.L. Stewart), dated June 8, 1992

2.5-6 Virginia Electric and Power Company letter (Serial No. 93-292) to the NRC, dated May 10, 1993

2.5-7 NRC (Bart C. Buckley) letter to Virginia Electric and Power Company (William Stewart), dated June 25, 1993

2.5-8 Virginia Electric and Power Company letter (Serial No. 02-297) to the NRC, dated July 11, 1992

3.0 Aging Management Review Results

3.1 Introduction

This chapter presents the staff's evaluation of the applicant's AMR. The section 3.0 of the LRAs provide the results of the aging management review for those structures and components (SCs) identified in Section 2.0 as being subject to aging management review. The applicant reviewed existing programs and activities for the SCs that are subject to an AMR, and identified those programs that can be used to manage the applicable aging effects. The applicant either identified a demonstration of the effectiveness of different programs consistent with 10 CFR 54.21(a)(3), or developed new aging management programs or activities to manage the remaining applicable aging effects. The applicant provides descriptions of the aging management programs (AMPs) in Appendix B of the LRAs, "Aging Management Activities."

3.2 Summary of Technical Information in the Application

The applicant described its AMR of the mechanical SCs for license renewal in the LRAs Section 3.1, "Reactor Coolant System," Section 3.2, "Engineered Safety Features," Section 3.3, "Auxiliary Systems," Section 3.4, "Steam and Power Conversion Systems," Section 3.5, "Containment, Structures, and Component Supports," and Section 3.6,"Electrical, and Instrument and Controls." The methodology used for performing aging management reviews including the process for identifying the aging effects requiring management is explained in Appendix C to the LRAs, "Aging Management Review Methodology."

3.3 Aging Management Review

The NRC staff evaluated the applicant's AMR of the structures, components, and commodity groups that have been identified as being subject to an AMR in Chapters 2 and 3 of the LRAs, and any additional SSCs identified by the staff during its scoping and screening evaluation, audit, and inspection activities. As part of this effort, the staff also reviewed the applicant's summary descriptions of the AMPs and the evaluations of the time-limited aging analyses (TLAAs) provided by the applicant in Appendix A to the LRAs, "UFSAR Supplement." A more detailed discussion of the additional FSAR supplement information can be found throughout Chapter 3 and 4 of this SER, as appropriate.

3.3.1 Existing Aging Management Activities

This section of the SER contains the staff's evaluation of 19 AMPs that are currently being implemented and discussed in Appendix B2.2 of the LRAs, "Existing Aging Management Activities," and are references as part of the AMR for two or more of the systems and/or structures. The staff's evaluation of the applicant's AMPs focuses on program elements rather than the details of specific plant procedures. To determine whether the applicant's AMPs are adequate to manage the effects of aging so that the intended functions will be maintained consistent with the current licensing basis (CLB) for the period of extended operation, the staff used 10 elements to evaluate each program and activity. The 10 elements of an effective AMP were developed as part of the staff's draft standard review plan for license renewal (SRP-LR), published in1997. The final version of the SRP-LR was published in July 2001.

The following 10 elements will be considered in evaluating each AMP used by the applicant to manage the applicable aging effects identified in this SER:

- scope of program
- preventative actions
- parameters monitors or inspected
- detection of aging effects
- monitoring and trending
- acceptance criteria
- corrective actions
- confirmation process
- administrative controls
- operating experience

In Appendix A to the LRAs, the applicant states that the quality assurance program implements the requirements of 10 CFR 50, Appendix B, and is consistent with the summary in Section A.2 of the standard review plan for license renewal. The quality assurance program includes the three elements of corrective action, confirmation process, and administrative controls; and is applicable to the safety-related and non-safety-related structures, systems, and components that are within the scope of license renewal.

The staff's evaluation of the applicant's corrective actions, confirmation process, and administrative controls are discussed separately, and generically evaluated in Section 3.3.2 of this SER.

3.3.1.1 Augmented Inspection Activities

The applicant describes its augmented inspection activities in Section B2.2.1 of Appendix B of each LRA. The applicant credits this inspection activity with managing the aging for systems, commodities, and major components in all four units. In addition, the applicant provides a summary description of the augmented inspection activities in Section A2.2.1 of the UFSAR supplement. The staff reviewed the applicant's description of the program in Section B2.2.1 of each LRA to determine whether the applicant has demonstrated that it will adequately manage the applicable effects of aging during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.3.1.1.1 Summary of Technical Information in the Application

In Section B2.2.1 of each LRA, the applicant states that the purpose of the augmented inspection activities is to perform examinations of selected components and supports in accordance with requirements identified in the Technical Specifications, UFSAR, license commitments, industry operating experience, and good practices for all four units. These activities are outside the required scope of ASME Section XI. However, selected activities are performed during each refueling outage in accordance with controlled procedures. The applicant has performed aging management reviews for the following systems, commodities, and major components in all four units that credit the augmented inspection activities for managing the aging effects of loss of material and cracking:

- chemical and volume control (SPS 1/2 only)

- containment spray (SPS 1/2 only)
- feedwater
- main steam
- reactor coolant system
- residual heat removal (SPS 1/2 only)
- safety injection (SPS 1/2 only)
- general structural supports
- pressurizer (SPS 1/2 only)

The applicant provides two tables in Section B2.2.1 of each LRA (one for NAS 1/2 and one for SPS 1/2) that summarize the augmented inspection activities for license renewal, the test methods, and the frequency of the examination. The applicant also states that:

> As a licensee followup action, as described in Section B4.0 of the LRAs, the station will implement an augmented examination of the pressurizer surge line connection to the reactor coolant system's hot-leg loop piping prior to the end of the current operating license term. These examinations will address the issue of thermal fatigue failure of welds due to environmental effects, GSI-190 (Reference19). Additionally, a Licensee Followup Action will be implemented to include inspection of the core barrel hold-down spring as one of the Augmented Inspection Activities. The initial inspection of the core barrel hold-down spring will be performed prior to the end of the current operating license term.

3.3.1.1.2 Staff Evaluation

The staff's evaluation of the augmented inspection activities focused on how the program manages aging effects through the effective incorporation of the following 10 elements: 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 indicates that the corrective actions, confirmation process, and administrative controls are part of the site-controlled quality assurance program. The staff's evaluation of these program attributes is provided separately in Section 3.3.2 of this SER. The remaining seven elements are discussed below.

Program scope: Section B2.2.1 of each LRA summarizes the test methods and frequency of the examinations for inspection items that are part of the augmented inspection activities. In order to complete the evaluation, the staff requested that the applicant confirm that this information listed in Section B2.2.1 of each LRA, and the corresponding acceptance criteria for each item, is the same as the commitments included in the CLB. The staff also requested a discussion of the technical basis for any differences. In a letter dated May 22, 2002 (Serial No. 02-277), the applicant verified that this information and the corresponding acceptance criteria for each item are consistent with the augmented inspection activities currently being performed under its CLB. The staff found this response acceptable and did not identify any need to expand the scope of the program for the period of extended operation beyond that already described in Section B2.2.1 of each LRA.

Preventive actions: There are no preventive or mitigative actions taken as part of this program, and the staff did not identify the need for such actions

Parameters monitored or inspected: The applicant states in Section B2.2.1 of each LRA that component conditions are monitored to detect degradation due to loss of material and cracking by use of visual testing, surface examinations, and volumetric examinations. The applicant also commits to the development of inspection procedures for the pressurizer surge line connection and the core barrel holddown springs. The initial inspections for these additional items will be performed prior to the end of the current operating license term. The commitment to the performance of these inspections is acceptable to the staff.

Detection of aging effects: The augmented inspection activities check for loss of material and cracking through a combination of visual inspections, surface examinations, and volumetric examinations. The applicant states in Section B2.2.1 of each LRA that these examinations are consistent with those endorsed by the NRC for ASME Section XI inspections. The staff accepts the nondestructive examination methods in the augmented inspection activities to be reliable and effective in detecting age-related degradation of the subject components.

Monitoring and trending: In Section B2.2.1 of each LRA, the applicant states that anomalous indications of degradation are documented on nondestructive examination reports and evaluations are performed for inspection results that do not meet established acceptance standards. The applicant’s activities include engineering evaluations to consider the extent of degradation so that timely corrective or mitigative actions are taken to provide reasonable assurance that intended functions of inspected components are maintained. The inspection frequencies for components covered by the augmented inspection activities are (1) every 40 months for turbine throttle valves and steam generator supports, (2) every refueling outage for reactor vessel incore flux thimble tubes, reactor vessel head, and steam generator feedwater nozzles, and (3) every ISI inspection period for the component supports. Welds for the main steam and feedwater postulated break locations are inspected over a 120-month interval with 25% of all selected welds inspected during each 40-month period and 75% completed by the end of each 120-moth interval. In a letter dated May 22, 2002 (Serial No. 02-277), the applicant verified that these inspection frequencies are consistent with the augmented inspection activities currently being performed under its CLB. The staff did not identify any need to change the inspection frequencies for the period of extended operation and, therefore, these monitoring and trending activities are acceptable to the staff.

Acceptance criteria: The applicant states in Section B2.2.1 of each LRA that the acceptance criteria for the augmented inspection activities are consistent with guidance provided in Section XI of the ASME Code. In a letter dated May 22, 2002 (Serial No. 02-277), the applicant verified that the acceptance criteria for the augmented inspection activities for the extended period of operation are the same as the commitments included in the CLB. The staff found the acceptance criteria used for the augmented inspection activities to be satisfactory for managing the effects of aging of the subject components and did not identify any need to change the acceptance criteria for the period of extended operation.

Operating experience: The applicant‘s discussion of operating experience for the augmented inspection activities does not provide any specific information with respect to the operating experience with the existing programs at NAS 1/2 and SPS 1/2. As such, the staff requested that the applicant provide specific information regarding the operating experience with the existing program at NAS 1/2 and SPS 1/2. In its response to RAI B2.2.1-1, the applicant states that a review of operating experience, including equipment failure and maintenance results, has not identified any indication of aging not being detected by inspection activities credited for license renewal. Inspection results have not identified any notable aging that warranted corrective action, or the need to trend ongoing degradation, to prevent a loss of intended function prior to the next scheduled inspection. Therefore, the results of operating experience have not generated any changes to inspection activities. If any anomalous results were found during an augmented inspection, an evaluation and any required maintenance would be initiated in accordance with the applicant's corrective action system, which implements the requirements of 10 CFR Part 50, Appendix B. The applicant used the eddy-current examinations of flux thimble tubes as an example of operating experience with augmented inspections. In this case, the applicant states that strict wall-thinning limits are established for the thimble tubes such that the tubes are repositioned or taken out of service well before a potential loss of reactor coolant system pressure boundary. The staff concludes that there is reasonable assurance that the effects of aging associated with the systems and commodities that credit the augmented inspection activities will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation.

3.3.1.1.3 Conclusions

The staff has reviewed the information provided in Section B2.2.1 of each LRA and the summary description of the augmented inspection activities in Section A2.2.1 of the UFSAR supplement. In addition, the staff considered the applicant's response to the staff's RAIs and additional information provided in a letter to the NRC dated May 22, 2002 (Serial No. 02-277).

On the basis of this review and the above evaluation, the staff finds that the applicant has demonstrated that the effects of aging associated with components covered by the augmented inspection activities will be adequately managed so that there is reasonable assurance that the intended functions will be consistent with the CLB for the period of extended operation.

3.3.1.1.4 FSAR Supplement

The staff reviewed Section A2.2.1 of the UFSAR supplement and found that the description of the augmented inspection activities is consistent with Section B2.2.1 of each LRA. However, Section B2.2.1 of each LRA states that the station will implement an augmented examination of the pressurizer surge line connection to the reactor coolant system's hot-leg loop piping prior to the end of the current operating license term, and an inspection of the core barrel holddown spring. These two items are included in each LRA, Table B4.0-1, which contains a comprehensive list of followup action items. The applicant was requested to explain why these commitments are not included in Section A2.2.1 of the UFSAR supplement.

In its response to RAI B2.2.9-3, the applicant stated that it would incorporate the followup actions from Table B4.0-1 of each LRA into the UFSAR supplements for Surry and North Anna. The applicant committed to describe the followup actions in the appropriate aging management activity summaries provided in UFSAR supplement of the applications. In its letter dated July 25, 2002, the applicant stated that all items originally in Table B4.0-1 of the LRAs have been incorporated into the text of their respective Aging Management Activities (AMAs) in the UFSAR Supplement. Since the applicant has completed this action, the staff considers confirmatory action 3.3.1.1-1 closed.

3.3.1.2 Battery Rack Inspections

The applicant describes its battery rack inspection activities in Section B2.2.2 of Appendix B to each LRA. The applicant credits this inspection activity with managing the potential aging of the supports for various batteries. The staff reviewed the applicant's description of the battery rack inspection program in Section B2.2.2 of each LRA to determine whether the applicant has demonstrated that it will adequately manage the applicable effects of aging during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.3.1.2.1 Summary of Technical Information in the Application

In Section B2.2.2 of each LRA, the applicant states that the purpose of the battery rack inspections will be to reasonably assure the integrity of the supports for various batteries consistent with the CLB throughout the period of extended operation. The applicant states that loss of material due to corrosion is the applicable aging effect for the battery racks. Inspections are performed, as part of the battery rack inspections, for the support racks of numerous batteries, including:

- main station batteries
- emergency diesel generator batteries
- diesel-driven fire pump battery
- security diesel generator battery
- station blackout (AAC) diesel generator battery

3.3.1.2.2 Staff Evaluation

The staff's evaluation of the battery rack inspections focused on how the program manages aging effects through the effective incorporation of the following 10 elements: program scope, preventive or mitigative 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 indicates that the corrective actions, confirmation process, and administrative controls are part of the site-controlled quality assurance program. The staff's evaluation of these program attributes is provided separately in Section 3.3.2 of this SER. The remaining seven elements are discussed below.

Program scope: The applicant stated that the battery rack inspection activity is credited with managing the aging effect of loss of material for battery racks, as indicated in Table 3.5.10-1 of each LRA, which covers general structural supports. The applicant stated that the periodic checks of rack integrity, coinciding with periodic battery inspections, are performed to determine the physical condition of support racks for batteries that are important for the proper functioning of components within the scope of license renewal. The staff finds that the applicant's program is in general accord with industry experience and is, therefore, acceptable.

Preventive actions: There are no preventive or mitigative actions taken as part of this program, and the staff did not identify the need for such actions.

Parameters monitored or inspected: The applicant states that the condition of the battery support racks is visually inspected on a periodic basis to reasonably assure that their function to adequately support the batteries is not compromised. The aging effect that is monitored by these inspections is loss of material due to corrosion. In addition to the battery support racks, the applicant was requested to discuss the effect of aging on battery spacers used in the seismic rack assembly of the batteries. In a letter dated May 22, 2002 (Serial No. 02-277), the applicant responded by stating that both rigid and compressible spacers are used between cells of station batteries. These spacers are considered to be part of the battery support rack and degradation of the spacers would be detected during the periodic inspections of the battery racks. Based on the applicant's responses and the scope of the battery rack inspections, the staff finds the parameters monitored are acceptable.

Detection of aging effects: The applicant states in Section B2.2.2 of each LRA that visual inspections are used to identify degradation of the support racks. These inspections check for loss of material (corrosion) of the support racks and provide reasonable assurance that the integrity of the racks is maintained during a seismic event. The applicant also indicates that once degradation is detected, engineering evaluations will determine whether the observed condition is significant enough to compromise the ability of the battery rack to perform its intended function during a seismic event. In addition, the applicant states that repairs that are required as a result of the engineering evaluation would be implemented through the corrective action system. The staff finds that the visual battery rack inspection activity provides reasonable assurance that loss of material of the battery rack supports will be detected prior to the loss of intended function.

Monitoring and trending: The inspection frequency for the battery rack inspections is typically quarterly, but is monthly or weekly on a few battery systems. The applicant states that engineering evaluation assesses whether any observed loss of material could result in a loss of intended function. In addition, all observations regarding the material condition of the battery racks are recorded in completed inspection procedures. The staff finds that quarterly inspections of the battery rack supports are sufficient to provide reasonable assurance that loss of material of the supports will be detected prior of the loss of intended function.

Acceptance criteria: The applicant states in Section B2.2.2 of each LRA that the acceptance criterion for visual inspections is the absence of anomalous indications of degradation. In addition, the applicant states that engineering evaluation will determine whether observed degradation of the battery rack supports is significant enough to compromise the ability of the support to perform its intended function during a seismic event. In addition, occurrence of degradation which is determined to be adverse to quality, is entered into the applicant's corrective action system. The staff finds that the acceptance criteria for the battery rack inspections provide reasonable assurance that the component section identified to have potentially unacceptable degradation will be subject to subsequent evaluations and remedial actions.

Operating experience: The applicant states in Section B2.2.2 of each LRA that incidents of battery rack corrosion have occurred and corrective action has been taken to repair or replace rack components as necessary. In addition, the applicant states that the battery rack inspections and corrective actions have been successful in maintaining battery rack integrity and will continue into the period of extended operation. Based on the applicant's description of the periodic inspection and corrective actions, and the evidence of their successful performance in the past, the staff considers the visual inspection program for battery racks to be acceptable.

3.3.1.2.3 Conclusions

The staff has reviewed the information provided in Section B2.2.2 of each LRA and the summary description of the battery rack inspections in Section A2.2.2 of the UFSAR supplement. In addition, the staff considered the information provided by the applicant in a letter to the NRC dated May 22, 2002 (Serial No. 02-277). On the basis of this review and the above evaluation, the staff finds that the applicant has demonstrated that the effect of aging associated with the battery rack supports will be adequately managed so that there is reasonable assurance that the intended functions will be maintained consistent with the CLB for the period of extended operation.

3.3.1.2.4 FSAR Supplement

The staff reviewed Section A2.2.2 of the UFSAR supplement and found that the description of the applicant's battery rack inspections is consistent with Section B2.2.2 of each LRA.

3.3.1.3 Boric Acid Corrosion Surveillance

The applicant describes its boric acid corrosion surveillance program in Section B2.2.3 of Appendix B of each LRA. The applicant credits this program for managing the aging effect of loss of material for all four units. The staff reviewed each LRA to determine whether the applicant has demonstrated that the boric acid corrosion surveillance program will adequately manage the applicable effects of aging in the plants during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.3.1.3.1 Summary of Technical Information in the Application

In Section B2.2.3 of each LRA, the applicant states that the inspections are performed to provide reasonable assurance that borated water leakage does not lead to undetected loss of material from the reactor coolant pressure boundary and surrounding components.

This AMP was developed by the applicant in response to Generic Letter 88-05, "Boric Acid Corrosion of Carbon Steel Reactor Pressure Boundary Components in PWR Plants." The applicant's program includes examination of primary coolant components for evidence of borated water leakage that could degrade the external surfaces of nearby structures or components and implementation of corrective actions to address coolant leakage. At a minimum, these activities are performed inside containment at the beginning and end of each refueling outage.

The following systems, structures, commodities, and major components credit this AMP for managing the aging effect of loss of material:

<u>System</u>

- blowdown
- chemical and volume control
- chilled water (NAS 1/2 only)
- component cooling water
- containment vacuum

- containment spray (SPS 1/2 only)
- quench spray (NAS 1/2 only)
- drains - aerated
- drains - gaseous
- feedwater
- fire protection
- fuel pit cooling
- gaseous waste (SPS 1/2 only)
- instrument air
- main steam
- neutron shield tank cooling
- post-accident hydrogen removal (NAS 1/2 only)
- primary and secondary plant gas supply
- primary grade water (SPS 1/2 only)
- radiation monitoring
- refueling purification (NAS 1/2 only)
- reactor cavity purification (SPS 1/2 only)
- reactor coolant system
- recirculation spray
- residual heat removal
- safety injection
- sampling system
- service air (NAS 1/2 only)
- service water
- steam generator water treatment (NAS 1/2 only)
- steam generator recirculation and transfer (SPS 1/2 only)
- vacuum priming
- ventilation
- vents - aerated (SPS 1/2 only)

Structure

- containment
- load-handling cranes and devices
- NSSS equipment supports

Commodity

- general structural supports
- miscellaneous structural commodities

Major Component

- pressurizer
- reactor vessel
- steam generator

3.3.1.3.2 Staff Evaluation

The staff's evaluation of the boric acid corrosion surveillance program focused on how the program manages aging effects through the effective incorporation of the following 10 elements: 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 indicates that the corrective actions, confirmation process, and administrative controls are part of the site-controlled quality assurance program. The staff's evaluation of these program attributes is provided separately in Section 3.3.2 of this SER. The remaining seven elements are discussed below.

Program scope: Section B2.2.3 of each LRA states that the scope of the boric acid corrosion surveillance activities includes the effects on the leaking borated systems and susceptible equipment and structures in the vicinity of leakage. The systems, structures, commodities, and major components inside containment that credit this activity are listed in Section B2.2.3.1 of the LRAs. Similar inspections for the effects of boric acid leakage on components outside containment are performed in accordance with the applicant's general-condition-monitoring activities which are described in Section B2.2.9 of each LRA. The staff agrees that the program includes the recommendations of NRC GL 88-05. The staff finds the scope of this AMP acceptable because the scope includes the systems, structures, commodities, and major components inside containment that may be affected by borated water leakage.

Preventive actions: The applicant states that the boric acid corrosion surveillance activities are considered to be condition monitoring and no preventive actions are performed. The staff observed during the review that the recommendations of GL 88-05 include preventive actions and it appeared that preventive actions are included in this AMP. In a letter dated May 22, 2002 (Serial No. 02-277), the applicant indicated that the boric acid corrosion surveillance activities are performed at the beginning of each refueling outage, or when the calculation of the primary-system leakage rate, which is required by Technical Specifications, indicates an increased level of unidentified leakage. If indications of leakage are found, the boric acid residue is removed, the cause of the leakage is determined, and repairs are implemented in accordance with the corrective action program. Operating experience confirms that leakage is discovered and corrected prior to a loss of intended function. Furthermore, the applicant stated that the boric acid corrosion surveillance activities are considered as preventive actions.

The staff found the additional clarifications that were provided by the applicant to be acceptable. The staff concludes that appropriate preventive actions are being performed in accordance with the requirements of NRC GL 88-05.

Parameters monitored or inspected: The applicant performs visual inspections of external surfaces inside the containment to determine the presence of borated water leakage, which could lead to the deterioration of susceptible components. Equipment surfaces, insulated surfaces, and surrounding areas are examined for discoloration, staining, boric acid residue, and other evidence of leakage. Components that have come in contact with borated water leaks are visually examined to determine whether degradation has occurred. The staff finds the parameters monitored to be acceptable since coolant leakage results in deposits of white boric acid crystals and presence of moisture can be observed by the naked eye.

Detection of aging effects: The applicant performs inspections of carbon steel components in accordance with Generic Letter 88-05 to determine the borated water leakage locations and pathways. These examinations do not need to be performed with the reactor coolant system pressurized. The applicant also performs additional visual inspections inside containment with the reactor coolant system at normal pressure, to determine the possible existence of leakage. These inspections are performed in accordance with ASME Section XI, as modified by NRC-approved relief requests. Upon identification of borated water leakage, the boric acid residue is removed, and a visual examination is performed by a qualified individual.

NRC Bulletin 2002-01, “Reactor Pressure Vessel Head Degradation and Reactor Coolant Pressure Boundary Integrity,” was issued as a result of the Davis-Besse control rod drive mechanism nozzle cracking event, which resulted in severe degradation of the reactor vessel head due to exposure to concentrated boric acid. To date, all licensees have responded to the bulletin, providing information about their boric acid corrosion control (BACC) programs. However, the staff has determined that a follow-up information request regarding the bulletin response is necessary because the licensee’s response to Bulletin 2002-01 lacked specificity, and therefore the staff could not make a reasonable assurance finding that the BACC programs are effective. This information request is necessary to permit the assessment of plant-specific compliance with NRC regulations. This information will also be used by the NRC staff to determine the need for, and to guide the development of, additional regulatory actions to prevent degradation of the reactor coolant pressure boundary.

The staff is currently reviewing the issues associated with NRC bulletin 2001-01, 2002-01, and 2002-02. Any future regulatory actions that may be required as a result of those reviews will be addressed by the staff in a separate regulatory action. The staff will continue to pursue this issue with the applicant through the issuance of the supplement to the bulletin.

Monitoring and trending: The applicant states in Section B2.2.3 of each LRA that monitoring under this AMP involves examination for evidence of borated water leakage, reviews of inspection results, and evaluations of the effects of leakage. Walkdowns for borated water leakage are performed at a frequency of each refueling outage. Therefore, the staff found the applicant’s approach of monitoring activities to be acceptable.

Acceptance criteria: The applicant’s acceptance criterion for visual inspections is the absence of detectable leakage or boric acid residues. Whenever evidence of borated water leakage exists, a visual examination is performed and the results are evaluated to determine whether degradation of susceptible components has occurred and whether the observed condition is acceptable without repair. The occurrence of degradation that is adverse to quality is entered into the applicant’s corrective action system. Therefore, the staff concludes that the applicant has demonstrated that the acceptance criteria to ensure that the intended functions of the systems, structures, commodities, and major components containing (or exposed to) borated water are acceptable.

Operating experience: The applicant has reported that evidence of boric acid residues have been found during the plant walkdown inspections during refueling outages. Borated water leaks have typically occurred at valve packings or bolted connections. The applicant states that these leaks are usually corrected by minor adjustments and have had only minor effects on equipment or structures in the vicinity of the leakage.

During a refueling outage in September 2002, the applicant performed a bare-metal inspection of the North Anna 2 vessel-head-nozzles. The inspection showed indications of leakage from the head penetration nozzles. The applicant performed visual and eddy current inspections of 65 penetrations in the reactor vessel head. The applicant identified indications in the weld surface of 63 penetrations. Six of the penetrations showed leakage above the head. The applicant plans to replace the reactor vessel head.

The staff is currently reviewing the issues associated with NRC Bulletins 2001-01, 2002-01, and 2002-02. NRC Bulletin 2002-01 was issued as a result of a control rod drive mechanism nozzle cracking event at Davis-Besse, which resulted in severe degradation of the reactor vessel head due to exposure to concentrated boric acid. To date, all licensees (except Davis-Besse) have responded to the bulletin, providing information about their boric acid corrosion control (BACC) programs. Any future regulatory actions that may be required as a result of those reviews will be addressed by the staff in a separate regulatory action. This is considered a current operating issue and will be handled as such. The staff will resolve this issue in accordance with 10 CFR 54.30 outside of the license renewal process.

Therefore, the staff concludes that the boric acid corrosion surveillance program has been effective in managing the effects of boric acid corrosion on the intended function of reactor components.

3.3.1.3.3 Conclusions

The staff has reviewed the information provided in Section B2.2.3 of each LRA and the summary description of the boric acid corrosion surveillance program in Section A2.2.3 of the UFSAR supplement. On the basis of this review, the above evaluation, and resolution of the current operating issues raised in Bulletins 2002-01 and 2002-02 in accordance with 10 CFR 54.30, the staff finds that the effects of aging associated with boric acid corrosion will be adequately managed so that there is reasonable assurance that the intended functions will be maintained consistent with the CLB for the period of extended operation.

3.3.1.3.4 FSAR Supplement

The staff reviewed Section A2.2.3 of the UFSAR supplement and found that the description of the applicant's boric acid corrosion surveillance program is consistent with Section B2.2.3 of each LRA. However, the applicant should modify the FSAR supplement descriptions of the boric acid corrosion surveillance program to reflect the information that was provided in response to NRC Bulletin 2002-01 and the information that will be provided in response to the supplement to the bulletin.

3.3.1.4 Chemistry Control Program for Primary Systems

The applicant describes its chemistry control program for primary systems in Section B2.2.4 of each LRA. The applicant credits this program for managing the aging effects of loss of material and cracking for all four units. The staff reviewed each LRA to determine whether the applicant has demonstrated that the chemistry control program for primary systems will adequately manage the applicable effects of aging during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.3.1.4.1 Summary of Technical Information in the Application

In Section B2.2.4 of each LRA, the applicant states that the purpose of the chemistry control program for primary systems is to provide reasonable assurance that water quality is compatible with materials of construction in the plant systems and equipment in order to minimize loss of material and cracking. The chemistry control program for primary systems creates an environment in which material degradation is minimized, thereby, maintaining material integrity and reducing the amount of corrosion products that could accumulate and interfere with the equipment operation or heat transfer.

The program is based on Technical Specification requirements and on EPRI guidelines provided in Technical Report TR-105714, entitled "PWR Primary-Water Chemistry Guidelines." The EPRI guidelines reflect industry operating experience and are revised based on this experience to optimize plant chemistry control. The applicant committed to revising its chemistry control program for primary systems to maintain consistency with the EPRI guidelines.

The applicant identified the following systems in all four units that credit the chemistry control program for primary systems for managing the aging effects for loss of material and cracking:

- blowdown (NAS 1/2 only)
- boron recovery
- chemical and volume control
- component cooling water
- quench spray (NAS 1/2 only)
- condensate (SPS 1/2 only)
- containment vacuum (NAS 1/2 only)
- containment spray (SPS 1/2 only)
- drains - gaseous
- fuel pit cooling
- heating (NAS 1/2 only) and ventilation
- high radiation sampling (NAS 1/2 only)
- liquid and solid waste (NAS 1/2 only)
- instrument air (SPS 1/2 only)
- neutron shield tank cooling
- radwaste (NAS 1/2 only)
- primary grade water (SPS 1/2 only)
- refueling purification (NAS 1/2 only)
- reactor cavity purification (SPS 1/2 only)
- reactor coolant system (including reactor primary-water and closed-water systems)
- recirculation spray
- residual heat removal
- safety injection
- sampling system
- vents - gaseous (SPS 1/2 only)

The applicant states that the scope of the chemistry control program for primary systems includes the following structures:

- containment

- fuel building
- load-handling cranes and devices
- NSSS equipment supports

The applicant states that the scope of the chemistry control program for primary systems includes the following commodities, and major components:

<u>Commodity</u>

- general structural supports

<u>Major Components</u>

- pressurizer
- reactor vessel
- reactor vessel internals
- steam generator

In addition, the applicant states that the scope of the chemistry control program for primary systems monitors fluid for the parameters within the following systems and components:

System/Component	Chemistry Parameters
• primary-grade water tank	aluminum, calcium, chloride, fluoride, magnesium, oxygen, silica, sodium, suspended solids, tritium
• primary systems	aluminum (required only if silica exceeds 1.0 ppm), boron, calcium (required only if silica exceeds 1.0 ppm), chloride, crud, fluoride, hydrogen, lithium, liquid isotopic, magnesium (required only if silica exceeds 1.0 ppm), oxygen, pH, silica, specific conductivity, sulfate, suspended solids, tritium
• component cooling	chloride, chromate, fluoride, liquid isotopic, pH, specific conductivity
• spent fuel pit	pH, aluminum, boron, calcium plus magnesium, chloride, fluoride, liquid isotopic, magnesium, silica, sodium sulfate, specific conductivity
• refueling water storage tank	aluminum, boron, calcium, chloride, fluoride, liquid isotopic, magnesium, pH, silica, suspended solids
• boric acid storage tank	aluminum, boron, calcium, chloride, fluoride, magnesium, silica
• accumulator tank	boron, chloride, fluoride
• chemical addition tank	chloride, sodium hydroxide
• boron injection tank*	boron
• casing cooling tank *	boron, chloride, fluoride, liquid isotopic, pH, silica

* Applicable to NAS 1/2 only

3.3.1.4.2 Staff Evaluation

The staff's evaluation of the chemistry control program for primary systems focused on how the program manages aging effects through the effective incorporation of the following 10 elements: 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 indicates that the corrective actions, confirmation process, and administrative controls are part of the site-controlled quality assurance program. The staff's evaluation of these program attributes is provided separately in Section 3.3.2 of this SER. The remaining seven elements are discussed below.

Program scope: Section B2.2.4 of each LRA lists systems, structures, major components, and a commodity that credit the chemistry control program for primary systems for minimizing loss of material and cracking. The four major components are the pressurizer, reactor vessel, reactor vessel internals, and the steam generator. The staff noted that the aging management review of the reactor coolant pumps is included as part of the reactor coolant system and that the related component groups credit this program.

The staff finds the scope of the program to be acceptable because it includes a comprehensive list of systems, structures, commodities, and major components exposed to a treated-water environment.

Preventive actions: Each LRA specifies that the chemistry control program for primary systems is a set of mitigative activities utilized to maintain water chemistry that is compatible with materials of construction. In particular, the levels of dissolved oxygen and other impurities are maintained at low levels, and system pH is maintained in the optimal range such that conditions for loss of material or cracking are minimized. The staff finds that these procedures are adequate because they include all of the activities needed to mitigate age-related effects in SCs that are within the scope of license renewal.

Parameters monitored or inspected: This AMP monitors fluid within 10 systems and components for NAS 1/2 and 8 systems and components for SPS 1/2. The parameters that are monitored are based on information in the EPRI guidelines and the requirements of the station's Technical Specifications. The parameters monitored and their acceptable ranges vary depending on the mode of plant operation (i.e., operations at full power, operation at a reduced power level, hot-standby operation, or plant shutdown).

In a letter dated May 22, 2002 (Serial No. 02-277), the applicant verified that the chemistry parameters monitored by this chemistry monitoring program are, at a minimum, complete, and consistently more conservative than the parameters in the EPRI guidelines. The applicant monitors some additional parameters that are not identified in the EPRI guidelines. The applicant explained that crud is the same as suspended solids and that it does monitor this impurity for intrusion into, and potential clogging of, the control rod drive mechanisms and the seal injection lines for the reactor coolant pumps, and (c) explained that it has sample and analysis procedures to control the quality of the sampling and analysis techniques. They verified that these procedures are controlled by its 10 CFR Part 50, Appendix B program.

The staff found the parameters monitored to be acceptable since they are in accordance with standard industry practice and the sample and analysis procedures are controlled by its 10 CFR Part 50, Appendix B program.

Detection of aging effects: The applicant states that the chemistry control program for primary systems mitigates rather than detects aging effects. The staff finds this acceptable and agrees that this AMP does not have aging detection capability and that its purpose is to maintain a coolant environment that will minimize aging effects such as loss of material and cracking.

Monitoring and trending: The applicant states that water chemistry parameters are monitored and the results are trended to provide timely indication of abnormal chemistry conditions. Monitoring and trending guidelines and sampling frequencies are included in the Chemistry Control Program for Primary Systems. Trending is stated to provide a basis for confirming that the sampling frequencies are appropriately set to provide effective chemistry monitoring. Therefore, the staff concludes that trending of the sampling frequencies can provide early indication of chemistry deviations, allowing for timely corrective action.

Acceptance criteria: The applicant states that the acceptance criteria reflect EPRI guidelines for parameters that have been shown to contribute to general corrosion and stress corrosion cracking of components. Control of oxygen in the primary-water will lead to mitigation of stress corrosion cracking. In general, adherence to the guidelines minimizes the effects of loss of material and cracking. The staff agrees that the EPRI guidelines for primary-water chemistry control will satisfactorily mitigate loss of material and cracking in all the systems identified in Section 3.3.1.4.1 of this SER.

Operating experience: The application states that operating experience indicates that chemistry parameters can drift from acceptable ranges, but that the chemistry control program for primary systems is effective in identifying these anomalies, implementing corrective actions, and trending the parameters. When chemistry results have reached a level at which loss of material or cracking could create a concern regarding loss of intended function, immediate corrective actions have been implemented to minimize the necessity for plant shutdown. The applicant states that the numerous component inspections that occur during preventative maintenance and corrective maintenance work activities confirm that there has been no significant degradation in the ability of the components to perform their intended functions due to chemistry concerns.

Such operating experience has provided feedback to revisions of the EPRI water chemistry guideline document. The staff concluded that the EPRI guideline document, which has been developed based on operating experience is effective over time with widespread use.

3.3.1.4.3 Conclusions

The staff has reviewed the information provided in Section B2.2.4 of each LRA and the summary description of the chemistry control program for primary systems in Section A2.2.4 of the UFSAR supplement. On the basis of this review and the above evaluation, the staff finds that the applicant has demonstrated that the effects of aging associated with the chemistry control program for primary systems will be adequately managed so that there is reasonable assurance that the intended functions will be maintained consistent with the CLB for the period of extended operation.

3.3.1.4.4 FSAR Supplement

The staff reviewed Section A2.2.4 of the UFSAR supplement and found that the description of the applicant's chemistry control program for primary systems is consistent with Section B2.2.4 of each LRA and that no changes were needed.

3.3.1.5 Chemistry Control Program for Secondary Systems

The applicant describes its chemistry control program for secondary systems in Section B2.2.5 of each LRA. The applicant credits this program for managing the aging effects of loss of material and cracking for all four units. The staff reviewed the applicant's description of the program in Section B2.2.5 of each LRA to determine whether the applicant has demonstrated that it will adequately manage the applicable effects of aging in the plants during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.3.1.5.1 Summary of Technical Information in the Application

The applicant states that the purpose of this AMP is to provide reasonable assurance that water quality is compatible with materials of construction in the plant systems and equipment in order to minimize loss of material and cracking. The chemistry control program for secondary systems creates an environment in which material degradation is minimized, thereby, maintaining material integrity and reducing the amount of corrosion product that could accumulate and interfere with the equipment operation or heat transfer.

The program is based on EPRI guidelines provided in Technical Report TR-102134, entitled "PWR Secondary-water Chemistry Guidelines." The EPRI guidelines reflect industry operating experience and are revised based on this experience to optimize plant chemistry control. The applicant committed to revising its chemistry control program for secondary systems to maintain consistency with the EPRI guidelines.

The applicant identified the following systems and major components in all four units that credit the chemistry control program for secondary systems for managing the aging effects for loss of material and cracking:

<u>System</u>

- alternate AC diesel generator system
- auxiliary steam
- bearing cooling (SPS 1/2 only)
- blowdown
- chilled water (NAS 1/2 only)
- emergency diesel generator system
- feedwater
- heating (NAS 1/2 only) and ventilation
- liquid and solid waste (NAS 1/2 only)
- main steam
- primary and secondary plant gas supply (SPS 1/2 only)
- sampling system
- security

- service water (SPS 1/2 only)
- steam drains (NAS 1/2 only)

Major Component

- steam generator

In addition, the applicant states that the scope of the chemistry control program for secondary systems monitors fluid for the parameters within the following systems and components:

System/Component	Chemistry Parameters
• Condensate Storage Tanks	silica, sodium, total organic carbon (not required if makeup water is analyzed for TOC)
• Condensate (NAS 1/2)	Ammonia, Cation Conductivity, Ethanolamine, Hydrazine, Oxygen, pH, Sodium, Specific Conductivity
• Condensate (SPS 1/2)	Ammonia, Cation Conductivity, Ethanolamine, Hydrazine, pH, Sodium, Specific Conductivity
• Condensate Polishing (NAS 1/2)	Cation Conductivity, Silica, Sodium, Specific Conductivity, Resin fines (when in demineralizer mode rather than filter mode)
• Condensate Polishing (SPS 1/2)	Chloride, Sodium, Specific Conductivity, Sulfate
• Feedwater	Acetate, Ammonia, Cation Conductivity, Copper, Formate, Hydrazine, Iron, Ethanolamine, Oxygen, pH, Sodium, Specific Conductivity
• Steam Generator	Acetate, Ammonia, Blowdown Rate, Cation Conductivity, Chloride, Formate, Gross Activity, Liquid Isotopic, Molar Ratio (Sodium Chloride), Ethanolamine, pH, Silica, Sodium, Specific Conductivity, Sulfate, Primary-to-secondary Leak Rate
• Main Steam	Cation Conductivity (monitored in one loop), Chloride (analysis required if corresponding SG exceeds Action Level 1, Oxygen (analysis required if condensate dissolved oxygen exceeds Action Level 2), Silica (analysis required if corresponding SG exceeds Action Level 1), Sodium (analysis required if corresponding SG exceeds Action Level 1), Sulfate (analysis required if corresponding SG exceeds Action Level 1)
• Steam Generator Wet Layup	Ammonia, Chloride, Hydrazine, pH, Sodium, Sulfate
• Diesel Generator Cooling (NAS 1/2)	Corrosion Inhibitor, Glycol Percent (Conditioner), pH (Boron-nitrite and Glycol Treatment)
• Diesel Generator Cooling (SPS 1/2)	Chromate, pH
• Station Makeup Water	Specific Conductivity, Silica, Sodium, Dissolved Oxygen, Total Organic Carbon

•	Air-conditioning	Corrosion Inhibitor, pH, Specific Conductivity
•	Steam Generator Blowdown Cleanup Effluent (SPS 1/2)	Cation Conductivity, Chloride, Hydrazine, Silica, Sodium

3.3.1.5.2 Staff Evaluation

The staff's evaluation of the chemistry control program for secondary systems focused on how the program manages aging effects through the effective incorporation of the following 10 elements: 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 indicates that the corrective actions, confirmation process, and administrative controls are part of the site-controlled quality assurance program. The staff's evaluation of these program attributes is provided separately in Section 3.3.2 of this SER. The remaining seven elements are discussed below.

Program scope: Section B2.2.5 of each LRA lists systems and components that credit the chemistry control program for secondary systems for minimizing loss of material and cracking. The major component included in the program is the steam generator.

The staff finds the scope of the program to be acceptable because it includes a comprehensive list of systems and components exposed to treated-water or steam environment.

Preventive actions: Each LRA specifies that the chemistry control program for secondary systems is a set of mitigative activities utilized to maintain water chemistry that is compatible with materials of construction. The aging effects to be mitigated through the program are loss of material and cracking. The staff finds that these procedures are adequate because they include all of the activities needed to mitigate age-related effects in SCs that are within the scope of license renewal.

Parameters monitored or inspected: This AMP monitors fluid within 10 systems and components for NAS 1/2 and 11 systems and components for SPS 1/2. The parameters that are monitored are based on information in the EPRI guidelines. The parameters monitored and their acceptable ranges vary depending on the mode of plant operation, (i.e., operations at full power, operation at a reduced power level, hot-standby operation, or plant shutdown).

In a letter dated May 22, 2002 (Serial No. 02-277), the applicant (a) verified that the chemistry parameters monitored by this chemistry monitoring program are, at a minimum, complete and consistent with, or more conservative than, the parameters in the EPRI guidelines. The applicant does monitor some additional parameters that are not identified in the EPRI guidelines, and (b) explained that it has sample and analysis procedures to control the quality of the sampling and analysis techniques. The applicant verified that these procedures are controlled by its 10 CFR Part 50, Appendix B program.

The staff found the parameters monitored to be acceptable since they are in accordance with standard industry practice and the sample and analysis procedures are controlled by its 10 CFR Part 50, Appendix B program.

Detection of aging effects: The applicant states that the chemistry control program for secondary systems mitigates rather than detects aging effects. The staff agrees that this AMP does not have aging detection capability and that its use is to maintain a fluid environment that will minimize aging effects such as loss of material and cracking, and therefore finds this acceptable.

Monitoring and trending: The applicant states that water chemistry parameters are monitored and the results trended to provide timely indication of abnormal chemistry conditions. Monitoring and trending guidelines and sampling frequencies are included in the Chemistry Control Program for Secondary Systems. Trending is stated to provide a basis for confirming that the sampling frequencies are appropriately set to provide effective chemistry monitoring. Therefore, the staff concludes that trending of the sampling frequencies can provide early indication of chemistry deviations, allowing for timely corrective action.

Acceptance criteria: The applicant states that the acceptance criteria reflect EPRI guidelines for parameters that have been shown to contribute to component degradation. In general, adherence to the guidelines minimizes the effects of loss of material and cracking. The staff agrees that the EPRI guidelines for secondary-water chemistry control will satisfactorily mitigate loss of material and cracking in all the systems identified in Section B2.2.5.1, above.

Operating experience: The application states that operating experience indicates that chemistry parameters can drift from acceptable ranges, but that the chemistry control program for secondary systems is effective in identifying these anomalies, implementing corrective actions, and trending the parameters. When chemistry results have reached a level at which loss of material or cracking could create a concern regarding loss of intended function, plant power reductions have been implemented until corrective actions were completed. With the exception of tubing in steam generators that already have been replaced, the numerous component inspections that occur during preventive maintenance and corrective maintenance work activities confirm that there has been no significant degradation of the ability of components to perform their intended functions due to coolant chemistry concerns. Changes in tubing materials and changes in chemistry controls have resulted in excellent performance for tubing in the replacement steam generators.

Such operating experience has provided feedback to revisions of the EPRI water chemistry guideline document. The EPRI guideline document, which is based on operating experience, has been widely used and the staff has found the EPRI guidelines to be effective for controlling chemistry parameters.

3.3.1.5.3 Conclusions

The staff has reviewed the information provided in Section B2.2.5 of each LRA and the summary description of the chemistry control program for secondary systems in Section A2.2.5 of the UFSAR supplement. On the basis of this review and the above evaluation, the staff finds that the applicant has demonstrated that the effects of aging associated with the chemistry control program for secondary systems structures and components will be adequately managed so that there is reasonable assurance that the intended functions will be maintained consistent with the CLB for the period of extended operation.

3.3.1.5.4 FSAR Supplement

The staff reviewed Section A2.2.5 of the UFSAR supplement and found that the description of the applicant's chemistry control program for secondary systems is consistent with Section B2.2.5 of each LRA and that no changes were needed.

3.3.1.6 Civil Engineering Structural Inspection

The applicant describes its civil engineering structural inspection activities in Section B2.2.6 of each LRA. The applicant credits this inspection program with assessing the overall condition of the North Anna and Surry buildings and structures, and identifies any ongoing degradation through a visual inspection process. The program monitors and assesses the condition of structures and structural components affected by aging, which may cause loss of intended functions. The staff reviewed each LRA to determine whether the applicant has demonstrated that the civil engineering structural inspection activities will adequately manage the applicable aging effects during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.3.1.6.1 Summary of Technical Information in the Application

In Section B2.2.6 of each LRA, the applicant describes the civil engineering structural inspection activities credited for aging management. The applicant states that the purpose of the inspection activities of this program is to assure the continuing capability of civil engineering structures to fulfill their intended functions. The structures monitored include the containment, auxiliary building, fuel building, other Class 1 structures, miscellaneous structures, yard structures, and earthen structures. The applicant listed the specific structural components and systems; which are fabricated from carbon steel, stainless steel, low-alloy steel, galvanized steel, aluminum, bronze, copper alloys, concrete, soil, elastomers, or ceramics, and inspected as part of the civil engineering structural inspection activities in Section 3.5 of each LRA.

The aging effects managed by the civil engineering structural inspection activities are loss of material for concrete and structural steel, cracking for concrete and masonry walls, and loss of material or loss of form for soil. The program provides for visual inspection and examination of accessible surfaces of structural components. Aging management of structural components that are normally inaccessible for inspection is accomplished by inspecting accessible structural components with similar materials and environments for aging effects that may be indicative of aging effects for the inaccessible structural components.

The applicant states that the civil engineering structural inspection activities will be expanded to bound the scope of inspections required for license renewal. This expansion will be implemented prior to the end of the current operating license term.

3.3.1.6.2 Staff Evaluation

The staff's evaluation of the civil engineering structural inspection activities focused on how the program manages aging effects through the effective incorporation of the following 10 elements: 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 indicates that the corrective actions, confirmation process, and administrative controls are part of the site-controlled quality assurance program. The staff's evaluation of these program attributes is provided separately in Section 3.3.2 of this SER. The remaining seven elements are discussed below.

Program scope: Section B2.2.6 of each LRA identifies the North Anna and Surry structures that are inspected by the civil engineering structural inspection activities. The applicant notes that not all portions or components within the structures that credit this program are within the scope of license renewal. In addition, portions of the structures that credit the civil engineering structural inspection that are infrequently accessed due to radiation, high temperature, or obstructions are covered by the one-time inspections of the infrequently accessed area inspection activities, which is discussed in Section B2.1.2 of each LRA. For structural components that are normally inaccessible for inspection, the applicant relies on the inspection of accessible structural components with similar materials and environments for aging effects that may be indicative of the aging effects for the inaccessible structural components. The applicant states that if an inaccessible area becomes accessible through dewatering, excavation, or installation of shielding, a followup action will be initiated for inspection of this area. Since the civil engineering structural inspection program is an existing program, the applicant states that a followup action is to expand the scope of the program to bound the scope of inspections required for license renewal prior to the end of the current operating license term. The staff finds that the scope of the civil engineering structural inspection activities is acceptable, since it includes an inspection and aging effects assessment of all the structures that credit this program.

Preventive actions: There are no preventive or mitigative actions taken as part of this program, and the staff did not identify the need for such actions.

Parameters monitored or inspected: Section B2.2.6 of each LRA lists the various concrete, masonry wall, steel, and earthen structures that are monitored by the civil engineering structural inspection activities. These include cracks, delaminations, honeycombs, water in-leakage, chemical leaching, peeling paint, and discoloration for concrete structures. For masonry walls, the inspection activities look for cracks of joints and missing or broken blocks. For steel structures the structural inspection activities look for (1) deformation, alteration, and significant rust on structural members, (2) loose, missing, and damaged anchors, fasteners, and pads, (3) missing and degraded grout under base plates, and (4) cracked welds. For earthen structures, the inspection activities cover erosion, cracking, depressed areas, and evidence of shifting, settlement, movement, seepage, and leakage. In addition, for inaccessible structural components exposed to groundwater, the values for sulfate, chloride, and pH in the groundwater are monitored to verify that the exposed components do not experience an aggressive environment. Although the applicant does not expect the groundwater at either North Anna or Surry to become aggressive, routine monitoring of the groundwater chemistry at both sites is presently being conducted and will be conducted on an annual basis during the period of extended operation. In addition, the applicant has committed to monitor the groundwater chemistry at a different time each year so that any seasonal variations in the groundwater chemistry may be detected.

Under the list of parameters monitored for concrete structures, Section B2.2.6 of each LRA, the applicant states that there are no significant aging effects requiring management for structural concrete located in a sheltered-air environment. In RAI 3.5-7, the staff disputed this statement since aging effects can and do occur in concrete in a sheltered-air environment. In response to

RAI 3.5-7, the applicant acknowledged that all accessible concrete components require aging management and, as such, Section A2.2.6 of the UFSAR supplement for the civil engineering structural monitoring inspection program needs to be updated to reflect this commitment.

In addition, under the list of parameters monitored for concrete structures, change in material properties is not listed as an aging effect. As listed above, the applicant examines concrete structures for, among other indicators, chemical leaching and discoloration, which are evidence of change in material properties. In response to RAI 3.5-7, the applicant has committed to credit the civil engineering structural inspection activity to manage change in material properties and the previously cited aging effects (cracking and loss of material) for concrete structures. The applicant's response to the above two issues for concrete structures are acceptable to the staff. In its letter dated July 25, 2002, the applicant stated that the UFSAR Supplement Section 18.2.6, "Civil Engineering Structural Inspections" has been modified to include change in material properties as an aging effect for both concrete and elastomer sealant and/or gasket materials. Since the applicant has completed this action, the staff considers confirmatory action 3.3.1.6-1 closed.

In RAI B2.2.6-1, the staff requested the applicant to discuss the aging of steel supports within some masonry walls. Some masonry walls that credit the civil engineering structural inspection activities have been structurally modified with steel supports to meet the requirements of IE Bulletin 80-11. In its response, the applicant stated that structural supporting steel that is required for masonry wall reinforcement is included within the scope of license renewal and is evaluated as building structural steel. Structural steel that supports these masonry walls is managed for loss of material using the civil engineering structural inspection activities. The staff finds this response to be acceptable.

The staff finds that the parameters that are monitored or inspected, as described above, are adequate and acceptable because they are directly related to the degradation of civil structures and visual inspections of these aging effects are an effective method to detect degraded conditions.

Detection of aging effects: For Surry, cracking, loss of material, loss of form, and gross indication of change in material properties are identified as the aging effects that are detected by visual inspections. For North Anna, only cracking, loss of material, and loss of form are identified as the applicable aging effects. As noted above, under the staff evaluation of "Parameters Monitored or Inspected", there was an inconsistency for North Anna in that change in material properties is not included as an applicable aging effect. This issue is resolved by the applicant's response to RAI 3.5-7. Therefore, the staff found the applicant's approach for the detection of aging effects to be acceptable.

Monitoring and trending: The applicant states that the structural monitoring activities are intended to assess the overall condition of structures. The inspection activities, which are typically performed every 5 years, rely on visual examinations of components in accessible areas during planned plant walkdowns. Documentation is made of the inspection results, which includes a general description of observed conditions, the location and size of discontinuities, and the noted effects of environmental conditions. The staff concludes that the approach described above for accessible areas and the methods described earlier for inaccessible and infrequently accessed areas are acceptable for monitoring the aging effects identified by the civil engineering structural inspection activity.

Acceptance criteria: Section B2.2.6 of each LRA states that the acceptance criterion for visual inspections is the absence of anomalous indications of degradation. Responsibility for the evaluation of inspection results is assigned to engineering personnel to determine whether analysis, repair, or additional inspection is required to reasonably assure that the structures that credit this program will continue to fulfill their intended functions. In addition, Section B2.2.6 of each LRA states that the acceptance criteria for concrete structures is based on recommendations in American Concrete Institute (ACI) document ACI-349-3R. The staff finds the acceptance criteria for the civil engineering structural inspection program provides reasonable assurance that observed degradation of structures will be adequately evaluated such that the structures that credit this program will continue to fulfill their intended functions during the period of extended operation.

Operating experience: The applicant states in Section B2.2.6 of each LRA that the civil engineering structural inspection activities are founded on the requirements of the Maintenance Rule (10 CFR 50.65). Aging effects of civil engineering structures are noted during routine inspections and corrective actions are taken, as necessary, following engineering evaluation. The applicant states that this is an ongoing process that will continue through the period of extended operation. The applicant also stated that structural inspections have been effective in identifying and correcting structural problems. The staff concludes that the civil engineering structural inspection activities will provide an effective aging management program for license renewal.

3.3.1.6.3 Conclusions

The staff has reviewed the information provided in Section B2.2.6 of each LRA and the summary description of the civil engineering structural inspection activities in Section A2.2.6 of the UFSAR supplement. In addition, the staff considered the applicant's response to the staff's RAIs. On the basis of this review and the above evaluation, the staff finds that the applicant has demonstrated that the effects of aging associated with the civil engineering structures will be adequately managed so that there is reasonable assurance that the intended functions will be maintained consistent with the CLB for the period of extended operation.

3.3.1.6.4 FSAR Supplement

The staff reviewed Section A2.2.6 of the UFSAR supplement and found that the description of the applicant's civil engineering structural inspection activities is consistent with Section B2.2.6 of each LRA. However, in Section B2.2.6 of each LRA, the applicant committed to two licensee followup actions, discussed above, that are not discussed in Section A2.2.6 of the UFSAR supplement. In response to RAI B2.2.9-3, the applicant stated that it would incorporate the followup actions, identified in Table B4.0-1 of each LRA, into the appropriate sections of the UFSAR supplement. In addition, as discussed under the staff's evaluation of "Parameters Monitored or Inspected," change in material properties was not listed as an applicable aging effect for concrete structures. In response to RAI 3.5-7, the applicant committed to credit the civil engineering structural inspection activity to manage change in material properties and the previously cited aging effects of cracking and loss of material for concrete structures. In the SER with open items, the staff indicated that this additional aging effect for concrete structures should be added to Section A2.2.6 of the UFSAR supplement.

In response to RAIs 3.5.5-1 and 3.5.6-4, the applicant committed to manage cracking and change in material properties for elastomer materials used in structures outside the containment. The applicant stated that the scope of the civil engineering and structural inspection activities would be clarified to include elastomers and their associated aging effects in the revised program summary description for the UFSAR supplement. In its letter dated July 25, 2002, the applicant stated that the UFSAR Supplement Section 18.2.6, Civil Engineering Structural Inspections has been modified to include change in material properties as an aging effect for both concrete and elastomer sealant and/or gasket materials. Since the applicant has completed this action, the staff considers confirmatory action 3.3.1.6-1 closed.

3.3.1.7 Fire Protection Program

The applicant describes its fire protection program in Section B2.2.7 of each LRA. The applicant credits this program with managing the potential aging of fire protection components that are within the scope of license renewal. The fire protection program monitors the fire protection systems through visual examinations, flow tests, and pressure monitoring. The staff reviewed each LRA to determine whether the applicant has demonstrated that the fire protection program will adequately manage the applicable effects of aging during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.3.1.7.1 Summary of Technical Information in the Application

In Section B2.2.7 of each LRA, the applicant states that the purpose of the fire protection program is to manage the effects of aging associated with components within the scope of the program so that there is reasonable assurance that their intended functions will be performed consistent with the CLB during the period of extended operation. In each LRA, the applicant states that the fire protection program will be used for managing the aging effects of loss of material, separation and cracking/delamination, heat transfer degradation, and change in material properties. The fire protection program includes visual inspections of fire barriers and fire protection equipment, including hose stations, hydrants, and sprinklers. Verification of system performance is accomplished by periodic flow tests. Verification of system piping integrity (to maintain a pressure boundary for the fire protection system) is accomplished by periodic testing and pressure monitoring. The applicant states that the fire protection program includes applicable National Fire Protection Association (NFPA) commitments and maintains compliance with NRC Branch Technical Position (BTP) 9.5-1. The applicant states that the fire protection plan will be revised to include the replacement or testing of a representative sample of sprinklers that have been in service for 50 years. This task will conform to the requirements of Section 2-3.1.1 of NFPA-25 and will be performed during the period of extended operation.

3.3.1.7.2 Staff Evaluation

The staff's evaluation of the fire protection program focused on how the program manages aging effects through the effective incorporation of the following 10 elements: 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 indicates that the corrective actions, confirmation process, and administrative controls are part of the site-controlled quality assurance program. The staff's evaluation of these program attributes is provided separately in Section 3.3.2 of this SER. The remaining seven elements are discussed below.

Program scope: Section B2.2.7 of each LRA states that the scope of aging management activities for the Fire protection program includes barriers (i.e., doors, walls, floors, ceilings, penetration seals, fire-retardant coatings, dampers, cable tray covers, and fire stops). Piping systems that are dry or that carry water are evaluated consistently with similar mechanical systems. This includes such components as pump casings, valve bodies, hose stations, hydrants, and sprinklers. The reactor coolant pump oil collection systems, which are installed for fire protection, also are in scope for license renewal.

The Scope section of the fire protection program identifies some of the applicable component groups listed in Tables 3.3.9-1 and 3.5.11-1 of each LRA, but not all of the components. For example, there is no mention of tanks, expansion joints, or seismic gap covers. In a letter dated May 22, 2002 (Serial No. 02-163), the applicant verified that it provides an adequate scope of the program in the scoping summary through the commodities listed in Appendix B and the hyperlinks to the appropriate tables in Chapters 2 and 3 of each LRA. The staff found the applicant's response acceptable and finds the scope of the fire protection program to be acceptable since it includes the appropriate components from the systems and commodities that credit this aging management activity.

Preventative actions: The applicant identified this activity as a condition- and performance-monitoring activity and, therefore, states that no preventive actions are performed. However, since there is no mention in Section B2.2.7 of each LRA for the need to perform periodic flushing of the water-based fire protection systems, the staff asked the applicant to explain the preventive actions used to ensure that no significant corrosion, MIC, or biofouling has occurred in these systems. In a letter dated May 22, 2002 (Serial No. 02-163), the applicant verified that periodic flushing is not performed for these systems. However, the applicant stated that it does perform an annual full-flow test to ensure that no significant corrosion, MIC, or biofouling has occurred and that adequate pressure and flow rates are available to meet the intended function. The staff found the applicant's response acceptable and concluded that appropriate preventive actions are being performed.

Parameters inspected or monitored: The applicant states that fire barriers are examined for cracking, breaks, holes, and gaps. Doors are verified to be capable of complete closure and latching and to fit properly in their frames. Penetration seals are checked for an adequate amount of fire stop material. Section B2.2.7 of each LRA also states that fire-retardant coatings, cable tray covers, and cable tray fire stops are checked for integrity. In addition, components such as hose stations and hydrants are inspected visually for indications of degradation and dampers are verified to be free of corrosion that could interfere with their closure. The water systems for fire protection are monitored for adequate system performance and integrity, as indicated by pressure and flow measurements.

In response to RAI B2.2.7-1, the applicant states that the integrity and absence of fouling of the fuel supply line for the diesel-driven fire pump is confirmed by an operational test of the pump that is performed as part of the fire protection program. The pump is run in the recirculation mode each month and the speed of the pump is verified to be within the expected range for the test, and verifies the ability of the fuel oil line to provide the expected amount of flow to the engine. A local inspection of the fire pump components, including the fuel oil line, is performed during the periodic test. Testing of the diesel-driven fire pump is consistent with NFPA-25. The run capability of the pump each month confirms the integrity and absence of fouling of the line that provides the fuel oil supply. However, Section 5-3.2.2 of NFPA-25 (1998) states that a weekly test of diesel-driven pump assemblies shall be conducted without flowing water. Since the applicant states that testing of the diesel-driven fire pump is monthly and consistent with NFPA-25, the applicant was asked to clarify this discrepancy. In a letter to the NRC dated May 22, 2002 (Serial No. 02-163), the applicant provided a supplemental response to RAI B2.2.7-1 that states that testing of the diesel driven fire pump is consistent with NFPA-25 based on the annual flow testing required by NFPA-25 that is performed by the applicant. As stated above, the applicant also performs monthly recirculation testing of the diesel-driven fire pump as required by the applicant's site-controlled Technical Requirements Manual (TRM). However, due to an oversight during the review of NFPA-25, the RAI response failed to note that the monthly recirculation testing frequency is different from the weekly frequency listed in NFPA-25. Although the applicant's fire protection program does not meet NFPA-25 requirements on this matter, the staff accepts the applicant's testing frequency since monthly testing is adequate to provide reasonable assurance of the integrity and absence of fouling of the fuel supply line for the diesel-driven fire pump for the purpose of managing aging effects.

Based on the information provided in Section B2.2.7 of each LRA and the additional information provided by the applicant in response to RAI B2.2.7-1, the staff finds the parameters monitored and inspected for the fire protection program to be comprehensive and acceptable.

Detection of aging effects: The applicant states that degradation of fire protection components is detected by visual examination to reasonably assure the absence of loss of material, separation and cracking/delamination, and change in material properties. The fire protection water system's performance and pressure boundary integrity are monitored by verifying acceptable values of pressure and flow in the underground fire water distribution system. Testing of the fire protection pumps provides indication of heat transfer degradation, and inspections of the pumps provide indication of loss of material. The applicant also states that air flow testing and visual inspections of sprinklers along dry portions of fire protection piping confirm the absence of blockage. Water flow tests of the deluge system for the station service and main transformers confirm the absence of flow blockage for the entire line from the main header to the spray nozzles.

In each LRA, the applicant states that during the period of extended operation, a representative sample of sprinklers, which have been in service for 50 years, will be replaced or tested in accordance with the requirements of NFPA-25, Section 2-3.1.1. The staff requested that the applicant clarify that the NFPA guidance, to perform this sampling every 10 years after the initial field service testing, will also be followed. In a letter dated May 22, 2002 (Serial No. 02-163), the applicant stated that it did not discuss replacing or testing every 10 years beyond the initial 50-year replacement or test because that would bring them to the end of the period of extended operation. However, the applicant stated that it is committed to NFPA-25, Section 2-3.1.1, and if the plants operate 10 years beyond the 50-year replacement or the test of the sprinkler heads, the applicant will perform the followup 10-year replacement or test. Because the applicant's response fully addressed staff's concerns, the staff found the applicant's response acceptable.

The staff requested the applicant to describe its aging management activities to manage the loss of material on the inside surfaces of piping so that the system's function is maintained. In response to RAI B2.2.7-2, the applicant stated that it would supplement the NFPA pressure and flowrate testing, credited in each LRA as part of the fire protection program activity, with the work control process activity in order to manage aging effects for the fire protection system piping. In addition, the applicant states that the work control process, as described in Section B2.2.19 of each LRA, provides numerous opportunities to perform internal inspections of fire protection piping. During the 7-year period between 1993 and 2000, there were in excess of 100 work orders each for Surry and North Anna for activities involving the internal surfaces of the fire protection system. These work orders provided representative samples of the materials and environments for the fire protection system. The applicant states that the identified frequency of work activities for the 7-year period is expected to continue into the period of extended operation. In addition, in a supplemental response to RAI B2.2.19-3, the applicant stated that as confirmation that the work control process program has inspected representative components from among those components that credit the work control process, the applicant will perform an audit of inspections performed by the work control process. Audits of the work control process, performed prior to year 40 of plant operation and again at year 50, will be used to determine if supplemental inspections of components that credit the work control process are needed. Most opportunities for inspecting the internal surfaces of the fire protection system arise from maintenance of valves performed under the work control process. These inspections are performed by maintenance personnel who are VT-qualified and trained as members of a quality maintenance team (QMT). The applicant further states that maintenance inspection findings of sedimentation or internal degradation are referred to engineering personnel for evaluation. Any corrective action required by the engineering evaluation is implemented through the applicant's corrective action system in accordance with 10 CFR Part 50, Appendix B. Furthermore, the applicant states in a supplemental response to RAI B2.2.19-3 that if ongoing general aging is identified in a system with a certain material and environmental combination, the applicant's corrective action program requires an evaluation of the entire system with the same material and environmental conditions and of other systems with similar material and environmental conditions. The staff concurs with the applicant's conclusion that the ongoing maintenance opportunities to inspect fire protection components in addition to supplemental inspections, as required, through the work control process provide a more continuous indication for the internal condition of piping and valves than would occasional disassembly for the sole purpose of inspection.

The staff found the applicant's fire protection program, as it relates to the detection of aging effects to be acceptable.

Monitoring and trending: The applicant states that fire barriers are typically inspected visually at 18-month intervals, except that doors are inspected more frequently. Various types of fire protection equipment are visually inspected at frequencies that vary from 31 days to 3 years. The integrity and performance of the fire protection systems are monitored by testing, which is typically performed at 18-month intervals. The pressure-retaining capability of the main fire protection loop is provided by continuous monitoring of the level and pressure in the hydro-pneumatic tank.

In its response to RAI B2.2.7-3, the applicant provided more specific information regarding the frequency of inspections for the applicable components. The applicant states that the inspection and testing activities listed below are performed in accordance with the fire protection program and that the testing and inspection frequencies are consistent with guidance provided by NFPA:

(a) Penetration seals are visually inspected to ensure adequate fill material and the absence of cracks or visible damage. At Surry, all seals are inspected every 18 months, except for those that are blocked on both sides with damming material, the removal of which could damage the seal. In these situations, the damming material (such as Marinite) is verified to be intact and free of damage. At North Anna, seals (except those with damming on both sides) are inspected on a rotating basis such that 20% of the seals are inspected every year.

(b) Fire doors are visually inspected to ensure that the doors have proper clearance and are free of obstructions, are intact (i.e., no wear or missing parts), have no holes, and are capable of being closed and latched. These inspections are performed monthly.

(c) Fire doors that have automatic hold-open mechanisms are functionally tested at least monthly to ensure that each auto-close mechanism is intact and capable of performing its intended function. The door-release function is tested, and the door is confirmed to be capable of closing and latching properly.

(d) Visual inspections of yard fire hydrants are performed at least quarterly.

(e) Fire hoses (and associated gaskets) are considered to be consumables that are not subject to an aging management review. Fire hydrant flow tests are performed every 3 years.

(f) The deluge and sprinkler systems are visually inspected every 18 months.

In its response to RAI B2.2.7-3, the applicant stated that testing and inspection frequencies are consistent with guidance provided by NFPA, but they also state under (e) above that fire hydrant flow tests are performed every 3 years. Since Section 4-3.2 of NFPA-25 (1998) states that hydrants shall be tested annually, the applicant was asked to clarify the discrepancy. In a letter to the NRC dated May 22, 2002 (Serial No. 02-163), the applicant provided a supplemental response to RAI B2.2.7-3 that provides surveillance frequencies for a number of components and states that the frequencies are consistent with NFPA. Hydrants are among this listing of components for the RAI response. NFPA-25 requires an annual flow test of hydrants, but the applicant performs the flow testing every 3 years as required by the applicant's TRM. This difference in testing frequency should have been identified as an exception to NFPA in the RAI response. Although the applicant's fire protection program does not meet NFPA-25 requirements on this matter, the staff accepts the applicant's testing frequency since flow testing every 3 years is performed as part of the CLB and is adequate to provide reasonable assurance of the integrity of the fire hydrants for the purpose of managing aging effects.

In its response to RAI B2.2.7-3(e), the applicant stated that it considers fire hoses and associated gaskets to be consumables and not subject to an aging management review. It is the staff's position that fire hoses can be excluded from an AMR provided the applicant (1) identifies in each LRA that all fire hoses are subject to replacement based on performance and condition monitoring programs and (2) explicitly states that the programs conform to NFPA 1962 or another code that provides a similar level of inspection and/or performance testing. Section C2.3 of each LRA states that the fire protection program complies with NFPA 1962 for fire hoses and that fire hoses are periodically inspected and replaced if they do not pass the inspection. Therefore, while these consumables are in the scope of license renewal, they do not require an AMR. This response is acceptable to the staff.

The monitoring activities credited for the fire protection program are consistent with current industry practices, are controlled by the applicant's quality assurance program and, therefore, are acceptable to the staff.

Acceptance criteria: The applicant states that the acceptance criterion for visual inspections is the absence of anomalous indications of degradation. Acceptance criteria for performance tests (i.e., flow and pressure tests) are provided in the appropriate test procedures. Occurrence of degradation that is adverse to quality is entered into the corrective action system. The staff found this to be acceptable.

Operating experience: The applicant states that component inspections and surveillance tests are performed consistently with guidance provided by NFPA. Degradation of fire barriers has occurred at doors and penetration seals, and is corrected promptly when found through routine walkdowns or planned inspections. Surveillance tests have been performed routinely, and have not identified any significant degradation of the fire suppression system.

In order to complete its review of operating experience, the staff requested that the applicant discuss the extent to which the fire barrier experiences reported in NRC Generic Letter 92-08 and NRC Information Notices 88-56, 91-47, 94–28, 97-70 have been incorporated in the fire protection program. In its November 30, 2001, response to RAI B2.2.7-4, the applicant provided the following information:

> (a) NRC Generic Letter 92-08 describes concerns with the integrity of Thermo-Lag 330-I fire barriers used to ensure functionality of electrical cables, particularly with respect to the separation of redundant safe-shutdown trains within the same fire area. Information Notice 91-47 describes a concern at River Bend Station regarding fire endurance testing of Thermo-Lag used for the protection of cabling. While Thermo-Lag 330-I is used as a fire barrier for a single application in the wall of a charging pump cubicle at North Anna, it is not relied upon as a fire barrier for any cabling at Surry and North Anna.
>
> (b) NRC Information Notices 88-56, 94-28, and 97-70 describe potential problems with fire-barrier penetration seals. Periodic surveillance is performed at Surry and North Anna to monitor penetration seals for the presence of voids, cracks, or deficiency of material. Any degradation found during these inspections is evaluated by engineering such that repairs would be implemented through the corrective action system in accordance with 10 CFR Part 50, Appendix B.
>
> (c) the applicant's operating experience has included findings of gaps or an insufficient amount of firestop material in penetration seals during inspections early in the plant history, indicating that these concerns were due to deficiencies in installation rather than aging. These findings were corrected. The frequency of inspection activities has been established consistent with NFPA requirements that take into account aging effects. Findings have been corrected through the

corrective action system in accordance with 10 CFR Part 50, Appendix B; and no changes in the inspection practices have been determined to be necessary. Any findings of deficiencies in the future will be evaluated to determine whether the inspection program needs to be modified.

The staff has found that water-based fire protection systems designed, inspected, tested and maintained in accordance with NFPA minimum standards have demonstrated reliable performance. On the basis of the operating experience described above, the staff concludes that the applicant's aging management activities have been effective in maintaining the intended function of the fire protection components within the scope of this evaluation, and can reasonably be expected to do so for the period of extended operation.

3.3.1.7.3 Conclusions

The staff has reviewed the information provided in Section B2.2.7 of each LRA and the summary description of the fire protection program in Section A2.2.7 of the UFSAR supplement. In addition, the staff considered the applicant's response to the staff's RAIs provided in letters to the NRC dated November 30, 2001, and May 22, 2002 (Serial No. 02-163). On the basis of this review and the above evaluation, the staff finds that the applicant has demonstrated that the effect of aging associated with fire protection components will be adequately managed so that there is reasonable assurance that the intended functions will be maintained consistent with the CLB for the period of extended operation.

3.3.1.7.4 FSAR Supplement

The staff reviewed Section A2.2.7 of the UFSAR supplement and found that the description of the applicant's fire protection program is consistent with Section B2.2.7 of each LRA, except as discussed below.

In each LRA Section B2.2.7, a licensee followup action has been identified to revise the fire protection plan to include the replacement or testing of a representative sample of sprinklers that have been in service for 50 years. This task will conform to the provisions of NFPA-25, Section 2-3.1.1, and will be performed during the period of extended operation. This item is included in each LRA, Table B4.0-1, which contains a comprehensive list of followup action items, but is not discussed in Section A2.2.7 of the UFSAR supplement.

In response to RAI B2.2.9-3, the applicant stated that it would incorporate the followup actions from Table B4.0-1 of each LRA into the UFSAR supplements in each LRA. The applicant committed to describe the followup actions in the appropriate aging management activity summaries provided in Appendix A of the applications.

In addition, in its response to RAI B2.2.7-2 dated November 30, 2001, the applicant stated that it would supplement the NFPA pressure and flowrate testing credited in each LRA as part of the fire protection program activity with the work control process activity in order to manage aging effects for the fire protection system piping. The staff requested that this commitment by the applicant be incorporated into Section A2.2.7 of the UFSAR supplement. In its letter dated July 25, 2002, the applicant stated that all items originally in Table B4.0-1 of the LRAs have been incorporated into the text of their respective AMAs in the UFSAR Supplement. This includes the Fire Protection Program in UFSAR Supplement Section 18.2.7. Since the applicant has completed this action, the staff considers confirmatory action 3.3.1.7-1 closed. In the same letter dated July 25, 2002, the applicant stated that the UFSAR Supplement Section 18.2.7, "Fire Protection Program," has been modified to credit the Work Control Process. Since the applicant has completed this action, the staff considers confirmatory action 3.3.1.7-2 closed.

3.3.1.8 Fuel Oil Chemistry

The applicant describes its fuel oil chemistry program in Section B2.2.8 of each LRA. The applicant also includes relevant materials from Section 3.3.4, "Diesel Generator Support Systems," and Section 3.3.9, "Fire Protection and Supporting Systems," of each LRA and the material applicable to the Surry plant only from Section 3.3.2, "Open Water Systems." This section addresses the procedures for controlling the fuel oil chemistry in order to ensure its compatibility with the materials of construction of the components exposed to the fuel oil environment. The staff reviewed each LRA to determine whether the applicant has demonstrated that the fuel oil chemistry program will adequately manage the applicable aging effects of aging during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.3.1.8.1 Technical Information in Application

In Section B2.2.8 of each LRA, the applicant specifies that the fuel oil chemistry program applies to the alternate AC diesel generator, emergency diesel generator, security, and fire protection systems. The components in these systems that are exposed to fuel oil are listed in Tables 3.3.4-1, 3.3.4-2, 3.3.4-3, and 3.3.9-1, respectively. These components are subject to aging effects which could cause degradation.

The applicant evaluated the methods for controlling fuel oil quality in order to ensure that it is compatible with the materials of construction of the components exposed to fuel oil. Use of improper fuel oil could lead either to corrosion damage of storage tanks or to accumulation of particulates or biological growth that would interfere with the operation of safety-related equipment. In the fuel oil chemistry program, the applicant specified fuel oil analyses, minimum sampling frequencies, and acceptance criteria needed for maintaining the required fuel oil quality. The acceptance criteria for these tests are based, to a great extent, on the ASTM standards listed in each LRA. Also, the applicant identified corrective actions which would be taken if the fuel oil did not meet the prescribed specifications.

3.3.1.8.2 Staff Evaluation

The staff's evaluation of the fuel oil chemistry control program focused on how the program manages aging effects through the effective incorporation of the following 10 elements: 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 indicates that the corrective actions, confirmation process, and administrative controls are part of the site-controlled quality assurance program. The staff's evaluation of these program attributes is provided separately in Section 3.3.2 of this SER. The remaining seven elements are discussed below.

The environment in the diesel fuel oil storage and transfer systems consists of fuel oil which occasionally may contain accumulated water and be contaminated with some impurities. Although fuel oil, in its pure form, is non-corrosive to metals, the presence of water, naturally occurring contaminants, or some fuel additives, can create corrosive environments. In the fuel oil storage and transfer system, the components remaining within the scope of license renewal are constructed from carbon steel, low-alloy steel, stainless steel, cast iron, copper, brass, and bronze. These components are subject to aging effects caused by loss of material due to different types of corrosion. However, the operating experience at several plants has indicated a very low incidence of corrosion failure of the components exposed to fuel oil. The most frequent incidents were related to clogging of strainers with sediments and degraded fuel oil.

In order to manage the aging effects due to the presence of water, particulates, and other contaminants in the fuel oil storage and transfer systems, the applicant has a program for testing the oil and taking corrective actions if its chemistry does not meet the prescribed specifications.

Program scope: The scope of the fuel oil chemistry program involves sampling and testing of the systems containing fuel oil, and taking corrective actions, if the specified criteria are not met. More specifically, sampling and testing activities are performed in the following tanks at the North Anna and Surry plants: above-ground storage tank, underground emergency diesel generator fuel tank, diesel generator day tanks, fire pump fuel tank, and security diesel generator fuel tank. They are also performed in the AAC diesel fuel oil tank in the North Anna plant and in the low-level intake structure fuel oil tank for the diesel generator operating service water pumps at the Surry plant.

The staff found the program scope acceptable because the tests and corrective actions specified in the program will ensure effective management of the age-related effects in the systems containing fuel oil.

Preventive actions: Maintaining proper fuel oil chemistry through regular checking for the presence of water, particulates, and other contaminants and taking appropriate corrective actions will mitigate the degradation of the components in the systems containing fuel oil. Use of biocide will minimize corrosion due to MIC and resulting biofouling. The staff finds that these procedures are adequate because they include all the activities needed for maintaining the quality of fuel oil and managing the age-related effects of the components in the systems containing fuel oil.

Parameters monitored or inspected: The fuel oil chemistry program monitors fuel oil quality by performing a number of tests. Most of these tests follow the procedures specified in the ASTM standards. The applicant has indicated that its test program will include testing fuel oil for the aerobic and sulfate reducing bacteria using the methods in vendor literature. For determining water and sediment content and for particulate testing in fuel oil, the applicant will follow the procedures described in ASTM D-1796 and ASTM D-2276, respectively. The staff finds that the procedures used by the applicant for monitoring fuel oil quality with regard to its effect on the components exposed to the fuel oil environment are based on well-established methods and the applicant’s inspection program is, therefore, acceptable.

Detection of aging effects: The fuel oil chemistry program is an activity which minimizes deleterious age-related effects by controlling the fuel oil environment and taking appropriate corrective actions. It does not directly detect aging effects. The purpose of the program is to ensure that optimum environment in the systems containing fuel oil exists and that no component degradation due to age-related effects is occurring. The staff found this acceptable because the chemistry program is a preventative program and as such is not credited for detecting aging effects.

Monitoring and trending: In each LRA the applicant described the monitoring and trending requirements for the parameters specifying properties of the fuel oil with respect to its effect on the aging of the components in the fuel oil systems. In the program sampling and testing of stored fuel oil will be performed at a frequency of once per calendar year. The sampling and analysis will provide an opportunity to detect fuel oil conditions that could lead to fuel oil tank degradation so that appropriate corrective actions could be taken in a timely manner. In addition, the freshly delivered oil will be sampled for water and sediment content prior to its transfer to the supply tanks. The staff reviewed the applicant's monitoring and trending program and found that it will provide the applicant with an effective way for controlling fuel oil quality.

Acceptance criteria: In each LRA, the applicant specifies the quality of fuel oil and criteria which should be maintained for minimizing the degradation of the components exposed to the fuel oil environment. Adherence to the criteria will ensure that the quality of fuel oil will be kept at an acceptable level and any departure from it will result in timely corrective action. The criteria follows the ASTM guidelines or guidance literature from the vendor and apply to the parameters that have been shown to contribute to component degradation. They include the requirements for determining the levels of water, sediments, particulates and bacteria causing MIC. The staff found the acceptance criteria for the fuel oil chemistry program, as specified in each LRA, to be effective in controlling aging effects for the components and systems exposed to fuel oil because they have low thresholds to allow for early detection and corrective action of fuel oil chemistry deviations.

Operating experience: Operating experience with the systems covered by the fuel oil chemistry program has demonstrated the effectiveness of the program. The experience at Surry identified a biofouling problem in the underground fuel oil storage tank. However, the corrective action, consisting of cleaning the tank, verifying its integrity, and refilling it with biocide-treated fuel oil, resolved the problem. This also prompted the applicant to enhance its fuel oil chemistry program by addition of bacteria sampling and biocide treatment. Verification of the integrity of fuel oil tanks was extended to the North Anna plant. The tank inspection was performed in accordance with station technical specifications. As a result of operating experience, the staff agrees that the applicant's corrective action program facilitated the development of a successful fuel oil chemistry program.

3.3.1.8.3 Conclusions

The staff has reviewed the information provided in Section B2.2.8 of each LRA and the summary description of the fuel oil chemistry program in Section A2.2.8 of the UFSAR supplement. On the basis of this review and the above evaluation, the staff finds that the applicant has demonstrated that the effects of aging associated with the fuel oil chemistry program structures and components will be adequately managed so that there is reasonable assurance that the intended functions will be maintained consistent with the CLB for the period of extended operation.

3.3.1.8.4 FSAR Supplement

The staff reviewed the description of the information in the FSAR relevant to the fuel oil chemistry program in the North Anna and Surry plants. It finds that the FSAR contains adequate description of the systems and operations required for supporting the fuel oil chemistry program.

3.3.1.9 General-condition-monitoring Activities

The applicant describes its general-condition-monitoring activities in Section B2.2.9 of each LRA. The applicant credits this program for managing the aging effects of loss of material, change in material properties and cracking for components that are located in normally accessible areas. The applicant also credits this program for managing the aging effect of separation and cracking/delamination for North Anna components that credit the general-condition-monitoring activities. The staff reviewed each LRA to determine whether the applicant has demonstrated that the general-condition-monitoring activities will adequately manage the applicable effects of aging during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.3.1.9.1 Summary of Technical Information in the Application

In Section B2.2.9 of each LRA, the applicant states that the purpose of the general-condition-monitoring activities is to provide reasonable assurance that the effects of aging will be managed so that the intended functions of components in normally accessible areas will be maintained consisted with the CLB during the period of extended operation. The applicant identified the following systems, structures, and commodities that credit this program for managing the aging effects of loss of material, change in material properties, and cracking. Additionally, general-condition-monitoring activities are credited for managing the aging effect of separation and cracking/delamination for North Anna fire wraps.

<u>System</u>

- alternate AC diesel generator system
- bearing cooling (SPS 1/2 only)
- blowdown
- boron recovery
- chemical and volume control
- chilled water (NAS 1/2 only)
- circulating water (SPS 1/2 only)
- component cooling water
- condensate (SPS 1/2 only)
- containment spray (SPS 1/2 only)
- containment vacuum
- quench spray (NAS 1/2 only)
- drains - aerated
- drains - gaseous
- emergency diesel generator system
- feedwater
- fire protection

- fuel pit cooling
- gaseous waste (SPS 1/2 only)
- heating (NAS 1/2 only) and ventilation
- high-radiation sampling (NAS 1/2 only)
- instrument air
- leakage monitoring
- liquid and solid waste (NAS 1/2 only)
- neutron shield tank cooling
- post-accident hydrogen removal (NAS 1/2 only)
- primary and secondary plant gas supply
- primary-grade water (SPS 1/2 only)
- radiation monitoring
- refueling purification (NAS 1/2 only)
- reactor cavity purification (SPS 1/2 only)
- reactor coolant system (reactor coolant)
- reactor coolant system (closed-water)
- recirculation spray
- residual heat removal
- safety injection
- sampling system
- security
- service air
- service water
- steam generator water treatment (NAS 1/2 only)
- steam generator recirculation and transfer (SPS 1/2 only)
- vacuum priming (SPS 1/2 only)
- vents - aerated (SPS 1/2 only)

Structure

- auxiliary building
- casing cooling pump house (NAS 1/2 only)
- containment
- quench spray pump house (NAS 1/2 only)
- containment spray pump building (SPS 1/2 only)
- fire pump house (SPS 1/2 only)
- fuel building
- load-handling cranes and devices
- main steam valve house
- safeguards building
- service building
- service water pump house (NAS 1/2 only)
- service water valve house (NAS 1/2 only)
- turbine building

Commodity

- general structural supports
- miscellaneous structural commodities

3.3.1.9.2 Staff Evaluation

The staff's evaluation of the general-condition-monitoring activities focused on how the program manages aging effects through the effective incorporation of the following 10 elements: 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 indicates that the corrective actions, confirmation process, and administrative controls are part of the site-controlled quality assurance program. The staff's evaluation of these program attributes is provided separately in Section 3.3.2 of this SER. The remaining seven elements are discussed below.

Scope of program: The applicant states in Section B2.2.9 of each LRA that the general-condition-monitoring activities are performed in three different ways:

- inspections of radiologically controlled areas for borated water leakage in areas outside containment
- periodic walkdown inspections of piping and equipment
- periodic area inspections to determine the condition of supports and doors. Supports for major equipment, piping, cables, and general plant components will be included, and doors within are as being within the scope of license renewal

The applicant further states that the scope of the general-condition-monitoring activities includes managing the aging effect of separation and cracking/delamination for NAS 1/2. Based on a review of the application, the staff observed that this program is credited for managing this aging effect only for fire wraps at NAS 1/2. In a letter dated May 22, 2002 (Serial No. 02-277), the applicant confirmed that SPS 1/2 does not use fire wraps. The applicant also stated that statements in Sections A2.2.7 and B2.2.7 of each LRA that indicate that the fire protection program is used to manage the aging of fire wraps are administrative errors and that the fire protection program is not used to manage aging of fire wraps. Based on the above clarifications, the staff found the scope of the general-condition-monitoring activities to be acceptable.

Preventive actions: There are no preventive or mitigative actions taken as part of this program, and the staff did not identify the need for such actions.

Parameters monitored or inspected: The applicant states that inspections by engineering personnel check the condition of components, equipment, and supports and provide compliance with the requirements of the Maintenance Rule, 10 CFR 50.65. The applicant also states that the following types of degradation or adverse conditions can be detected by visual inspections:

- component leakage
- rust or corrosion products
- peeling, bubbling, or flaking coatings
- indications of chemical attack
- corroded fasteners
- cracking (of concrete, supports, equipment, sealants)
- bubbled, discolored, or cracked electrical insulation

- damaged or missing thermal insulation (the concern being material integrity, but not thermal performance)
- deformed or mispositioned piping and cable supports
- wastage due to boric acid leakage

In a letter dated May 22, 2002 (Serial No. 02-277), the applicant stated that the above-listed degradations and adverse conditions will be detected, as applicable, by the general-condition-monitoring activities. The applicant also states that the cracking of concrete, referenced in the list above, is the concrete associated with anchors, which can affect the intended function of these anchors. Based on the above clarifications, the staff found that the list of the types of degradation or adverse conditions that will be detected by the visual inspections included in this program is comprehensive and acceptable.

Detection of aging effects: For the general-condition-monitoring activities, the external condition of supports, piping, doors, and equipment is determined by visual inspection. The applicant credits these activities for managing the aging effects of loss of material, change in material properties, and cracking for all four units, and for managing the aging effect of separation and cracking/delamination for NAS 1/2 fire wraps. The applicant committed to the development of additional procedural guidance to direct thorough and consistent inspections of component supports and doors. The applicant further commits to completing initial inspections, using the additional guidance, prior to the end of the current operating license term. The staff agrees with the applicant's approach and accepts the commitment to develop further procedural guidance. The use of visual inspection of the external condition of supports, piping, doors, and equipment that credit the general-condition-monitoring activities is considered by the staff to be a reasonable means of detecting the aging effects managed by this monitoring activity.

Monitoring and trending: The applicant states that visual monitoring of the supports, piping, doors, and equipment in normally accessed areas is accomplished with a spaces approach, with an inspection frequency that varies from weekly to once per refueling outage. In response to RAI B2.2.9-1, the applicant states that the term "spaces approach" is defined in document NEI 95-10 and refers to all systems, structures, and components (SSCs) in a particular area of the plant that share a common bounding environmental parameter, such as temperature and are in close proximity, such as within a room or a portion of the floor of a building. The applicant also states that all supports, doors, piping, and equipment in a "space" within the scope of the general-condition-monitoring activities are subject to inspection at least once per refueling outage cycle as part of engineering walkdowns. In addition, the applicant committed in Section B2.2.9 of each LRA to developing, prior to the end of the current operating license term, procedural guidance for engineers and health physics technicians regarding inspection criteria that focus on detection of aging effects during general-condition-monitoring activities. The staff agrees with the inspection frequency used for the general-condition-monitoring activities and accepts the applicant's commitment to develop further procedural guidance.

Acceptance criteria: The applicant states that the acceptance criterion for visual inspections is the absence of anomalous indications of degradation. Evaluations of anomalies found as part of the general-condition-monitoring activities determine whether analysis, repair, or further inspection is required. Occurrence of degradation that is adverse to quality is entered into the applicant's corrective action system. The staff found the acceptance criteria for the general-condition-monitoring activities to be acceptable.

Operating experience: The applicant states that the effects of aging are found in normally accessed areas during routine work tasks and inspections. Engineering evaluations and corrective actions are implemented, as necessary, to correct conditions that are adverse to quality. The applicant also reports that inspection results for visits from outside organizations such as INPO confirm a continuing high level of management attention to maintaining plant integrity.

In its response to RAI B2.2.9-2, in a letter dated November 30, 2001, the applicant provided specific information regarding the operating experience for this existing program. The following three examples were described to demonstrate the effectiveness of the general-condition-monitoring activities in identifying aging-related problems before loss of system intended function and subsequent programmatic improvements: (1) cracking in the flexible ventilation connections, (2) loss of material from the flood control throttle shields, and (3) loss of material from the service water vent line. These examples also demonstrated the use of the applicant's corrective action system in identifying effective corrective actions that prevent future degradation throughout the plant. However, during a general inspection of equipment in containment at Surry Unit 2 on April 2, 2002, the NRC staff identified external corrosion on the coated component cooling system piping. Since the aging management of the component cooling water piping is part of the general-condition-monitoring program, the staff was initially concerned that the walkdowns performed as part of the general-condition-monitoring program may have been inadequate. However, during discussions with the applicant, the NRC inspectors determined that the external corrosion of the component cooling water piping was identified through refueling outage walkdowns and entered into the applicant's corrective action program as far back as 1992. These outage walkdowns are part of the general-condition-monitoring activities. In addition, the NRC inspectors noted that the applicant has inspected and documented the condition of the component cooling water piping several times over the past ten years. To ascertain the extent of the corrosion of the component cooling water piping, the applicant has made several wall-thickness measurements. The NRC inspectors determined that in all cases since 1992, the wall-thickness measurements, taken at areas of coating degradation and corrosion, showed the pipe-wall thickness to be well above minimum thickness and, therefore, no operability issued were identified. The NRC inspectors concluded that the coating of the component cooling water piping may need to be refurbished to ensure that the required minimum-wall-thickness is maintained during the period of extended operation. The applicant is currently evaluating this issue within its corrective actions program.

3.3.1.9.3 Conclusions

The staff has reviewed the information provided in Section B2.2.9 of each LRA and the summary description of the general-condition-monitoring activities in Section A2.2.9 of the UFSAR supplement. In addition, the staff considered the applicant's response to the staff's RAIs provided in a letter dated November 30, 2001. On the basis of this review and the above evaluation, the staff finds that the applicant has demonstrated that the program can adequately manage the aging effects in the systems, structures and commodities that credit the general-condition-monitoring activities so that the intended functions will be maintained consistent with the CLB for the period of extended operation.

3.3.1.9.4 FSAR Supplement

The staff reviewed Section A2.2.9 of the UFSAR supplement and found that the description of the applicant's general-condition-monitoring activities is consistent with Section B2.2.9 of each LRA. However, in Section B2.2.9 of each LRA, the applicant committed to the following two licensee followup actions that are not discussed in the UFSAR: (1) Additional procedural guidance will be developed to direct thorough and consistent inspections of component supports and doors (initial inspections will be completed, using the additional guidance, prior to the end of the current operating license term), and (2) Procedural guidance will be developed for engineers and health physics technicians regarding inspection criteria that focus on detection of aging effects during general-condition-monitoring activities. The guidance will be developed prior to the end of the current operating license term. These two items are included in each LRA, Table B4.0-1, which contains a comprehensive list of followup action items.

In its response to RAI B2.2.9-3, in a letter dated November 30, 2001, the applicant stated that it will incorporate the licensee followup actions from Table B4.0-1 of each LRA into the UFSAR supplements for the Surry and North Anna Power Stations. The applicant committed to describe the followup actions in the appropriate Aging Management Activity summaries provided in Appendix A of the applications. In its letter dated July 25, 2002, the applicant stated that all items originally in Table B4.0-1 of the LRAs have been incorporated into the text of their respective AMAs in the UFSAR Supplement. This includes General Condition Monitoring in UFSAR Supplement Section 18.2.9. Since the applicant has completed this action, the staff considers confirmatory action 3.3.1.9-1 closed.

3.3.1.10 Inspection Activities - Load-handling Cranes and Devices

The applicant describes its inspection activities for load-handling cranes and devices in Section B2.2.10 of each LRA. The applicant credits this inspection activity with managing the aging effect of loss of material for cranes, monorails, and their associated components. The staff reviewed each LRA to determine whether the applicant has demonstrated that the inspection activities for load-handling cranes and devices will adequately manage the aging effect of loss of material during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.3.1.10.1 Summary of Technical Information in the Application

In Section B2.2.10 of each LRA, the applicant states that the purpose of the inspection activities for load-handling cranes and devices is to provide reasonable assurance that the aging effect of loss of material will be managed so that the intended functions of the load-handling cranes and devices will be maintained consistent with the CLB during the period of extended operation. The applicant states that the aging management documents for this program have been developed in compliance with ASME B30.2, “Overhead and Gantry Cranes,” for cranes and ASME B30.11, “Monorail Systems and Underhung Cranes,” for monorails. The inspection activities also address the applicable load-handling concerns identified in NUREG-0612, “Control of Heavy Loads at Nuclear Power Plants.” The applicant states that it uses its work control process to direct the structural integrity inspections of applicable cranes which includes steps to check the condition of the structural girders on the cranes, and the runways along which the cranes move.

The applicant states that the following load-handling cranes and devices are within the scope of the inspection activities for this program:

- containment polar cranes
- containment jib crane
- containment annulus monorail
- refueling manipulator crane
- fuel handling bridge crane
- new fuel transfer elevator
- spent fuel crane
- auxiliary building monorails

3.3.1.10.2 Staff Evaluation

The staff's evaluation of the inspection activities for load-handling cranes and devices focused on how the program manages the aging effect of loss of material through the effective incorporation of the following 10 elements: 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 indicates that the corrective actions, confirmation process, and administrative controls, are part of the site-controlled quality assurance program. The staff's evaluation of these program attributes is provided separately in Section 3.3.2 of this SER. The remaining seven elements are discussed below.

Program scope: Section B2.2.10 of each LRA identifies the load-handling cranes and their associated components, such as rails, towers, load trolley steel, fasteners, base plates, and anchorages, that credit these inspection activities. The staff finds the scope of the inspection activities for load-handling cranes and devices to be acceptable since it includes all of the load-handling cranes subject to an AMR.

Preventive actions: There are no preventive or mitigative actions taken as part of this program, and the staff did not identify the need for such actions.

Parameters monitored or inspected: The applicant indicates that the inspection activities for load-handling cranes and devices determines the overall condition of the cranes and monorails. In addition, the inspection activities include specific steps for checking the condition of the structural members (i.e., rails and towers) and fasteners on the cranes and lifting devices, the runways along which the cranes move, and the baseplates and anchorages for the runways and monorails. From the structural items listed above, it was not clear to the staff whether the examination of the condition of the anchorages includes the grout and concrete surrounding the anchors. Based on the applicant's response to RAI 3.5.10-2, the general condition activities will be used to manage the potential cracking of concrete associated with piping and equipment anchors. The applicant states in Section B2.2.10 of each LRA that a followup action will be initiated to implement a one-time inspection of a representative sample of the box girders for the polar cranes. The inspection will be performed between year 30 and the end of the current operating license term. Since visual inspections can be used to verify the overall condition of the cranes and monorails, such inspections carried out by the inspection activities for load-handling cranes and monorails are acceptable to the staff.

Detection of aging effects: Loss of material is identified as the aging effect associated with the load-handling cranes and devices. The loss of material is found by visual inspections. The staff agrees with the use of visual inspection of the cranes and devices to identify loss of material.

Monitoring and trending: The applicant states that the cranes and devices located inside containment are inspected at a frequency of once per fuel cycle. The cranes outside containment are inspected annually. The applicant uses its work control process to direct the inspections of the applicable cranes. In RAI B2.2.10-1 the staff requested that the applicant clarify the interaction between the inspection activities for load-handling cranes and devices and the work control process as it relates to the inspection frequencies for the cranes and monorails. In response, the applicant stated that the inspections are implemented using the work control process. Since the response provided by the applicant to the staff's RAI was inadequate, the staff requested further clarification concerning the interaction between these two aging management activities. In response to Supplemental RAI B2.2.10-1, dated May 22, 2002 (Serial No. 02-277), the applicant stated that the aging management activities for the load-handling cranes and devices take advantage of inspections that are scheduled through the work control process. The inspection frequencies for the load-handling cranes and devices are as stated in Section B2.2.10 of each LRA; however, the inspection activities for the load-handling cranes and devices do not schedule inspections independently of the work control process. Since the applicant stated that it would adhere to the inspection frequencies stated in Section B2.2.10 for the load-handling cranes and devices, the staff finds that the applicant's response to RAI B2.2.10-1 is acceptable.

Acceptance criteria: The applicant states that the acceptance criterion for visual inspections is the absence of anomalous indications of degradation. Identified discrepancies are corrected. If the discrepancy cannot be resolved as part of the inspection, appropriate notations are made in the inspection procedure or work control document, and the discrepancy is evaluated by engineering personnel. Occurrence of degradation adverse to quality is entered into the applicant's corrective action system. Since the acceptance criterion is consistent with the degradation of concern and detectable by visual inspections, this approach is consistent with current industry practices and, therefore, the acceptance criterion is acceptable to the staff.

Operating experience: The applicant states that anomalous conditions with cranes and lifting devices have been identified. These anomalies have principally involved misaligned runways. Such misalignment is not a result of age-related degradation and is not a concern for license renewal. The observed runway discrepancies were resolved either during the inspection process or through the applicant's corrective action system. Operating experience confirms the absence of significant structural degradation of cranes. Based on the operating experience presented by the applicant, the staff finds that the applicant's operating experience has demonstrated that the inspection activities for the load-handling cranes and devices can reasonably be expected to maintain the intended functions of the cranes and monorails that are within the scope of this program for the period of extended operation.

3.3.1.10.3 Conclusions

The staff has reviewed the information provided by the applicant in Section B2.2.10 of each LRA and the summary description of the inspection activities for load-handling cranes and devices in Section A2.2.10 of the UFSAR supplement. In addition, the staff considered the applicant's response to the staff's RAIs. On the basis of this review and the above evaluation, the staff finds that there is reasonable assurance that the applicant has demonstrated that the aging effect of loss of material associated with the load-handling cranes and devices will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation.

3.3.1.10.4 FSAR Supplement

The staff reviewed Section A2.2.10 of the UFSAR supplement and found that the description of the applicant's inspection activities with respect to load-handling cranes and devices are consistent with Section B2.2.10 of each LRA. However, in Section B2.2.10 of each LRA, the applicant committed to one licensee followup action that is not discussed in the UFSAR supplement. The licensee followup action is to implement a one-time internal inspection of a representative sample of the box girders for the polar cranes. The inspection will be performed between year 30 and the end of the current operating license term. This item is included in each LRA, Table B4.0-1, which contains a comprehensive list of followup action items, but is not discussed in Section A2.2.10 of the UFSAR supplement.

In its response to RAI B2.2.9-3 in a letter to the NRC dated November 30, 2001, the applicant stated that it would incorporate the licensee followup actions from Table B4.0-1 of each LRA into the UFSAR supplements for the Surry and North Anna Power Stations. The applicant committed to describe the followup actions in the appropriate aging management activity summaries provided in Appendix A of the applications. In its letter dated July 25, 2002, the applicant stated that all items originally in Table B4.0-1 of the LRAs have been incorporated into the text of their respective AMAs. The UFSAR Supplement Section 18.2.10, "Inspection Activities - Load Handling Cranes and Devices" has been modified to include the box girder inspections. Since the applicant has completed this action, the staff considers confirmatory action 3.3.1.10-1 closed.

3.3.1.11 ISI Program - Component and Component Support Inspections

The applicant describes its ISI program for component and component support inspections in Section B2.2.11 of each LRA. The applicant credits this inspection program with managing the potential aging of ASME Class 1 and Class 2 components and component supports by assuring compliance with the provisions of ASME Section XI, Subsections IWB, IWC, and IWF. Inservice inspections are performed by the ISI program to detect component degradation prior to loss of intended function. The staff reviewed each LRA to determine whether the applicant has demonstrated that the ISI program for component and component support inspections will adequately manage the applicable aging effects during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.3.1.11.1 Summary of Technical Information in the Application

In Section B2.2.11 of each LRA, the applicant states that the purpose of the ISI program for component and component support inspections is to manage the aging of ASME Class 1 and Class 2 components and component supports by assuring compliance with the requirements of Subsections IWB, IWC, and IWF of ASME Section XI (1989 edition for North Anna Unit 1 and Surry Units 1 and 2, and 1995 edition with 1996 addenda for North Anna Unit 2). The scope of the program includes Class 1 components, Class 2 carbon steel piping in the feedwater and main steam piping systems, and component supports. The program is implemented in accordance with the individual inservice inspection plan for each unit. The ISI requirements may be modified by applicable code cases and relief requests approved by the staff specifically for each unit. These are subject to re-evaluation for use during subsequent 120-month inspection intervals. In addition, as a licensee followup action, the applicant has committed to following industry activities related to failure mechanisms for small-bore piping and will evaluate changes to inspection activities based on industry recommendations. This activity is outlined in Appendix B4.0 of each LRA, “Licensee Followup Actions.”

The applicant also states that a transition to risk-informed inservice inspection (RI-ISI) is currently underway. The RI-ISI program evaluates the nondestructive examination (NDE) of components specified by ASME Section XI, Categories B-F and B-J. The component inspections are in accordance with the requirements specified in NRC-approved Westinghouse Topical Report WCAP-14572, Revision 1-NP-A. As required by the topical report, examinations performed are based upon the postulated failure mechanism associated with the piping being inspected. ASME Code Case N-577 contains a table that describes the failure mechanisms and associated examination requirements. Surry Unit 1 is a full-scope RI-ISI program covering piping in Class 1, 2, 3 and non-class systems. The Surry Unit 1 program has been approved by the NRC. Surry Unit 2 has also been approved but includes Class 1 systems only. The inspection programs at the two North Anna units will include risk-informed inspections of Class 1 components. The process of developing the scope for the risk-informed inspection program includes not only an evaluation of risk significance and failure probability, but also considers operating experience.

Surface examinations for Class 1 piping less than 4-inch NPS are performed as part of the ASME Section XI inservice inspection program. Volumetric examinations of these small-bore pipes will be added to the scope of ISI based upon risk significance and probability of failure. At this time, no small-bore butt welds or socket welds have been designated high-safety-significant, and no volumetric inspections of Class 1 small-bore piping welds are planned. However, Surry Unit 1 is performing volumetric examinations on a sample population of welds in several 3-inch lines in the safety injection, and chemical volume and, control systems. These are Class 2 lines but are used as leading indicators for small-bore piping conditions in Class 1 systems. As a followup action, the applicant is committed to following industry activities related to failure mechanisms for small-bore piping and will evaluate changes to inspection activities based on industry recommendations. This activity is outlined in Appendix B4.0 of each LRA, “Licensee Followup Actions.”

3.3.1.11.2 Staff Evaluation

The staff’s evaluation of the ISI program for component and component support inspections focused on how the program manages aging effects through the effective incorporation of the following 10 elements: 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 indicates that the corrective actions, confirmation process, and administrative controls are part of the site-controlled quality assurance program. The staff’s evaluation of these program attributes is provided separately in Section 3.3.2 of this SER. The remaining seven elements are discussed below.

Program scope: The following systems, structures, commodities, and major components credit the ISI program for component and component support inspections for managing the aging effects of loss of material, cracking, gross indications of loss of pre-load, and gross indication of reduction in fracture toughness.

System	AMR Results Section
chemical and volume control	Section 3.3.1, “Primary Process Systems”
feedwater	Section 3.4, “Steam and Power Conversion Systems”
main steam	Section 3.4, “Steam and Power Conversion Systems”
reactor coolant System	Section 3.1.1, “Reactor Coolant System”
residual heat removal	Section 3.2, “Engineered Safety Features”
safety injection	Section 3.2, “Engineered Safety Features”
sampling system	Section 3.3.1, “Primary Process Systems”

Structures	AMR Results Section
NSSS equipment supports	Section 3.5.9, “NSSS Equipment Supports”

Commodity	AMR Results Section
general structural supports	Section 3.5.10, “General Structural Supports”

Major Component	AMR Results Section
pressurizer	Section 3.1.4, “Pressurizer”

The applicant stated: “License renewal concerns with respect to Subsection IWC include only the carbon steel piping that is susceptible to high energy line breaks in the feedwater and main steam systems.” Subsection IWC identifies a number of examination categories applicable to Class 2 systems in general. Therefore, the staff issued RAI B2.2.11-1(a) requesting that the applicant either (1) describe the AMA credited to manage aging of Class 2 systems, in lieu of IWC, or (2) explain the technical basis for concluding that Class 2 systems do not require aging management. In addition, the ISI program for component and component support inspections does not reference ASME Section XI, Subsection IWD, applicable to Class 3 systems. 10 CFR 50.55a includes Section IWD inspection requirements for Class 3 systems. Therefore, the staff issued RAI B2.2.11-1(b) requesting that the applicant either (1) describe the AMA credited to manage aging of Class 3 systems, in lieu of IWD, or (2) explain the technical basis for concluding that Class 3 systems do not require aging management. In response the applicant states that the mechanical components, other than ASME Class 1, were not specifically identified in the application by their ASME Class designation. However, Class 2 and Class 3 components have been determined to be subject to aging effects, such as loss of material and cracking, and these effects will be managed as indicated in the aging management review results tables provided in the application. The staff considers the applicant’s response to be acceptable. The staff finds the scope of the ISI program for component and component support inspections to be acceptable since it includes the applicable ASME Class 1 and Class 2 components. ASME Class 2 and Class 3 components not covered by this program but subject to aging management for license renewal are covered by other aging management activities described in Appendix B to each LRA.

Preventive actions: There are no preventive or mitigative actions taken as part of this program, and the staff did not identify the need for such actions.

Parameters monitored or inspected: The types of components and component support examinations performed, which are prescribed by ASME Section XI, include visual inspection, surface examinations, and volumetric examinations. The extent of inspection for each component is defined in the inservice inspection plan for each unit. The staff finds this to be acceptable.

Detection of aging effects: Inservice inspections are performed to detect component degradation prior to loss of intended function. The examinations specified by ASME Section XI utilize visual, surface, and volumetric inspections to detect loss of material, cracking, gross indications of loss of pre-load, and gross indications of reduction in fracture toughness, which presents itself as cracking of cast-austenitic stainless steel valve bodies due to thermal embrittlement. Surface examinations extend 1/2 inch on each side of welds. The volumetric examinations include a region equivalent to 1/2 of the material thickness on each side of welds for Class 1 components, and 1/2 inch on each side of welds for Class 2 components. The applicable categories from ASME Section XI, and the required examination types in each category, are listed in Section B2.2.10 of each LRA.

ASME Code Case N-481, "Alternate Examination Requirements for Cast Austenitic Pump Casings," lists steps that can be taken in lieu of the volumetric examination requirement of IWB 2500-1 for pump casings. The applicant invokes this code case for the inspection of reactor coolant pump casings. The alternate steps include:

- VT-2 examination of the exterior of pumps during pressure testing
- VT-1 examination of external surfaces of one pump casing
- VT-3 examination of internal surfaces whenever a pump is disassembled for maintenance
- evaluation to demonstrate safety and serviceability of pump casings

In a letter from C. I. Grimes to D. J. Walters (Nuclear Energy Institute), the NRC staff stated that detection of a reduction of fracture toughness for cast stainless steel pump casings and valve bodies can be adequately detected by existing ASME Code inspections. No additional evaluation for reduction of fracture toughness is required for these cast stainless steel components.

The staff found the applicant's approach for the detection of aging effects acceptable.

Monitoring and trending: Details of the scope of the ASME Section XI inservice inspections are documented in the inservice inspection plan. During the course of the inspections, the extent of surface or volumetric flaws is characterized by the nondestructive examinations. Anomalous indications of degradation are recorded on nondestructive examination (NDE) reports, which are kept in the applicant's station records. Table IWB 2500-1 of Subsection IWB describes the inspection sampling requirements, the examination methods, and the examination frequencies for Class 1 components. Subsection IWC addresses the Class 2 carbon-steel piping of the feedwater and main steam systems and Subsection IWF addresses component supports. Inspection results that do not satisfy the acceptance standards of Section XI, Subsections IWB, IWC, and IWF, are evaluated by engineering personnel to determine if action is required. An anomalous indication that is a sign of degradation will require a disposition of acceptability, component repair, or component replacement, as determined by engineering evaluation. Reportable weld indications, which are revealed by the inservice inspections in Class 1 components, require additional inspections of similar components in accordance with IWB 2430. The staff finds the monitoring and trending activities of the ISI program for component and component support inspections to be acceptable.

Acceptance criteria: Acceptance standards for inservice inspections are identified in Subsection IWB for Class 1 components, Subsection IWC for Class 2 components, and Subsection IWF for component supports. Table IWB 2500-1 refers to acceptance standards listed in Paragraph IWB 3500 for Class 1 components. Similarly, acceptance standards for Class 2 welds are listed in Section IWC 3500. Anomalous indications that are signs of degradation that are revealed by the inservice inspections would require additional inspections of similar components in accordance with Section XI. Evidence of loss of material and cracking and gross indication of loss of pre-load or reduction of fracture toughness would require engineering evaluation for determination of the appropriate corrective action. The occurrence of degradation adverse to quality will be entered into the applicant's corrective action system. The staff finds that the acceptance criteria for the ISI program for component and component support inspections is adequate because that the intended functions of the components that credit this program will be maintained during the period of extended operation.

Operating experience: The applicant has extensive operating experience and ASME Section XI inspection histories indicating a minimal number of leaks at the reactor coolant system pressure boundary. This experience includes data from reactor coolant system leakage monitoring as required by Technical Specifications and a determination of the source of leakage if an event occurs during power operation. Degradation of components and component supports that is found through these inspections is recorded and corrected as directed by engineering evaluations to maintain component intended functions. Early detection of component degradation confirms the effectiveness of the inspection program. This is typical of the inservice inspections that have been performed throughout the utility industry. Flaws exceeding the allowable flaw size are evaluated for acceptability. Continued service is allowed based on the evaluation along with reexamination during future inspection periods as specified by ASME Section XI. If the subsequent examinations reveal that the flaw has not grown, it is considered stable and no further monitoring of that flaw is necessary. With the exception of recent inspection results of the North Anna 2 reactor vessel head penetrations and welds, the applicant has no known flaws exceeding ASME Section XI acceptance criteria that have not been evaluated and reinspected in accordance with ASME Section XI provisions.

The weld area cracking event that was observed in the RCS hot leg piping at the V.C. Summer plant resulted, in part, from the use of Inconel welds. This issue is discussed in IN 2000-17. The applicant used this IN and other operating experience reports provided by INPO to evaluate the potential impact for Surry and North Anna. While alloy 82/182 are not used on the hot leg or cold leg piping at Surry and North Anna, there are other locations within the boundary of the RCS in which alloy 82/182 welds are present at Surry and North Anna.

In order to ensure that possible leakage at the dissimilar metal piping weld locations is detected, the applicant remains committed to the provisions of ASME Section XI, Subsection IWA-5000, which specifies hold times during hydrostatic testing. For insulated components, a hold time of four hours is specified after attaining system temperature and pressure. If the component is uninsulated, the hold time is 10 minutes. The applicant is committed to maintain compliance with the provisions of IWA-5000. In addition, the applicant plans to achieve conformance with ASME Section XI, Appendix VIII, Supplement 10, which identifies new requirements to be implemented by November 22, 2002. These requirements describe updated qualification blocks and personnel qualification for examining dissimilar-metal welds. The applicant also continues its involvement with the Materials Reliability Project (MRP), and will evaluate any new recommendations that may be developed with respect to dissimilar-metal piping welds.

Based on the applicant's operating experience, the staff concludes that the ISI program for components and component supports should be an effective aging management program for license renewal.

3.3.1.11.3 Conclusions

The staff has reviewed the information provided in Section B2.2.11 of each LRA and the summary description of the ISI program for component and component support inspections in Section A2.2.11 of the UFSAR supplement. In addition, the staff considered the applicant's response to the staff's RAIs. On the basis of this review and the above evaluation, the staff finds that there is reasonable assurance that the applicant has demonstrated that the aging effects associated with the ISI program for component and component support inspections will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation.

3.3.1.11.4 FSAR Supplement

The staff reviewed Appendix A2.2.11 of the UFSAR supplement and found that the description of the applicant's ISI program for component and component support inspections is consistent with Section B2.2.11 of each LRA. However, in Section B2.2.11 of each LRA, the applicant committed to a followup action that is not discussed in the UFSAR supplement. This followup action commits the applicant to follow industry activities related to failure mechanisms for small-bore piping and evaluate changes to inspection activities based on industry experience. This item is included in each LRA, Table B4.0-1, which contains a comprehensive list of followup action items, but is not discussed in Section A2.2.11 of the UFSAR supplement.

In response to RAI B2.2.9-3, the applicant stated that it would incorporate the followup actions from Table B4.0-1 of each LRA into the UFSAR supplements for the Surry and North Anna Power Stations. The applicant committed to describe the followup actions in the appropriate Aging Management Activity summaries provided in Appendix A of the applications. In its letter dated July 25, 2002, the applicant stated that all items originally in Table B4.0-1 of the LRAs have been incorporated into the text of their respective AMAs. The UFSAR Supplement Section 18.2.11, "ISI Program – Component and Component Support Inspection" has been modified to include the use of industry activities and guidance related to small-bore piping issues and inspections. Since the applicant has completed this action, the staff considers confirmatory action 3.3.1.11-1 closed.

3.3.1.12 ISI Program - Containment Inspection

The applicant describes its ISI program for containment inspection in Section B2.2.12 of each LRA. The applicant credits this program with managing the aging effect of loss of material for containment surfaces and pressure-retaining bolting and components. The staff reviewed each LRA to determine whether the applicant has demonstrated that the ISI program for containment inspection will adequately manage the aging effect of loss of material during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.3.1.12.1 Summary of Technical Information in the Application

In Section B2.2.12 of each LRA, the applicant states that the purpose of the ISI program for containment inspection is to provide reasonable assurance that the aging effect of loss of material will be managed so that the intended functions of the containment and pressure-retaining bolting and components will be maintained consistent with the CLB during the period of extended operation. The applicant states in Section B2.2.12 of each LRA that the ISI program for containment inspection for concrete containments and containment steel liners implements the requirements in 10 CFR 50.55a and Subsections IWE and IWL of ASME Section XI, 1992 edition through 1992 addenda. The program incorporates applicable code cases and approved relief requests. The provisions of 10 CFR 50.55a are invoked for inaccessible areas within the containment structure. For license renewal, only Subsection IWE is credited for managing aging effects for the containment structure.

3.3.1.12.2 Staff Evaluation

The staff's evaluation of the ISI program for containment inspection focused on how the program manages aging effects through the effective incorporation of the following 10 elements: 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 indicates that the corrective actions, confirmation process, and administrative controls are part of the site-controlled quality assurance program. The staff's evaluation of these program attributes is provided separately in Section 3.3.2 of this SER. The remaining seven elements are discussed below.

Program scope: The applicant states that the scope of the Subsection IWE Inspection Program for the containment steel liner is in compliance with the requirements of 10 CFR 50.55a, which invokes ASME Section XI. The scope of Subsection IWE inspections described in LRA Section B2.2.12 is a (1) visual (VT-3) inspection of containment surface (Category E-A), (2) visual (VT-1) and volumetric inspections of containment surfaces requiring augmented inspections (Category E-C), (3) visual (VT-1) inspection of pressure-retaining bolting (Category E-G), and (4) visual (VT-2) inspection of all pressure-retaining components (Category E-P). These IWE inspections are implemented only for accessible areas.

The first item listed above, visual (VT-3) inspection of containment surface (Category E-A), contains a footnote, which states that examination includes attachment welds between structural attachments and the pressure-retaining boundary (i.e., the containment liner). The staff notes that the above footnote should also indicate that the examination includes the reinforcing structures and attachment welds to reinforcing structures (e.g., stiffening rings, manhole frames, and reinforcement around openings) as required by Footnotes 2 and 5 of ASME Subsection IWE, Table IWE-2500-1. In addition, the examination of welds should include the weld metal and base metal for 1/2 inch beyond the edge of the weld. In response to RAI B2.2.12-1(a), the applicant states that it implements the requirements of Footnote 2 of ASME Subsection IWE, Table IWE-2500-1, by performing examinations of reinforcing structures and attachments to reinforcing structures (including stiffening rings and reinforcement around openings for the Surry and North Anna containment buildings). As required by Footnote 5, these examinations include the weld metal and base metal for 1/2 inch beyond the edge of the weld. The staff found this response to be acceptable.

The list of component type categories for the ISI program for containment inspection does not include seals, gaskets, and moisture barriers, identified as Examination Category E-D in ASME Subsection IWE. LRA Table 3.5.1-1 indicates that aging effects for containment O-rings are managed by the applicant's work control process aging management activity. Therefore, the staff issued RAI B2.2.12-1(b) requesting that the applicant describe the scope and implementation of the work control process as it applies to seals, gaskets, and moisture barriers used in the containment structure. In response, the applicant states that it uses the work control process to manage the aging of containment seals and gaskets, identified as O-rings in Table 3.5.1-1 of each LRA, since that activity involves more thorough and more frequent inspection of the seals and gaskets provided by the inservice inspections, which are required only once per 10-year interval. In addition the applicant states that there are no moisture barriers incorporated into the design of the containment structures for Surry or North Anna that are within the scope of ISI-IWE, Category E-D inspections. The staff found this response to be acceptable.

The ISI program for containment inspections implements visual examination, VT-1, for pressure-retaining bolting. The staff notes that for bolted connections that are not disassembled and reassembled during the inspection interval, the examination method should require a bolt torquing or tension test in accordance with the requirements contained in ASME Subsection IWE, Table IWE-2500-1. In response to RAI B2.2.12-1(c), the applicant states that ASME Subsection IWE, Table IWE-2500-1, Subcategory E-G, requires bolt torquing or tension testing for bolted connections that are not disassembled and reassembled during the inspection interval. For Surry and North Anna, the applicant submitted relief request IWE-5 in 1998 to permit reliance upon 10 CFR Part 50 Appendix J (Type B) testing in lieu of bolt torque or tension testing for bolted connections that are verified by Appendix J results to not experience unacceptable leakage. This relief request was approved by the NRC staff as indicated in NRC letter no. 99-256, dated April 21, 1999, and establishes the current licensing basis requirement for testing of bolted connections that are not disassembled or reassembled during the inspection interval. The staff found this response to be acceptable.

In Section B2.2.12 of each LRA, the applicant states that only Subsection IWE (steel portions of containment) is credited for managing aging effects of the containment structure. During the staff's review of LRA Section 3.5.1, "Containment," a number of questions were raised regarding aging effects of the concrete portions of containment and the basis for limiting the aging management of containment to only the steel elements of containment. In response to RAI 3.5-3, the applicant stated that it would credit the examinations specified by ASME Section XI, Subsection IWL, Examination Category L-A, to manage the potential aging effects of concrete structural members of the containment. The applicant states that these examinations will be added to the ISI program for containment inspections aging management activity.

The staff finds the scope of the ISI program for containment inspections, as augmented by the applicant's response to the staff's RAIs, to be acceptable.

Preventive actions: There are no preventive or mitigative actions taken as part of this program, and the staff did not identify the need for such actions.

Parameters monitored or inspected: The ISI program for containment inspection specifies that the required inservice examinations for the containment steel liner are listed in Table IWE 2500-1 of ASME Section XI, as modified by applicable code cases and relief requests. Visual and volumetric inspections are described. Exempted items, such as inaccessible areas, are listed in Paragraph IWE 1220. Table IWE 2500-1 identifies inspection sampling requirements, examination methods, and examination frequencies. The applicant also indicates that in accordance with IWE-3511, when areas of the liner to be inspected are painted or coated, the examination also checks for evidence of flaking, blistering, peeling, discoloration, and other signs of stress. The staff considers the parameters monitored for the ISI program for containment inspection to be acceptable.

Detection of aging effects: The applicant states that loss of material is the aging effect for the containment steel liner. Surface degradation and wall thinning are two indications of this aging effect. They are determined by visual and volumetric examinations. The frequency and scope of examination requirements specified in 10 CFR 50.55a and Subsection IWE provide reasonable assurance that the aging effect is detected prior to compromising design basis requirements. The component material degradation conditions, which the inspections are intended to detect, are listed in Subsection IWE for the containment steel liner. Guidance for performing VT examinations, and evaluating VT results with respect to the acceptance standards of IWE, is provided in an administrative procedure. The staff finds that the aging effect of loss of material will be adequately managed by the ISI program for containment inspection.

Monitoring and trending: The applicant indicates that the details of the scope for the ASME Section XI, Subsection IWE inspections are documented in the IWE/IWL program plan for each station. The inspections are performed to identify degraded conditions in areas that are accessible. The evaluations of these accessible areas provide the basis for extrapolation to the expected condition of inaccessible areas and an assessment of degradation in such areas. The applicant indicated that the surface condition is characterized using visual examinations during IWE inspections. Anomalous indications of degradation are recorded on inspection reports that are kept in the applicant’s station records. Engineering evaluations are performed for inspection results that do not meet established acceptance standards.

Regarding the schedule and frequency of the examinations, the applicant states that the inspection program required by Subsection IWE is divided into 120-month (10-years) intervals. The 10-year interval for IWE is further divided into three periods. However, the initial implementation of these inspections on September 9, 1996, allowed 5 years for the initial IWE inspection period, and 12 years for the first interval. Portions of the IWE examinations are performed during each 40-month (i.e., 3-year) period such that the entire scope of examinations is completed during the 10-year interval. Prior to the end of each interval, the IWE/IWL Program Plan for each unit is revised to reflect the appropriate update of the ASME Code, and to reflect any revised inspection requirements.

The applicant indicates that the IWE/IWL program plan for each unit will be revised prior to the end of each interval to reflect the appropriate update of the ASME Code, and to incorporate any revised inspection requirements. The revision to the IWE/IWL Program Plan should be consistent with the current approved editions of the ASME Code, in accordance with revisions to 10 CFR 50.55a. The staff issued RAI B2.2.12-2 requesting that the applicant clarify its statement to confirm that it is consistent with this staff position, or provide a more detailed explanation as to why it is different from the staff’s position. The applicant’s response to RAI

B2.2.12-2 states that they will ensure that the IWE/IWL program plan is consistent with the currently approved edition of the ASME Code in accordance with 10 CFR 50.55a and in effect during the respective 10-year interval for the Surry and North Anna units. The staff finds this response to be acceptable.

Acceptance criteria: The ISI program for containment inspection indicates that the acceptance standards for the IWE inspection are identified in ASME Section XI, Table IWE 2500-1 and refers to 10 CFR 50 Appendix J, Option B. Section B2.2.12 of each LRA also states that the occurrence of degradation that is adverse to quality will be entered into the applicant's corrective action system. The use of the acceptance standards as defined in ASME Section XI, Subsection IWE and in 10 CFR Part 50, Appendix J, which is referred to in Subsection IWE, is acceptable to the staff.

Operating experience: The ISI program for containment inspection indicates that compliance with the inspection provisions of ASME Section XI, Subsection IWE, since September 9, 1996. Any degradation of the containment steel liner that is found during inspections is noted and corrected, as necessary, to preclude adverse effects on plant safety and operability.

Previous containment liner inspections at Surry Units 1 and 2 have occasionally found corroded areas of the steel liner. Such areas have been cleaned and recoated. IWE inspection results for Unit 1 in 1998 and for Unit 2 in 1999, found no significant degradation down to the level of the interface joint with the floor. In addition, the applicant decided to excavate several areas of concrete to check the condition of the steel liner below the interface joint. Excavation of concrete in seven areas of the Unit 1 containment confirmed the absence of significant degradation for the liner. Wall thickness measurements showed that considerable margin remains with respect to minimum acceptable values. Observations of the condition of the interface joint for Unit 2 similarly confirmed good material condition and concluded that no further destructive examination was warranted based on the favorable findings for Unit 1.

During the North Anna Unit 2 refueling outage in 1999, a localized area of the Containment liner was found to be corroded. Successful restoration efforts were completed.

From the information provided it is apparent that loss of material of the containment liner has occurred, although the degradation was not significant. Therefore, continued examinations in accessible and inaccessible areas of the containment is crucial to ensure that the intended functions of the containment will be maintained during the period of extended operation. The staff finds that the demonstrated operating experience for the ISI program for containment inspection is adequate to ensure that the intended functions of the containment will be maintained consistent with the CLB during the period of extended operation.

3.3.1.12.3 Conclusions

The staff has reviewed the information provided in Section B2.2.12 of each LRA and the summary description of the ISI program for containment inspection in Section A2.2.12 of the UFSAR supplement. In addition, the staff considered the applicant's response to the staff's RAIs. On the basis of this review and the above evaluation, the staff finds that there is reasonable assurance that the applicant has demonstrated that the aging effects associated with the ISI program for containment inspection will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation.

3.3.1.12.4 FSAR Supplement

The staff reviewed Section A2.2.12 of the UFSAR supplement and found that the description of the applicant's ISI program for containment inspection is consistent with Section B2.2.12 of each LRA. However, the applicant's response to RAI 3.5-3 states that they will credit the examinations specified by ASME Section XI, Subsection IWL, Examination Category L-A, to manage the potential aging effects of concrete structural members of the containment and that these examinations will be added to the ISI program for containment inspection aging management activity. The applicant further states in its response to this RAI that will change the UFSAR supplement that will be presented to the NRC staff in a future revision. In its letter dated July 25, 2002, the applicant stated that the UFSAR Supplement Section 18.2.12, "ISI Program – Containment Inspection" has been revised to incorporate ASME Section XI, Subsection IWL. Since the applicant has completed this action, the staff considers confirmatory action 3.3.1.12-1 closed.

3.3.1.13 ISI Program - Reactor Vessel

The applicant describes its inservice inspection (ISI) program for the reactor vessels in Section B2.2.13 of the LRAs. This section of the LRAs describes the applicant's evaluation of this program in terms of the aging management program attributes provided in the Standard Review Plan for License Renewal. The applicant credits this program for managing the aging effects of loss of material, cracking, gross indications of loss of pre-load, and gross indications of reduction in fracture toughness for all four units.

The staff reviewed the applicant's description of the program in Appendix B2.2.13 of the LRAs to determine whether the applicant has demonstrated that it will adequately manage the applicable effects of aging in the plants during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.3.1.13.1 Summary of Technical Information in the Application

In accordance with 10CFR50.55a, the ISI program is implemented to meet the requirements of ASME Section XI, Rules for Inservice Inspection of Nuclear Power Plant Components. For North Anna 1, the 1989 edition of the ASME Code is applicable, whereas for North Anna 2 the 1995 edition with the 1996 Addenda are applied. For Surry 1 and 2, the 1989 edition of the ASME Code is used. Each of the four units has its own individual ISI plan which describes the procedure for implementing the provisions of ASME Section XI, Subsection IWB (Class 1). Each ISI Plan is approved by the NRC for a 120-month inspection interval. Additional augmented inspection activities have been included in the ISI Plans to address industry concerns regarding the RVs. These areas are for the control rod drive housings on the upper head, and the incore flux thimble tubes in the reactor vessel bottom. NRC Bulletin 88-09, "Thimble Tube Thinning in Westinghouse Reactors," and Generic Letter 97-01, "Degradation of Control Rod Drive Mechanism Nozzle and Other Vessel Closure Head Penetrations," provide the basis for these augmented inspections.

3.3.1.13.2 Staff Evaluation

The staff's evaluation of the reactor vessel ISI program focused on how the program manages aging effects through the effective incorporation of the following 10 elements: program scope, preventive actions, parameters monitored or inspected, detection of aging defects, monitoring and trending, acceptance criteria, corrective actions, confirmation process, administrative controls, and operating experience. The applicant indicates 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 3.3.2 of this SER. The remaining seven elements are discussed below.

The staff reviewed the information included in Section B2.2.13 of the LRAs. The review was performed to verify that the ISI program for the reactor vessel will ensure that the aging effects of loss of material, cracking, gross indications of loss of pre-load, and gross indications of reduction in fracture toughness will be adequately managed so that intended functions will be maintained consistent with the CLB for the period of extended operation for all four reactor vessels.

Program scope: This AMP is credited with managing the aging effects of loss of material, cracking, gross indications of loss of pre-load, and gross indications of reduction in fracture toughness. The applicant stated that the reactor vessel ISI program reasonably assures the pressure-retaining capability of the reactor vessel welds; the studs, nuts and washers that are used for vessel closure; the surface and attachments on the interior of the vessel; the housings and housing tubes for CRDMs on the upper head; incore flux thimbles and guide tubes that penetrate the lower head; and the seal table and fittings. Among the vessel welds included in the scope of license renewal for the North Anna are the head-to-flange weld, the shell-to-flange weld, the nozzle welds, the circumferential vessel welds, and the integrally-welded attachments. These same welds are inspected for the Surry, but since they also have longitudinal welds these are also included in the inspection program.

The relevant ASME Section XI categories of examinations that address aging effects in RV subcomponents are listed in each LRA as:

Component Type Category	Category	Method
Pressure-retaining welds in reactor vessel	B-A	Volumetric/surface
Full-penetration welds of nozzles in vessels	B-D	Volumetric
Pressure-retaining partial penetration metal welds in vessels	B-E	Visual
Pressure-retaining dissimilar metal welds	B-F	Volumetric/surface
Pressure-retaining bolting greater than 5.08 cm (2 inches) in diameter	B-G-1	Visual/surface/volumetric
Interior of reactor vessel	B-N-1	Visual
Integrally welded core support structures and interior attachments	B-N-2	Visual

in reactor vessel		
Pressure-retaining welds in control rod housings	B-O	Volumetric/surface
All-pressure-retaining components	B-P	Visual

Preventive actions: The applicant stated that the current AMP is for condition monitoring only and has included no preventive actions. As such, there are no preventive or mitigative actions nor did the staff identify a need for such action.

Parameters monitored or inspected: The ISI program - reactor vessel, in accordance with ASME Section XI, inspects the following components using a combination of surface, volumetric, and visual examinations:

- reactor vessel welds
- reactor vessel studs, nuts, and washers
- incore flux thimble guide tubes
- peripheral CRDM locations

Augmented inspection activities are also performed on the RV upper head region to visually check for leakage at mechanical closures and to provide compliance with NRC GL-97-01 and to perform eddy current examinations on the incore flux thimble tubes to check wall thickness in compliance with NRC Bulletin 88-09.

The reactor vessel ISI program examinations are performed during each refueling outage at both North Anna and Surry sites. One exception is the SPS 1/2 incore flux thimble guide tubes which are inspected every other refueling cycle. This is because the guide tubes at Surry are double walled and are expected to have higher integrity than the single-walled North Anna tubes.

In Table B4.0-1 of each LRA, Licensee Followup Action, the applicant committed to follow industry efforts to stay aware of new recommendations (in addition to existing reliance on chemistry control and existing ASME Section XI inspections) regarding inspection of core support lugs. Industry recommendations will be considered by the applicant to determine the need for enhanced inspection.

The staff found the parameters monitored to be acceptable because ISI examination of reactor vessel welds, reactor vessel studs, nuts, and washers. incore flux thimble guide tubes and peripheral CRDM locations will ensure adequate RV integrity during the period of extended operation.

Detection of aging effects: The applicant stated that the ASME Section XI visual, surface, and volumetric examinations are utilized to detect loss of material, cracking, and gross indications of loss of pre-load (as indicated by bolt loosening). Augmented inspection activities include bare-metal visual examination of the vessel head, non-visual nondestructive examination (NDE) inspection of the reactor vessel head and penetrations, and under-the-head volumetric and surface examinations. An additional augmented inspection activity involves eddy current testing of the incore flux thimble tubes to detect loss of material. Finally, as part of a licensee followup action the applicant committed to remain active in industry groups in order to stay aware of any new industry recommendations regarding inspection of core support lugs. Industry recommendations will be considered to determine the need for enhanced inspections. The staff finds this approach acceptable. Compliance with the ASME Code Section XI requirements and performance of visual examination, bare-metal visual examination of the vessel head, non-visual NDE inspection of the reactor vessel head and penetrations, and under-the-head volumetric and surface examinations of the vessel head will detect cracking and the presence of boric acid accumulations due to leakage through the pressure boundary.

Monitoring and Trending: The applicant stated that the ASME Section XI inspections are performed once every ten years. Anomalous indications that are signs of degradation are documented and kept in station records. Engineering evaluations are performed for inspection results that do not meet established acceptance standards. These evaluations take into account the extent of degradation, so that timely corrective or mitigative actions are taken. The staff finds this approach to be acceptable because it is based on methods that are sufficient to provide predictability of extending of degradation so that the timely corrective or mitigative actions are possible.

Acceptance criteria: The applicant stated that the acceptance criterion for the non-destructive examination is the absence of anomalous indications that are signs of degradation. Acceptance standards for the inspections of RV pressure retaining welds are provided in ASME Section XI, Subsection IWB 3500. For visual inspection activities, the acceptance criterion for inspection of the vessel head area is absence of evidence of leakage. In the case of the inspections for the incore flux thimble tubes the acceptance criterion is for the tubes to remain above the minimum allowable wall thickness value. The staff finds the above listed acceptance criteria to be appropriate to ensure the integrity of the RV.

Operating experience: In the LRAs, the applicant stated that operating experience and inspection histories indicate the lack of reactor RV degradation. Operating experience includes (a) reactor pressure boundary leakage monitoring as required by Technical Specifications, and (b) RV inspections during refueling outages as well as augmented inspection activities on the RV upper head and incore flux thimble tubes. Industry experiences will be monitored at the North Anna and Surry plants to determine whether additional inspection activities will be need in the future. Operating experience at the North Anna and Surry plants is stated to have shown that there has been no significant indication of loss of material, cracking, gross loss of pre-load, or gross loss of fracture toughness in the RVs at the North Anna and Surry plants. With the exception of September 2002 reactor vessel head inspection findings at North Anna 2, the staff found that operating experience at North Anna and Surry supports the attributes of this program.

The staff is currently reviewing the issues associated with NRC bulletin 2001-01, 2002-01, and 2002-02. Any future regulatory actions that may be required as a result of those reviews will be addressed by the staff in a separate regulatory action.

The three attributes of the quality assurance program namely, corrective actions, confirmation process, and administrative controls have been separately evaluated in Section 3.3.2 of this SER.

As part of its review of operating experience at the four units, the applicant addressed the vessel head penetration (VHP) concerns raised by the NRC in GL 97-01. The applicant provided the following information pertinent to the period of extended operation. The criteria for ranking the VHPs are based on establishing a benchmark probability that a 75% through-wall crack would be detected and exist in the most PWSCC-degraded CRDM nozzle at D.C. Cook 2 relative to the time of VHP inspections at this plant in 1994. NEI normalized nozzle failure at the U.S. reactors relative to the date of January 1, 1997. The most susceptible reactors are placed in Tier 1 which predicts reaching the probability of a 75% through-wall failure in five years. For intermediate susceptibility reactors (Tier 2) reaching the probability would take between five and ten years. The applicant provided a response to NRC requests for its four reactors regarding the following items:

1. "An assessment of the susceptibility of your VHPs to develop PWSCC during the period of extended operation."

The applicant's response to the NRC indicated that Surry 1 and North Anna 1 were grouped in the industry category for most susceptible to PWSCC. Surry 2 and North Anna 2 were placed in the intermediate category for susceptibility to cracking. Review of these rankings was carried out at the May 10, 2000, by the Materials Research Project (MRP) CRDM/Alloy 600 Issues Task Group (ITG) meeting in Washington, DC. After further analyses it was concluded that the rankings for the four vessels would remain the same. The rankings are reflected in the augmented inspections for the VHPs.

2. "A confirmation that the VHPs at you facilities are included under the scope of your boric acid corrosion inspection program."

The applicant has developed Augmented Inspection Manual Attachment 36 for Surry, and Attachment 18 for North Anna to address cracking concerns for VHPs as identified in GL 97-01. Modified visual (VT-2) inspections are carried out every refueling outage to identify the presence of boric acid crystals. This inspection is carried out as part of the augmented inspection activities, and is not part of the boric acid corrosion surveillance program.

3. "A summary of the results of inspections that have been completed on your VHPs prior to the license renewal application, as appropriate."

In 1997, Virginia Power provided a summary of the VHP inspection results through the fall 1995 outage for Surry 1, the fall 1997 outage for Surry 2, the spring 1997 outage for North Anna 1, and the fall 1996 outage for North Anna 2. The VHPs are inspected at every refueling outage in accordance with the requirements of Attachment 18 of the augmented inspection activities.

The North Anna 2 VHP nozzles inspection was performed during the September 2002 refueling outage. The applicant performed a bare-metal inspection on the reactor vessel head and penetrations. The inspection showed indications of leakage from the head penetration nozzles. The applicant performed visual and eddy current inspections of 65 penetrations in the reactor vessel head. The applicant identified indications in the weld surface of 63 penetrations. Six of the penetrations showed leakage above the head. The applicant plans to replace the reactor vessel head.

The staff is currently reviewing the issues associated with NRC bulletin 2001-01, 2002-01, and 2002-02. Any future regulatory actions that may be required as a result of those reviews will be addressed by the staff in a separate regulatory action.

3.3.1.13.3 Conclusions

On the basis of the review of the reactor vessels ISI program described above, the staff finds that the program will adequately manage the loss of material, cracking, gross indications of loss of pre-load, and gross indications of reduction in fracture toughness for the RV subcomponents. Therefore, the staff concludes that the applicant has demonstrated that the above aging effects associated with the RV subcomponents that credit this activity will be adequately managed so that the intended functions will be maintained consistent with the CLB throughout the period of extended operation.

3.3.1.13.4 FSAR Supplement

The staff reviewed Section A2.2.13 of the UFSAR supplement and found that the description of the applicant's ISI program for reactor vessels is consistent with Section B2.2.13 of each LRA.

3.3.1.14 Reactor Vessel Integrity Management

The applicant describes its reactor vessel integrity management program (RVIMP) in Section B2.2.14 of the LRAs. This section of the LRAs describes the applicant's evaluation of this program in terms of the aging management program attributes provided in the Standard Review Plan for License Renewal. The applicant credits this program for managing the aging effect of the reactor vessel neutron embrittlement for both North Anna and Surry plants.

The staff reviewed the applicant's description of the program in Appendix B2.2.14 of the LRAs to determine whether the applicant has demonstrated that it will adequately manage the applicable effect of aging in the plants during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.3.1.14.1 Summary of Technical Information in the Application

The applicant states that it includes radiation capsule surveillance activity, the reactor vessel fast neutron fluence calculations, the analysis to determine the temperature for nil-ductility transition (RT_{NDT}) for the reactor vessel beltline materials, the analysis to determine the Charpy upper shelf energy (C_VUSE) for the reactor vessel beltline materials, the analysis to determine reactor coolant system pressure-temperature operating limits and low temperature overpressure protection system (LTOPS) setpoints, and pressurized thermal shock (PTS) screening calculations. The applicant states that surveillance capsules were placed in each of the North Anna and Surry reactors and post-irradiation testing of Charpy V-notch and tensile specimens is carried out. Radiation damage is measured by comparing the results obtained with those from unirradiated specimens. The applicant states that the testing program fulfills the requirements of ASTM E-185, "Standard Practice for Conducting Surveillance Tests for Light-Water Cooled Nuclear Power Reactor Vessels," which is endorsed by 10 CFR Part 50, Appendix H, "Reactor Vessel Material Surveillance Program Requirements."

In this AMP, the applicant calculates vessel fluence using an in-house neutron transport code in accordance with the approved reactor vessel fluence analysis methodology. The applicant states that the analysis is performed according to the draft NRC Regulatory Guide DG-1053, "Calculational and Dosimeter Methods for Determining Pressure Vessel Neutron Fluence." The calculated fluencies are benchmarked using dosimeter information from the irradiation surveillance activities.

3.3.1.14.2 Staff Evaluation

The staff's evaluation of the RVIMP focused on how the program manages aging effects through the effective incorporation of the following 10 elements: program scope, preventive actions, parameters monitored or inspected, detection of aging defects, monitoring and trending, acceptance criteria, corrective actions, confirmation process, administrative controls, and operating experience. The applicant indicates 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 3.3.2 of this SER. The remaining seven elements are discussed below. The staff reviewed the information included in Section B2.2.14 of the LRAs, regarding the applicant's demonstration of the RVIMP to ensure that the aging effects of reactor vessel neutron embrittlement will be adequately managed so that intended functions will be maintained consistent with the CLB for the period of extended operation for all four reactor vessels.

Program scope: The applicant states that the scope of the AMP to manage the effects of reduction of fracture toughness for the North Anna and Surry reactor vessels is covered by the reactor vessel integrity management program. This AMP is focused on assuring adequate fracture toughness of the reactor vessel beltline plate and weld materials. The neutron dosimetry and materials property data derived from the surveillance tests are used in calculations and evaluations that demonstrate compliance with applicable regulations. The staff found the scope of RVIMP acceptable because the neutron dosimetry and materials property data derived from the surveillance tests will demonstrate compliance with the NRC regulations.

Preventive actions: The applicant states that the reactor vessel integrity management program AMP are for condition monitoring of the vessel, so that preventive actions are not required. The staff found the applicant's conclusion acceptable that preventive actions are not required.

Parameters monitored or inspected: The applicant states that the parameter monitored at the North Anna and Surry RVs is the RV material fracture toughness, based on the Charpy V-notch and tensile test results for specimens of RV plate and welds material. The staff agrees with the applicant that the Charpy V-notch and tensile test results for irradiated specimens of RV plate and weld material will provide information about RV materials fracture toughness.

Detection of aging effects: The aging effect for RV steel is stated by the applicant to be reduction in fracture toughness. The extent of aging is determined by testing and evaluating irradiated samples of RV material. The staff finds this approach acceptable because testing will determine reduction in fracture toughness.

Monitoring and Trending: The applicant states that neutron dosimetry and materials property data derived from the surveillance program are use to evaluate the RV and surveillance capsule neutron fluencies, RT_{NDT}, and C_VUSE. This information is used to develop reactor coolant pressure-temperature limits and LTOPS setpoints, and to demonstrate compliance with regulations governing RV integrity. The staff finds this to be acceptable. The staff finds this approach to be acceptable because it is based on methods that are sufficient to provide predictability of the extend of degradation so timely corrective or mitigative actions are possible.

Acceptance criteria: The applicant sates that the North Anna and Surry RV capsule surveillance activities are used to establish acceptance values for the following parameters:

- heatup and cooldown limits, as implemented by Technical Specifications, to reasonable assure vessel integrity.
- a pressurized thermal shock reference temperature that is within the scoping criteria of 10 CFR 50.61
- a fast fluence value for the surveillance capsule that bounds the expected fluence at the affected vessel beltline material through the period of extended operation
- compliance with the acceptance criteria governing the Charpy V-notch upper shelf energy given in 10 CFR 50, Appendix G.

The applicant stated that, based on established parameters, calculations are performed to reasonably assure that the units will remain within acceptable values. The staff found that acceptance criteria based on the results of the North Anna and Surry RV capsule surveillance activities to be acceptable.

Operating experience: The heatup and cooldown curves that are used for station operation are updated by using the results from the vessel surveillance specimen evaluations. The applicant stated that evaluations for RT_{PTS} confirm compliance with acceptance criteria in 10 CFR 50.61. Values for C_VUSE either have been verified to remain above the limit in 10 CFR 50, Appendix G, or an equivalent margin analysis has been performed. The staff agrees with the applicant's conclusions. The staff has approved the North Anna and Surry P-T curves which are based upon the results of the vessel surveillance specimen evaluation.

The three attributes of the quality assurance program namely, corrective actions, confirmation process, and administrative controls have been separately evaluated in Section 3.3.2 of this SER.

3.3.1.14.3 Conclusions

On the basis of the review of the reactor vessel integrity management program described above, the staff finds that the program will adequately manage the reactor vessel neutron embrittlement in the beltline region. Therefore, the staff concludes that the applicant has demonstrated that the above aging effect associated with the RV beltline region that credit this activity will be adequately managed so that the intended functions will be maintained consistent with the CLB throughout the period of extended operation.

3.3.1.14.4 FSAR Supplement

The staff reviewed Section A2.2.14 of the UFSAR supplement and found that the description of the applicant's reactor vessel integrity management program is consistent with Section B2.2.14 of each LRA.

3.3.1.15 Reactor Vessel Internals Inspection

The applicant describes its reactor vessel internals inspection program in Section B2.2.15 of the LRAs. This section of the LRAs describes the applicant's evaluation of this program in terms of aging management program attributes provided in the Standard Review Plan for license renewal. The applicant credited this program for managing the effects of aging for the reactor vessel internals at both stations.

The staff reviewed the applicant's description of the program in Section B2.2.15 of the LRAs to determine whether the applicant has demonstrated that it will adequately manage the applicable effects of aging in the plants during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.3.1.15.1 Summary of Technical Information in the Application

The applicant stated that this AMP is primarily comprised of the inservice inspection program in accordance with ASME Section XI requirements, a one time focused inspection of the reactor vessel internals, and an Augmented Inspection Activity as part of the licensee follow-up actions for the core barrel holddown spring.

The reactor vessel internals inspection is implemented to meet the requirements of Subsections IWB, Table IWB 2500-1 (Examination Category B-N-3) of IWB-3520 of ASME Section XI. For North Anna 1 and Surry 1 and 2, this is in accordance with the 1989 Edition and for North Anna 2, the 1995 Edition with the 1996 Addenda.

The applicant performs visual inspections on the surfaces of the reactor vessel internals in accordance with the ISI requirements listed in ASME Section XI, Subsection IWB, Examination Category B-N-3. These inspections check for: 1) structural distortion or displacement of parts to the extent that component function may be impaired, 2) loose, missing, cracked, or fractured parts, bolting, or fasteners, and 3) structural degradation of interior attachments such that the original cross-sectional area is reduced. The applicant stated that it would remain active in industry groups to stay aware of new industry developments regarding such issues as void swelling, neutron embrittlement of baffle and barrel bolting, and thermal embrittlement of CASS components.

3.3.1.15.2 Staff Evaluation

The staff's evaluation of the ISI program, reactor vessel focused on how the program manages aging effects through the effective incorporation of the following 10 elements: program scope, preventive actions, parameters monitored or inspected, detection of aging defects, monitoring and trending, acceptance criteria, corrective actions, confirmation process, administrative controls, and operating experience. The applicant indicates 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 3.3.2 of this SER. The remaining seven elements are discussed below.

The staff reviewed the information included in Section B2.2.15 of the LRAs, regarding the applicant's demonstration of the reactor vessel internals inspection program to ensure that the aging effects of loss of material, cracking, gross indications of loss of pre-load, and gross indications of reductions in fracture toughness will be adequately managed so that intended functions will be maintained consistent with the CLB for the period of extended operation for reactor vessel internals components within the scope of license renewal.

Program scope: The ISI Program for reactor vessel internals is implemented in accordance with the individual ISI Plan for each unit. In accordance with 10CFR50.55a, the Reactor Vessel Internals Inspection for the Surry and North Anna , the ISI Plan is implemented to meet the requirements of Subsections IWB of ASME Section XI. Each ISI Plan provides details for the implementation of inspections specified by ASME Section XI, Subsections IWB (Class 1). Table IWB 2500-1 includes Examination Category B-N-3, Removable Core Support Structures. The acceptance standards for the visual examinations (VT-3) of Category B-N-3 are summarized in paragraph IWB-3520. Each ISI Plan is developed and approved by the staff for a 120-month inspection interval, as modified by applicable relief requests and Code Cases.

In addition to this, a one-time focused inspection of the reactor vessel internals will be performed between year 30 and the end of the current operating license term for a single Surry or North Anna reactor that is evaluated to be most susceptible to identified aging effects. An additional augmented inspection activity will include an inspection of the core barrel holddown spring to address the aging effect of gross indication of loss of pre-load.

The applicant will also follow industry events to remain cognizant of any new developments regarding such issues as neutron embrittlement of baffle and barrel bolting, void swelling, and thermal embrittlement of the reactor vessel internals components made of CASS. The scope of this one time inspection will be consistent with industry developments on these issues. The staff finds the scope acceptable for this AMP because the scope is comprehensive in that it includes a variety of reactor internals.

Preventive/mitigative actions: There are no preventative/mitigative actions associated with this program, nor did the staff identify a need for such.

Parameters monitored: The applicant performs visual inspections on the surfaces of the reactor vessel internals in accordance with the ISI requirements listed in ASME Section XI, Subsection IWB, Examination Category B-N-3. These inspections check for: 1) structural distortion or displacement of parts to the extent that component function may be impaired, 2) loose, missing, cracked, or fractured parts, bolting, or fasteners, and 3) structural degradation of interior attachments such that the original cross-sectional area is reduced. The applicant stated that it would remain active in industry groups to stay aware of new industry developments regarding such issues as void swelling and thermal embrittlement of cast austenitic stainless steel components. The staff finds that the inspection parameters are acceptable because the inspections check for variety of degradation effects that may affect the reactor internals.

Detection of aging effects: The applicant performs visual inspections to detect loss of material, cracking, gross indications of loss of pre-load, and gross indications of reduction in fracture toughness. An additional augmented inspection activity is performed for the core barrel hold-down spring to check for gross indications of loss of pre-load. The staff finds the applicants methods for detection of aging effects acceptable. Performance of visual inspections will detect loss of material, cracking, gross indications of loss of pre-load, and gross indications of reduction in fracture toughness.

Monitoring and trending: The applicant states that ASME Section XI inspections will be performed at a frequency of once per 10-year interval. Anomalous indications that are signs of degradation are documented on non-destructive examination reports which are kept in Station

Records. Engineering evaluations are performed for inspection results that do not meet established acceptance standards. These evaluations consider the extent of degradation to reasonably assure that timely corrective action or mitigative actions are taken. An additional task of a one-time focused inspection of the internals will check for all five of the aging effects by applying an inspection activity based on the leading indicator approach. The applicant states this approach will be based on factors including fluence, stress, and material susceptibility, and will identify subcomponents judged to be most susceptible. This inspection will be performed between year 30 and the end of the current operating license term on the single Surry or North Anna reactor determined to be most susceptible to the aging effects identified. The results of the inspections will determine the need for inspections at the other reactors. If future industry developments suggest the need for an alternate inspection plan during the period of extended operation, or negate the need for a one-time inspection, the applicant will modify the proposed inspection program. The staff finds this approach to be acceptable because it is based on methods that are sufficient to provide predictability of the extend of degradation so timely corrective or mitigative actions are possible.

Acceptance criteria: The applicant states that the acceptance standards are per ASME Section XI, Subsection IWB-3500. The staff finds this acceptance criteria to be acceptable.

Operating experience: The applicant states that compliance with ASME Section XI has been in place at North Anna and Surry plants since initial operation. The Inspection results have not indicated any age-related degradation problems with the reactor vessel internals. Industry experience has indicated a concern regarding degradation of the control rod guide tube split pins that are used in the upper internals. The nickel-based alloy X750 split pins are susceptible to stress corrosion cracking. Replacement split pins were installed at Surry 1, but examination of the original split pins found no degradation. Similarly, replacement split pins, with improved heat treatment characteristics, were installed at North Anna 1 and 2. One incidence of an original split pin failure was seen at North Anna 1, however examination of the remaining original split pins found no additional problems. The applicant states that based on the favorable examinations of the split pins for Surry 1, and the North Anna pins, and that the fact that split pin cracking has no adverse effect on safety-related functions since the internals package would maintain the original configuration, the split pins have not been replaced at Surry 2. The staff found that operating experience had confirmed the adequacy of the reactor vessel internals inspection program.

3.3.1.15.3 Conclusions

On the basis of the review of the reactor vessel internals inspection program described above, the staff finds that the program can adequately manage the loss of material, cracking, gross indications of loss of pre-load, and gross indications of reductions in fracture toughness for RV internals subcomponents. Therefore, the staff concludes that the applicant has demonstrated that the above aging effects associated with the RV internals that credit this activity will be adequately managed so that the intended functions will be maintained consistent with the CLB throughout the period of extended operation.

3.3.1.15.4 FSAR Supplement

The staff reviewed Section A2.2.15 of the UFSAR supplement and found that the description of the applicant's reactor vessel internals inspection program is consistent with Section B2.2.15 of each LRA.

3.3.1.16 Secondary Piping and Component Inspection

The applicant describes its secondary piping and component inspection program in Section B2.2.16 of each LRA. The applicant credits this inspection program with implementing a standardized method of identifying and inspecting components that are susceptible to flow-accelerated corrosion (FAC). The staff reviewed each LRA to determine whether the applicant has demonstrated that the secondary piping and component inspection will adequately manage loss of material due to FAC during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.3.1.16.1 Summary of Technical Information in the Application

The applicant states in Section B2.2.16 of each LRA that the secondary piping and component inspection program implements a standardized method of identifying, inspecting, and tracking components which are susceptible to FAC in both single- and two-phase flow conditions. This program has been developed in accordance with NRC Generic Letter 89-08, "Erosion/Corrosion-Induced Pipe Wall Thinning," NUREG-1344, "Erosion/Corrosion Induced Pipe Wall Thinning in U.S. Nuclear Power Plants," and EPRI guideline NSAC-202L, "Recommendations for an Effective Flow-accelerated Corrosion Program."

The program is used to identify piping locations, and pumps and valves, that are susceptible to FAC degradation. By performing ultrasonic measurements on piping segments, as directed by the AMP procedures, piping components are identified for repair or replacement prior to reaching minimum allowable wall thickness. Visual inspections of the internals of nonpiping components, such as valves, are performed as the equipment is opened for other repairs and/or maintenance, to determine whether FAC degradation is occurring. The applicant considers pump casings and valve bodies retaining pressure in high energy systems as being bounded by the piping inspections performed for the program.

The following systems credit this AMP for managing the aging effect of loss of material:

- auxiliary steam
- blowdown
- feedwater
- main steam
- steam drains (NAS 1/2 only)

3.3.1.16.2 Staff Evaluation

The staff's evaluation of the secondary piping and component inspection focused on how the program manages aging effects through the effective incorporation of the following 10 elements: 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 indicates that the corrective actions, confirmation process, and administrative controls are part of the site-controlled quality assurance program. The staff's evaluation of these program attributes is provided separately in Section 3.3.2 of this SER. The remaining seven elements are discussed below.

Scope of program: The applicant states in Section B2.2.16 of each LRA that the secondary piping and component inspection program evaluates the FAC-susceptible portions of the systems identified in Section B2.2.16.1 above. The scope of the inspection program is developed based on the following considerations:

- piping components that have been categorized as "potential replacement" during previous inspection periods
- piping components that have not been inspected during previous inspection periods
- piping components that were inspected during previous inspection period and rated as requiring inspection during the current inspection period
- piping components that have been replaced in previous inspection periods but require an inspection to verify projected wear rate
- piping adjacent to pumps and valves that have been previously repaired or replaced
- lessons learned from previous inspection periods and from industry experience
- input from a FAC-monitoring computer code (i.e., CHECKWORKS-FAC)
- the requirement for baseline inspections on selected components that have been replaced
- carbon steel or low-alloy steel piping components located immediately downstream of FAC-resistant materials
- consideration of changes in operating conditions that may cause FAC
- other appropriate selection tools as may be developed by the industry in the future

The staff finds the scope of the AMP to be acceptable in that it includes the applicable components in the systems that credit this program and follows the recommendations in NRC GL 89-08, NUREG-1344, and EPRI guideline NSAC-202L.

Preventive actions: The applicant identified this activity as condition monitoring. Accordingly no preventive actions are required, and the staff did not identify the need for such action. However, it is noted that the applicant reduces the susceptibility to FAC by controlling the feedwater pH value to be toward the upper end of the acceptable range that is listed in the applicant's chemistry control program for secondary systems, which is described in Section B2.2.5 of each LRA.

Parameters monitored or inspected: The applicant performs visual inspections to determine if degradation of the internal surface is occurring. Ultrasonic thickness measurements are made to determine if loss of material due to wall thinning is occurring. The staff finds that ultrasonic testing will be capable of determining the remaining wall thickness in the components within the scope of this program; therefore, the parameters monitored are acceptable.

Detection of aging effects: The aging effect of loss of material due to FAC is detected by volumetric inspections and, where possible, internal visual inspections. The staff finds this approach acceptable for detecting wall thinning.

Monitoring and trending: The applicant develops inspection plans using results of past inspections, predictions from the CHECKWORKS-FAC computer code, results of water chemistry analyses, and industry experience. Trending of ultrasonic wall thickness measurements are used to provide reasonable assurance that structural integrity will be maintained between inspections. Examination results are evaluated and inspection, repair, and replacement plans are developed by the applicant at a frequency of at least once per 18 months (refueling interval) for each unit. The staff has found that the use of CHECKWORKS is acceptable because it provides a bounding analysis for FAC. The staff concludes that the inspection plans and schedule developed by the applicant on the bases of the results of such a predictive code, and the other factors considered by the applicant, provides reasonable assurance that structural integrity will be maintained between inspections.

Acceptance criteria: The applicant uses engineering evaluations of trend projections, along with code minimum wall thickness requirements, to determine when component repair or replacement is needed. The acceptance criterion for visual inspections is the absence of visible degradation. The staff concludes that this acceptance criteria is adequate to demonstrate that a loss of material due to wall thinning will be managed for the period of extended operation.

Operating experience: The applicant has reported that wall thinning and pitting have occurred in plant components that are within the scope of the secondary piping and component inspection program. The major through-wall failure of condensate piping that occurred at Surry in 1986 resulted in the issuance of NRC Bulletin 87-01, "Thinning of Pipe Walls in Nuclear Power Plants," and initiated the current FAC inspection and repair activities. Since this AMP has been implemented, the applicant has reported that the continued improvement in the management of FAC has significantly reduced the likelihood of the recurrence of such an event. The applicant uses FAC-resistant material for replacement components to reduce the susceptibility of these components and the extent of reinspections. The applicant states that repairs and replacements have occurred in the condensate, feedwater, extraction steam, and steam drain systems as a result of early detection and implementation of the corrective action system for each unit. The staff concludes that the applicant has demonstrated that the secondary piping and component inspection program has been effective in managing FAC in carbon steel piping and components.

3.3.1.16.3 Conclusions

The staff has reviewed the information provided in Section B2.2.16 of each LRA and the summary description of the secondary piping and component inspection program in Section A2.2.16 of the UFSAR supplement. On the basis of this review, the staff finds that the applicant has demonstrated that loss of material due to FAC will be adequately managed for the components that credit this program so that the intended functions will be maintained consistent with the CLB for the period of extended operation.

3.3.1.16.4 FSAR Supplement

The staff reviewed Section A2.2.16 of the UFSAR supplement and found that the description of the applicant's secondary piping and component inspection program is consistent with Section B2.2.16 of each LRA and that no changes were needed.

3.3.1.17 Service Water System Inspections

The applicant describes its service water system inspections in Section B2.2.17 of each LRA. The applicant credits this program for managing the aging effects of change in material properties, loss of material and heat transfer degradation for components cooled by service water. The staff reviewed the applicant's description of the program in Section B2.2.17 of each LRA to determine whether the applicant has demonstrated that it will adequately manage the applicable effects of aging in the plants during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.3.1.17.1 Summary of Technical Information in the Application

In Section B2.2.17 of each LRA, the applicant states that all four units maintain compliance with NRC Generic Letter 89-13, "Service Water System Problems Affecting Safety-Related Equipment." The primary objectives of the applicant's service water system inspections are to (1) remove excessive accumulations of biofouling agents, corrosion products, and silt; and (2) repair defective protective coatings and degraded service water system piping and components that could adversely affect performance. The applicant states that preventive maintenance, inspection, and repair procedures have been developed to provide reasonable assurance that any adverse effects of exposure to service water are adequately addressed. Furthermore, the applicant adds biocide to the service water system of all four units to reduce biological growth (including MIC) that could lead to degradation of components exposed to the service water.

The following systems credit this AMP for managing the aging effects of change in material properties, loss of material, and heat transfer degradation:

- heating (NAS 1/2) and ventilation
- service water
- component cooling water
- instrument air (NAS 1/2 only)
- circulating water (SPS 1/2 only)
- vacuum priming (SPS 1/2 only)

3.3.1.17.2 Staff Evaluation

The staff's evaluation of the service water system inspections focused on how the program manages aging effects through the effective incorporation of the following 10 elements: 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 indicates that the corrective actions, confirmation process, and administrative controls are part of the site-controlled quality assurance program. The staff's evaluation of these program attributes is provided separately in Section 3.3.2 of this SER. The remaining seven elements are discussed below.

Scope of program: Section B2.2.17 of each LRA identifies the systems that credit the service water system inspections for managing the aging effects of change in material properties, loss of material and heat transfer degradation. The applicant identified the components in the systems that credit this AMP in Sections 3.3 and 3.4 of each LRA. These components are included in the program since they could experience degradation because of their contact with service water. The staff finds the scope of the program to be acceptable because it maintains compliance with the requirements of GL 89-13.

Preventive actions: The applicant states in Section B2.2.17 of each LRA that the inspections and testing of components affected by service water are designated condition monitoring and performance monitoring, respectively and, accordingly, no preventive actions are performed.

The staff observed during the review that the recommendations of GL 89-13 include control or preventive measures and that some measures are included in this AMP. In order to complete the review of this AMP attribute, the staff requested the applicant to (a) explain why the addition of biocide to the service water system to reduce biological growth (including MIC) is not considered a preventive action, and (b) clarify if the program includes flushing of infrequently used systems as recommended by GL 89-13. In a letter dated May 22, 2002 (Serial No. 02-277), the applicant (a) agreed that they should have considered injection of a biocide to be a preventive action, and (b) explained that the only infrequently used system that falls within the scope of GL 89-13 is the containment recirculating spray heat exchange service water supply line, which is maintained in dry layup and, therefore, does not need to be flushed. The staff found the additional clarifications provided by the applicant to be acceptable and concludes that appropriate preventive actions are being performed in accordance with the requirements of GL 89-13.

Parameters monitored or inspected: In Section B2.2.17 of each LRA, the applicant states that inspections of components exposed to service water are performed to check for changes in material properties for components made of copper and copper alloys and for loss of material which could be a result of biofouling or occur in metallic components due to defects in protective coatings. Furthermore, the applicant states that heat transfer performance parameters for selected components cooled by service water are periodically monitored.

In order to complete the review of this AMP attribute, the staff requested that the applicant explain why inspections for cleanliness of the piping, components, heat exchangers, and the internal linings and coatings are not included in the program. In a letter dated May 22, 2002 (Serial No. 02-277), the applicant explained that, for the purpose of license renewal, it is concerned with maintaining the intended function of the components of concern. Maintaining a cleanliness standard is beyond the scope of license renewal. However, the applicant restated that its program is consistent with the requirements and guidance in GL 89-13, and will provide the necessary cleanliness to provide reasonable assurance that the intended function is maintained.

The staff found parameters monitored or inspected, coupled with the requirements and guidance in GL 89-13, to be acceptable.

Detection of aging effects: In Section B2.2.17 of each LRA, the applicant states visual inspections are performed to check for loss of material and changes in material properties and that heat transfer testing is performed to identify the aging effects of loss of material and heat transfer degradation. Furthermore, the applicant states that volumetric inspections are also performed to check for loss of material due to MIC for NAS 1/2 only. In the section on “Confirmation Process” in Section B2.2.17 of each LRA, the applicant states that periodic inspections of the service water system are performed to assess the degree of biofouling, the integrity of surface coatings, and the extent of pipe surface damage or wall thinning; and to provide confirmation of previous corrective actions. In a letter dated May 22, 2002 (Serial No. 02-277), the applicant explained that operating experience has shown that NAS 1/2 lake water creates an environment where MIC is a concern in its service water system, making volumetric exams necessary to provide reasonable assurance that the associated aging will be properly managed for the period of extended operation. However, SPS 1/2 operating experience shows that MIC is not a concern for the river water used at SPS 1/2 and, therefore, volumetric exams are not necessary to provide reasonable assurance that MIC will be properly managed for the period of extended operation at SPS 1 /2. The staff found the applicant's approach for the detection of aging effects to be acceptable.

Monitoring and trending: In Section 2.2.17 of each LRA, the applicant states that inspections and testing are performed at different frequencies that range from weekly to every refueling outage for components exposed to service water. Inspection and heat exchanger testing results are recorded in procedures that are retained in records for all four units. Furthermore, engineering evaluations are performed for anomalous inspection or heat transfer testing results. In a letter dated May 22, 2002 (Serial No. 02-277), the applicant confirmed that the inspection and testing frequencies for the extended period of operation will continue to be accordance with the applicant's commitments under NRC GL 89-13.The staff found this commitment to be acceptable.

Acceptance criteria: The acceptance criterion for visual inspections is the absence of anomalous indications of degradation. In the case of service water, degradation includes biofouling, and material degradation. Engineering evaluations determine whether observed deterioration of material condition is sufficiently extensive to lead to loss of intended function for components exposed to the service water. The degraded condition of material or of heat transfer capability may require prompt remediation. Occurrence of degradation that is adverse to quality is entered into the applicant's corrective action system.

In its response to RAI B2.2.17-1, in a letter dated November 30, 2001, the applicant states that the objectives of the service water inspection activity are to remove accumulations of biofouling agents, to inspect for degradation of protective coatings, and to repair degraded protective coatings. The applicant further states that inspection and cleaning procedures require that component surfaces be free of visible debris, adherents, slime layers, or other foreign material. The staff finds that the applicant's commitment to NRC GL 89-13, including acceptance criteria based on effective cleaning of biological fouling organisms and maintenance of protective coatings, to be acceptable.

Operating experience: The applicant states in Section B2.2.17 of each LRA that inspections and tests have led to numerous piping repairs and design changes that have been implemented to replace degraded portions of the service water system. The inspection and testing results have been used as input to the engineering evaluation process to make necessary adjustments to inspection and testing frequencies and scopes. As discussed above, all four units maintain compliance with the requirements of NRC Generic Letter 89-13. The guidance of NRC GL 89-13 has been implemented for approximately 10 years and has been effective in managing aging effects due to biofouling, corrosion, erosion, protective coating failures, and silting in structures and components serviced by open-cycle cooling water systems.

3.3.1.17.3 Conclusions

The staff has reviewed the information provided in Section B2.2.17 of each LRA and the summary description of the service water system inspections in Section A2.2.17 of the UFSAR supplement. In addition, the staff considered the applicant's response to the staff's RAIs. On the basis of the review of the service water system inspections described above, the staff concludes that the applicant has demonstrated that the program can adequately manage the aging effects in the systems that credit this activity so that the intended functions will be maintained consistent with the CLB for the period of extended operation.

3.3.1.17.4 FSAR Supplement

The staff reviewed Section A2.2.17 of the UFSAR supplement and found that the description of the applicant's service water system inspections is consistent with Section B2.2.17 of each LRA and that no changes were needed.

3.3.1.18 Steam Generator Inspections

The applicant describes its steam generator inspections program in Section B2.2.18 of the LRAs. This section of the LRAs describes the applicant's evaluation of this program in terms of aging management program attributes provided in the Standard Review Plan for license renewal. The applicant credits this program as managing the effects of aging for the steam generators at all four units.

The staff reviewed the applicant's description of the program in Section B2.2.18 of the LRAs to determine whether the applicant has demonstrated that it will adequately manage the applicable effects of aging in the plants during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.3.1.18.1 Summary of Technical Information in the Application

The applicant states that, in accordance with 10 CFR 50.55a, the steam generator inspections AMP is implemented to meet the requirements of Subsections IWB (Class 1) and IWC (Class 2) of ASME Section XI. The inspection activities are conducted in accordance with the individual ISI plans for each unit. Each plan provides details of the required inspections. One of the aging concerns for the steam generator is cracking of the primary coolant nozzles (which are carbon steel clad with stainless steel), and safe ends (with stainless steel or Inconel buttering). The applicant states that weld areas in the steam generator have the highest stress levels and, consequently, have the highest potential for crack initiation and growth. Cladding is not highly stressed because of post-weld heat treatments along with the vessel. Additional steam generator inspections are carried out according to plant Technical Specifications, guidelines given in NEI 97-06, and Electric Power Research Institute Steam Generator Inspection Guidelines. Augmented inspection activities for steam generator supports and feedwater nozzles are performed and are described in Section B2.2.1 of the LRAs.

3.3.1.18.2 Staff Evaluation

The staff's evaluation of the steam generator inspections program focused on how the program manages aging effects through the effective incorporation of the following 10 elements:

program scope, preventive actions, parameters monitored or inspected, detection of aging defects, monitoring and trending, acceptance criteria, corrective actions, confirmation process, administrative controls, and operating experience. The applicant indicates 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 3.3.2 of this SER. The remaining seven elements are discussed below.

Program scope: The scope of the steam generator inspections AMP covers primary and secondary systems. Inspections for the primary side include the following:

- general inspection of the full length of the tubes
- special interest inspections of suspected anomalous indications in accordance with site-specific guidelines
- U-bend areas of anti-vibration bar contact points
- critical area inspections at the U-bend transition of Row 1 tubes
- critical area inspections of the hot leg top-of-tubesheet expansion area
- video inspections for general condition assessment of the tubesheet and tubesheet plugs
- weld inspections
- bolting

Secondary side inspections are focused on:

- inner radii inspections of feedwater and main steam nozzles.
- weld inspections.
- supports.
- routine video inspections of the tubesheet area and the annulus area, as necessary, to detect the presence of deposits, sludge, foreign material, or other general degradation.

The three categories of inspection are listed below as:

Component Type Category	Category	Method
	Class 1	
Pressure-retaining welds in vessels other than reactor vessels	B-B	Volumetric
Welds of nozzles in vessels	B-D	Visual (VT-1 in lieu of volumetric)
Pressure-retaining dissimilar metal welds	B-F	Volumetric/Surface
Pressure-retaining bolting 2-inches and less in diameter	B-G-2	Visual
Steam generator tubing	B-Q	Volumetric
	Class 2	
Pressure-retaining welds in pressure vessels	C-A	Volumetric
Pressure-retaining nozzle welds	C-B	Volumetric/Surface

in vessels		
	Component Supports	
Supports	F-A	Visual

The staff found the scope of this program acceptable because the applicant has included all major steam generator components within the scope of the program.

Preventive actions: The applicant states that there are no preventive actions in the steam generator inspections AMP because this AMP is designated as condition monitoring. The staff concurs with this statement.

Parameters monitored or inspected: The applicant states that surface conditions of subcomponents in both the primary and secondary sides of the steam generator are monitored for indications of degradation. Volumetric examinations are also performed for the steam generator tubes and for Section XI IWB and IWC welds. The staff found that the inspection parameters are acceptable because the steam generator components are monitored for indication of degradation.

Detection of aging effects: Aging effects, which include loss of material, cracking, and gross indications of loss of pre-load are stated to be detected by a combination of visual inspections, surface examinations, and volumetric examinations. Inspections for tubing degradation are conducted in accordance with ASME Section XI, Subsection IWB. The staff found that the applicant has proposed acceptable detection techniques which will detect degradation of steam generator components.

Monitoring and trending: In this section of the steam generator inspections AMP, the applicant briefly describes the types of non-destructive tests that are used for the various subcomponent monitoring activities. From the descriptions given, the staff finds these monitoring activities to be acceptable. However, the staff issued an RAI to obtain clarification regarding the trending practices. In response to RAI Item B2.2.18-3, the applicant stated that the results of non-destructive examinations and videotaped inspections are retained and utilized to provide a basis for trending and development of plans for subsequent inspections and anticipatory repairs. The staff finds this approach acceptable because the results of nondestructive examinations will be used to provide basis for trending to provide predictability of the extend of degradation so timely corrective or mitigative actions are possible

Acceptance criteria: The applicant states that acceptance criteria for steam generator subcomponent inspections are provided in ASME Section XI, Subsections IWB 3500 and IWC 3500. Results for steam generator inspections that are outside the scope of ASME Section XI are stated to be dispositioned by the applicant's engineering department. In response to RAI Item B2.2.18-4, the applicant stated that engineering evaluations are performed considering the original design basis of the component. Any corrective actions resulting from the engineering evaluation are implemented through the corrective action system. The staff found the applicant's acceptance criteria acceptable because it uses acceptance criteria included in ASME Code, Section XI.

Operating experience: The applicant states that the Surry 1 steam generators were replaced in 1981 and Surry 2 in 1980. Extensive cumulative inspections in accordance with ASME Section XI and plant technical specifications resulted in less than 1% of the total tubes being plugged in the two steam generators. The North Anna 1 steam generators were replaced in 1993 and the North Anna 2 steam generators were replaced in 1995. One tube in the new steam generators at North Anna Unit 1 was preventively plugged due to an anomalous inspection finding. Another single tube at North Anna 2 was plugged during the 2001 refueling outage because of localized wear at the support plate. The applicant states that these inspection results attest to the excellent performance of the steam generator tubes.

In the steam generator inspections AMP, the applicant notes that there have been no detected flaws in the non-tube subcomponents at North Anna. Some secondary-side flaws were detected in non-tube subcomponents at Surry, which were either repaired or accepted after evaluation. No other problems were reported for the North Anna and Surry steam generator subcomponents.

In response to Information Notice 90-04, “Cracking of the Upper Shell-to-Transition Cone Girth Welds,” which states that UT examination of these welds, specified by ASME Section XI, may not be sufficient to differentiate between isolated cracks and inherent geometric conditions, the applicant performed enhanced inspections (MT examination) on the North Anna and Surry girth welds. No degradation indications were found for any of these steam generators. The staff found that the North Anna and Surry operating experience and their reliance on accepted industry inspection methods captured in ASME Section XI, EPRI Guidelines, NEI 97-06, and plant TS confirms the adequacy of the steam generator inspection program to identify flaws in steam generator components.

3.3.1.18.3 FSAR Supplement

The staff reviewed Section A2.2.18 of the UFSAR supplement and found that the description of the applicant’s reactor vessel internals inspection program is consistent with Section B2.2.18 of each LRA.

3.3.1.18.4 Conclusions

On the basis of the review of the steam generator inspections program described above, the staff finds that the program can adequately manage the loss of material, cracking, and loss of pre-load for the steam generator subcomponents. Therefore, the staff concludes that the applicant has demonstrated that the above aging effects associated with the steam generator subcomponents that credit this activity will be adequately managed so that the intended functions will be maintained consistent with the CLB throughout the period of extended operation.

3.3.1.19 Work Control Process

The applicant describes its work control process aging management activity in Section B2.2.19 of each LRA. The applicant credits the work control process with managing the potential aging of a wide variety of mechanical systems and selected metallic and nonmetallic elements of structures within the scope of license renewal. The staff reviewed each LRA to determine whether the applicant has demonstrated that the work control process activities will adequately manage the applicable aging effects during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.3.1.19.1 Summary of Technical Information in the Application

In Section B2.2.19 of each LRA, the applicant states that performance testing and maintenance activities, both preventive and corrective, are planned and conducted in accordance with the station's work control process. The work control process integrates and coordinates the combined efforts of the applicant's maintenance, engineering, operations, and other support organizations to manage maintenance, predictive analysis, and testing activities. The applicant states that its maintenance activities provide opportunities to visually inspect the surfaces (internal and external) of plant components and adjacent piping. Adjacent piping is primarily the internal piping surface immediately adjacent to a system component accessible through the component for visual inspection. Visual inspections performed through the work control process provide data that can be used to determine the effectiveness of aging management activities to detect the aging effects of cracking, loss of material, gross indications of change of material properties, and separation and cracking/delamination. Performance testing on heat exchangers evaluates the heat transfer capability of the components to determine if heat transfer degradation is occurring. In addition, the applicant states that the work control process also provides opportunities through preventive maintenance sampling (predictive analysis) to collect lubricating oil and engine coolant samples for analysis. Identification of contaminants would provide early indication of an adverse environment that can lead to material degradation.

The applicant cites EPRI Technical Report TR-107514, "Aging-Related Degradation Inspection Methodology and Demonstration," as a basis for using the sampling opportunities of the work control process as an aging management tool. Rather than scheduling specific inspections of components that credit the work control process for aging management, the applicant uses work control opportunities as a means of inspecting passive components during the planned maintenance activities implemented through the work control process. EPRI TR-107514 provides a relationship of required sample size versus sample population size for a 90/90 confidence level that the sample population adequately identifies occurrences of interest, which in this case are the effects of aging. In Section B2.2.19 of each LRA, the applicant listed the number of work control opportunities within material/environment combinations at Surry Power Station from June 1993 to September 2000. The applicant states,

> The selected systems identified in the table represent the range of material/environment combinations that were considered during the aging management review of structures and components. *The results of component behavior for each material/environment combination are valid regardless of the system in which the component exists*. As indicated in the table, the extent of material/environment combinations, and the ample number of work control opportunities that exist, *eliminates the need to schedule specific inspections*. The scope and frequency of the work control process are adequate to detect aging and provide reasonable assurance that the intended functions are maintained [*emphasis added*].

3.3.1.19.2 Staff Evaluation

The staff's evaluation of the work control process focused on how the program manages aging effects through the effective incorporation of the following 10 elements: 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 indicates that the corrective actions, confirmation process, and administrative controls are part of the site-controlled quality assurance program. The staff's evaluation of these program attributes is provided separately in Section 3.3.2 of this SER. The remaining seven elements are discussed below.

Program scope: The applicant uses the work control process to manage the aging effects of several of the component groups listed in Section 3 of each LRA. Specifically, the work control process manages, either by itself or in conjunction with other AMAs, about 45% of all of the Section 3.3, "Aging Management of Auxiliary Systems," component groups and about 88% of all of the Section 3.4, "Steam and Power Conversion Systems" component groups. In total, about 400 of the component groups subject to an AMR (approximately 200 component groups for each LRA) credit the work control process AMA. In Section B2.2.19 of each LRA, the applicant listed the specific systems that credit the work control process and also provides a more general list of the "sample opportunities" for each system through the application of the work control process. The latter list identifies the work control process sample opportunities for specific material and internal environment combinations for each system. The applicant uses performance testing and maintenance activities, both preventive and corrective, that are scheduled through the work control process to perform and document visual inspections of the internal and external surfaces of the components and adjacent passive components. The applicant states that the scope of the work control process includes (1) visual examinations of the internal and external surfaces of mechanical components and adjacent piping, (2) performance tests of mechanical components and heat exchangers, and (3) routine maintenance sampling of motor lubricating oil and engine coolant.

The staff had several concerns with the scope of the work control process AMA. Through the work control process, the applicant takes credit for the inspection of components that may not be actually examined via this aging management activity. Under the work control process, components within a given system are categorized by their material/environment combination such that the inspection of, for example, a carbon steel component in treated water within the feedwater system is credited by the applicant as being indicative of all carbon steel components in treated water within the feedwater system. The applicant credits the number of sample opportunities provided by the work control process for a given material/environment combination within a system as assurance that the aging effects for the components that credit this AMA are adequately managed. The staff was concerned that with this approach not all of the components that credit the work control process will be directly examined at some time during the period of extended operation. Specifically, the staff was concerned that the similarity of given material/environment combinations, as a justification for not directly inspecting certain components, would result in the inadequate managing of the aging effects for the components that credit the work control process. Also, since the work control process categorizes components by their material/environment combination rather than by their component group designations that are listed in Section 3 of each LRA, the staff was concerned that some component groups that credit the work control process may not be adequately tracked by this AMA. In a supplemental RAI, the staff requested that the applicant confirm that all of the component groups, listed in Section 3 of each LRA, that credit the work control process are covered by the planned maintenance portion (i.e., preventive maintenance, predictive analysis, periodic surveillance) of the work control process such that these components will be periodically inspected during the period of extended operation. In a May 22, 2002 (Serial No. 02-163), response to the staff's RAI, the applicant provided the following information concerning the scope of the work control process:

> The basis for the Work Control Process (WCP) as an aging management activity (AMA), as described in LRA Section B2.2.19, is that all material and environment combinations for component groups that credit the WCP are included within the scope of the WCP AMA. The WCP AMA focus is on material/environment combinations because the materials of construction in conjunction with the environmental stressors associated with the structure or component are the basis for determining applicable aging effects and the management of those aging effects. However, at the staff's request, we have reviewed the systems and material-environment combinations to help the staff determine the completeness of the WCP.
>
> The Work Control Process, as it applies to general aging, uses a number of different types of maintenance activities. The primary intent of this program is to use planned maintenance activities that are performed on a frequency of 3 months to 120 months. The planned work control activities provide opportunities to inspect and monitor the material condition of plant systems, component groups, and the predominant material-environment combinations located throughout the systems that use this AMA to manage general aging. Planned maintenance activities can be categorized into three programmatic categories:
>
> - preventive maintenance activities
> - predictive analysis maintenance activities
> - periodic surveillance testing
>
> The Work Control Process supplements the planned maintenance activities with corrective maintenance activities. Numerous opportunities arise to inspect structures and component groups that are managed by the WCP. In addition to the structures and components that are subject to an AMR, the corrective maintenance activities also provide opportunities for inspecting active and/or short-lived components with the same materials and environments identifying ongoing aging in the components groups subject to aging. Although these corrective maintenance activities are not performed at preplanned locations or at specific frequencies, the Work Control Process AMA requires the applicant to take advantage of every opportunity to ensure aging is being managed. A maintenance history review from 1993 to the present has verified that corrective maintenance has provided ample opportunities to periodically inspect systems, component groups, and material-environment combinations throughout the systems monitored by the Work Control Process.
>
> Although these corrective maintenance activities are performed at random locations with no specific frequencies, statistically the number of opportunities and diverse sampling of systems are reliable for the purpose of aging

management. As the plant ages, maintenance activities are not expected to decline and it is reasonable to assume that the maintenance history is reflective with respect to the numbers and diverse locations of anticipated maintenance for future years. Therefore, corrective maintenance activities will contribute to the management of aging effects such that there is reasonable assurance that intended functions will be maintained.

Along with the planned and corrective maintenance activities, the applicant's Corrective Action System requires an evaluation of aging to ensure that aging is not occurring in other locations with the same material and environment. These evaluations are not limited by system boundaries. Aging identified in a location within a system that cannot be explained by environmental/operational conditions at that specific location will require additional inspections within the same system and other systems with the same material environmental conditions.

Additionally, based on maintenance history reviews and an assessment of the breadth of the planned maintenance performed at the Surry and North Anna stations, when supplemented by the numerous inspection opportunities afforded by corrective maintenance activities and the stringent requirements of the corrective action system, the WCP AMA provides adequate management of aging effects such that there is reasonable assurance that intended functions will be maintained throughout the period of extended operation.

As confirmation that the Work Control Process has inspected representative components from each component group for which WCP is credited to manage the effects of aging, the applicant will perform an audit of inspections actually performed and, if WCP activities are found not to be representative, supplemental inspections will be performed. Two audits of the WCP are anticipated, and each will consist of a review of 10 years of historical data. One audit will be performed prior to 40 years of plant operation, and another will be performed at approximately 50 years of plant operation. Any required supplemental inspections would be completed within 5 years after the audit is performed.

The applicant's response to the staff's RAI is important in establishing that observed degradation of a component will require the inspection of similar components with the same material/environment combination both within and outside the system boundaries. In addition, the work control process will be audited to ensure that "representative components from each component group for which WCP is credited to manage the effects of aging" have been inspected. The applicant states that supplemental inspections will be completed within 5 years of the audit if the work control process activities are found not to be representative of all the component groups that credit this AMA. These additional commitments will need to be included in the UFSAR Supplement for the Work Control Process AMA.

In RAI B2.2.19-1, the staff requested that the applicant withdraw its reference to EPRI Technical Report TR-107514, since this technical report has not been reviewed or approved by the staff. In response, the applicant states that it is revising its work control process activity to eliminate reference to the statistical guidance of EPRI TR-107514. Instead, the applicant provides an extensive summary of the number of inspection opportunities that have occurred during work control activities from June 1993 through August 2001. The staff noted in this summary of inspection opportunities provided by the applicant that several additional systems, in addition to those listed in Section B2.2.19 of each LRA were listed as being part of the work control process AMA. In its response to the staff's inquiry regarding these additional systems, the applicant states:

> The response to RAI B2.2.19-3 included the Work Control Process activities for systems and components that are not listed in LRA Section B2.2.19 as crediting the WCP for managing the effects of aging. A number of additional systems and components were added to the scope of license renewal by the response to RAI 2.1-3, and the WCP was credited for managing aging effects for fire protection system components by the response to RAI B2.2.7-2. Additionally, WCP provides confirmation of the effectiveness of the Chemistry Control Programs for primary systems, secondary systems, and fuel oil, as described in LRA Sections A2.2.19 and B2.2.19. The systems and components for which the chemistry control program are credited for management of aging effects are also included in the response to RAI B2.2.19-3
>
> The basis of the WCP as an AMA, as described in LRA Section B2.2.19, includes the results of work control activities performed on components for which the WCP is not credited to manage aging. These activities are considered in the representative inspections when a material and environment combination is representative of in-scope components. Therefore, the inspection opportunities provided in the response to RAI B2.2.19-3 are relevant to the basis of WCP as an effective AMA, even for systems and components for which the WCP is indirectly credited to manage aging effects.

The applicant's response concerning the additional systems that credit the work control process AMA, as a result of staff RAIs for Section 2 of each LRA, will need to be documented in the UFSAR Supplement for this AMA. In addition, the applicant's removal of references to EPRI TR-107514 will need to be documented in the UFSAR Supplement for the work control process AMA. Also, since the applicant stated that it would audit the inspection activities of the work control process to ensure that all of the component groups that credit this AMA are adequately sampled, the use of inspection results for components that do not credit the work control process as an indication for component groups with a similar material/environment combination is acceptable.

Once these additional commitments, as stated above, are incorporated into the work control process and also into the UFSAR Supplement for the work control AMA, the staff finds that the scope of the work control process is adequate to ensure that the component groups that credit this AMA will be monitored during the period of extended operation.

Preventive actions: The applicant identified the inspection activities as condition monitoring, the testing activities as performance monitoring, and the maintenance activities, performed under the work control process, as mitigative actions. The staff accepts this characterization.

Parameters monitored or inspected: The applicant states that visual inspections of internal and external surfaces are performed for mechanical components and their adjacent piping during the performance of maintenance, in accordance with the work control process, to determine the presence of cracking, loss of material, and gross indications of change in material properties. Visual inspections of structural components are performed to check for cracking, separation and cracking/delamination, change in material properties, and loss of material. Performance testing for various heat exchangers check heat transfer performance parameters for indications of heat transfer degradation. Lubricating oil and engine coolant samples are analyzed to detect contaminants as an indication of an adverse environment that can lead to material degradation. The staff agrees that the parameters monitored or inspected are acceptable because they are directly related to the aging effects to be managed by this program.

Detection of aging effects: The applicant states that cracking, separation and cracking/delamination, loss of material, and gross indications of change in material properties are the aging effects that are monitored by internal and external maintenance inspections for mechanical components and inspections of structural components. Changes in heat transfer capability are monitored through periodic performance testing of heat exchangers. Lubricating oil and engine coolant samples provide indication of an adverse environment that can lead to material degradation.

The applicant provided additional information related to the detection of aging effects in its November 30, 2001, response to RAI B2.2.19-3, the applicant states that visual inspections performed by VT-qualified personnel monitor system aging for cracking, loss of material, and change of material properties. Additionally, the work control process provides visual inspections to supplement the primary, secondary, and fuel oil chemistry control programs. The applicant's maintenance program uses quality maintenance teams (QMTs) to enhance the quality and thoroughness of maintenance activities. The QMTs consist of trained and certified craftsmen who have the authority to perform maintenance and to perform a quality check on the work of other maintenance personnel. QMT personnel are provided technical training, which includes inspector certification and visual testing (VT) certification in accordance with station administrative procedures. Additionally, QMT personnel are required to attend annual retraining and to recertify their VT qualifications every three years.

The applicant also states that the periodic testing monitors for heat transfer degradation of coolers and heat exchangers. Additionally, fluid samples (oil and coolant) are collected for analysis of contaminants and chemical properties. These tests and samples are used to monitor the physical condition of system components in support of aging mitigation programs.

The staff finds that the inspection, testing, and sampling activities described for this AMP are acceptable for detecting the applicable aging effects.

Monitoring and trending: In each LRA Section B2.2.19, the applicant states that a review of maintenance data for the past 7 years at SPS indicated that the inspection opportunities available through the work control process exceeded the minimum number of random samples necessary to obtain a 90/90 confidence level that aging effects would, if present, be identified. Therefore, the applicant believes that sufficient inspection opportunities are available to provide reasonable assurance that systems are adequately monitored.

To demonstrate that the work control process provides sufficient opportunity to adequately manage the applicable aging effects, the staff requested the applicant to provide a summary of its operating experience for the past 7 years for systems and structures that credit the work control process in order to specifically show that the work control process provides sufficient opportunity to examine the different materials and environments so that there is reasonable assurance that the applicable effects of aging will be managed and the intended function will be maintained during the period of extended operation. To demonstrate reasonable assurance, the staff requested the applicant to characterize the type of maintenance as predictive, preventive, or periodic corrective maintenance. In the response to RAI B2.2.19-3, in a letter to the NRC dated November 30, 2001, the applicant provided tables of data to demonstrate that numerous system, component, and material and environment inspection opportunities are available, as verified by the applicant's work order database (June 1993 through August 2001). The applicant concluded that these inspection opportunities provide reasonable assurance that the applicable effects of aging will continue to be managed such that the intended functions will be maintained throughout the period of extended operation. The staff has reviewed the information in these tables, as well as supplemental information provided by the applicant in a letter to the NRC dated May 22, 2002 (Serial No. 02-163). Based on the information provided, the staff has determined that once the provision for auditing the work control process at years 40 and 50 is added to the program, this AMA will provide sufficient monitoring activities for the components that credit this program. The applicant's commitment to audit the work control process is discussed in greater detail in the Scope section above.

Prior to the end of the current operating license term, the applicant committed to implementing changes in the maintenance procedures to provide reasonable assurance that consistent internal inspections will be completed during the process of performing maintenance tasks. In order to understand the intent of this commitment, the staff requested the applicant to explain the type and corresponding purpose of the changes that will be implemented. In the response to RAIs 2.2.19-2 and 3, in a letter to the NRC dated November 30, 2001, the applicant states that the inspection steps are presently included in maintenance procedures, but the level of guidance for the performance of inspections is not consistent. For the period of extended operation, consistency will be provided by changes that are being made to the maintenance procedures. The revised guidance will improve monitoring and trending capability. The additional steps being placed into preventive maintenance and corrective maintenance procedures direct maintenance personnel to visually inspect internal and external surfaces of components being disassembled (including the piping adjacent to these components) to ensure that there are no indications of loss of material (corrosion or wear), cracking, or separation of material. Internal areas also are inspected for sedimentation or corrosion product buildup. The inspection steps direct the maintenance department personnel to notify engineering if any such conditions are found. Since no unique set of acceptance criteria can be established for the myriad situations that arise from inspections of components and structures, the requirement to perform an engineering evaluation of inspection results will ensure that intended functions are maintained. The engineering evaluation determines the appropriate course of action through the applicant's corrective action system in accordance with 10 CFR Part 50, Appendix B. The staff found this response to be an acceptable explanation of the intent of the planned changes to the maintenance procedures.

Acceptance criteria: The acceptance criterion for visual inspections, testing, or sampling is the absence of anomalous indications that are signs of degradation. The staff finds this to be acceptable.

Operating experience: The applicant states that the work control process activities that involve component inspections, performance testing, and maintenance sampling are performed routinely and that the number of inspection opportunities afforded is statistically significant. The applicant reports that the excellent physical condition of all four units indicates successful experience with the implementation of the work control process.

In order to complete its review, the staff requested that the applicant provide additional information regarding operating experience with the existing work control process at North Anna and Surry. In the response to RAI B2.2.19-3, in a letter to the NRC dated November 30, 2001, the applicant described the following four operating experiences as examples to demonstrate the effectiveness of the work control process in identifying age-related concerns, before loss of intended function and making programmatic improvements: (1) loss of material in extraction steam piping, (2) loss of material in service water strainers, (3) loss of material from the main control room chiller condenser, and (4) cracking of the residual heat removal pipe. The staff review of these examples demonstrates the effectiveness of the applicant's work control process and its use of the corrective action system. The applicant states that its history of successful use of work control process at the North Anna and Surry Power Stations demonstrates that the work control process is effective in managing the aging effects of structures, systems, and components.

On the basis of the operating experience described above, the staff concludes that the applicant's aging management activities have been effective in maintaining the intended function of the systems, structures, and commodities within the scope of this evaluation, and can reasonably be expected to do so for the period of extended operation.

3.3.1.19.3 Conclusions

The staff has reviewed the information provided in Section B2.2.19 of Appendix B to each LRA and the summary description of the work control process activities in Section A2.2.19 of the UFSAR Supplement. In addition, the staff considered the applicant's November 30, 2001, response to the staff's RAIs and the applicant's May 22, 2002 (Serial No. 02-163), response to the staff's supplemental RAIs. On the basis of this review and the above evaluation, the staff finds that once the applicant incorporates the commitment to audit the work control process, as discussed above, the effects of aging associated with the component groups that credit the work control process will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation.

3.3.1.19.4 FSAR Supplement

The staff reviewed Section A2.2.19 of the UFSAR Supplement and found that the description of the applicant's work control process activities is consistent with Section B2.2.19 of each LRA. However, the staff identified six areas that UFSAR supplements needed revision. These areas have been explained below.

1. In Section B2.2.19 of each LRA the applicant states: "As a Licensee Follow-up Action, changes will be implemented into the maintenance procedures to provide reasonable assurance that consistent internal inspections will be completed during the process of performing maintenance tasks. These changes will be implemented prior to the end of the current operating license term." This item is included in each LRA Table B4.0-1 but is not discussed in Section A2.2.19 of the UFSAR Supplement. The staff asked the applicant to add this item into UFSAR supplements.

2. In response to RAIs 2.1-3, B2.2.7-2, and B2.2.19-3, a number of additional systems and components were added to the scope of the work control process. The staff asked the applicant to list these added systems to the scope of the work control process in the UFSAR supplements for the Surry and North Anna Power Stations.

3. In response to RAIs 2.1-3, B2.2.7-2, and B2.2.19-3, the applicant committed to audit the work control process at years 40 and 50 and to perform supplemental inspections, as necessary, within 5 years of the audit. The staff asked the applicant to revise the UFSAR supplements for the work control process AMA to include this commitment.

4. In response to RAIs 2.1-3, B2.2.7-2, and B2.2.19-3, the applicant committed to inspect similar material/environment components, both within the system and outside the system, if aging identified in a location within a system cannot be explained by environmental/operational conditions at that specific location. The staff asked the applicant to revise the UFSAR supplements for the work control process AMA to include this commitment.

5. In response to RAIs 2.1-3, B2.2.7-2, and B2.2.19-3, the applicant committed to remove references to EPRI TR-107514 from the work control process description. The staff requested the applicant to revise the UFSAR supplements accordingly.

6. Finally, in Section A2.2.19 of each LRA included two items related to "water treeing." Water treeing is a degradation and long-term failure phenomenon that has been documented for medium-voltage electrical cable with certain extruded polyethylene and EPRI insulations. Similar information was not included in Section B2.2.19 of the LRA. In the SER with open items issued in June 2002, the staff asked the applicant to revise the UFSAR supplements to incorporate requested information.

In response to this confirmatory action (3.3.1.19-1), in its letter dated July 25, 2002, the applicant stated:

1. The Licensee Follow-up Action for changes to maintenance procedures to assure consistent internal inspections has been added to Section 18.2.19 of the UFSAR Supplement. The applicant has completed this action.

2. The systems and components originally identified in the LRAs for which the work control process was credited were not identified in the proposed UFSAR Supplement provided as Appendix A to the LRAs. The systems identified as expanded scope or a new scoped-in systems in response to RAI 2.1-3 were documented in a license renewal technical report. This document will be one of the basis documents used in the periodic auditing of the scope of the work control process as committed to in RAI Response B2.2.19-3. The commitment to audit has been incorporated into the UFSAR Supplement. (Reference Item #3 below.) The Response to RAI B2.2.19-3 also credited the work control process for the fire protection system. This commitment has also been incorporated into the UFSAR Supplement. (Refer to Confirmatory Action 3.3.1.7-2.) Therefore, no additional revision to the UFSAR supplement is necessary to address this issue.

3. RAI responses made a commitment to audit the work control process at years 40 and 50 and to perform supplemental inspections, as necessary, within 5 years. This commitment has been incorporated into Section 18.2.19 of the UFSAR Supplement. The audit will ensure that all systems and components for which the work control process was credited, including all systems identified in RAI responses, will be represented in the program. The applicant has completed this action.

4. RAI responses made a commitment that if aging identified in a location within a system cannot be explained by environmental/operational conditions at that location, an inspection of similar material/environmental components, both within and outside the system, would be performed. This commitment has been incorporated into Section 18.2.19 of the UFSAR Supplement. The applicant has completed this action.

5. RAI responses withdrew the use and reference to EPRI report TR-107514. No reference to this report was made in the proposed UFSAR Supplement (Appendix A) which accompanied the LRAs. Therefore, no revision to the UFSAR Supplement is necessary. No additional action is required.

6. The USFAR Supplement has been revised to remove the “boxed areas” (North Anna specific info) for “water treeing” from the Work Control Process AMA in Section 18.2.19. However, water treeing is addressed in Section18.1.4 of the UFSAR Supplement, “Non-EQ Cable Monitoring program.” The applicant has completed this action.

Since the applicant has completed these actions, the staff considers confirmatory action 3.3.1.19-1 closed.

3.3.2 Quality Assurance Program

The NRC staff has reviewed each LRA’s Section 2.0 of Appendix B, “Aging Management Activities,” in accordance with 10 CFR 54.21(a)(3) and 10 CFR 54.21(d). In Section 2.0 of Appendix B to each LRA, the applicant describes its quality assurance program information with respect to the various aging management programs. The staff’s evaluation of the aging management programs focused on how the program manages aging effects through the effective incorporation of the following 10 elements: program scope, preventative actions, parameters monitored or inspected, detection of aging effect, monitoring and trending, acceptance criteria, corrective actions, confirmation process, administrative controls, and operating experience. 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 aging management programs.

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. Therefore, those aspects of the aging management process that affect the quality of safety-related SSCs are subject to the quality assurance requirements of Appendix B to 10 CFR Part 50. For non-safety-related SSCs that are subject to an AMR, the existing 10 CFR Part 50, Appendix B, quality assurance program may be used by the applicant to address the attributes of corrective actions, confirmation process, and administrative controls.

Summary of Technical Information in Application

The applicant stated that the quality assurance program implements the requirements of 10 CFR 50, Appendix B, and is consistent with the summary in Section A.2 of the Standard Review Plan for License Renewal. The quality assurance program includes the elements of corrective action, confirmation process, and administrative controls. These elements are applicable to the safety-related and non-safety-related structures, systems, and components that are within the scope of license renewal.

For each program described in Section 2.0 of Appendix B to each LRA, the applicant provides a general description of the corrective actions, administrative controls, and confirmation process common to all aging management programs for SSCs within the scope of license renewal.

The applicant's programs and activities that are credited with managing the effects of aging can be divided into new and existing programs. As described in Section 2.0 of Appendix B to each LRA, the applicant uses the following specific attributes to describe these programs and activities:

- Corrective actions: a description of the action taken when the established acceptance criterion or standard is not met. This includes timely root cause determination and prevention of recurrence, as appropriate.

- Administrative controls: the identification of the plant administrative structure under which the programs are executed.
- Scope: a clear statement of the reason why the program exists for license renewal.

- Preventive actions: a description of preventive actions taken to mitigate the effects of the susceptible aging mechanisms, and the basis for the effectiveness of these actions.

- Parameters monitored or inspected: a description of parameters that are monitored or inspected and how they relate to the degradation of the particular component or structure and its intended function.

- Detection of aging effects: a description of the type of action or technique used to identify or manage the aging effects or relevant conditions.

- Monitoring and trending: a description of the monitoring, inspection, or testing frequency and sample size (if applicable).

- Acceptance criteria: the identification of the acceptance criteria or standards for the relevant conditions to be monitored or the chosen examination methods.

- Confirmation process: a description of the process to ensure that adequate corrective actions have been completed and are effective.

- Operating experience and demonstration: a summary of the operating experience of the aging management program, including past corrective actions resulting in program enhancements or additional programs. Program demonstration is also included in this summary.

Staff Evaluation

The staff has determined the adequacy of certain aspects of the applicant's programs to manage the effects of aging. The particular aspects reviewed by the staff in this section encompass three quality assurance program attributes, namely corrective actions, confirmation process, and administrative controls. These three attributes of the quality assurance program are used by all of the applicant's aging management programs.

For all of the aging management programs, three attributes (corrective actions, confirmation process, and administrative controls) are specifically addressed by reference to the applicant's quality assurance programs. However, Section 2.0 of Appendix B of each LRA did not specifically describe in detail how the quality assurance programs address the three elements. During the scoping and screening methodology audit conducted on September 10-14, 2001, the NRC staff reviewed the applicant's implementation of the corrective actions, administrative controls, and confirmation process described in Section 2.0 of Appendix B of each LRA. During the audit, the applicant stated that the attributes of corrective action, confirmation process, and document control were developed and are integral to the site quality assurance programs. The staff confirmed that the applicant credited this process for both the safety-related and non-safety-related SSCs within the scope of license renewal. In addition the staff verified that the definitions for each of the attributes of the AMPs were consistent with those definitions in Section A.2 of the SRP for Review of License Renewal Applications. In a letter dated October 22, 2001, the NRC staff requested that the applicant provide a description of how the quality assurance program specifically addresses the three elements consistent with the staff's understanding as a result of the audit discussions. In response to that request, the applicant further described the three elements in a letter dated January 16, 2002. The applicant stated that the corrective actions for conditions that are adverse to quality are performed in accordance with the corrective action system as part of the quality assurance program. The corrective action process provides reasonable assurance that deficiencies adverse to quality are either promptly corrected or are evaluated to be acceptable. Where evaluations are performed without repair or replacement, engineering analysis reasonably assures that the structure or component intended function is maintained consistent with the current licensing basis. If the deficiency is assessed to be significantly adverse to quality, the cause of the condition is determined, and an action plan is developed to preclude repetition. The corrective action system identifies repetitive discrepancies and initiates additional corrective action to prevent recurrence. With respect to administrative controls, the applicant stated that the administrative and implementation procedures are reviewed, approved, and maintained as controlled documents in accordance with the procedure control process and the quality assurance program. For the confirmation process attribute, the applicant states that the confirmation process is integral to the corrective action system. Evaluation of post-maintenance conditions that occur as a result of required repairs or replacements, including inspections and tests, where appropriate, provide reasonable assurance that required repairs or replacements have been satisfactorily implemented and therefore reasonable assurance that the corrective actions have been satisfactorily implemented. Additionally, for those programs where sampling and testing on a periodic basis is used to provide reasonable assurance that parameters remain within acceptable limits, the confirmation process requires followup sampling and testing to confirm the completeness of any corrective actions which may need to be taken.

Based on the information provided in each LRA, as supplemented by the applicant's January 16, 2002, response to the staff's RAI, the NRC staff has determined that the corrective actions, confirmation process, and administrative controls are addressed in the applicant's approved quality assurance program. The staff has also determined that all the aging management programs for SSCs within the scope of license renewal are subject to the requirements of the applicant's quality assurance program.

Section A2.0, Programs and Activities, FSAR Supplement

The applicant has provided a summary description of the programs and activities for managing the effects of aging and the evaluation of time-limited aging analyses for the period of extended operation in UFSAR Chapter 18, which is also included in Appendix A to each LRA. The UFSAR supplement provides a brief explanation of the new and existing programs that the applicant will use to manage the effects of aging. The explanation contains a summary of several important attributes of aging management programs, as defined in NEI 95-10 and SRP-LR, such as inspections and techniques used to identify aging effects. The quality assurance programs, with respect to three attributes of the AMPs (corrective actions, confirmation process, and administrative controls), are briefly described in the UFSAR supplement. However, the applicant has provided a more detailed description of the technical and quality assurance attributes in Appendix B to each LRA.

For non-safety-related structures and components that are subject to an AMR for license renewal, an applicant has an option to expand the scope of its 10 CFR Part 50, Appendix B, program to include these structures and components to address corrective actions, confirmation process, and administrative controls for aging management during the period of extended operation. In accordance with Appendix A.2, "Quality Assurance for Aging Management Programs (Branch Technical Position IQMB-1)," Section A.2.2, Item 2 to the draft SRP, the applicant should document a commitment to expand the scope of its 10 CFR Part 50, Appendix B, quality assurance program to include non-safety-related structures and components in the UFSAR supplement consistent with Section 2.0 of Appendix B to each LRA. The staff has verified that the applicant did expand the scope of quality assurance program to include both safety-related and non safety-related SSCs within the scope of license renewal. Therefore, committing to the applicant's quality assurance program for all aging management programs for safety- and non-safety-related SSCs within the scope of license renewal is an acceptable approach to meeting Branch Technical Position IQMB-1.

Conclusion

The staff finds that the quality assurance attributes are consistent with 10 CFR 54.21(a)(3). Therefore, the applicant's quality assurance description for its aging management programs is acceptable. The staff finds that the applicant's UFSAR Chapter 18 supplement and its January 16, 2002, response to the staff's RAI provides a sufficient description of the quality assurance programs and attributes and activities for managing the effects of aging.

3.3.3 Time-limited Aging Analyses (TLAA) Support Activities

3.3.3.1 Environmental Qualification Program

In the LRAs, Section B3.1, "Environmental Qualification Program," the applicant describes the aging management activities used to manage aging associated with the environmentally qualified equipment that is within the scope of license renewal and subject to an AMR. This program is consistent with the requirements of 10 CFR 50.49, and will be continued throughout the period of extended operation. In addition, the applicant provides a summary description of the environmental qualification (EQ) program in Appendix A of each LRA, the "UFSAR supplement," Section B2.1.

3.3.3.1.1 Summary of Technical Information in the Application

In each LRA Section 4.4, the applicant identified the NAS 1/2 and the SPS 1/2 10 CFR 50.49 Environmental Qualification (EQ) Program as a Time-Limited Aging Analyses (TLAA) in accordance with 10 CFR 54.3 and 54.21(c) for the purpose of license renewal. To meet the requirements of 10 CFR 54.21(c)(1), the applicant chose option iii ("to demonstrate that the effects of aging on the intended functions will be adequately managed for the period of extended operation") using its EQ program to manage the effects of aging. In Section B3.1 of each LRA, the applicant describes its EQ program using the 10 elements of an effective aging management program described in the standard review plan. The applicant states that the purpose of the EQ program is to provide reasonable assurance that the effects of aging will be managed so that the intended function will be maintained consistent with the CLB during the period of extended operation for the EQ equipment that are considered TLAAs and within the scope of license renewal. The applicant further states that it provides this reasonable assurance through analysis, testing, refurbishment, or replacement that the equipment qualification is adequately managed now and for the period of extended operation. In addition, qualification records will be maintained for all equipment subjected to the EQ rule, and the qualification process will be used to verify that the EQ components are capable of performing its safety function when subjected to various postulated environmental conditions.

The environmental conditions and the resulting aging effects managed by the EQ program include the aging resulting from the expected ranges of temperature, pressure, humidity, radiation, and accident conditions such as chemical spray and submergence.

The applicant identified the SSCs that are managed by the EQ Program to include safety-related equipment, non-safety-related electrical equipment whose failure could prevent accomplishments of safety functions and certain post-accident monitoring equipment as described in Regulatory Guide 1.97. However, only those EQ components that are within the scope of license renewal and have a qualified life of greater than 40 years are considered long-lived and, therefore, are within the scope of the EQ program for the purpose of TLAAs for license renewal. Components with a qualified lifetime of less than 40 years are included in a periodic replacement program, and are not considered TLAAs.

3.3.3.1.2 Staff Evaluation

The staff's evaluation of the NAS 1/2 and the SPS 1/2 EQ program focused on how the applicant demonstrated that the program can be used to manage the applicable aging effect through incorporation of the 10 elements of an effective aging management program as described in the standard review plan: program scope, preventive or mitigative actions, parameters monitored or inspected, detection of aging effects, monitoring and trending, acceptance criteria, corrective actions, confirmation process, administrative controls, and operating experience. Because the applicant has credited its 10 CFR Part 50, Appendix B program for the implementation of the corrective actions, confirmation process, and administrative controls, the following staff evaluation will only address the remaining seven elements. The staff's evaluation of EQ program components that are TLAAs for the purpose of license renewal is provided in Section 4.4 of this SER. The staff's evaluation of the applicable aging effects are provided in Section 3.3.3.1 of this SER. The following is the staff's evaluation of each of the seven elements for the EQ equipment as submitted by the applicant in Section B3.1 of each LRA to fulfill the requirements of 10 CFR 54.21(c)(1)(iii)

Program scope: As previously stated, the applicant credits the EQ program activities with managing aging of safety-related equipment, non-safety-related electrical equipment whose failure could prevent accomplishments of safety functions, and certain post-accident monitoring equipment as described in Regulatory Guide 1.97 EQ components that are within the scope of license renewal and that have a qualified life of greater than 40 years. Components with a qualified lifetime of less than 40 years are included in a periodic replacement program, and are not considered TLAAs. In addition, the applicant states that the EQ program manages aging resulting from the expected ranges of temperature, pressure, humidity, radiation, and accident conditions such as chemical spray and submergence. The staff's evaluation of the scope of the program is further evaluated below, under other related program elements. However, the staff's evaluation verified that the scope of the applicant's program included the long-lived EQ components required under 10 CFR 50.49 and has no concerns with the applicant not including those components that are included within a periodic replacement program and is, therefore, acceptable.

Preventive actions: The applicant states that the component that have been determined by EQ evaluation to have age-related limitations or restrictions are refurbished, re-qualified, or replaced prior to exceeding its qualified life, and becoming incapable of performing its intended functions. The staff agrees that refurbishing, re-qualifying, or replacing a component prior to exceeding that component's qualified life are preventive actions. This approach is consistent with the requirements of 10 CFR 50.49 and 10 CFR 54.21(c)(1) and, therefore acceptable.

Parameters monitored or inspected: The applicant states that the service histories for EQ components are monitored by the preventive maintenance program to reasonably assure that the components are refurbished, re-qualified, or replaced prior to reaching the end of their established qualified lifetime. The use of preventive maintenance activities to identify the need to review the environmental qualifications of EQ components with sufficient time to refurbish, re-qualify, or replace a component prior to exceeding its qualified life are consistent with the requirements of 10 CFR 50.49 and 10 CFR 54.21(c)(1) and, therefore acceptable to the staff.

Detection of aging effects: The applicant states that EQ program is used to manage aging resulting from the expected ranges of temperature, pressure, humidity, radiation, and accident conditions such as chemical spray and submergence through the use of environmental qualification calculations. Therefore, the EQ program is not used to detect any specific ongoing aging for the purpose of TLAAs and, therefore, this program element is not applicable to the EQ program for TLAAs. The staff recognizes that consistent with 10 CFR 50.49, the EQ program is not used to detect ongoing aging. Therefore, the staff found the applicant's response acceptable.

Monitoring and trending: The EQ Program involves monitoring the installed time of EQ components, comparing this duration to the established qualified lifetime for the component, and providing reasonable assurance that refurbishment, re-qualification, or replacement occurs prior reaching the qualified lifetime limit. Monitoring the installed time and the established qualified life of each EQ component is consistent with the requirements of 10 CFR 50.49 and 10 CFR 54.21(c)(1) and is, therefore, acceptable to the staff. The applicant did not identify any trending activities, and the staff does not see the need for trending in this application.

Acceptance criteria: The applicant identified that the acceptance criteria for EQ components is not to let the installed time exceed the qualified life. The applicant states that EQ components must be refurbished, re-qualified, or replaced prior to reaching the end of their established qualified lifetime. This acceptance criteria is consistent with the requirements of 10 CFR 50.49 and 10 CFR 54.21(c)(1) and is, therefore, acceptable to the staff.

Operating experience: The applicant states that the EQ program has been effective in maintaining the qualified life of EQ components consistent with the EQ requirements of 10 CFR 50.49 in the past. This past success provides reasonable assurance that EQ program will continue to ensure the following: 1) maintain the qualification documentation reviews for affected electrical components, 2) evaluate the qualified lifetime for affected components, and 3) provide for equipment refurbishment, re-qualification, or replacement prior to the expiration of the qualified lifetime. The preventive maintenance, incorporation of relevant industry information and experience, and implementation of corrective actions when necessary have been successful in maintaining the qualification of electrical equipment and will continue into the period of extended operation. On the basis of this operating experience, the staff concludes that the EQ program can continue to be effective in maintaining the intended function of EQ components that are qualified for the current operating term, and can continue to do so for the period of extended operation.

3.3.3.1.3 Conclusion

The staff has reviewed the information provided in each LRA, Section B3.1, "Environmental Qualification Program," and the summary description of the EQ program provided by the applicant in Appendix A, the "UFSAR supplement," Section A3.1. The staff has also evaluated the scope of EQ components that meet the requirements of 10 CFR 54.3 and 54.21(c)(1), and the associated AMR of these components, and documented these evaluation separately in Sections 2.5 and 3.3.3.1 of this SER, respectively. On the basis of the review of this information and the above evaluation, the staff finds that the applicant has demonstrated that the effects of aging on the intended functions of the EQ components within the scope of this review will be adequately managed for the period of extended operation.

3.3.3.1.4 FSAR Supplement

The staff reviewed the FSAR supplement and determined that it provides a sufficient summary description of the EQ program to satisfy the requirements of 10 CFR 54.21(d).

3.3.3.2 Transient Cycle Counting Program

3.3.3.2.1 Summary of Technical Information in the Application

The applicant described its Transient Cycle Counting Program (TCCP) in Section B3.2 of the NAS and SPS LRAs. The TCCP is designed to track cyclic and transient occurrences to ensure that reactor coolant pressure boundary components will remain within ASME, Section III fatigue limits.

3.3.3.2.2 Staff Evaluation

The staff's evaluation of the TCCP focused on how the program manages fatigue through effective incorporation of the following 10 elements: program scope, preventive or mitigative actions, parameters monitored or inspected, detection of aging effects, monitoring and trending, corrective actions, confirmation process, administrative controls, and operating experience.

Program scope: The scope of the TCCP at both stations includes reactor coolant pressure boundary components for which the design analysis assumes a specific number of transients for fatigue. The staff considers the scope of the TCCP, which includes reactor coolant pressure boundary components with fatigue analyses, to be acceptable.

Preventive and mitigative actions: The applicant indicated that the TCCP is mitigative because it provides reasonable assurance of compliance with design assumptions for NAS and SPS during the lifetime of the plants. The staff did not identify the need for any additional preventive or mitigative actions.

Parameters inspected or monitored: The program records the number of the following normal and upset operational transients for NAS and SPS:

- heatup/cooldown
- step load increase/decrease of 10%
- large load reduction of 50%
- loss of load > 15%
- loss of flow in one loop
- full-power reactor trip
- inadvertent auxiliary pressurizer spray
- loss of AC power

The NAS TCCP includes the following additional transients:

- inadvertent safety injection
- normal charging and letdown return to service
- charging trip with delayed return to service

Section 4.3 of this SER contains a discussion of the transients that are monitored by the TCCP. The staff considers the monitoring of these transients at NAS and SPS is appropriate because the objective of the program is to provide assurance that the design fatigue analyses remain valid.

Detection of aging effects: The program monitors the number of design transients at NAS and SPS used in the fatigue analysis of components. This provides assurance that the fatigue analyses of record remain valid during the period of extended operation. The staff finds this monitoring appropriate.

Monitoring and trending: According to the applicant, the number of transient cycles is updated quarterly for NAS and SPS for comparison with the design limit. As discussed for the corrective action element, the applicant intends to initiate corrective actions if the number of transient cycles approaches the number assumed in the analysis. The staff finds that the applicant's quarterly updating is sufficient to allow for timely corrective action. Therefore, the staff finds this program element acceptable.

Acceptance criteria: The acceptance criteria are the magnitude and number of cycles of each transient assumed in the design analyses for NAS and SPS components. By meeting these criteria, the applicant provides assurance that the plants will stay within the design limits. Therefore, the staff considers these criteria acceptable.

Corrective actions: The applicant indicated that, if the number of transient cycles approaches the number assumed for the plant design, further analysis will be performed to account for the magnitude of these cycles. The applicant indicated that, if warranted, component repair or replacement would be initiated. A further description of the staff review of the corrective action program is contained in Section 3.3.2 of this SER.

Confirmation process: The applicant indicated that a formal log is maintained to record transient cycles and that periodic reviews of the logged information are performed. A further description of the staff review of the confirmation process is contained in Section 3.3.2 of this SER.

Administrative controls: The applicant indicated that implementation procedures are reviewed, approved, and maintained as controlled documents in accordance with the procedure control process. A further description of the staff review of the administrative controls is contained in Section 3.3.2 of this SER.

Operating experience: The applicant's program tracks design transients to provide assurance that the design transient limits are not exceeded during the period of extended operation. The applicant indicated that, based on operating experience at NAS, it has identified charging line flow isolation events for further monitoring. The applicant has instrumented the charging line nozzle to evaluate the impact of these transients. In response to RAI 4.3-1, the applicant indicated that temperature data from the existing plant instrumentation is being collected to validate the NAS design transients. The staff finds that the applicant has adequately addressed operating experience.

3.3.3.2.3 FSAR Supplement

The staff reviewed the FSAR supplement and determined that it provides a sufficient summary description of the TCCP to satisfy the requirements of 10 CFR 54.21(d).

3.3.3.2.4 Conclusions

The staff has reviewed the information in LRA Section B3.2 regarding the TCCP. The applicant references the TCCP in its discussion of the fatigue TLAAs as a method to manage the fatigue usage of reactor coolant pressure boundary components. The staff considers the applicant's program, which counts plant transients to ensure that the number does not exceed the number assumed in the fatigue design of reactor coolant pressure boundary components, to be an acceptable program for managing the fatigue TLAA during the period of extended operation.

The staff concludes that the TCCP will adequately manage thermal fatigue of RCS components for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.4 New Aging Management Programs and Activities

3.3.4.1 Buried Piping and Valve Inspection Activities

The applicant describes its buried piping and valve inspection activities in Section B2.1.1 of each LRA. The applicant credits this inspection activity with managing potential aging on the exterior surface of buried piping and valves that are within the scope of license renewal. The staff reviewed each LRA to determine whether the applicant has demonstrated that buried piping and valve inspection activities will adequately manage the applicable effects of aging during the period of extended operation as required by 10 CFR 54.21 (a)(3).

3.3.4.1.1 Summary of Technical Information in the Application

In Section B2.1.1of each LRA, the applicant identified the buried piping and valve inspection activities as a new initiative that will be used for managing the aging effects of loss of material on external surfaces of buried components of the systems and structures that credit this program. In addition, in the SPS LRA, the applicant credits these inspection activities for managing the aging effect of change in material properties for some piping materials that are used at SPS but not used at NAS.

Prior to the period of extended operation, the applicant stated that it would use the newly developed inspection activities to confirm the integrity of buried piping and valves due to the existence of aging effects requiring management. These activities include examining representative samples of buried piping and valves consisting of various materials, with various protective measures, in different soil conditions. The applicant will perform one-time inspections of representative valves and a sample length (i.e., several feet) of piping for each combination of material and burial condition. An engineering evaluation of the inspected components will be performed to determine the need for future actions, if any. The applicant states that the development and implementation of these inspection activities will be completed prior to entering into the period of extended operation.

The applicant stated that it would implement the buried piping and valve inspection activities for the buried portions of the following systems that are subject to an AMR at both NAS and SPS:

- emergency diesel generator system
- fire protection
- safety injection
- service water
- containment/quench spray

The buried piping and valve inspection activities will be implemented on the buried portions of the following systems that are subject to an AMR at North Anna (only):

- recirculation spray
- residual heat removal

The buried piping and valve inspection activities will be implemented on the buried portions of the following systems that are subject to an AMR at Surry (only):

- condensate
- feedwater
- security

The buried piping and valve inspection activities will also be implemented on the buried flood wall carbon steel culvert west of the turbine building at North Anna (only).

The inspections will be performed on representative samples of SCs with the following material/burial condition combinations:

- carbon steel, coated (includes cast iron)
- carbon steel, coated, wrapped
- stainless steel, coated, wrapped
- carbon steel, coated, wrapped, with cathodic protection (NAS 1/2 only)
- copper-nickel, uncoated (Surry only - not initially identified in Section B2.1.1 of neither LRA, but confirmed In its response to RAI B2.1.1-1 in a letter to the NRC dated September 27, 2001)

3.3.4.1.2 Staff Evaluation

The staff's evaluation of the buried piping and valve inspection activities focused on how the program manages aging effects through the effective incorporation of the following 10 elements: 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 indicates that the corrective actions, confirmation process, and administrative controls are part of the site-controlled quality assurance program. The staff's evaluation of these program attributes is provided separately in Section 3.3.2 of this SER. The remaining seven elements are discussed below.

Program scope: In Section B2.1.1 of each LRA, the applicant identified the systems, structures, and material/burial combinations of the SCs that are within the scope of license renewal and subject to an AMR, and that credit the buried piping and valve inspection activities. In a letter to the staff dated September 27, 2001, the applicant responded to staff RAI B2.1.1-1 asking the applicant to identify if any copper-nickel alloy materials in a buried environment is within the scope of license renewal and subject to an AMR. The applicant responded that copper-nickel (uncoated) is a buried material used at SPS that was administratively overlooked in the LRA.

The staff requested a clarification of whether the buried pipe inspection program includes periodic inspections when components in the applicable systems are excavated for any reason, and how often the applicant expects these inspections to take place. In a letter dated May 22, 2002 (Serial No. 02-277), the applicant stated that the work control process program includes the inspection of components when they are excavated. However, the applicant stated that neither NAS nor SPS has needed to excavate buried components very often in the past. Therefore, the applicant's program will ensure that a sample of each component, based on material and environment, will be excavated at least once prior to the period of extended operation to ensure adequate aging management prior to entering the period of extended operation.

The staff requested the applicant to clarify the criteria that will be used to select the representative samples of buried pipes. In a letter dated May 22, 2002 (Serial No. 02-277), the applicant indicated that the representative samples for buried pipes will be solely based on the material of the buried components and the burial conditions of each component. The applicant also confirmed that there is no significant difference in the soil conditions at the different sites that would make a difference in the aging management activities needed at each site.

The staff finds the scope of this AMP acceptable because the scope of the program and the applicant's responses to the staff are comprehensive in that they include the systems and structures of the exterior surface of buried piping and valves that are subject to an AMR.

Preventive actions: The applicant identified that the external surfaces of buried piping and valves typically have been coated, wrapped with a protective material, and/or protected with a cathodic protection system during installation to prevent buried components from being exposed to a potentially aggressive soil environment. Although these preventive measures are identified as part of the applicant's description of burial conditions, the applicant does not consider the actual inspection activities as preventive actions. The staff considers inspection activities as a means of detecting, not preventing aging, and, therefore, agrees that there are no preventive actions associated with the buried piping and valve inspection activities.

Parameters monitored or inspected: In Section B.2.1.1 of each LRA, the applicant states that the external surfaces of the buried components that will be sampled as part of this aging management activity will be inspected for evidence of degradation such as damaged coating and/or wrap and aging. Visual inspections and nondestructive examination (NDE) would be used to identify a loss of material due to excessive corrosion and increased susceptibility to loss of material as indicated by damaged coating and/or wrap. Visual inspection would also be used to identify changes in material properties of 90/10 copper-nickel alloy components. Because visual inspection and NDE can detect damage to protective coating and wrap, ongoing corrosion, and discoloration from changes in material properties, and is consistent with current industry practice, the use of these inspection techniques on excavated components is acceptable to the staff.

Detection of aging effects: The applicant states that the external condition of buried components will be examined using a one-time inspection performed in accordance with the Work Control Process. The one-time inspection will be performed on representative samples of each of the materials and burial conditions (independent of the system) that are identified in Section B2.1.1 of each LRA. The one-time inspection will be performed between year 30 and the end of the current operating license term. Because the concern of aging is dependent on the materials and burial conditions, and not on system boundaries, the staff finds that it is not necessary for the applicant to sample based on system boundaries.

In addition to the information provided in each LRA, the applicant responded to a staff's request for additional information in a letter to the NRC dated September 27, 2001. In its response, the applicant informed the staff that ongoing maintenance activities for buried components predominantly involve the excavation of valves, including visual inspections of the internal and external surfaces of adjacent piping. These tasks occur at an average frequency of three times per year (primarily on the fire protection system) at both Surry and North Anna, and provide the opportunity to examine the integrity of the components, coatings, and wraps on buried piping and valves. These maintenance activities and practices are expected to continue into the period of extended operation at a similar frequency of occurrence, enhancing the aging management of the buried piping and valves that are within the scope of license renewal throughout the period of extended operation.

The applicant states that visual inspections will be used to detect cracking of protective coatings and loss of material from protective coatings or the substrate material. For Surry, visual inspections will also be used to detect gross indications of change in material properties for the copper-nickel pipe. The staff requested a clarification as to the use of visual inspections to detect gross indications of changes in material properties for copper-nickel components. In a letter dated May 22, 2002 (Serial No. 02-277), the applicant stated that copper-nickel piping is primarily used underground and in air environments with intermittent wetted conditions in service water lines that connect to chillers that are within the scope of license renewal. The applicant stated that it does not expect to see any changes in material properties (such as selective leaching) in the buried copper-nickel piping, and that the changes in material properties of the service water lines to the chillers will be the lead indication of any potential aging. Because the service water lines to the chillers are available for visual inspections, the applicant will be able to observe any changes in material properties. In a September 27, 2001, response to RAI B2.1.1-2 to NRC, the applicant further states that a 90/10 alloy of copper-nickel is used as buried piping at Surry and that operating experience confirms that the 90/10 alloy is much less susceptible to selective leaching than is aluminum-bronze alloy.

The buried components include cast iron and copper-nickel material. Since these materials are susceptible to selective leaching, the staff requested that the applicant explain why the program does not include hardness measurements of a selected set of components to determine whether loss of material due to selected leaching is not occurring for the period of extended operation. In a letter dated May 22, 2002 (Serial No. 02-277), the applicant stated that the buried piping inspection activities are intended to detect any damage to the protective coating that would allow damage to the buried piping. If damage to the coating is found, the applicant would then take the appropriate steps, including hardness testing when appropriate, to identify any damage to the pipe as a result of the piping being exposed to underground conditions.

The use of a one-time inspection prior to, and the ongoing inspection activities during the period of extended operation is consistent with industry practice, and is considered by the staff to be a reasonable means of detecting aging before the loss of intended function. The staff agrees that this one-time inspection can be performed just before the end of the license for North Anna and Surry because no problems have been identified with prior operating experience and any mechanisms of degradation would be slow acting.

Monitoring and trending: Inspection results are documented in accordance with the applicant's Work Control Process that is within the scope of the applicant's 10 CFR Part 50, Appendix B, quality assurance program. If additional NDE is performed, anomalous indications of degradation will be documented in NDE reports that also are maintained in accordance with the applicant's quality assurance program. No trending is performed for the buried piping and valve inspection activities, and none is required by current industry practice for visual and NDE inspection activities in similar applications. The monitoring activities credited that are controlled by the applicant's quality assurance program and are consistent with current industry practices and, therefore, are acceptable to the staff.

In the North Anna LRA, the applicant states that some of the buried piping uses cathodic protection. The staff recognizes that monitoring cathodic current is a good means of identifying potential damage to coating material of buried components and asked the applicant why it did not take advantage of this indication in its aging management activities. In a letter dated May 22, 2002 (Serial No. 02-277), the applicant explained that its current aging management activities are adequate as described in each LRA. However, the applicant stated that it monitors cathodic protection current along with pipe-to-soil potential current as a means of identifying degradation of buried component coating but do not take credit for these activities as aging management activities. The staff found this response acceptable because monitoring cathodic protection is not required. Furthermore, the applicant’s use of the one-time inspection, prior to and the ongoing inspection activities during the period of extended operation, is consistent with industry practice.

Acceptance criteria: In Section B2.1.1 of each LRA, the applicant states that the acceptance criterion for the visual inspections discussed above is the absence of anomalous indications of degradation. A trained coatings/materials engineer will perform the inspections and determine whether the observed condition is acceptable. In addition, the applicable NDE acceptance criterion is the absence of any anomalies that is an indication of degradation, as well. Any indication of degradation that is adverse to quality will be entered into the applicant’s corrective action system. Because degradation to wrap, coating, and component surfaces is detectable by visual inspections and NDE performed by trained individuals, and this approach is consistent with current industry practices, the acceptance criteria are acceptable to the staff.

Operating experience: In Section B2.1.1 of each LRA, the applicant states that significant external degradation of buried piping due to the aging effects requiring management has not been found. In a September 27, 2001, response to RAI B2.1.1-3, the applicant further describes its operating experience. Maintenance activities for buried carbon steel (including cast iron) piping and valves have principally involved fire protection components at Surry and North Anna Power Stations. The service water system at North Anna also includes buried carbon steel components, which are coated or wrapped similarly to fire protection components to prevent water intrusion that could lead to loss of material from the metallic surfaces. Maintenance activities for buried components predominantly involve the excavation of valves; however, visual inspections of the internal and external surfaces of adjacent piping are also performed. These tasks occur at an average frequency of three times per year at both Surry and North Anna, and provide the opportunity to examine the integrity of wrappings and coatings and the material condition of the valves and adjacent piping. A review of operating experience has identified failure of buried piping; however, these failures were not attributed to aging or failure of coating material.

On the basis of this operating experience resulting from the implementation of the work control process described above, and the added aging management activities (one-time inspections) that will be implemented by the buried piping and valves inspection activities, the staff concludes that the aging management activities described above have been effective at maintaining the intended function of the buried components within the scope of this evaluation, and can reasonably be expected to do so for the period of extended operation.

3.3.4.1.3 Conclusions

The staff has reviewed the information provided in Section B2.1.1 of each LRA and the summary description of the buried piping and valve inspection activities in Section A2.1.1 of the UFSAR supplement. In addition, the staff considered the applicant's response to the staff's RAIs provided in a letter to the NRC dated September 27, 2001 and information provided in a letter dated May 22, 2002 (Serial No. 02-277). On the basis of this review and the above evaluation, the staff finds that there is reasonable assurance that the applicant has demonstrated that the effect of aging associated with the buried piping and valves within the scope of this evaluation will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation.

3.3.4.1.4 FSAR Supplement

The staff reviewed Section A2.1.1 of the UFSAR supplement and found that the description of the applicant's buried piping and valve inspection activities is consistent with Section B2.1.1 of each LRA and that no changes were needed.

3.3.4.2 Infrequently Accessed Area Inspection Activities

The applicant describes its infrequently accessed area inspection activities in Section B2.1.2 of each LRA. The applicant credits this inspection activity with managing the potential aging of structures and components that are within the scope of license renewal but not readily accessible because of physical and environmental limitations. The inspection activity monitors and assesses the condition of infrequently accessed structures and components affected by aging, which may cause loss of material. The staff reviewed Section B2.1.2 of each LRA to determine whether the applicant has demonstrated that infrequently accessed area inspection activities will adequately manage the applicable effects of aging during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.3.4.2.1 Summary of Technical Information in the Application

In Section B2.1.2 of each LRA, the applicant states that the purpose of the infrequently accessed area inspection activities is to provide reasonable assurance that the effects of aging will be managed so that the intended functions of equipment and components, which are not readily accessible will be maintained consistent with the CLB during the period of extended operation. The applicant identified these inspection activities as a new initiative that will be used to manage the aging effects of loss of material on the external surfaces of the infrequently accessed components that are subject to an AMR and credit this program. These activities are one-time inspections prior to the end of the current license period to assess the aging of the components located in areas not routinely accessed due to high radiation, high temperature, confined spaces, location behind security or missile barriers, or normally flooded conditions. The applicant will perform an engineering evaluation of the inspection results to determine the potential need for any subsequent inspections.

The applicant stated that it would implement the inspection activities for the infrequently accessed portions of the following systems, structures and commodities that are subject to an AMR and credit this program at NAS and SPS:

- feedwater (NAS 1/2 only)
- recirculation spray
- safety injection
- service water
- neutron shield tank cooling
- auxiliary feedwater tunnel (NAS 1/2 only)
- containment
- service water expansion joint enclosure (NAS 1/2 only)
- service water tie-in vault (NAS 1/2 only)
- yard valve pit (NAS 1/2 only)
- NSSS equipment supports
- general structural supports

The applicant identified the infrequently accessed areas to include representative regions and equipment in the following areas:

- reactor containment sump
- reactor containment keyway (including the integrity of the neutron shield tank)
- cover for containment dome plug
- volume control tank cubicle
- black battery building (SPS 1/2 only)
- cable-spreading rooms, cable tunnels, upper areas of emergency switchgear rooms
- new fuel storage area
- auxiliary building filter and ion exchanger cubicles
- tunnel from turbine building to auxiliary building

In addition, the following infrequently accessed areas are specific to North Anna:

- emergency diesel generator exhaust bunkers
- service water (SW) expansion joint vault
- SW tie-in vault
- auxiliary SW valve pit
- turbine building SW valve pit
- SW valve house lower level
- SW pump house lower level
- spray array structure in SW reservoir
- auxiliary SW expansion joint vault
- charging pump pipe chase
- auxiliary feedwater piping tunnel

3.3.4.2.2 Staff Evaluation

The staff's evaluation of the infrequently accessed area inspection activities focused on how the program manages aging effects through the effective incorporation of the following 10 elements: 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 indicates that the corrective actions, confirmation process, and administrative controls are part of the site-controlled quality assurance program. The staff's evaluation of these program attributes is provided separately in Section 3.3.2 of this SER. The remaining seven elements are discussed below.

Program scope: Section B2.1.2 of each LRA identifies the systems, structures, and commodities that credit the infrequently accessed area inspection activities for managing the aging effect of loss of material. The applicant also states that the scope of these activities includes “representative regions and equipment in the following areas.” The specific areas for North Anna and Surry are identified in Section B.2.1.2.1 of each LRA. In a letter dated May 22, 2002 (Serial No. 02-277), the applicant stated that the list provided in Section B2.1.2 of each LRA is a complete list of infrequently accessed areas. The applicant also explained that any area of the plant that contains any SSCs within the scope of license renewal and subject to an AMR which is not routinely accessible because of radiation levels, temperature, operationally flooded areas, or physical obstructions (behind or beneath concrete walls) was considered an infrequently inspected area. In the same letter, the applicant explained that it did not mean to limit the scope of SSCs by the use of “representative regions and equipment,” and that all of the structures, supports, piping, and equipment within each specific area/region are included within the scope of the inspection.

The staff’s evaluation of the scope of this program verified that the infrequently accessed area inspection activities were implemented using acceptable criteria for determining infrequently accessed areas. In addition, the applicant identified a large number of infrequently accessed areas containing structures and components that are subject to an AMR. The staff finds the scope of the programs to be acceptable.

Preventive actions: There are no preventive or mitigative actions taken as part of this program, and the staff did not identify the need for such actions.

Parameters monitored or inspected: In Section B2.1.2 of each LRA, the applicant identified the following types of degradation or adverse conditions that can be detected by visual inspections:

- component leakage
- rust or corrosion products
- peeling, bubbling, or flaking coatings
- indications of chemical attack
- corroded fasteners
- cracking (of concrete, supports, equipment, sealants)
- bubbled, discolored, or cracked electrical insulation
- damaged or missing thermal insulation (focus on material integrity, not thermal
- performance)
- deformed or mispositioned piping and cable supports
- wastage due to boric acid leakage

In a letter dated May 22, 2002 (Serial No. 02-277), the applicant clarified that the above list of degraded or adverse conditions is a complete list of aging effects that will be managed by the infrequently accessed areas inspection activity. In the same letter, the applicant also explained that the cracking of concrete referenced under this AMP refers to the concrete associated with the applicable piping and equipment anchors that can potentially affect the intended function of the associated anchor. Because visual inspection can be used to identify each of the types of degradation and adverse conditions noted by the applicant, such inspections of structures and components in infrequently accessed areas are acceptable to the staff.

Detection of aging effects: The applicant states that visual inspection of the external condition of structures, supports, piping, and equipment will be used to detect the aging effect of loss of material. The applicant's response to RAI 3.5-1 states that the potential aging effects of loss of material, cracking, and change in material properties related to the concrete access shafts of the subsurface drainage system will be managed by the infrequently accessed area inspection activity. In addition, the applicant's response to RAI 3.5-7 states that they will credit the civil engineering structural inspection activity and the infrequently accessed area inspection activity, described in Sections B2.2.6 and B2.1.2 of each LRA, respectively, to manage the aging effects of loss of material, cracking and change in material properties of concrete.

The description of the infrequently accessed area inspection activities in Section B2.1.2 of each LRA only identifies "loss of material" under "scope" and "detection of aging effects." In the SER with open items issued in June 2002, the staff stated that to be consistent with the new commitments made in its response to RAIs 3.5-1 and 3.5-7, the applicant needed to clarify that the scope of the infrequently accessed area inspection activities would be revised to include management of the aging effects of loss of material, cracking and change in material properties of concrete. In its letter dated July 25, 2002, the applicant stated that the UFSAR Supplement Section 18.1.2, "Infrequently Accessed Area Inspection Activities" has been modified to include cracking and change in material properties as aging effects requiring management for concrete. Since the applicant has completed this action, the staff considers confirmatory action 3.3.4.2-1 closed.

The use of visual inspection of the external condition of infrequently accessed structures, supports, piping, and equipment is consistent with industry practices, and is considered by the staff, to be a reasonable means of detecting loss of material, cracking, and change in material properties before the loss of intended function.

Monitoring and trending: In Section B2.1.2 of each LRA, the applicant states that the monitoring of the structures, supports, piping, and equipment in infrequently accessed areas will be accomplished using the applicant's work control process, which is presented in Section B2.2.19 of each LRA, to perform one-time inspections. The applicant committed to conducting the inspections between year 30 and the end of the current operating license term and will document the results for evaluation and retention. If degradation is identified, it will be evaluated and corrected in accordance with the applicant's corrective action program. Trending is currently not part of this program and none is required by current industry practices for visual inspection activities in similar applications. The monitoring activities credited are controlled by the applicant's quality assurance program, are consistent with current industry practices and, therefore, are acceptable to the staff.

Acceptance criteria: In Section B2.1.2 of each LRA, the applicant states that the acceptance criterion for visual inspections is the absence of anomalous indications of degradation. Furthermore, responsibility for the evaluation of visual indications will be assigned to "Engineering." In a letter dated May 22, 2002 (Serial No. 02-277), the applicant explained that the qualifications of the personnel performing the inspections and evaluating the associated indications will be consistent with the applicable ASME Code qualifications for inspectors. Evaluations of indications of degradation found during these activities will determine whether analysis, repair, or further inspection will be required. Because the acceptance criterion is consistent with the degradation of concern and detectable by visual inspections, and will be performed by trained individuals, this approach is consistent with current industry practices and, therefore, the acceptance criterion is acceptable to the staff.

Operating experience: In Section B2.1.2 of each LRA, the applicant reports that in 1999, a visual inspection at North Anna found degraded supports in the auxiliary feedwater piping tunnel. The applicant cites the resultant corrective actions for the supports and the establishment of a surveillance activity for the auxiliary feedwater pipe tunnel as an example for demonstrating appropriate resolution of the observed degraded condition. This one-time inspection activity is a new program to be applied by the applicant. However, the elements of these inspections as discussed above are consistent with years of industry practice that has been effective in maintaining similar structures and components and, therefore, can reasonably be expected to be effective at maintaining the intended functions of the structures and components that are within the scope of this evaluation for the period of extended operation.

3.3.4.2.3 Conclusions

The staff has reviewed the information provided in Section B2.1.2 of each LRA and the summary description of the infrequently accessed area inspection activities in Section A2.1.2 of the UFSAR supplement. In addition, the staff considered the applicant's November 30, 2001, response to the staff's RAIs provided in a letter to the NRC dated November 30, 2001 and additional information provided in a letter dated May 22, 2002 (Serial No. 02-277). On the basis of this review and the above evaluation, the staff finds that the effect of aging associated with infrequently accessed structures and components will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation.

3.3.4.2.4 FSAR Supplement

The staff reviewed Section A2.1.2 of the UFSAR supplement and found that the description of the applicant's infrequently accessed areas inspection activities is consistent with Section B2.1.2 of each LRA. However, the applicant's response to RAI 3.5-1 states that the potential aging effects of loss of material, cracking, and change in material properties related to the concrete access shafts of the subsurface drainage system will be managed by the infrequently accessed area inspection activity. The applicant's response to RAI 3.5-7 states that it will credit the civil engineering structural inspection activity and the infrequently accessed area inspection activity, described in Sections B2.2.6 and B2.1.2 of each LRA, respectively, to manage the aging effects of loss of material, cracking, and change in material properties of concrete. The description of the infrequently accessed area inspection activities in Section B2.1.2 of each LRA only identifies loss of material as the aging effect to be managed by this aging management activity.

In the SER with open items issued in June 2002, the staff stated that to be consistent with the new commitments made In its response to RAIs 3.5-1 and 3.5-7, the applicant needed to clarify that the infrequently accessed area inspection activities would be revised to include management of these two additional aging effects (cracking and change in material properties). In its response to the RAIs, the applicant acknowledged that its responses would require changes to the UFSAR supplement and committed to submit these changes to the NRC staff in a future revision. In response to this concern, in its letter dated July 25, 2002, the applicant stated that the UFSAR Supplement Section 18.1.2, “Infrequently Accessed Area Inspection Activities,” has been modified to include cracking and change in material properties as aging effects requiring management for concrete.

Since the applicant has completed this action, the staff considers confirmatory action 3.3.4.2-1 closed.

3.3.4.3 Tank Inspection Activities

The applicant describes its tank inspection activities in Section B2.1.3 of each LRA. The applicant credits this inspection activity with managing the potential aging of in-scope tanks associated with various systems. In addition, the applicant provides a summary description of the tank inspection activities in Section A2.1.3 of the UFSAR supplement. The staff reviewed the applicant’s description of the program in Section B2.1.3 of each LRA to determine whether the applicant has demonstrated that it will adequately manage the applicable effects of aging during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.3.4.3.1 Summary of Technical Information in the Application

In Section B2.1.3 of each LRA, the applicant states that the purpose of the tank inspection activities is to perform inspections of above-ground and underground tanks to provide reasonable assurance that the tanks will perform their intended functions consistent with the current licensing basis throughout the period of extended operation. The tank inspections will be one-time inspections and will use a representative sampling of each type of tank. The applicant committed to perform the tank inspection activities between year 30 and the end of the current operating license term. The applicant will perform an engineering evaluation of the inspection results to determine the potential need for any subsequent inspections.

The applicant stated that it would implement the tank inspection activities for tanks located in the following systems that are subject to an AMR and credit this program at both NAS and SPS:

- alternate AC diesel generator system (diesel generator support systems)
- condensate (steam and power conversion systems)
- quench spray (engineered safety features)
- emergency diesel generator system (diesel generator support systems)
- feedwater (steam and power conversion systems)
- fire protection (fire protection and supporting systems)
- recirculation spray (engineered safety features)
- security (diesel generator support systems)

3.3.4.3.2 Staff Evaluation

The staff’s evaluation of the tank inspection activities focused on how the program manages aging effects through the effective incorporation of the following 10 elements: program scope, preventive or mitigative 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 indicates that the corrective actions, confirmation process, and administrative controls are part of the site-controlled quality assurance program. The staff's evaluation of these program attributes is provided separately in Section 3.3.2 of this SER. The remaining seven elements are discussed below.

Scope of program: Section B2.1.3 of each LRA identifies the following representative tanks to be inspected for the tank inspections activities:

- emergency diesel generator fuel oil tanks
- alternate AC diesel generator fuel oil tanks
- security diesel generator fuel oil tanks
- emergency diesel generator and alternate AC diesel generator starting air tanks
- emergency diesel generator and alternate AC diesel generator coolant tanks
- underground fuel oil storage tanks
- diesel-driven fire pump fuel oil storage tank
- refueling water storage tanks
- chemical addition tanks
- emergency condensate storage tanks
- casing cooling tanks (NAS only)
- service water pump house air receiver (NAS only)

The applicant states that the choice of representative tanks to be inspected will be dependent on the tank's material of construction, its contents, the foundation upon which the tank is based, and the type of coating. In addition, the applicant may select substitute tanks, that have the same construction, contents, and foundation/coatings as the in-scope tanks, but are more easily accessed. The applicant states that this substitution will occur only after an engineering evaluation to determine the appropriateness of inspecting the substitute tanks. The staff's evaluation of the scope of this program verified that the tank inspection activities will provide an adequate assessment of the different in-scope above-ground and underground tanks.

Preventive actions: There are no preventive or mitigative actions taken as part of this program, and the staff did not identify the need for such actions.

Parameters monitored or inspected: The applicant states that uncoated surfaces and surface coatings inside the selected tanks will be inspected. In addition, the external surfaces of tanks will be inspected as part of the tank inspection activities. This includes the external surfaces of tanks that are not easily accessible. Because visual inspection can be used to identify loss of material of the internal and external surfaces of tanks, inspection of the above ground and underground tanks that are within the scope of license renewal is acceptable to the staff.

Detection of aging effects: The applicant states that the internal and/or external surface conditions will be evaluated by visual examination to identify loss of material. In addition, volumetric examinations will be performed to determine the extent of wall thinning on tanks that are founded on soil or buried. The use of visual inspection of the internal and external surfaces of tanks is consistent with industry practices and is considered by the staff to be a reasonable means to detect loss of material before the loss of intended function.

Monitoring and trending: The applicant states that the inspection of tank surfaces will be accomplished using the applicant's work control process, which is presented in Section B2.2.19 of each LRA, to perform one-time inspections. The applicant committed to conducting the one-time inspections between year 30 and the end of the current operating license term and will document the results for evaluation and retention. If degradation is identified, it will be evaluated and corrected in accordance with the applicant's corrective action program. The extent of wall thinning will be characterized by nondestructive examination (NDE) and will be recorded on NDE reports and kept in the applicant's station records. In RAI B2.1.3-2, the staff requested clarification of the monitoring activities used by the tank inspection activities. In response, the applicant stated that future tank inspection activities, beyond the one-time inspections, will be based on an engineering evaluation of the results of the one-time inspections. In addition, these engineering evaluations of the one-time tank inspections will take place prior to beginning the period of extended operation. The monitoring activities used by the applicant are consistent with current industry practices, and, therefore, are acceptable to the staff.

Acceptance criteria: The applicant states that the acceptance criterion for visual tank inspections is the absence of anomalous indications of degradation. The acceptance criteria for volumetric inspections are based on minimum wall thickness requirements. Evaluations of indication of degradation found during the visual and volumetric examinations of the tanks will determine whether corrective action is required. The staff considers these acceptance criteria to be a reasonable benchmark for initiating corrective action.

Operating experience: The applicant states that indications of degradation that have been found during previous tank inspections have been evaluated to determine the acceptability of the observed condition or to develop a corrective action plan. In addition, operating experience from prior tank inspections and the corrective action activities that have been performed by the applicant, although limited in scope, indicates that there has been no significant loss of material from the base metal. In RAI B2.1.3-1, the staff requested further information regarding past tank inspections at North Anna and Surry. In response the applicant stated that periodic tank inspection is a new activity for North Anna and Surry and that only limited internal and external tank surfaces of selected tanks have been examined. The external surfaces of most above-ground tanks that are not readily accessible have not been previously inspected. Buried tanks have also not yet been inspected by the applicant. Internal visual inspection of condensate storage tanks, fire protection tanks (SPS 1/2 only), and underground fuel oil storage tanks have been performed by the applicant and "some deterioration of protective coatings has been found and corrected" by the applicant's corrective action program. The staff finds the description of the operating experience reasonable, and the tank inspection activities to be included as part of this aging management activity acceptable.

3.3.4.3.3 Conclusions

The staff has reviewed the information provided in Section B2.1.3 of each LRA and the summary description of the tank inspection activities in Section A2.1.3 of the UFSAR supplement. In addition, the staff considered the applicant's response to the staff's RAIs provided in a letter to the NRC dated November 30, 2001. On the basis of this review and the above evaluation, the staff finds the applicant has demonstrated that the effect of aging associated with the tanks, which are within the scope of this evaluation, will be adequately managed so that there is reasonable assurance that the intended functions will be maintained consistent with the CLB for the period of extended operation.

3.3.4.3.4 FSAR Supplement

The staff reviewed Section A2.1.3 of the UFSAR supplement and found that the description of the tank inspection activities is consistent with Section B2.1.3 of each LRA.

3.4 Reactor Coolant Systems

The North Anna and Surry include the following mechanical components within the reactor coolant systems that require an AMR:

- Westinghouse (W) designed primary coolant Class 1 piping and associated connections to other support systems (including the reactor coolant pumps and their motor oil collection system, and the neutron shield tank)
- reactor vessels (including the control rod drive mechanism housing, and the vessel head vent piping and fittings)
- reactor vessel internals
- pressurizers (including safety relief valves, and pressure relief tank)
- steam generators

Each reactor coolant system (RCS) consists of three primary piping loops (A, B, and C) interconnected at each reactor vessel. Each primary piping loop contains one reactor coolant pump, one steam generator, valves, and interconnecting piping. The pressurizer, connected to Loop C hot leg, provides a means for controlling the RCS pressure. The RCS also contains piping and components that allow venting of the reactor vessel and the pressurizer.

The neutron shield tank (NST) is located inside the primary shield wall around the reactor vessel. The tank provides support for the reactor vessel and limits heat transfer to the primary shield wall. The tank is cooled by the neutron shield tank cooling system.

Results from AMR of these components are described in Section 3.1, “Aging Management of Reactor Coolant System,” of both North Anna and Surry LRAs. During the review of these AMR results, the staff requested additional information to obtain clarification on certain AMR results from the applicant. In response to staff’s RAIs, the applicant provided additional information in several documented letters and telecommunication summaries as follows:

- summary of October 9, 11, and 15, 2001, telecommunication with Virginia Electric and Power Company
- summary of August 8, 9, 13, 27, and 28, 2001, telecommunication with Virginia Electric and Power Company
- applicant’s letter dated October 22, 2001, Serial No. 01-685
- applicant’s letter dated October 22, 2001, Serial No. 01-686
- applicant’s letter dated November 30, 2001, Serial No. 01-647

The applicant’s AMRs for the RCS components (i.e., Class 1 piping and associated components, reactor vessel internals, and pressurizers) are described in a series of Westinghouse Owners Group (WOG) topical reports. These reports are:

WCAP-14575-A	Aging Management Evaluation for Class 1 Piping and Associated Pressure Boundary Components

WCAP-14577, Rev. 1-A	License Renewal Evaluation: Aging Management for Reactor Internals
WCAP-14574-A	License Renewal Evaluation: Aging Management Evaluation for Pressurizers

The staff previously approved these Westinghouse topical reports, having determined that they presented adequate information to meet the requirements of 10 CFR 54.21(a)(3) for managing the aging effects on the RCS components.

An applicant may incorporate NRC-approved WOG topical reports by reference if the conditions of approval in the final safety evaluation report (FSER) of the specific report are met. In Section C4.0 of the LRAs, the applicant discussed the process used to evaluate the plant-specific RCS components against these topical reports. The applicant stated that the information in these topical reports was reviewed for applicability to the station and the AMR report was used to document the comparisons between the equipment, materials, fabrication techniques, installed configuration, modes of operation and environments evaluated in the topical report and those that exist for the plant. In the LRA Sections 3.1.1, 3.1.3, and 3.1.4, the applicant confirmed that it used the AMRs performed on the reactor coolant Class 1 piping and associated pressure boundary components, reactor vessel internals, and pressurizers, respectively. The applicant stated that the RCS components described in these topical reports bound the RCS components, with some clarifications, for both North Anna and Surry. Also, the applicant stated that Tables 3.1.1-W1, 3.1.3-W1, and 3.1.4-W1 in each LRA provide the reconciliation of the FSER applicant action items for these RCS components.

3.4.1 Reactor Coolant Piping and Associated Components

The RCS contains reactor coolant (RC) piping and associated connections to other systems. The RC piping subject to an AMR includes portions of the Class 1 RCS pressure boundary that are connected to the following components: the reactor vessel, the steam generators (primary side), the pressurizer, and the reactor coolant pump (RCP). Portions of other systems that are attached to the RC piping and that contain Class 1 components, include the chemical and volume control system (CVCS), high head/low head safety injection (HH/LHSI) systems, residual heat removal (RHR) system, reactor vessel level inventory system (RVLIS), and accumulator lines. Several components including nozzles and thermal sleeves, branch line restrictors, valves including power operated relief valves (PORV), and RCP thermal barriers and seals, are also included within the scope of the RC piping. In addition, vents, drains, and instrument lines attached to the RC piping contain Class 1 components. The RC piping also includes piping (e.g., fittings, branch connections, safe ends, and thermal sleeves), valve bodies (pressure-retaining parts of RCS isolation/boundary valves), bolted closures, and bolted connections.

The RC piping includes the RCP motor oil collection system components for North Anna. These components are included in the fire protection (FP) system for Surry.

3.4.1.1 Summary of Technical Information in the Application

The applicant described its AMR for the RC piping and associated components in LRA Section 3.1.1, “Reactor Coolant System,” as supplemented by RAI responses. The staff reviewed this section of the LRAs and the RAI responses to determine whether the applicant has demonstrated that the effects of aging on the Class 1 RC piping and associated components within the RCS will be adequately managed during the period of extended operation, as required by 10 CFR 54.21(a)(3).

The applicant confirmed that the RC piping and associated components for North Anna and Surry plants are bounded, with several clarifications, by the description of Class 1 piping contained in WCAP-14575-A, "Aging Management Evaluation for Class 1 Piping and Associated Pressure Boundary Components." The staff issued the FSER for WCAP-14575-A by letter dated November 8, 2000. The applicant's clarifications associated with this report include the following:

- The topical report assumes that the primary system chemistry control program does not manage loss of material or cracking from stress corrosion. However, the chemistry control program for primary systems at both plants manages these aging effects.

- The topical report considers wear due to relative motion or sliding as an aging effect that requires an AMR of limited number of RCS components. The applicant's aging management reviews indicated that wear in RC piping components at both plants will not result in such an aging effect requiring management.

- The topical report does not require aging management of flow restricting orifices. The LRA requires aging management of flow restricting orifices.

- The topical report specifically addressed Class 1 piping and associated pressure boundary components that support the operation of the RCS. However, the applicant claims that the AMR results presented in both LRAs consider Class 1, 2, and 3 components within the scope of the RC piping and associated components.

- The topical report states that Westinghouse had a policy of prohibiting the use of sensitized austenitic stainless steel and controlled the fabrication and installation process. Therefore, the topical report does not address stress corrosion cracking (SCC) of sensitized pipe. However, the pressurizer spray lines at Surry are sensitized and the aging effect associated with the spray lines are addressed in the AMR for the RCS.

The RC piping, pipe fittings, and associated components that are subject to an AMR have been designed to meet the requirements of USAS B31.1 Code (Surry) and USAS B31.7 Code (North Anna) for Pressure Piping or ASME Boiler and Pressure Vessel Code, Section III. The predominant material of construction for these components is stainless steel, including cast austenitic stainless steel (CASS), with carbon steel, low-alloy steel, and copper alloys used to a lesser extent. With the exception of the pressurizer spray line at Surry, there is no sensitized stainless steel in the RCS. Design considerations in the selection of materials for RC components, including small bore pipe, reduce the potential for SCC.

The RC system components that are within the scope of license renewal are internally exposed to different types of treated water (i.e., borated water, primary grade water, component cooling (CC) water, and distilled de-aerated water) and lubricating oil (motor coolers). The system is predominantly internally exposed to borated water at approximately 315.6 °C (600 of) and 15.41 MPa (2,235 psig). These components are located in the containment and the auxiliary building and are externally exposed to an air environment. External surfaces near pipe fitting connections (e.g., flange) may also be exposed to borated water leakage conditions.

The component cooling water system provides cooling water for the RCP motor's lower and upper bearing oil coolers, and the RCP motor's stator coolers. The lower bearing cooler is a coiled tube design. The tube outside is exposed to oil inside the oil reservoir and air outside of the reservoir, and the tube inside is exposed to treated water (component cooling). The upper bearing cooler is a tube and shell design. The tube side is exposed to treated water and the shell side to the lube oil. The stator cooler is a fin and tube design with treated water inside the tube and air on the outside of the tube.

The reactor vessel's level instrumentation system (RVLIS) is a stagnant system with bellows used to separate the primary reactor coolant from the treated water (i.e., distilled de-aerated water).

3.4.1.1.1 Aging Effects

In accordance with Table 3.1.1-1 of the LRAs, the applicant identified the following two intended functions for the RC piping and associated components, based on the requirements of 10 CFR 54.4(a):

- maintain the integrity of the reactor coolant pressure boundary
- limit flow due to a downstream break to a value less than the normal RCS makeup capability

This is consistent with the staff's FSER on the topical report, WCAP-14575-A.

The aging effects applicable to the RC piping and associated components requiring aging management are:

- cracking of stainless steel components (including CASS) in treated water or steam environments in case of components interfacing with the pressurizer steam space)
- cracking and loss of material from sensitized stainless steel components at Surry in a treated water environment
- cracking of copper alloy components in the air environment
- loss of material from carbon steel, low-alloy steel, and copper alloy components in treated water, air, lubricating oil, or steam environments
- loss of material from carbon steel, low-alloy steel, and copper alloy components in a borated water leakage environment
- reduction in fracture toughness of CASS pumps and valves in a high-temperature treated water or steam environment
- loss of pre-load of ASME Class 1 bolting in an air environment

3.4.1.1.2 Aging Management Programs

In the LRA Section 3.1.1, the applicant identifies the following AMPs for the RC piping and associated components:

- chemistry control program for primary systems
- boric acid corrosion surveillance
- general condition monitoring activities
- work control process
- augmented inspection activities
- ISI program - component and component support inspections

The applicant concludes that these programs would manage the effects of aging in such a way that the intended functions of the RC piping and associated components would be maintained consistent with the CLB under all design loading conditions for the period of extended operation.

In addition, the TLAAs associated with RC piping and associated components include:

- thermal fatigue of RC piping
- leak-before-break (LBB)
- RCP fatigue (Code Case N-481)

3.4.1.2 Staff Evaluation

The staff reviewed the information included in LRA Section 3.1.1, “Reactor Coolant System,” (including Tables 3.1.1-1 and 3.1.1-W1), the staff’s FSER on topical report WCAP-14575-A, and pertinent sections of LRA Appendices A and B, for both North Anna and Surry plants. The review was performed to verify 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 for the RC piping and associated components.

The applicant addressed all renewal application action items that are included in the FSER for WCAP-14575-A in each LRA Table 3.1.1-W1 for the North Anna and Surry stations. There are 10 action items in the staff’s FSER on WCAP-14575-A.

<u>Action Items from Previous Staff FSER for WCAP-14575-A</u>

From its review of this information, the staff finds that the applicant’s response to the 10 “Renewal Applicant Action Items” resolve the applicant action items in the FSER for WCAP-14575-A. The action items, applicant’s responses, and staff’s evaluations are provided in the following paragraphs.

- Item 1: The license renewal applicant is to verify that its plant is bounded by the technical report. Further, the renewal applicant is to commit to programs described as necessary in the technical report to manage the effects of aging during the period of extended operation on the functionality of the reactor coolant system piping. Applicants for license renewal will be responsible for describing any such commitments and identify how such commitments will be controlled. Any deviations from the aging management programs with this technical report described as necessary to manage the effects of aging during the period of extended operation and to maintain the functionality of the reactor coolant system piping and associated pressure boundary components or other information presented in the report, such as materials of construction, will have to be identified by the renewal applicant and evaluated on a plant-specific basis in accordance with 10 CFR 54.21(a)(3) and (c)(1).

Response: As discussed in Section 3.0 and associated tables, the ASME Class 1 piping and associated pressure boundary components are bounded by the topical report with regard to design criteria and features, materials of construction, fabrication techniques, installed configuration, mode of operation and environments/exposures. The programs necessary to manage the effects of aging are identified in Section 3.0. A detailed discussion of the aging management activities is provided in Appendix B. In Section 3.4.1.1 of this SER, the applicant clarifies several positions discussed in the topical report. Based on these considerations, the staff finds the applicant has verified that its plants are bounded by the topical report. Because the report allows for plant differences Therefore, the staff found the applicant's clarifications acceptable

- Item 2: Summary description of the programs and evaluation of Time-Limited Aging Analyses are to be provided in the license renewal FSAR supplement in accordance with 10 CFR 54.21(d).

  Response: A summary of the programs identified to manage the results of the effects of aging and the Time-Limited Aging Analyses evaluation results for ASME Class 1 piping, valves, and reactor coolant pumps are provided in the UFSAR supplement in Appendix A. The staff finds this response to be acceptable.

- Item 3: The renewal applicant should complete the updated review of generic communications and capture any additional items not identified by the original review.

  Response: A review of the generic communications related to the reactor coolant system has been completed. The aging management review of the reactor coolant system captures industry issues with no additional aging effects identified. The staff issued an RAI to further understand the review process used in evaluating the generic communications associated with RCS components. In response to RAI Item 3.1.1.2-1, the applicant stated that the following criteria were used to identify aging issues in generic communications relevant to the RCS components: (a) the issue is aging related (i.e., not a design deficiency or operational event), (b) the issue is applicable to in-scope RCS components, and (c) the issue involves a material/environment combination or aging mechanism/effect that was not already considered in the AMR for the RCS. The staff found the applicant's response to be acceptable.

- Item 4: Applications must provide a description of all insulation used on austenitic stainless steel Nuclear Steam Supply System piping to ensure the piping is not susceptible to stress-corrosion cracking from halogens.

  Response: Halogens are controlled by insulation specifications to minimize the potential for SCC. The insulation materials for the RC system meet the recommendations of Regulatory Guide 1.36, "Nonmetallic Thermal Insulation for Austenitic Stainless Steel." This ensures no adverse material interaction with the external surface of the RC system components. The staff finds this response to be acceptable.

- Item 5: The license renewal applicant should describe how each plant-specific AMP addresses the following 10 elements: (1) scope of the program, (2) preventive actions, (3) parameters monitored or inspected, (4) detection of aging effects, (5) monitoring and trending, (6) acceptance criteria, (7) corrective actions, (8) confirmation process, (9) administrative controls, and (10) operating experience.

  Response: Programs necessary to manage the effects of aging for Class 1 piping and reactor coolant pumps address the 10 elements identified. These programs are identified in Table 3.1.1-1, Reactor Coolant System, and described in Appendix B, Aging Management Activities. The staff finds this response to be acceptable. The staff's evaluation of the aging management programs is discussed in Section 3.3.1 and 3.3.4 of this SER.

- Item 6: The license renewal applicant should perform additional inspection of small-bore RC system piping, that is, less than 4-inch-size piping, for license renewal to provide assurance that potential cracking of small-bore piping is adequately managed during the period of extended operation.

  Response: In general, SCC (including primary water SCC) in the RC system is managed by proper material selection for the system environment, and by controlling the chemical properties of the environment. This latter activity is identified as the chemistry control for primary systems program, which is supplemented by the work control process.

  The applicant is implementing a risk-informed inservice inspection (RI-ISI) program at Surry and North Anna as part of the ASME Section XI ISI Program. Volumetric examinations of small-bore piping would be added to the scope of ISI based upon risk significance and probability of failure. At this time, no small-bore butt or socket welds have been designated as high safety significance and no volumetric inspections of Class 1 small-bore pipe are planned.

  However, volumetric examinations are being performed on Surry 1 on a sample population of welds in several 3-inch lines in safety injection and chemical and volume control systems. These are Class 2 lines, but are used as leading indicators for small-bore piping conditions in Class 1 systems. The staff issued an RAI to further understand how these Class 2 lines bound the Class 1 lines within the scope of the license renewal. In response to the RAI Item 3.1.1.2-2, the applicant further reviewed the inspections being performed as part of the risk-informed inservice inspection programs and has determined that volumetric examinations of Class 2 small bore piping welds have limited value in managing aging for in-scope Class 1 small bore piping.

  The applicant actively participates in the EPRI sponsored Materials Reliability Project (MRP) Industry Task Group (ITG) on thermal fatigue. In addition, as indicated in Appendix B4.0, Licensee Follow-up Actions, of the LRAs, the applicant has committed to following all on-going industry activities related to failure mechanisms for small-bore piping and will evaluate changes to inspection activities based on industry recommendations. Changes will be made to the activities contained in the ISI program - component and component support inspections, as appropriate, based on industry recommendations. Based on the above considerations, the staff found the applicant's approach for aging management of small bore piping to be acceptable because ISI programs and changes to ISI programs are subject to the NRC review and approval prior to implementation.

- Item 7: Components that have delta ferrite levels below the susceptibility screening criteria have adequate fracture toughness and do not require supplemental inspection. As a result of thermal embrittlement, components that have delta ferrite level exceeding the screening criterion may not have adequate fracture toughness and do require additional evaluation or examination. The license renewal applicant should address thermal-aging issues in accordance with the staff's comments in Section 3.3.3 of this evaluation.

  Response: Reduction in fracture toughness is identified as an aging effect related to thermal aging. ASME Class 1 piping, valves and reactor coolant pumps have been evaluated for reduction in fracture toughness and the results are presented in Section 3.1.1, Reactor Coolant System. The staff finds this to be acceptable.

- Item 8: The license renewal applicant should perform additional fatigue evaluation or propose an AMP to address the components labeled I-M and I-RA in Tables 3-2 through 3-16 of WCAP-14575.

  Response: The applicant has established an Aging Management Activity (AMA), performed a plant-specific fatigue evaluation, or a USAS B31.7 (North Anna) or a USAS B31.1 (Surry) evaluation for the applicable components labeled I-M and I-RA in Tables 3-2 through 3-16 of WCAP-14575.

  The B31.1 piping and plant-specific metal fatigue evaluation results are provided in Section 4.0, Time-Limited Aging Analyses, of the LRAs.

  A combination of the aging management review results for the Pressurizer (Section 3.1.4), Reactor Pressure Vessel (Section 3.1.2), Steam Generator (Section 3.1.5), Reactor Coolant System (3.1.1), the Primary Process Systems (Section 3.3.1) and the Engineered Safety Features (Section 3.2) addresses the various aging management activities (AMAs) related to the components labeled I-M and I-RA in Tables 3-2 through 3-16 of WCAP-14575.

  In response to staff's RAI 4.3-4, the applicant stated that the components labeled I-M and I-RA in WCAP-14575, Tables 3-2 through 3-16 are all piping components such as elbows, nozzles, straight pipes etc., which are Class 1 piping and associated pressure boundary components. These components are analyzed in accordance with the requirements of ANSI B31.7 for North Anna and ANSI B31.1 for Surry, satisfying appropriate Code limits. The staff found the applicant's fatigue evaluation of the subject components to be acceptable because the fatigue limits meet the applicable construction codes.

- Item 9: The staff recommendation for the closure of GSI-190, "Fatigue Evaluation of Metal Components for 60-Year Plant Life" is contained in a December 26, 1999, memorandum from Ashok Thadani to William Travers. The license renewal applicant should address the effects of the coolant environment on component fatigue life as aging management programs are formulated in support of license renewal. The evaluation of a sample of components with high-fatigue usage factors using the latest available environmental fatigue data is an acceptable method to address the effects of the coolant environment on component fatigue life.

Response: Section 4.3.4 of the LRAs, "Environmentally Assisted Fatigue," presents the results of the plant-specific evaluation of ASME Class 1 components with regard to environmental effects on fatigue. The surge line nozzle connection at the reactor coolant system's hot leg pipe is the leading indicator for reactor water environmental effects. As indicated in Table 3.1.1-1, Reactor Coolant System, an augmented inspection activity has been specifically developed to inspect for cracking of the pressurizer surge line weld at the RC system hot leg pipe connection. The development of these augmented inspection activities is identified as a licensee followup action, as described in Section B4.0 of the LRAs.

In response to staff's RAIs 4.3-5 through 7, the applicant stated that based on the plant-specific environmental fatigue evaluation the pressurizer sub-components have acceptable CUF values, with the exception of the surge nozzle, spray nozzle, lower head heater well, upper head shell, and instrument nozzle. The applicant will inspect the pressurizer surge line weld at the hot leg pipe connection as an augmented inspection program item, so that flaw initiation and growth can be detected and/or monitored. The results of these inspections and the results of planned research by the EPRI Materials Reliability Program (MRP) will be utilized to assess the appropriate approach for addressing environmentally-assisted fatigue of the surge lines. Should the applicant decide to manage environmentally-assisted fatigue by an AMP during the period of extended operation, inspection details will be provided to the staff for review. The staff finds this response to be acceptable.

- Item 10: The license renewal applicant should revise AMP-3.6 to include an assessment of the margin on loads in conformance with the staff guidance provided in Reference 11. In addition, AMP-3.6 should be revised to indicate if the CASS component is repaired or replaced per ASME Code, Section XI IWB-4000 or IWB-7000, a new LBB analysis based on the material properties of the repaired or replaced component (and accounting for its thermal aging through the period of extended operation, as appropriate), is required to confirm the applicability of LBB. The inservice examination/flaw evaluation option is, per the basis on which the NRC staff has approved LBB in the past, insufficient to reestablish LBB approval.

  Response: If ASME Class 1 cast austenitic stainless steel components are repaired or replaced, the applicant design control procedures would evaluate the existing LBB analysis based on replacement material properties. The staff finds this response to be acceptable.

3.4.1.2.1 Aging Effects

The material of construction for the RC piping and associated components subject to an AMR is stainless steel, including cast austenitic stainless steel (CASS) for pipe fittings, pump casings, and valve bodies. Carbon steel and low alloy steel are used for bolting, RCP motor's upper bearing coolers. The copper alloys are used in the RCP motor bearing and stator coolers. Most RC piping and associated components are exposed to primary treated water and air.

Some specific components are exposed to lubricating oil, steam, or borated water. In accordance to Table 3.1.1-1 of the LRAs, the aging effects requiring aging management for RC piping and associated components are:

- cracking
- loss of material
- reduction in fracture toughness
- loss of pre-load

The fatigue-sensitive piping and pipe fittings, valve bodies larger than 4-inch nominal pipe size, and the RCP pressure boundary closure components are susceptible to fatigue-related cracking. Since austenitic stainless steel is not susceptible to corrosion and stress corrosion in pressurized water reactor primary coolant, cracking due to corrosion/stress corrosion is not a concern for primary loop components excluding dissimilar metal. The applicant states that the insulation materials for the RC system meets the recommendations of Regulatory Guide 1.36 and therefore, no adverse material interaction with the external surface of the RC system components will cause stress corrosion cracking from halogens. The pressurizer spray lines at Surry are sensitized and therefore, these lines are susceptible to intergranular stress corrosion cracking (IGSCC).

Loss of material due to erosion in RC piping and associated components is not considered significant because of the design and operational characteristics of the system. However, loss of material due to erosion/corrosion, specifically due to boric acid exposure to external surfaces near leaky bolted connection, is an aging effect requiring aging management.

Irradiation embrittlement is not a concern for the RC piping and associated components because the expected neutron fluence is much less than the threshold level at which changes in properties of the material would occur. However, thermal aging of CASS components are susceptible to reduction in fracture toughness. The reduction in fracture toughness causes a reduction in the critical flaw size for the component. In accordance with Table 3.1.1-1 of the LRAs, the applicant states that loss of fracture toughness due to thermal embrittlement of the CASS pipe and elbows is not an aging effect requiring management because the results of the Leak-Before-Break (LBB) TLAA in Section 4.7.3 of the LRAs demonstrated that there was a large margin between detectable flaw size and flaw instability.

Loss of preload due to stress relaxation is an aging effect applicable to RCP and valve bolted closures. The applicant states that wear in RC piping and associated components at both stations will not result in such an aging effect requiring management. However, the topical report considers wear due to relative motion or sliding as an applicable aging effect for bolted connections. The staff issued an RAI to obtain clarification from the applicant. In response to RAI Item 3.1.1.2.1-1, the applicant stated that although North Anna and Surry have no operating history of “wear” in the areas of concern, the loss of material in the in-scope RC piping and associated components is considered as an applicable aging effect.

Based on these considerations, the staff finds the aging effects identified by the applicant for the RC piping and associated components to be consistent with the topical report.

3.4.1.2.2 Aging Management Programs

The staff evaluation of the applicant's AMPs focused on the program elements rather than details of specific plant procedures. The staff's approach to evaluating each program and activity used to manage the applicable aging effects is described in Section 3.3 of this SER.

The AMPs that apply to the Class 1 RC piping and associated components include the following:

- chemistry control program for primary systems
- boric acid corrosion surveillance
- general condition monitoring activities
- work control process
- augmented inspection activities
- ISI program - component and component support inspections

The staff's review of these AMPs that apply to the RC piping and associated components may be found in Section 3.3 of this SER. In addition, the TLAAs associated with RC piping and associated components include the following:

- thermal fatigue of RC piping
- leak-before-break
- RCP fatigue crack growth (Code Case N-481)

The staff's review of TLAAs that apply to the RC piping and associated components may be found in Section 4.0 of this SER.

In Table 3.1.1-1 of the LRA, the applicant listed all RC piping and associated components within the scope of license renewal with their intended functions, material groups, and both internal and external environments. Also, the table identified their aging effects requiring management and the plant-specific AMPs required to manage these aging effects during the period of extended operation. The applicant states that the applicable aging effects on RC piping and associated components will be adequately managed by the plant-specific AMPs identified in this table during the period of extended operation.

The chemistry control program for primary systems provides water quality that is compatible with the materials of construction in the RC piping and associated components in order to minimize loss of material and cracking. This program is developed based on the plant technical specification requirements and on EPRI guidelines, which reflects industry experience.

The boric acid corrosion surveillance program was developed in response to Generic Letter 88-05. Inspections are performed to provide reasonable assurance that borated water leakage from the reactor coolant pressure boundary does not lead to undetected loss of material on the external surface of RC piping and associated components, specifically those made out of carbon steel or copper. The boric acid corrosion surveillance program is discussed in detail in Section 3.3.1.3 of this SER.

The inservice inspection (ISI) program - component and component support inspections manages aging effects of loss of material, cracking, gross indications of loss of pre-load, and gross indication of reduction in fracture toughness. The scope of the ISI program for Class 1 and Class 2 components complies with the provisions of ASME Section XI, Subsections IWB and IWC. Examination categories applicable to Class 1 and Class 2 RC piping and associated components are B-F for dissimilar metal welds, B-G-1 and B-G-2 for bolting, B-J for similar metal welds, B-L-1 and B-L-2 for pump casings, B-M-1 and B-M-2 for valve bodies, B-P for all pressure retaining components, and C-F-2 for welds in carbon steel or low alloy steel piping. Depending on the examination category, the methods of inspections may include visual, surface and/or volumetric examination of weld locations susceptible to aging degradation. In response to RAI Item 3.1.1.2.2-1, the in-scope Class 2 components operate in less than 140 of and hence, cracking in these components due to SCC is not an applicable aging effect.

Surry has implemented the risk-informed inservice inspection (RI-ISI) program for examination category B-J and B-F welds in piping. Unit 1 has included all Class 1, 2, 3 and non-class systems, while Unit 2 has included Class 1 systems only. North Anna will implement the RI-ISI program for the Class 1 systems only.

Surface examinations for Class 1 piping less than 4-inch nominal pipe size (NPS) are performed as part of the ASME Section XI ISI program. Volumetric examinations of these small-bore pipes would be added to the scope of RI-ISI based on risk significance and probability of failure. At this time, no small-bore piping butt welds or socket welds have been designated high safety significance, and no volumetric inspections of Class 1 piping are planned. However, in accordance with Table B4.0-1 on licensee follow-on actions, Surry 1 is planning to perform volumetric examinations on a sample population of welds in several 3-inch lines in the safety injection and chemical volume and control systems. These are Class 2 lines, but are used as leading indicators for small-bore piping conditions in Class 1 systems. The staff issued an RAI to further understand how these Class 2 lines bound the Class 1 lines within the scope of the license renewal. In response to the RAI Item 3.1.1.2-2, the applicant further reviewed the inspections being performed as part of the risk-informed inservice inspection programs and has determined that volumetric examinations of Class 2 small bore piping welds have limited value in managing aging for in-scope Class 1 small bore piping.

The applicant participates in the EPRI's Materials Reliability Project Industry Task Group on thermal fatigue which is currently developing guidance for the management of fatigue caused by cyclic thermal stratification and environmental effects. The applicant is committed to following industry activities related to failure mechanisms for small-bore piping and will evaluate changes to inspection activities based on industry recommendations.

General condition monitoring activities are performed for the assessment and management of aging for components that are located in normally accessible areas. This program manages the aging effects of loss of material, change in material properties, and cracking. These activities are performed in three different ways: inspections of radiologically controlled areas once a week, periodic inspection and walkdown inspections during normal and refueling outages, and periodic inspections of supports and doors. As a licensee followup action (Table B4.0-1), additional procedures will be developed to inspect component supports and doors.

The objective of augmented inspection activities is to perform examinations of selected components and supports in accordance with requirements identified in the plant technical specifications, UFSAR, licensee commitments, industry operating experience, and good practices for the plant. These activities are outside the scope of ASME Section XI requirements. The Class 1 and Class 2 sensitized stainless steel circumferential and longitudinal welds, branch connections, and socket welds are subject to both surface and volumetric examinations during each refueling outage for Surry where sensitized materials are used in the pressurizer spray lines.

On the basis of the evaluations of the AMPs identified above, the staff concludes that the aforementioned AMPs are acceptable for managing the pertinent aging effects and providing assurance that the intended function of the RC Class 1 piping and associated components will be maintained consistent with the CLB throughout the period of extended operation.

The RCS primary loop piping and balance-of-plant piping at Surry, except the pressurizer surge lines, are analyzed to the requirements of ANSI B31.1. The RCS pressure boundary piping and loop stop valves for North Anna are analyzed to the requirements of ANSI B31.7 (i.e., equivalent to ASME Section III, Class1), while the balance-of-plant piping is analyzed to the requirements of ANSI B31.1 which is equivalent to the requirements of ANSI B31.7, Class 2 and Class 3 rules. The pressurizer surge lines have been analyzed to the requirements of ASME Section III for Class 1 components. Design requirements in ANSI B31.1 use a stress range reduction factor to provide conservatism in the piping design to account for fatigue due to thermal cycle operation. The hot and cold leg sample lines at Surry, as determined to be the limiting case, have been found to experience approximately 3,120 cycles, significantly fewer than 7,000 cycles up to which the stress range reduction factor is 1.0. These lines at North Anna are qualified for 22,000 cycles, including stress range reduction factors. The total cycles expected to be experienced by the sample lines will be less than 9,000 cycles for a 60-year period.

To account for the environmental effects, the applicant states that only the surge line piping requires further evaluation for the period of extended operation. However, in lieu of additional analyses to refine the cumulative usage factor for the pressurizer surge line, the applicant selected aging management to address the surge line fatigue during the period of extended operation. The surge line weld at the hot leg pipe connection is chosen to be included in an augmented inspection program, so that flaw initiation and growth can be detected and/or monitored. In addition, the applicant will evaluate the results of the Materials Reliability Program (MRP) by the EPRI to adjust the technique, frequency and number of locations to be inspected during the period of extended operation. This provides reasonable assurance that the cracking due to thermal fatigue for the RC piping will be managed such that components within the scope of license renewal will perform their intended functions during the period of extended operation.

The objective of the leak-before-break (LBB) analysis is to determine whether a postulated crack causing a leak, will grow to become unstable and lead to a full circumferential break when subjected to the worst possible combinations of plant loading. The detailed evaluation showed that the RC piping are not subject to such unstable conditions under the worst combination of plant loading. To maintain the LBB design basis for the plant, the LBB evaluation using design transient cycles has been performed for a 60-year plant life. The new analysis considered the effect of thermal aging of CASS and concluded that the design is bounded by the generic Westinghouse analyses. Since the design transients and cycles are applicable to 60 years of operation, the LBB analysis is considered valid for the period of extended operation.

ASME Code Case N-481 provides an alternative to the ASME Section XI inservice inspection requirement of the RCP casing welds. The code case allows the replacement of volumetric examination of RCP casing with a fracture mechanics-based integrity evaluation supplemented by specific visual examinations. Based on the Westinghouse analysis on the RCP casing integrity, the applicant states that the provisions of Code Case N-481 are satisfied for 60-year service.

During normal operation, the RCP flywheel possesses sufficient kinetic energy to potentially produce high-energy missiles in the unlikely event of failure. The aging effect of concern is fatigue crack initiation in the flywheel. An evaluation of a failure over the period of extended operation demonstrates that the flywheel has a high structural integrity with a very high flaw tolerance and negligible flaw crack growth over a 60-year service life.

3.4.1.3 Conclusions

The staff has reviewed the information included in Section 3.1.1 of the LRAs, as supplemented by the RAI responses, and other pertinent sections of the LRAs. On the basis of this review, the staff concludes that the applicant has demonstrated that the effects of aging associated with the Class 1 RC piping and associated components will be adequately managed so that there is reasonable assurance that these components will perform their intended functions consistent with the CLB throughout the period of extended operation.

3.4.2 Reactor Vessels

The four reactor vessels (RVs) at the two plants, North Anna and Surry, are characterized as standard Westinghouse 399 cm (157-inch) ID three-loop vessels. Each RV is a cylindrical shell with a welded, hemispherical lower head and a flanged hemispherical upper head. The North Anna reactor vessel shells are constructed of forged rings welded together circumferentially, whereas the Surry shells are of welded plate segments. The hot-leg and cold-leg reactor coolant piping for each of the three loops is welded to the primary nozzles that have stainless steel safe ends. The internal surfaces of the vessels are clad with stainless steel to protect the carbon steel vessel from corrosion by the borated reactor coolant. As stated in Section 3.1.2 of the LRAs, a few RV components made from carbon or low-alloy steel are clad with a weld overlay of stainless steel with the exception of selected locations that are clad with high-nickel alloys. The RV provides structural support for the reactor core and a pressure boundary for the reactor coolant in which the core is submerged. The core support ledge, located inside the vessel just below the vessel flange, supports the weight of the reactor vessel internals and the fuel core. The lower internals assembly hangs from the core support ledge and is provided with lateral support by core support lugs.

The RV is vertically mounted on welded support pads attached to the bottom of the primary nozzles, which are located below the vessel flange. The weight of the vessel is transmitted through the nozzle support pads to the neutron shield tank that surrounds the vessel. The reactor vessel closure head dome is penetrated by the control rod drive mechanism (CRDM) housing and a vent pipe. The lower head has penetrations (instrumentation tubes), for movable in-core nuclear flux thimble tubes, which extend into the reactor vessel interior and mate with the lower internal assembly.

The vessel flange and closure head flange are joined by fifty-eight 15.24 cm (6 inch) studs, nuts, and spherical washers. Two concentric, hollow, metallic O-rings between the closure head flange and the vessel flange form an inner and outer seal. A dynamic seal is formed when the closure head is bolted in place and by the internal pressure in the RV.

3.4.2.1 Summary of Technical Information in the Application

The applicant described its AMR of the RVs in LRA Section 3.1.2, "Reactor Vessel," as supplemented by RAI responses. The staff reviewed this section of the LRAs and the RAI responses to determine whether the applicant has demonstrated that the effects of aging on the RVs in the RCS will be adequately managed during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Table 3.1.2-1 of the LRAs listed 23 subcomponents of the RV that are subject to aging management review. They include shell components, nozzles, vessel penetrations such as the CRDM housing and instrumentation tubes. OF these subcomponents, 20 perform a passive pressure boundary intended function, while the remaining three provide passive intended functions for structural and/or functional support for in-scope equipment. The table specifies the component material, its service environment, the aging effect requiring management, and the relevant aging management activity.

3.4.2.1.1 Aging Effects

Table 3.1.2-1 of the LRAs lists the service environments that may cause aging degradation. They include external RV environments (air and borated water from leaks) and an internal environment (treated water). For stainless steel and nickel-based alloys, air acting on external surfaces was not considered to cause any aging effect and no aging management activities were specified for this environment. On the other hand the RV shell was cited as a subcomponent that was susceptible to a reduction in fracture toughness as a result of radiation. External attack of RV subcomponents made from carbon and low-alloy steel may cause loss of material due to corrosion by borated water leakage.

For RV internal environments, Table 3.1.2-1 specifies that stainless steel and nickel-based alloys are susceptible to cracking and loss of material in treated water and treated water/steam environments. Cast austenitic stainless steel (CASS) is also stated to be susceptible to a reduction in fracture toughness during exposure to treated water.

In Section B1.2 of the LRA, the applicant states that industry operating experience was used to identify aging effects and mechanisms that could challenge the intended functions of systems and structures within the scope of license renewal. These included in-house review of deviation reports in electronic data bases at the North Anna and Surry stations. The data bases included the time period between 1990 and mid 1999 and included about 50,000 deviation reports. In addition, the applicant reviewed and dispositioned industry operating experiences reported in NRC Information Notices, INPO reports, and manufacturing bulletins in order to include corrective actions in the aging management activities (AMAs) of the plants. From these activities, the applicant has identified in Section 3.1.2 of the LRAs the following aging effects for RV subcomponents that require management:

- cracking of stainless steel (including CASS), carbon steel, low-alloy steel, and nickel-based alloy subcomponents in treated water or air environments
- loss of material from stainless steel (including CASS) and nickel-based alloy subcomponents in a treated water environment
- loss of material from carbon steel and low-alloy steel subcomponents in a borated water leakage environment
- loss of preload of ASME Class 1 closure studs in an air environment
- reduction of fracture toughness of CASS subcomponents in a high-temperature treated water environment
- reduction of fracture toughness of carbon steel and low-alloy steel subcomponents in an air environment

3.4.2.1.2 Aging Management Programs

In Section 3.1.2 of the LRA, the applicant listed the following AMPs that will manage the aging effects for the RV components:

- chemistry control program for primary systems
- boric acid surveillance
- ISI program - reactor vessel
- reactor vessel integrity management

Appendix B of the LRAs provides a description of how these AMPs will be used to adequately manage the aging effects associated with the RV components so that there is reasonable assurance that their intended functions will be maintained consistent with the CLB during the period of extended operation.

In addition to the AMPs, Section 3.1.2 of the LRA identifies six TLAAs associated with RV subcomponents. These include the following:

- fatigue
- tensioning and detensioning of studs
- pressurized thermal shock
- upper shelf energy
- pressure-temperature limits
- reactor vessel underclad cracking

A description of these TLAAs is given in Section 4.0 of the LRAs.

3.4.2.2 Staff Evaluation

The staff reviewed the information included in the LRA Section 3.1.2 (including Table 3.1.2-1), the RAI responses by the applicant, and pertinent sections of LRA Appendices A and B, regarding the applicant's demonstration 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 for the RVs.

The applicant has identified two intended functions applicable to the RVs. They include reactor coolant pressure boundary and structural support function for the reactor core. The staff finds that the applicant has appropriately identified these two intended functions for the RVs.

3.4.2.2.1 Aging Effects

Section 3.1.2 of the LRAs defines the environmental conditions that are responsible for aging effects. The LRA states that the internal surfaces of the RV are wetted by treated water (borated water) at an operating pressure of 15.41 MPa gage (2,235 psig). The maximum operating temperature for reactor coolant water at North Anna is 327.3 °C (621.2 of). For Surry, it is 318.7 °C (605.6 of). Table 3.0-2 of the LRAs states that RV subcomponents exposed to sheltered air experience operating temperature between 0-48.9 °C (32-120 of), and those exposed to containment air have operating temperatures between 47.8-51.7 °C (75-125 of). External surfaces may also be exposed to borated water leakage conditions. The LRAs also state that the RV subcomponents are also exposed to different levels of high-energy neutron irradiation, with the RV beltline region having the most limiting (highest) exposure.

In Section B1.2, of the LRAs, the applicant stated that industry operating experience was used to identify aging effects and mechanisms that could challenge the intended functions of systems and structures within the scope of license renewal. The applicant also used the plant-specific deviation reports, NRC information notices, industry reports and manufacturing bulletins to determine the aging effects applicable to RV components. From these activities, the applicant has identified in Section 3.1.2 of the LRAs the following aging effects applicable to RV subcomponents that require management:

- cracking
- loss of material
- loss of preload
- reduction in fracture toughness

With respect to cracking, the RV and its subcomponents may be subject to this aging effect from fatigue or primary water stress corrosion cracking (PWSCC). Fatigue may be caused by large cyclic changes in stress as a result of thermal transients during service. PWSCC in stainless steels may be initiated by off-normal chemistry of the primary coolant together with the presence of tensile stresses in the reactor vessel. Loss of material may occur in all types of material as a result of coolant action at elevated temperature. However, more severe loss of material occurs in carbon and low-alloy steel components if leaking primary coolant forms concentrated boric acid which can attack external surfaces which are exposed to air. Bolting is susceptible to loss of preload if they and/or washers undergo stress relaxation at elevated service temperatures. This, in turn, could lead to coolant leakage past seals between bolted surfaces. Long-term service at elevated temperature may cause loss in fracture toughness of CASS components, and neutron irradiation will also cause losses in fracture toughness of RV components. OF particular concern is the RV itself because of its role in maintaining reactor coolant levels around the core and core internals.

NRC Bulletin No. 88-09 and Information Notice No. 87-44 revealed that flow-induced vibration wear (i.e., thinning) of the thimble tubes resulted in degradation of the RCS pressure boundary and could lead to a potentially non-isolable leak of reactor coolant. The amount of vibration the thimble tubes experience is determined by plant-specific factors such as the gap distance from the lower core plate to the fuel assembly instrument tube, the amount of clearance between the thimble tube and the guide or instrument tube, the axial component of the local fluid velocity, the thickness of the thimble tube, and the moment of inertia of the thimble tube. The staff concluded in the bulletin that the only effective method for determining thimble tube integrity is through plant-specific inspections and periodic monitoring. The staff issued an RAI to obtain clarification from the applicant. In response to RAI Item 3.1.3.2-1, the applicant stated that the loss of material due to wear in thimble tubes is managed by the ISI program - reactor vessel.

On the basis of the description of the RV internal and external environments, materials used in the fabrication of various RV components, the operating experience at North Anna and Surry plants, and the applicant's survey of industry and plant-specific experience, the staff concludes that the applicant has identified the aging effects that are applicable for the RVs.

3.4.2.2.2 Aging Management Programs

The staff evaluation of the applicant's AMPs focused on the program elements rather than details of specific plant procedures. The staff's approach to evaluating each program and activity used to manage the applicable aging effects is described in Section 3.3 of this SER.

In Table 3.1.2-1 of the LRAs, the applicant listed the AMPs that will manage the aging effects associated with the RV subcomponents. They include:

- chemistry control program for primary systems
- boric acid surveillance
- ISI program - reactor vessel
- reactor vessel integrity management

The chemistry control program for primary systems is a set of mitigative activities utilized to maintain water chemistry that is compatible with the materials used in the construction of the reactor vessel and its subcomponents. This program is applicable to subcomponents made from stainless steel, CASS, and nickel-based alloys that are subject to cracking and/or loss of material while exposed to treated water. This AMP is designed to minimize corrosive attack of RV subcomponents by reducing the concentrations of impurities in the primary coolant to within specified levels. This has the added effect on reducing the electrical conductivity of the coolant which also inhibits the electrochemical corrosion processes. The staff's evaluation of this AMP is discussed in Section 3.3.1.4 of this SER. Based on the operating experience, the applicant confirms that there has been no significant degradation in the ability of RV subcomponents to perform their intended functions due to chemistry concerns.

The boric acid corrosion surveillance program was developed in response to Generic Letter 88-05. The program is applicable to carbon and low-alloy steel subcomponents exposed to borated water leakage. The aging effect is loss of material. This program carries out non-destructive examination of the external surfaces of RV subcomponents to check for locations where primary coolant is leaking. Nuts, bolts, and washers are made from carbon or low-alloy steel are susceptible to this type of attack when the leaking coolant concentrates on their surfaces where air is also present. The external surface, visual inspections are performed inside the containment to determine the presence of borated water leakage, which could lead to surface degradation of RV components, specifically near the closure studs, nuts, washers, and the refueling seal ledge. Based on the operating experience, the applicant states that significant borated water leakage has not occurred in the RV components at both stations. However, inspection activities have located minor leakage in certain components and the applicant has repaired leaks that have occurred. The boric acid corrosion surveillance program is discussed in detail in Section 3.3.1.3 of this SER.

The reactor vessel ISI program is applicable to a large number of RV subcomponents made from carbon and low alloy steel, stainless steel, CASS, and nickel-based alloys that are exposed to treated water, air, and borated water. The aging effects for carbon and low-alloy steel subcomponents are cracking and loss of preload in an external air environment. For stainless steel, CASS, and nickel-based alloys, the aging effects are dominated by cracking, with an added aging effect for CASS which is a reduction in fracture toughness. In this program, ASME Section XI inspections are conducted to check for cracking or loss of material. Visual, surface, and volumetric examinations are included for the specific RV subcomponents. This program assures the pressure retaining capability of the RV welds; the studs, nuts, and washers that are used for vessel closure; the surface and attachments on the interior of the vessel; the housings and housing tubes for control rod drive mechanism on the upper head; the incore flux thimbles and guide tubes that penetrate the lower head; and the seal table and fittings. Among the vessel welds included in the scope of license renewal are the head-to-flange weld, the shell-to-flange weld, the nozzle welds, the circumferential and longitudinal (for Surry only) vessel welds, and integrally-welded attachments. The staff's evaluation of this AMP is discussed in Section 3.3.1.13 of this SER. This AMP identifies two additional inspections that are included in the augmented inspection activities in Section B2.2.1 of the LRAs. They are basically enhanced ASME Section XI inspections and include the incore flux thimble tubes in the RV bottom and the control rod drive housings on the upper head.

Since the thimble tubes at Surry are double wall structures, wall thinning is not considered a potential aging effect and therefore, these tubes are examined every other refueling outage. On the other hand, North Anna incore flux thimble tubes are of single-wall construction and hence are examined each refueling outage. The applicant states that as part of this inspection, eddy current examinations of the incore flux thimble tubes are performed to check wall thickness.

In accordance with Generic Letter 97-01, the weld between the CRDM nozzle and the reactor vessel head, and the portion of the nozzle inside the reactor vessel head above the nozzle-to-vessel are susceptible to PWSCC. The staff concluded that if cracks occurred at the vessel head penetrations (VHPs), the cracks would be predominantly axial, the cracks would result in detectable leakage before catastrophic failure, and the leakage would be detected during visual examinations before significant damage to the RV closure head would occur. In addition, circumferential intergranular attack (IGA) associated with the weld between the inner surface of the RV closure head and the CRDM penetration in one of the CRDM penetrations was discovered in a foreign reactor. Westinghouse suggested that all plants control sulfur content in the primary water in order to mitigate this aging effect. During the spring 1996 refueling outage, North Anna inspected some high-stress areas on each outer ring of CRDM penetration of its Unit 1 reactor using eddy current testing and found no indications.

In accordance with the GL 97-01, as part of the augmented inspection activities in Section B2.2.1 of the LRAs, the applicant is committed to perform VT-2 visual inspection of the RV upper head region during every refueling outage for evidence of leakage at mechanical closures. In response to RAI Item 3.1.2.2.2-1 with regard to circumferential cracking of CRD tube, the applicant will incorporate appropriate AMP as the recommendations to this emerging issue are finalized as part of the CLB.

Recent discoveries of cracked and leaking Alloy 600 vessel head penetration (VHP) nozzles at four pressurized water reactors (PWRs) raised concerns about the structural integrity of the VHP nozzles. As a result, the staff issued Bulletin 2001-01, "Circumferential Cracking of Reactor Pressure Vessel Head Penetration Nozzles," which required all PWR addressees to provide a description of the extent of VHP nozzle leakage and cracking detected and, if cracking is identified, a description of inspections, repairs, and other corrective actions taken to satisfy applicable regulatory requirements. The applicant's responses to NRC bulletin 2001-01 are as follows.

North Anna 1: The VHP nozzle inspections were performed during the Fall 2001 refueling outage. No repairs were required.

North Anna 2: The VHP nozzle inspections were performed during the September 2002 refueling outage. The applicant performed a bare-metal inspection on the reactor vessel head and penetrations. The inspection showed indications of leakage from the head penetration nozzles. The applicant performed visual and eddy current inspections of 65 penetrations in the reactor vessel head. They have identified indications in the weld surface of 63 penetrations. Six of the penetrations showed leakage above the head. The applicant plans to replace the reactor vessel head.

Surry 1: The VHP nozzle inspections were performed during the October 2001 refueling outage. Six repairs were required.

Surry 2: The VHP nozzle inspections were performed during the November 2001 shutdown. No repairs were required.

The applicant's LRA annual update letter, dated July 22, 2002, stated that it plans replacing reactor vessel heads for all four Surry and North Anna units. The replacement of reactor vessel heads is currently scheduled to be completed in year 2005.

On August 9, 2002, the NRC staff issued Bulletin 2002-02, "Reactor Pressure Vessel Head and Vessel Head Penetration Nozzle Inspection Programs," which advised the pressurized water reactor owners that visual examination may need to be supplemented with additional inspection methods such as volumetric and surface examinations. The bulletin also advised the pressurized water reactor owners that the inspection methods and frequencies should be demonstrated to be reliable and effective.

The staff is currently reviewing the issues associated with NRC Bulletins 2001-01, 2002-01 and 2002-02. Any future regulatory actions that may be required as a result of those reviews will be addressed by the staff in a separate regulatory action.

In Table B4.0-1, "Licensee Follow-up Action," the applicant committed to follow industry efforts to stay aware of new recommendations (in addition to existing reliance on chemistry control and existing ASME Section XI inspections) regarding inspection of core support lugs. Industry recommendations will be considered by the applicant to determine the need for enhanced inspection. This commitment is reiterated in the Summary for the ISI program -reactor vessel AMP.

The reactor vessel integrity management program is applicable to the carbon and low-alloy steel RV shell, including the cladding. The aging effect is reduction of fracture toughness. This program includes the following activities:

- the irradiation capsule surveillance activity
- the reactor vessel fast neutron fluence calculations
- the analysis to determine the temperature for nil-ductility transition (RT_{NDT}) for the reactor vessel beltline materials
- the analysis to determine the Charpy upper shelf energy (C_VUSE) for the reactor vessel beltline materials
- the analysis to determine RCS pressure-temperature operating limits and low temperature overpressure system (LTOPS) setpoints
- pressurized thermal shock (PTS) screening calculations

The staff's evaluation of this AMP is discussed in Section 3.3.1.14 of this SER. The applicant actively participated in the WOG effort that developed a series of evaluations whose purpose was to demonstrate that the aging effects on RCS components are adequately managed for the period of extended operation.

On the basis of the evaluation of the AMPs identified above, the staff concludes that these AMPs are acceptable for managing the pertinent aging effects and providing assurance that the intended functions of the RV components will be maintained consistent with the CLB throughout the period of extended operation.

The TLAA categories relevant to the RV components are listed in Section 3.1.2 of the LRAs and the staff's assessment of these TLAAs are included in Section 4.0 of this SER. They are:

- Fatigue: This aging effect is a result of cyclic thermal or mechanical transients that result in possible fatigue damage because of the cyclic stresses that it causes. Table 4.1.1 of the LRAs states that the fatigue analyses involve ASME Section III, Class 1 analyses of all RV components. Based on this, for all components except studs (Surry and North Anna) and loop stop valves (North Anna only), the original analyses remain valid for the period of extended operation.

- Tensioning and detensioning of studs: This fatigue aging effect is caused by thermal transients which cause thermal expansion and contraction of bolts and bolted surfaces, leading to cyclic stresses during service. Table 4.1.1 of the LRAs states that the fatigue analyses involve ASME Section III, Class 1 analyses of all RV components. For studs (Surry and North Anna) and loop stop valves (North Anna only), the analyses have been projected to the end of the period of extended operation.

- Pressurized thermal shock: PTS may occur in a reactor vessel during a severe thermal transient, such as a loss-of-coolant accident or a steam line break. As stated in Section 4.2.2 of the LRA, these events may challenge the integrity of the RV under the following conditions: severe overcooling of the inside surface of the RV followed by high repressurization, significant degradation of the vessel fracture toughness, and the presence of a critical size defect in the vessel wall. The analysis associated with PTS has been projected to the end of the period of extended operation.

- Upper shelf energy: As stated in Section 4.2.1 of the LRA, RV integrity during the period of extended operation is associated with maintaining a minimum USE value as required by 10 CFR 50, Appendix G. Appendix G requires that a utility submit an analysis at least three years prior to the time that the USE of any RV material is predicted to fall below 50 ft-lb, as measured by Charpy V-notch specimen testing. From these data obtained from surveillance tests, the USE may be predicted through the period of extended operation. The analysis associated with USE has been projected to the end of the period of extended operation.

- Pressure-temperature limits: These are heatup and cooldown limit curves that are calculated, using the most limiting value of $RT_{NDT,}$ to determine normal safe operating pressure-temperature limits for the reactor vessel. The embrittling effects of neutron irradiation are most severe at the RV beltline region, and surveillance specimen testing is used to estimate the increase in RT_{NDT} during reactor service. The analysis associated with P-T operating limits has been projected to the end of the period of extended operation.

- Reactor vessel underclad cracking: RV underclad cracking was stated in Section 4.3.2 of the LRAs as being first detected in 1971 in a European reactor vessel. It occurred along grain boundaries of the base metal heat-affected zone beneath the stainless steel clad. The analysis for underclad crack growth is performed using fracture mechanics methodologies to check crack growth over the period of extended performance for an assumed set of design transients. This analysis associated with RV underclad crack growth has been projected to the end of the period of extended operation.

3.4.2.3 Conclusions

The staff has reviewed the information on AMPs given in Section 3.1.2 "Reactor Vessel," as supplemented by the applicant's RAI responses. On the basis of this review, the staff concludes that the applicant has demonstrated that the effects of aging associated with the RVs will be adequately managed such that there is reasonable assurance that the intended functions will be maintained consistent with the CLB throughout the period of extended operation.

3.4.3 Reactor Vessel Internals

The reactor vessel (RV) internals consist of the lower core support structure (including the entire core barrel and thermal shield), upper core support structure, and the incore instrumentation support structures. The lower internals assembly, which may be removed following a complete core offload consists of the core barrel, core baffle, lower core plate and support columns, the thermal shield, intermediate diffuser plate, and bottom support plate. The upper internals assembly is removed during each refueling outage to obtain access to the reactor core, and consists of the top support plate, deep beam sections, upper core plate, support columns, and guide tube assemblies. The incore instrumentation support structures consist of an upper system to convey and support thermocouples penetrating the vessel head, and a lower system to convey and support flux thimbles penetrating the bottom vessel.

The RV internals support the core, maintain fuel alignment, limit fuel assembly movement, maintain alignment between fuel assemblies and control rod drive mechanisms, direct coolant flow past the fuel elements, direct coolant flow to the pressure vessel head, provide gamma and neutron shielding, and provide guides for the incore instrumentation.

As described by the applicant in the LRAs, the design and operating characteristics of the RV internals for the North Anna and Surry plants are similar with the following exceptions. The North Anna 1 RV internals have been modified to change the flow path of the reactor coolant from downflow between the core barrel and baffle plates to an upflow direction. This was accomplished by plugging the core barrel flow holes and creating new holes in the top former plate. The North Anna 2 RV internals were not modified. An intermediate perforated diffuser plate is added between the bottom support plate and the lower core plate in the Surry RV internals to enhance flow uniformity entering the core. The maximum operating temperature of the reactor coolant water at full power is 327.3 ^{o}C (621.2 of) for North Anna, and 318.6 ^{o}C (605.6 of) for Surry.

3.4.3.1 Summary of Technical Information in the Application

The applicant described its AMR of the RV internals in LRA Section 3.1.3, “Reactor Vessel Internals,” as supplemented by RAI responses. The staff reviewed this section of the LRAs to determine whether the applicant has demonstrated that the effects of aging on the RV internals will be adequately managed during the period of extended operation, as required by 10 CFR 54.21(a)(3).

The applicant confirms that the RV internals for both stations are bounded, with several clarifications, by the description of the RV internals contained in WCAP -14577, Rev. 1-A, “License Renewal Evaluation: Aging Management for Reactor Internals.” The staff issued the FSER for WCAP-14577, Rev. 1-A by letter dated February 10, 2001. These clarifications associated with RV internals include the following:

- The topical report assumes that the primary system water chemistry program is in place, and does not recognize this program in the management of loss of material or cracking from stress corrosion. For the aging management review of the RV internals, the chemistry control program for primary systems manages these aging effects.

- The topical report considers wear, which is defined as damage to a solid surface caused by removal or plastic deformation of material by way of mechanical contact characterized by a loss of material during relative motion or sliding, as an aging effect which requires management. In the AMR, the applicant concludes that wear will not result in an aging effect requiring management.

- The topical report includes an evaluation of the flux thimble tubes. The applicant evaluates the effect of aging for this component with the reactor vessel in Section 3.1.2.

- The topical report discusses IASCC and SCC aging mechanisms separately while the AMR of the RV internals combines the discussion of these mechanisms as part of the cracking aging effect.

- The topical report credits the loose parts monitoring program and the neutron noise monitoring program as AMR programs to manage cracking, the loss of material, and the loss of pre-load. The applicant does not credit these programs for managing the effects of aging for the RV internals. Rather the inspection requirements identified in the RV internals inspection are credited.

- The topical report identifies that primary water stress corrosion cracking (PWSCC) can occur in nickel-based alloys that are subjected to high stress. In the AMR of the RV internals, all nickel-based alloys are conservatively treated as being susceptible to PWSCC regardless of the stresses within the subcomponents.

3.4.3.1.1 Aging Effects

As stated in topical report WCAP-14577, Rev. 1-A, the reactor internals perform the following intended functions:

- provide the capability to shut down the reactor and maintain it in a safe shutdown condition
- prevent failure of all non-safety-related SSCs whose failure could prevent any of these functions
- ensure the integrity of the reactor coolant pressure boundary (bottom-mounted instrumentation flux thimbles only)

Specific functions for the individual subcomponents can be defined as:

- provide support and orientation of the reactor core
- provide support, orientation, guidance, and protection of the control rod assemblies
- provide a passageway for the distribution of the reactor coolant flow to the reactor core
- provide a passageway for support, guidance, and protection for incore instrumentation
- provide a secondary core support for limiting the core support downward displacement
- provide gamma and neutron shielding for the RPV

A review of Section 3.1.3 of the LRAs, confirms that the designs of the RV internals for the plants encompass these intended and specific functions.

The RV internals are in contact with borated water, and are exposed to a normal operating pressure of 15.41 MPa (2,235 psig). The operating environment is maintained in accordance with the chemistry control program for primary systems. The SPS and NAS reactor internals were designed to Westinghouse criteria, which were established prior to the issuance of the ASME Code Section III, subsection NG. The Westinghouse criteria contained no TLAAs and used pressure load calculations instead of fatigue calculations.

All RV internals are fabricated from stainless steel, except for the control rod guide tube split pins and the radial support clevis inserts, which are fabricated from a nickel-based alloy.

In the LRAs, Section 3.1.3, the applicant identifies the following applicable aging effects for the subcomponents subject to an AMR:

- cracking of stainless steel (including cast austenitic stainless steel) and nickel-based alloy subcomponents in a treated water environment
- loss of material from stainless steel (including cast austenitic stainless steel), and nickel-based alloy subcomponents in a treated water environment
- loss of pre-load of stainless steel bolting and core barrel holddown spring in a treated water environment
- reduction in fracture toughness of stainless steel (including cast austenitic stainless steel) subcomponents in a high-temperature treated water environment

The applicant also states that dimensional changes due to void swelling is a potential aging effect requiring management. A license renewal industry position on void swelling is being developed. The applicant will follow this issue and evaluate appropriate changes to the RV internals inspection program once an industry position has been established.

Section 2.6.7.2 of topical report WCAP-14577, Rev. 1-A states that the guide tube split pins have experienced SCC. The split pin degradation issue has been addressed on a plant-specific basis either by a complete support pin replacement, or through inspections that demonstrate no degradation. As stated in the LRAs, replacement split pins were installed at Surry 1, but examination of the original split pins revealed no degradation. North Anna 1 did experience a failure of an original split pin. Replacement split pins, with improved heat treatment characteristics, were installed for the North Anna. Based on the favorable split pin examinations at Surry 1 and the North Anna, along with the fact that split pin failures would have no adverse effect on the safety-related functions of the RV internals, the split pins have not been replaced at Surry 2.

3.4.3.1.2 Aging Management Programs

As stated in the LRAs, Section 3.1.3 and Table 3.1.3-1, the applicant identifies the following AMPs for the RV internals:

- reactor vessel internals inspection
- chemistry control program for primary systems

The applicant concluded that these programs would adequately manage the effects of aging so that there is reasonable assurance that the intended functions associated with the RV internals will be maintained consistent with the CLB under all design loading conditions throughout the period of extended operation.

3.4.3.2 Staff Evaluation

The staff reviewed the information included in LRA Section 3.1.3 (including Tables 3.1.3-1 and 3.1.3-W1), and pertinent sections of LRA Appendices A and B, as supplemented by the RAI responses. In addition to the applicable sections contained in the LRAs, topical report WCAP-14577, Rev. 1-A, and the staff's FSER on the topical report were also reviewed to determine 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 for the RV internals.

The applicant addressed all renewal applicant action items that are included in the FSER for WCAP-14577, Rev. 1-A in LRA Table 3.1.3-W1 for both plants. There are 11 action items in the staff's FSER on WCAP-14577, Rev.1-A.

Action Items from Previous Staff FSER for WCAP-14577, Rev.1-A

From its review of this information, the staff finds that the applicant's response to the 11 "Renewal Applicant Action Items" resolve the applicant action items in the FSER for WCAP-145777, Rev.1-A. The action items, applicant's responses, and staff's evaluations are provided in the following paragraphs.

- Item 1: To ensure applicability of the results and conclusions of WCAP-14577 to the applicant's plant(s), the license renewal applicant is to verify that the critical parameters for the plant are bounded by the topical report. Further, the renewal applicant must commit to programs described as necessary in the topical report to manage the effects of aging during the period of extended operation on the functionality of the reactor vessel components. Applicants for license renewal will be responsible for describing any such commitments and proposing the appropriate regulatory controls. Any deviations from the aging management programs described in this topical report as necessary to manage the effects of aging during the period of extended operation and to maintain the functionality of the reactor vessel internal components or other information presented in the report, such as materials of construction, must be identified by the renewal applicant and evaluated on a plant-specific basis in accordance with 10 CFR 54.21(a)(3) and (c)(1).

  Response: As discussed in Section 3.1.3, Reactor Vessel Internals, the RV internals are bounded by the topical report with regard to design criteria and features, material of construction, fabrication techniques, installed configuration, mode of operation and environments/exposures. The programs necessary to manage the effects of aging are identified in Table 3.1.3-1, Reactor Vessel Internals, and described in Appendix B.

  The applicant has reviewed the current designs and operation of the RV internals, and has determined that the internals are bounded by the descriptions contained in WCAP-14577 with the exception of the flux thimble tubes, which are evaluated for the effects of aging with the RV (see Section 3.1.2 of the LRAs). The applicant's AMPs for the RV internals are described in Appendix B of the LRAs. The staff evaluation of these AMPs is provided in Section 3.3.1.15 of this SER. The staff finds this to be acceptable.

- Item 2: A summary description of the programs and activities for managing the effects of aging and the evaluations of TLAA's must be provided in the license renewal FSAR supplement in accordance with 10 CFR 54.21(d).

  Response: A summary of the programs identified to manage the effects of aging and the evaluation of TLAAs for the RV internals is provided in the UFSAR supplement in Appendix A. The staff finds this to be acceptable.

- Item 3: For the holddown spring, applicants for license renewal are expected to address intended function, aging management review, and appropriate aging management program(s).

  Response: The holddown spring is in-scope for the RV internals. The results of the AMR for the RV internals are provided in Section 3.1.3 and summarized along with the intended function and the programs necessary to manage the effects of aging in Table 3.1.3-1, Reactor Vessel Internals. A description of these programs is provided in Appendix B.

  The applicant has included the passive function of the holddown spring in Section 3.1.3 of the LRAs. In Section B4.0 of the LRAs, the applicant has included an augmented inspection activities as one of the Licensee Follow-up Actions which suggests that the core barrel hold-down springs will be inspected for the loss of pre-load and the initial inspection will be performed prior to the end of the current operating license. The staff finds this to be acceptable.

- Item 4: The license renewal applicant must address aging management review, and appropriate aging management program(s), for guide tube support pins.

  Response: The guide tube support (split) pins are in-scope for the RV internals. The results of the aging management review for the RV internals are provided in Section 3.1.3 and summarized along with the intended function and the programs necessary to manage the effects of aging in Table 3.1.3-1, Reactor Vessel Internals. A description of these programs is provided in Appendix B.

  The applicant has identified the two AMPs associated with the control rod guide tube split pins in Table 3.1.3-1 of the LRA, and provided a description of these two AMPs in Appendix B. As noted in the topical report, Surry 2 has not upgraded to the new material, and Surry 1 has a different support pin design by Framatome, which is excluded from the topical report requiring plant-specific actions, as indicated in Section 2.6.7.2 of the topical report, WCAP-145777, Rev.1-A. The Surry 2 support pin is the original design which was a pre-stressed tensile design to perform its intended function. The staff issued an RAI to further understand how aging of these support pins will be managed throughout the period of extended operation. In response to the RAI Item 3.1.3.2-2, the applicant stated that the cracking of these control rod guide tube split pins is managed by the chemistry control program and the RV internals inspection activities. Based on these considerations, the staff found the applicant's identification of the AMPs for the guide support pins to be acceptable.

- Item 5: The license renewal applicant must explicitly identify the materials of fabrication of each of the components within the scope of the topical report. The applicable aging effects should be reviewed for each component based on the materials of fabrication and the environment.

  Response: The materials for each in-scope RV internals along with aging effects and environments are identified in Table 3.1.3-1, Reactor Vessel Internals. A description of these programs is provided in Appendix B.

  The applicant has identified the material of fabrication for the RV internals in Section 3.1.3 (Table 3.1.3-1) of the LRAs. This table also identifies the applicable aging effects. The staff finds this to be acceptable.

- Item 6: The license renewal applicant must describe its aging management plans for loss of fracture toughness in cast austenitic steel RV internals components, considering the synergistic effects of thermal aging and neutron irradiation embrittlement in reducing the fracture toughness of these components.

  Response: The program necessary to manage the reduction of fracture toughness in cast austenitic stainless steel RV internals is described in Appendix B, Reactor Vessel Internals Inspection.

  The applicant has identified the RV internals inspection program in Appendix B of the LRAs, as the program to manage the loss of fracture toughness in cast austenitic stainless steel reactor vessel internal components. The staff issued an RAI to further clarify the applicant's plan to manage this aging effect. In response to RAI Item 3.1.3.2-3, the applicant stated that the aging management activities in this program will be identified as a follow-up action item to monitor industry initiatives under EPRI's Materials Reliability Program. The applicant will implement the NRC-approved industry activities resulting from this program, as appropriate. The staff finds this response to be acceptable.

- Item 7: The license renewal applicant must describe its aging management plans for void swelling during the license renewal period.

  Response: A license renewal industry position on void swelling is being developed. The applicant will follow this issue and evaluate appropriate changes to the reactor vessel internals inspection, as identified in Appendix B, once an industry position has been established.

  Section 3.2.10 of the final SER on topical report WCAP-14577, Rev. 1-A states that the staff considers void swelling to be a significant issue. References cited predict swelling as great as 14% for PWR baffle-former assemblies. Although in LRA Section C3.9.1 of the LRA it is stated that there is not any evidence of, or any discernable effects attributable to void swelling, the applicant has stated in LRA Section B2.2.15 that it will remain cognizant of industry developments on the void swelling issue, and evaluate any appropriate changes to the reactor vessel internals inspection AMP once an industry position is established. The staff finds this to be acceptable.

- Item 8: Applicants for license renewal must describe how each plant-specific AMP addresses the following elements: (1) scope of the program, (2) preventative actions, (3) parameters monitored or inspected, (4) detection of aging effects, (5) monitoring and trending, (6) acceptance criteria, (7) corrective actions, (8) confirmation process, (9) administrative controls, and (10) operating experience.

  Response: The programs necessary to manage the effects of aging for the RV internals addresses the 10 elements identified. These programs are identified in Table 3.1.3-1, Reactor Vessel Internals, and described in Appendix B.

  The applicant states that the two AMP's designated to manage aging for the RV internals, the chemistry control program for primary systems and the reactor vessel internals inspection program, as described in Appendix B of the LRAs, adequately address the ten elements identified. The staff evaluation for these two AMPs applicable to RV internals may be found in Sections B2.2.4 and B2.2.15. The staff finds this to be acceptable.

- Item 9: The license renewal applicant must address plant-specific plans for management of cracking (and loss of fracture toughness) of reactor vessel internal components, including any plans for augmented inspection activities.

  Response: The programs necessary to manage cracking and reduction of fracture toughness are identified in Table 3.1.3-1, "Reactor Vessel Internals," and described in Appendix B.

  The applicant has identified two AMPs, the chemistry control program for primary systems and the reactor vessel internals inspection program (as described in Appendix B of the LRAs), as adequate to manage cracking and loss of fracture toughness. As discussed in Section 3.3.1 of the FSER for topical report WCAP-14577, Rev.1-A, the visual VT-3 examination required by Examination Category B-N-3 may not be adequate to detect cracking of the susceptible reactor vessel internal components. The examination technique used must be capable of detecting the types of cracking expected to occur. The staff concludes that augmented inspection is warranted for cracking and loss of fracture toughness. As noted in Table 4-2 of the topical report, the ASME Section XI Examination, as supplemented when relevant conditions are detected (IWB-3142), can manage the effects of irradiation embrittlement for components even though the fluence levels for 60 years of total service may exceed the threshold fluence level for the material of construction. The staff issued an RAI to further understand how cracking will be managed during the period of extended operation. In response to RAI 3.1.3.2-4, the applicant stated that NRC-approved industry activities resulting from the EPRI Materials Reliability Program initiatives, as appropriate, will be implemented to manage the aging effects associated with RV internals. The staff finds this to be acceptable.

- Item 10: The license renewal applicant must address plant-specific plans for management of age-related degradation of baffle/former and barrel/former bolting, including any plans for augmented inspection activities.

Response: The programs necessary to manage age-related degradation of baffle/former and barrel/former bolting are identified in Table 3.1.3-1, “Reactor Vessel Internals,” and described in Appendix B.

European plants identified the cracking of baffle former bolts in 1988. The materials and design of the reactor vessel internals (RVI) of these plants, including the baffle former bolting, are similar to those of the domestic Westinghouse plants. At the foreign plants, ultrasonic examination was performed to identify baffle bolt cracking. Historically, baffle bolt cracking has not been identified as an issue for domestic plants.

Domestic plant RVI baffle former bolts are subject to the visual examination requirements of the ASME B&PV Code, Section XI. However, the baffle bolt cracking occurs at the juncture of the bolt head and shank, which is not accessible for visual inspection. The NRC issued Information Notice 98-11, “Cracking of Reactor Vessel Internals Baffle Bolts in Foreign Plants,” on March 25, 1998, to alert licensees to this baffle bolt cracking experience.

The Westinghouse Owners Group (WOG) had periodic meetings and interactions with the staff from 1997 to the present regarding its ongoing programs and activities to resolve the baffle bolt cracking issue. The ongoing programs and activities include (1) development and approval of a prescribed analytical methodology for evaluating the acceptability of baffle bolting distributions under faulted conditions, (2) assessment of the safety significance of potentially degraded baffle bolting, (3) baffle bolting inspections, replacements, and testing at lead plants, and, (4) development of inspection monitoring activities and aging management programs. The first three activities have been completed. The current WOG activities include evaluation of the results of the ultrasonic examination of integrity of the baffle former bolts in four WOG plants, and the hot cell evaluation of baffle bolts removed from three of the Westinghouse plants. The WOG continues to meet with the staff periodically to present status reports on these activities.

The applicant has identified two AMPs, the chemistry control program for primary systems and the RVI inspection program (as described in Appendix B of the LRA), as adequate to manage aging effects on baffle/former and barrel/former bolting. Section 3.3.4 of the FSER for topical report WCAP-14577, Rev. 1-A states that VT-3 examinations alone will not detect cracking in these bolts. Augmented inspections, such as ultrasonic inspections, are proposed in the FSER to provide effective management of the effects of aging on these bolts.

The applicant has committed to a one-time focused inspection of the internals to check for all aging effects, applying the leading indicator approach. The leading indicator approach will be based on several factors such as fluence, stress, and material susceptibility. The inspection will be performed between year 30 and the end of the term of the current operating license on the single Surry or North Anna reactor determined to be the most susceptible to the identified aging effects. The inspection results will determine the need for inspection of the other reactors.

In addition, in response to RAI Item 3.1.3.2-5, the applicant stated that the NRC-approved industry activities resulting from the EPRI’s Materials Reliability Program initiatives, as appropriate, will be implemented to manage the aging effects associated with barrel/former and baffle/former bolting. In response to RAI 3.1.3.2-5, the applicant stated that the NRC-approved industry activities resulting from the EPRI's Materials Reliability Program initiatives, as appropriate, will be implemented to manage the aging effects associated with barrel/former and baffle/former bolting.

- Item 11: The license renewal applicant must address the TLAA of fatigue on a plant-specific basis.

  Response: The reactor internals were designed and fabricated before the existence of Subsection NG (Core Structures) of the ASME Code. The criterion utilized by Westinghouse for pre-1974 plants was developed internally within Westinghouse and is similar to the subsection NG requirements since many of the Westinghouse designers were members of the ASME code committee that developed the NG subsection. No ASME code design or stress report was required and therefore does not exist for those reactor internals.

  To assess the acceptability of the RV internals relative to fatigue for the period of extended operation, the methodology of WCAP-14577 was followed. The preferred approach is to demonstrate that the fatigue effects anticipated for the license renewal term are bounded by the fatigue effects anticipated for the original service period. It is projected that the number of transients for 60 years, including period of extended operation will be less than the design transients. All significant transients will be monitored as described in Section B3.2, Transient Cycle Counting. This will assure that the transients for 60 years will be within design values. The staff finds this to be acceptable.

3.4.3.2.1 Aging Effects

In Section 3.1.3 and Table 3.1.3-1 of the LRA, the applicant identifies the following aging effects associated with the RV internals:

- cracking
- loss of material
- loss of pre-load
- reduction in fracture toughness

Specific discussions for each of these aging effects was discussed in Section C3.0 of the LRAs. Section 3.2 of the FSER on Topical report WCAP-14577, Rev. 1-A discusses the aging mechanisms and effects for the RV internals.

In addition to those identified by the applicant, neutron irradiation embrittlement, creep, wear, and fatigue were also identified as aging mechanisms by the topical report. The applicants position on the neutron irradiation effect was discussed in detail in the LRAs. Though the staff did not agree with the neutron fluence threshold used to screen components, the staff found that it did address those components with the highest fluences. In response to RAI Item 3.1.3.2.1-1(a), the applicant has added the lower support plate as susceptible to loss of fracture toughness due to neutron embrittlement. The applicant in Section C3.5.2 states that this aging mechanism has been evaluated during the AMRs. For stainless steel alloys and nickel-based alloys, creep is not a concern at PWR conditions with temperatures below 537.8°C (1000°F). However, the topical report indicates that irradiation creep can be caused by defects that result from neutron flux exposure. Therefore, the baffle/former and barrel/former bolting are identified as susceptible to loss of preload as an applicable aging effect. Wear, while not a significant aging effect for most RV internals, can be potentially significant at interfaces of components which have relative motion. The applicant in Sections 3.1.3 and C3.1.7 of the LRAs states that it was found not to be an aging effect requiring aging management. However, in response to RAI Item 3.1.3.2-1, the applicant stated that loss of material due to wear for RV internals in-scope components is managed by the RV internals inspection program.

Based on the description of the internal and external environments, materials used, the applicant's reliance on the RV internals inspection program, and the applicant's review of industry and plant-specific experience, the staff concludes that the applicant has identified the aging effects that are applicable for the RV internals.

3.4.3.2.2 Aging Management Programs

Section 4.0 of topical report WCAP-14577 Rev. 1-A discusses aging management activities and program attributes applicable to RV internals. Tables 4-2, 4-3, 4-5, and 4-6 in this topical report provide this information for specific aging mechanisms (e.g., IASCC, stress relaxation, wear, and fatigue). Table 4-4 provides the aging management activities attributable for wear in BMI flux thimbles. Tables 4-7 and 4-8 provide additional activities and program attributes for the aging management of baffle/former bolts and core barrel/former bolts respectively.

The applicant identifies two AMPs used to manage the effects of aging for the RV internals:

- chemistry control program for primary systems
- reactor vessel internals inspection

The staff's evaluation of the applicant's AMPs focused on the program elements rather than details of specific plant procedures.

Chemistry control program for primary systems, as stated by the applicant in Section B2.2.4 of the LRAs, is to provide reasonable assurance that the reactor water quality is compatible with the materials of construction in the plant systems and equipment in order to minimize loss of material and cracking. The RV internals is listed as a major component applicable to this AMP. This AMP is based upon Technical Specifications and the EPRI guidelines provided in Technical Report TR-105714. The EPRI guidelines reflect industry operating experience and are revised as necessary to optimize plant chemistry control. The staff's evaluation of this AMP is provided in Section 3.3.1.4 of this SER.

Reactor vessel internals inspection, as discussed in Section B2.2.15 of the LRAs, is primarily comprised of the inservice inspection program, a one time focused inspection of the RV internals, and an augmented inspection activity as part of the licensee follow-up actions for the core barrel holddown spring. The staff's evaluation of this AMP is provided in Section B2.2.15.

On the basis of the evaluation of the AMPs identified above, the staff concluded that these AMPs are acceptable for managing the pertinent aging effects and providing assurance that the intended functions of the RV internals will be maintained consistent with the CLB throughout the period of extended operation.

3.4.3.3 Conclusions

The staff has reviewed the information on AMPs given in Section 3.1.3 "Reactor Vessel Internals," and Appendix B of the LRA, as supplemented by applicant's RAI responses. On the basis of this review, the staff concludes that the applicant has demonstrated that the effects of aging associated with the RV Internals will be adequately managed such that there is reasonable assurance that the intended functions will be maintained consistent with the CLB throughout the period of extended operation.

3.4.4 Pressurizers

One pressurizer per RV is connected to the RCS hot leg piping via the surge line and the cold leg piping via the spray line. The spray line and surge line nozzles are provided with thermal sleeves. The internal surfaces of the pressurizer are clad with stainless steel which provides corrosion resistance to the borated coolant water. Access is provided by a manway opening near the top of the pressurizer. During normal operation, the pressurizer contains a combination of borated reactor coolant and steam that is maintained at the desired temperature and pressure by the electric heaters and pressurizer spray system. The chemical and volume control system maintains the desired water level in the pressurizer during steady-state operation. Section 2.3.1.4 of the LRAs gives a general description of the North Anna and Surry pressurizers, which are designed in accordance with the ASME Code, Section III.

The pressurizer is designed to accommodate insurges and outsurges caused by the power load transients. During an insurge, the spray system condenses steam to prevent the pressure reaching the operating point of the power-operated relief valve. A continuous spray flow is provided to ensure that the water chemistry within the pressurizer is consistent with that in the RCS. During an outsurge, water flashes to steam due to the resulting pressure reduction and the automatic actuation of the heaters to keep the pressure above the minimum allowable limit.

The applicant states that the intended function of the pressurizer is to maintain the structural integrity of the reactor coolant pressure boundary. Another intended function for certain pressurizer subcomponents is to provide support for maintaining the integrity of pressure boundary components.

3.4.4.1 Summary of Technical Information in the Application

Table 2.3.1-4 of the LRAs lists the passive functions of each pressurizer subcomponent. Twenty-one subcomponents are specified, and all but two have an intended function of maintaining the pressure boundary. The remaining two (seismic support lugs and the support skirt/flange) have the intended function of providing structural and/or functional support for in-scope equipment.

Section 3.1.4 of the LRAs provides an aging management review of the pressurizers, which is summarized in Table 3.1.4-1. The table provides the following information for each subcomponent: (1) the passive function, (2) the material group, (3) the environment, (4) the aging effects requiring management, and (5) the specific aging management activities used for managing these aging effects.

In addition, the Westinghouse Owners Group Life Cycle Management & License Renewal Program has prepared a topical report, WCAP-14574-A, “Aging Management Evaluation for Pressurizers,” which is used as the primary reference for developing the aging management review for the pressurizer. The FSER for WCAP-14574-A was issued by letter dated October 26, 2000. In Section 3.1.4 of the LRAs, the applicant states that the scope of the pressurizer described in the topical report bounds the North Anna and Surry pressurizers with the following clarifications:

- the topical report assumes the primary system chemistry control program is in place and does not recognize the program in the management of loss of material or cracking from stress corrosion. For the aging management review of the North Anna and Surry pressurizers, the chemistry control program for primary systems manages these aging effects.

- in general, cracking of pressurizer subcomponents (regardless of aging mechanism) is managed by the ISI program - component and component support inspections.

- the topical report does not recognize loss of pre-load due to stress relaxation as an aging effect requiring management. For the North Anna and Surry pressurizers, loss of pre-load is considered to be an aging effect and is managed by the ISI program - component and component support inspections.

- in the topical report, nickel-based alloy (Alloy 82/182), which is used to butter pressurizer surge, spray, relief and safety nozzles, is not considered to require aging management. In the LRA, the applicant stated that cracking of nickel-based alloys in pressurizers is considered to be an aging effect requiring management, and is managed with the chemistry control program for primary systems.

- in the topical report, the stress corrosion cracking of sensitized stainless steel nozzle safe ends is considered to be an aging effect that is managed by ASME Section XI inspections. In the Surry LRA, the stress corrosion cracking is managed by the chemistry control program for primary systems in addition to the ASME Section XI inspections.

- for Surry, stress corrosion cracking of instrument and sample nozzles is an aging effect managed by the augmented inspection activities program. The topical report does not identify any equivalent aging management program.

- the topical report does not recognize boric acid corrosion of the pressurizer as an aging effect. However, the applicant considers boric acid wastage as an aging effect managed by the boric acid corrosion surveillance program.

- with the exception of SCC/PWSCC, the topical report does not identify any additional corrosion mechanisms for stainless steel in treated water and/or steam environment. The applicant believes that crevice corrosion/under deposit attack and pitting corrosion require aging management for stainless steel in treated water. These aging mechanisms are managed by the chemistry control program for primary systems.

- the topical report identifies valve support bracket lugs as subcomponents within the scope of license renewal. However, the applicant points out that their pressurizers do not have this subcomponent.

Section 3.1.4 of the LRAs also includes a general description of pressurizer materials, and pressurizer internal and external environments. The North Anna pressurizer surge, spray, relief, and safety nozzles were buttered with nickel-based alloy (Alloy 82/182). The Surry pressurizer safe ends and welds were exposed to post-weld heat treatment (PWHT), which resulted in sensitization of the stainless steel material. The internal environments include treated (borated) water and steam. The external environments include air as well as borated water at coolant leakage points in the pressurizer.

3.4.4.1.1 Aging Effects

In Table 3.1.4-1 of the LRAs, the applicant, in accordance with 10 CFR 54.4(a), has identified the following two intended functions applicable to the pressurizer and associated subcomponents:

- provide a pressure boundary (19 subcomponents)
- provide structural and/or functional support for in-scope equipment (seismic support lugs, and support skirt/flange)

The aging effects associated with the pressurizer and its subcomponents that require aging management are listed in Section 3.1.4 of the LRAs and include:

- cracking of carbon steel and low-alloy steel subcomponents in an air environment and cracking of stainless steel in a treated water/steam environment
- cracking and loss of material in nickel-based subcomponents in a treated water/steam environment for North Anna
- cracking and loss of material in sensitized stainless steel components in air and treated water environments for Surry
- loss of material from stainless steel subcomponents in a treated water/steam environment
- loss of material from carbon steel and low-alloy steel subcomponents in a borated water leakage environment
- loss of pre-load of the pressurizer low-alloy steel manway bolting

3.4.4.1.2 Aging Management Programs

In Section 3.1.4 of the LRAs, the applicant listed the AMPs for managing pressurizer aging effects. The aging effects for the pressurizer subcomponents are given in Table 3.1.4-1 of the LRAs as cracking, loss of material, and loss of pre-load. In this Table and in Section 3.1.4 of the LRAs, the licensee lists the applicable AMPs for managing these effects associated with pressurizers and they are given as:

- chemistry control program for primary systems.

- ISI program - component and component support inspections.
- boric acid corrosion surveillance.
- augmented inspection activities for Surry

These programs are described in more detail in Appendix B of the LRA.

The applicant concludes that, based on the demonstrations of the AMPs in Appendix B and the TLAA in Section 4.0 of the LRA, the aging effects associated with the pressurizer subcomponents will be adequately managed so that there is reasonable assurance that the intended functions will be maintained consistent with the CLB during the period of extended operation.

In addition, the LRA specifies “Metal Fatigue” as an applicable TLAA associated with the pressurizer.

3.4.4.2 Staff Evaluation

In accordance with 10 CFR 54.21(a)(3) and (c)(1), the staff reviewed the information in Section 3.1.4 (including Tables 3.1.4-1 and 3.1.4-W1), pertinent sections of LRA Appendices A and B, and the staff’s FSER on the topical report WCAP-14574-A. The review was performed to verify 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 for the pressurizer subcomponents.

The applicant addressed all renewal applicant action items that are included in the FSER for WCAP-14574, Rev. 1-A, in LRA Table 3.1.4-W1 for both stations. There are 10 action items in the staff’s FSER on WCAP-14574, Rev.1-A.

<u>Action Items from Previous Staff FSER for WCAP-14574, Rev.1-A</u>

From its review of this information, the staff finds that the applicant’s response to the 10 “Renewal Applicant Action Items” resolve the applicant action items in the FSER for WCAP-14574, Rev.1-A. The action items, applicant’s responses, and staff’s evaluations are provided in the following paragraphs.

- Item 1: License renewal applicants should identify the TLAAs for the pressurizer components, define the associated CUF and, in accordance with 10 CFR 54.21(c)(1), demonstrate the TLAAs meet the CLB fatigue design criterion, CUF < 1.0, for the extended period of operation, including the insurge/outsurge and other transient loads not included in the CLB, which are appropriate to such an extended TLAA, as described in the WOG report “Mitigation and Evaluation of Thermal Transients Caused by Insurges and Outsurges,” MUHP-5060/5061/5062, and considering the effects of the coolant environment on critical fatigue locations. The applicant must describe the methodology used for evaluating insurge/outsurge and other off-normal and additional transients in the fatigue TLAAs.

  Response: The pressurizer TLAA evaluation is provided in Section 4.3, Metal Fatigue.

The licensee stated, in Section 4.3.1 of the LRAs, that in response to NRC Bulletin 88-11 the pressurizer surge lines were analyzed for the insurge/outsurge event, which imposed thermal loads not considered in the original analyses.

The staff has separately reviewed the issue of environmentally-assisted fatigue in Section 4.3 of this SER. The applicant has conducted a separate analysis to determine whether additional actions will be needed during the period of extended operation. Part of this new analysis was to determine the most fatigue-sensitive subcomponents in the North Anna and Surry plants. Among these was the pressurizer surge line, including the pressurizer and hot leg nozzles. Using data from NUREG/CR-6260, "Application of NUREG/CR-5999 Interim Design Curves to Selected Nuclear Power Plant Components," and NUREG/CR-6583, "Effect of LWR Coolants on the Fatigue Design Curves of Carbon and Low-Alloy Steels," the applicant has scaled up the plant-specific CUF for fatigue-sensitive locations for the pressurizers (as well as other components) to account for environmental effects. Based on these adjustments, the applicant states that only the pressurizer surge line piping requires further evaluation for the period of extended operation. In lieu of additional analyses to refine the CUF for the surge line, the applicant has opted to implement an AMP to address surge line fatigue failure during the period of extended operation. Specifically, the surge line weld at the hot leg pipe connection will be examined in an augmented inspection program. This will, according to the applicant, provide reasonable assurance that the potential reactor water environmental effects will be managed such that components within the scope of license renewal will continue to perform their CLB function during the period of extended operation. The augmented inspection activities in Section B2.2.1 of the LRA do not include the pressurizer surge line for checking fatigue cracking. However, the applicant has identified this in Section B4.0 of the LRA as one of the licensee follow-up actions. The staff finds this to be acceptable.

- Item 2: In the report, WOG concluded that general corrosion is nonsignificant for the internal surfaces of Westinghouse-designed pressurizers and that no further evaluations of general corrosion are necessary. While the staff concurs that hydrogen overpressure can mitigate the aggressive corrosive effect of oxygen in creviced geometries on the internal pressurizer surfaces, applicants for license renewal will have to provide a basis (statement) in their plant-specific applications about how their water chemistry control programs will provide a sufficient level of hydrogen overpressure to manage general corrosion of the internal surfaces of their pressurizers.

  Response: A hydrogen overpressure is maintained in the volume control tanks to minimize general corrosion in the reactor coolant system, as well as the pressurizer. The chemistry control program for primary systems is based on EPRI document TR-105714 (PWR Primary Water Chemistry Guidelines). These guidelines establish strict limits on hydrogen concentration, which are verified through periodic sampling. The hydrogen overpressure, in combination with stainless steel cladding of components, ensures that general corrosion is a non-significant aging mechanism. The chemistry control program for primary systems is described in Appendix B.

  The staff finds this response to be acceptable since the applicant is adhering to industry-recommended guidelines on acceptable hydrogen overpressure limits.

- Item 3: The staff finds that the criteria in GL 88-05 and the Section XI requirements for conducting leak tests and VT-2 type visual examinations of the pressurizer boundary are acceptable programs for managing boric acid corrosion of the external, ferritic surfaces and components of the pressurizer. However, the report fails to refer to the actual provisions in the ASME Code, Section XI that require mandatory system leak tests of the pressurizer boundary. The applicants must identify the appropriate Code inspection requirements from ASME Code Table IWB-2500-1.

  Response: Mandatory leak testing of the pressurizers is specified by ASME Section XI, Subsection IWB, Table IWB-2500-1, Category B-P. The staff finds this response to be acceptable.

- Item 4: The staff concurs that the potential to develop SCC in the bolting materials will be minimized if the yield strength of the material is held less than 150 ksi, or the hardness is less than 32 on the Rockwell C hardness scale; however, the staff concludes that conformance with the minimum yield strength criteria in ASME Specification SA-193, Grade B7, does not in itself preclude a quenched and tempered low-alloy steel from developing SCC, especially if the acceptable yield strength is greater than the acceptable yield strength of 150 ksi. To take credit for the criteria in EPRI Report NP-5769, the applicant needs to state the acceptable yield strengths for the quenched and tempered low-alloy steel bolting materials (e.g., SA-193 Grade B, materials) are in the range of 105-150 ksi.

  Response: SCC of bolting is addressed in Appendix C.

  The staff finds that this action item is not fully addressed in Section C3.2.1 of the LRA on bolting. The applicant stated that the yield strength of low-alloy steel bolting has been measured, and found to be less than 150 ksi. However, in response to RAI Item 3.1.4.2-1, the applicant stated that all Grade B7 materials were purchased in accordance with the requirements of SA-193 under 10 CFR 50, Appendix B, procurement program. Because bolting procurement program met the requirements of 10 CFR Part 50, Appendix B, the staff finds this response to be acceptable.

- Item 5: The staff considers the discussion in Section 3.5.2 to be extremely confusing in that it appears WOG is making three different conclusions that conflict with one another:

  a. That fluid velocity and particulate conditions are not sufficient in the pressurizer to consider that erosion is a plausible degradation mechanism that could affect the integrity of subcomponents in the pressurizer.

  b. That several components in the pressurizer (refer to the list above) are exposed to fluid flows that have the potential to result in erosion of the components.

  c. That only one component in the pressurizer (the spray head) is exposed to a fluid flow that has the potential to result in erosion of the component.

  The applicant should state why erosion is not plausible for the surge nozzle thermal sleeve, spray nozzle thermal sleeve, surge nozzle safe-end, and spray nozzle safe-end. If erosion is plausible, then an AMP is required.

Response: The relatively low flow velocity in the spray and surge line thermal sleeves and safe ends, combined with the use of stainless steel materials and limited particulate matter in the system, ensured that the loss of material due to erosion is not an aging effect requiring aging management. Since erosion does not occur in low flow velocity locations, the staff finds this response to be acceptable.

- Item 6: Applicants for license renewal must describe how each plant-specific AMP addresses the following 10 elements: (1) scope of the program, (2) preventive action, (3) parameters monitored or inspected, (4) detection of aging effects, (5) monitoring and trending, (6) acceptance criteria, (7) corrective actions, (8) confirmation process, (9) administrative controls, (10) operating experience.

  Response: The programs necessary to manage the effects of aging for the pressurizer address the 10 elements identified. These programs are identified in Table 3.1.4-1, Pressurizers, and described in Appendix B. The staff finds this response to be acceptable.

- Item 7: Applicants for license renewal must provide sufficient details in their LRAs about how their GL 88-05 programs and ISI programs will be sufficient to manage the corrosive effects of boric acid leakage on their pressurizer components during the proposed extended operating terms for their facilities, including postulated leakage from the pressurizer nozzles, pressurizer nozzle-to-vessel welds, pressurizer nozzle safe end welds, and pressurizer manway bolting materials.

  Response: Boric acid wastage is an aging mechanism requiring management of the external surfaces of the pressurizers. The boric acid corrosion surveillance activity is credited with managing boric acid wastage. The system pressure test specified by ASME Section XI, Subsection IWB, Table IWB-2500-1, Category B-P may also be used to detect pressurizer leakage. The boric acid corrosion surveillance activity and the ISI program - component and component support inspections are described in Appendix B. Included in the description is a demonstration of program effectiveness.

  The staff, in its review of the boric acid corrosion surveillance AMP in Section 3.3.1.3 of this SER, notes that it involves visual examination of the pressurizer surfaces for evidence of coolant leakage. In addition, the ISI program - component and component support inspections (reviewed in Section 3.3.1.11 of this SER) includes pressurizer subcomponent inspections to check for leaks. The subcomponents include full- and partial-penetration welds in nozzles, and bolting. In addition, as mentioned by the applicant in response to this action item, ASME Section XI, Examination Category B-P inspection requirements may also be used to check for pressurizer leaks. Since the applicant has identified a broad range of AMPs that will detect pressurizer leakage, the staff finds that the applicant’s response to this action item is acceptable.

- Item 8: The staff concludes that an AMP is necessary to control and manage the potential for SCC to occur in welded pressurizer penetration nozzles and manway bolting materials, and recommends that a licensee could credit the following programs as the basis for managing the phenomena of PWSCC/IGSCC of the pressurizer components: (1) the primary coolant chemistry program; (2) the ISI program of the pressurizers; and (3) the plant-specific quality assurance program as it pertains to assuring that previous welding activities on welds in the pressurizer have been controlled in accordance with the pertinent requirements of 10 CFR 50, Appendix B, and with the pertinent welding requirements of the ASME Code for Class 1 systems. The staff concludes that applicants need to extend AMP-2.1 to the pressurizer penetration nozzles, to the nozzle-to-vessel welds, and to the manway bolting materials, and to include the appropriate Code requirements among the program attributes listed in Table 4-1 and summarized in the text in Section 4.1 of this report.

Applicants for license renewal must provide sufficient details in their LRAs as to how their primary coolant chemistry control programs, ISI programs, and 10 CFR 50, Appendix B quality assurance programs will be sufficient to manage the potential for SCC to occur in the pressurizer nozzle components and bolted manway covers during the proposed extended operating term for their facilities.

Response (North Anna): SCC of bolting is addressed in Appendix C. The chemistry control program for primary systems manages SCC in pressurizer subcomponents, including nozzles and the manway cover insert plate, by limiting total halogen content in the primary coolant. ISI program inspections (Table IWB-2500-1) are used to detect cracking resulting from flaw initiation and growth. These programs are described in Appendix B, which include a demonstration of the effectiveness of the programs. The Quality Assurance Program is applicable to all programs credited for aging management.

Response (SPS 1/2): The response to this action item for Surry is similar to that for North Anna except that the following sentence has been added for the Surry response. Based on cracking of instrument line nozzles that has occurred, augmented inspection activities (visual examination) are also performed on small-bore instrument and sample nozzles to check for indications of boric acid.

The staff finds that the applicant has provided sufficient details in its LRAs as to how their primary coolant chemistry control programs, ISI programs, and 10 CFR 50, Appendix B quality assurance programs will be sufficient to manage the potential for SCC, therefore, the staff finds these responses to be acceptable.

- Item 9: Applicants must propose an AMP to verify whether or not thermal fatigue-induced cracking has propagated through the clad into the ferritic base material or weld material beneath the clad.

  Response: There is no industry experience to suggest that cracks initiating at the clad inner surfaces in the pressurizer will propagate into the underlying base metal or weld metal. Observed flaws in other plants were monitored for an extended period of time, and no significant flaw growth was observed. In 1990, several indications were discovered in the pressurizer cladding in the Connecticut Yankee plant. Ultrasonic inspection confirmed that the indications did not penetrate into the ferritic base metal and, therefore, in accordance with ASME Section XI, the indications were acceptable without repair. A surveillance program was initiated, and after two follow-up inspections that showed no change, the surveillance program was discontinued with NRC approval. In several of the cases of observed cracking, fracture mechanics analyses were performed, and demonstrated that the cladding indications would not compromise the integrity of the primary system components.

At temperatures greater than 82°C (180°F), the cladding has virtually no impact on the fracture behavior. This is the low end of the plant operating temperature range. ASME Section XI flaw evaluation rules require that the effects of cladding must be considered in any structural integrity evaluation, especially for postulated flaws that penetrate the cladding into the base metal. The actual impact on the cladding on such an evaluation is negligible. The pressurizer shell design considers fatigue usage throughout the operating lifetime and includes adequate margin. This is expected to preclude the formation of fatigue cracks in the cladding material. The fracture mechanics evaluations performed for actual observed cracks in other plants indicate that the cracks do not grow significantly over the plant lifetime. Therefore, a specific aging management program to manage fatigue cracking of the pressurizer cladding is not required.

On the basis of the prior evaluation for the Connecticut Yankee pressurizer which showed that, after two follow-up inspections, there was no evidence of further crack growth, and that none of the cracks had penetrated into the base metal, the staff concurs that an aging management program for underclad cracking is not required. For the Connecticut Yankee pressurizer, the topical report states that it was concluded that the cracks may have been caused by a spray of cold water onto the cladding during a low-water transient. Therefore, this is a situation not generally applicable to Westinghouse pressurizers. The staff finds this response to be acceptable.

- Item 10: The staff is concerned that IGSCC in the heat-affected zones of 304 stainless steel supports that are welded to the pressurizer cladding could grow as a result of thermal fatigue into the adjacent pressure boundary during the license renewal term. The staff considers that these welds will not require aging management in the extended operating periods if applicants can provide reasonable justification that sensitization has not occurred in these welds during the fabrication of these components. Therefore, applicants for license renewal must provide a discussion of how the implementation of their plant-specific procedures and quality assurance requirements, if any, for the welding and testing of these austenitic stainless steel components provides reasonable assurance that sensitization has not occurred in these welds and associated heat-affected zones. In addition, the staff request that applicants for license renewal identify whether these welds fall into item B8.20 of Section XI, Examination Category B-H, Integral Attachments for Vessels, and if applicable, whether the applicants have performed the mandatory volumetric or surface examinations of these welds during the ISI intervals referenced in the examination category.

  Response: The pressurizer cladding material and weld metal used to join the pressurizer internal supports and cladding were selected to have sufficiently low carbon content to minimize the possibility of sensitization. However, the existence of sensitized areas in the heat-affected zones of 304 stainless steel support welds cannot be totally excluded. Therefore cracking due to stress corrosion cracking is an aging effect requiring aging management for internal pressurizer welds. The chemistry control program for primary systems, as described in Section B2.2.4 of Appendix B, is credited with management of this aging effect. Control of oxygen, chlorides, and halogens provides an essentially benign environment, which has been shown to be effective in limiting stress corrosion cracking. Pressurizer internal welds do not fall under item B8.20 of ASME Section XI Examination Category B-H.

The staff concurs that sensitization may be present in the heat-affected zones of 304 stainless steel support welded to the cladding. It also concurs that the chemistry control program for primary systems will mitigate SCC in these welded joints. Finally, the staff agrees that internal welds do not fall under item B8.20 of examination category B-H since footnote (1)a in Table IWB-2500-1 (Examination Category B-H) states that this examination pertains to attachments on the outside surface of the pressure retaining component. Therefore, the staff finds this to be acceptable.

3.4.4.2.1 Aging Effects

The materials of construction for the pressurizer are stainless steel, low-alloy steel, and carbon steel. In Section 3.1.4 of the North Anna LRA it is stated that the pressurizer surge, spray, relief, and safety nozzles are all buttered with nickel-based alloy (Alloy 82/182). For Surry it is stated that all surfaces of low-alloy and carbon steel subcomponents that are in contact with borated water are weld overlaid with stainless steel to provide corrosion resistance. From Table 3.1.4-1 of the LRAs, the aging effects requiring management are:

- cracking
- loss of material
- loss of pre-load

Cracking of carbon and low-alloy steel pressurizer subcomponents may occur in air and in treated water steam environments. In Section 4.3.4 of the LRA, the applicant noted that the surge line nozzle in the pressurizer is the leading indicator for reactor water environmental fatigue effects, specifically, the surge line connecting the pressurizer to the reactor coolant hot leg piping. An augmented inspection program has been proposed as a follow-up action to examine the surge line weld at the hot leg piping connection in order to detect flaw initiation and growth. The support skirt and flange, lower head, the relief nozzle, the safety nozzle, the shell, spray nozzle, surge nozzle, and seismic support lugs are all susceptible to fatigue cracking in an air environment, as stated in Table 3.1.4-1. Stainless steel and nickel-based subcomponents, mainly nozzles and thermal sleeves, are susceptible to SCC in the presence of treated water and steam, also stated in Table 3.1.4-1.

Leakage of primary coolant in the pressurizer will lead to evaporation and concentration of the coolant and may cause significant loss of material (wastage) of carbon and low-ploy steel subcomponents. Table 3.1.4-1 of the LRA lists 12 pressurizer subcomponents that may be affected by loss of materials. This aging effect is managed by the boric acid corrosion surveillance AMP which the staff has reviewed in Section 3.3.1.3 of this SER.

Loss of pre-load is possible in the manway cover bolts of the pressurizer. This may be a result of corrosion of the bolt by boric acid or by stress relaxation within the bolt caused by thermally activated structural changes in the steel. This aging effect is managed by the ISI program - component and component support AMP which the staff has reviewed in 3.3.1.11 of the SER.

Based on these considerations, the staff finds the aging effects identified by the applicant for the pressurizer components to be consistent with the topical report.

3.4.4.2.2 Aging Management Programs

The staff's evaluation of the applicant's AMPs focused on the program elements rather than details of specific plant procedures. The staff's approach to evaluating each program and activity used to manage the applicable aging effects is described in Section 3.3 of this SER. Table 3.1.4-1 of the LRA lists the pressurizer subcomponents that require aging management together with their intended functions, applicable aging effects, and the AMPs designed to manage the aging effects. The applicant specifies in Table 3.1.4-1 that the following AMPs as being applicable to the pressurizer:

- chemistry control program for primary systems
- ISI program - components and component support inspections
- boric acid corrosion surveillance

The chemistry control program for primary systems is described in Section B2.2.4 of the LRAs. Its purpose is to provide reasonable assurance that water quality is compatible with the materials of construction in plant systems and equipment in order to minimize loss of material and cracking. This AMP is based on the applicant's Technical Specifications and Electric Power Research Institute (EPRI) guidelines provided in technical report TR-105714, "Primary Water Chemistry Guidelines." Pressurizer materials included in this AMP include stainless steels susceptible to cracking and loss of material in treated water environments, and North Anna nickel-based 82/182 alloys in treated water environments. The coolant chemistry is monitored and trended so that timely indication of abnormal chemistry conditions is possible. Corrective action is taken if abnormal trends are detected so that water chemistry is maintained within acceptable limits. A staff review of the chemistry control for primary systems AMP is given in Section 3.3.1.4 of this SER.

The ISI program - component and component support inspections AMP is described in Section B2.2.11 of the LRAs. Its purpose is to inspect ASME Class 1 and 2 components to provide reasonable assurance that components and component supports are in compliance with the provisions of ASME Section XI, Subsections IWB, IWC, and IWF. From the LRA, the inspections applicable to the pressurizer include the following Class 1 subcomponents:

- Examination Category B-B (pressure-retaining welds in vessels other than reactor vessel - volumetric)
- Examination Category B-D (full-penetration welds of nozzles in vessels - volumetric)
- Examination Category B-E (pressure-retaining partial penetrations in welds in vessels - visual)
- Examination Category B-F (pressure-retaining dissimilar metal welds - volumetric/surface)
- Examination Category B-G-1 (pressure-retaining bolting greater than 2 inches in diameter - visual/surface/volumetric)
- Examination Category B-G-2 (pressure-retaining bolting less than 2 inches in diameter - visual)
- Examination Category B-H (integral attachment for vessels)
- Examination Category B-P (all pressure-retaining components)

The ISI examinations are carried out to detect component degradation prior to loss of intended function. The inspections are capable of detecting loss of material, cracking, gross indications of loss of pre-load, and gross loss of fracture toughness which may manifest itself as cracking. A staff review of this AMP is given in Section 3.3.1.11 of this SER.

The boric acid surveillance AMP is described in Section B2.2.3 of the LRA. It is relevant to carbon and low-alloy steel subcomponents of the pressurizer as described in Table 3.1.4-1 of the application. Subcomponents such as the shell, lower head, manway and manway bolts, relief nozzle, and safety nozzle are parts of the pressurizer that may be involved as a result of leaking primary coolant and its concentration to form boric acid. Loss of material is the aging effect monitored using inspections that comply with NRC Generic Letter 88-05 and ASME Section XI criteria. Visual inspections are performed to detect evidence of coolant leakage or boric acid residue. If degradation of susceptible components has occurred, an engineering evaluation is made to determine whether the observed condition is acceptable without repair. For degradation that is adverse to quality, the occurrence is entered into the plant corrective action system. A staff review of this AMP is given in Section 3.3.1.3 of this SER.

On the basis of the evaluations of these AMPs identified above, the staff concludes that these AMPs are acceptable for managing the pertinent aging effects and providing assurance that the intended functions of the pressurizer components will be maintained consistent with the CLB throughout the period of extended operation.

Fatigue cracking of pressurizer subcomponents is evaluated as a TLAA on metal fatigue in Section 4.3 of the LRA. The analyses for the pressurizer include ASME Code, Section III, Class 1 evaluations of the CUF for subcomponents, and environmentally-assisted fatigue effects. A staff review of this TLAA is given in Section 4.3 of this SER.

3.4.4.3 Conclusions

The staff has reviewed the information included in Section 3.1.4 of the LRAs, as supplemented by the RAI responses. On the basis of this review, the staff concludes that the applicant has demonstrated that the effects of aging associated with the pressurizer components will be adequately managed so that there is reasonable assurance that these components will perform their intended functions in accordance with the CLB throughout the period of extended operation.

3.4.5 Steam Generators

Each unit has three recirculating steam generators, with one steam generator in each of the three reactor coolant loops. They are vertical, shell and U-tube heat exchangers with integral moisture-separating equipment. The steam generators facilitate transfer of heat from the single-phase, high-pressure, high-temperature borated reactor coolant on the primary side of the tubes to the two-phase steam-water mixture on the secondary side. Reactor coolant flows through the primary side of the inverted U-tubes, entering and leaving through he primary nozzles located in the hemispherical bottom chamber (the channel head). The channel head is welded to the tubesheet from which the tubes bundle is attached. Within the channel head is a vertical divider plate which separates the inlet from the outlet flow. The tube bundle is surrounded by a cylindrical wrapper. The space between the wrapper and steam generator shell is termed as the downcomer. Feedwater and recirculated water flows down the downcomer, around the base of the wrapper, and through the tube bundle. The feedwater is heated to boiling in the tube bundle by the transfer of heat from the reactor coolant on the primary side. Saturated steam/water mixture enters the moisture separator section where the water is removed from the mixture and dried in the evaporator. Dry steam exits the steam outlet-nozzle and is piped to the turbines.

3.4.5.1 Summary of Technical Information in the Application

The steam generators are designed and fabricated in accordance with Section III of the ASME Boiler and Pressure Vessel Code requirements. Table 3.1.5-1 of the application provides the following information on each steam generator subcomponent: (1) the passive function, (2) the material group, (3) the environment, (4) the aging effects requiring management, and (5) the specific aging management activities that would manage these aging effects during the extended period of operation. The subcomponents requiring management include: anti-vibration bars, channel head, channel head divider plate, feedwater inlet nozzle, primary inlet and outlet nozzle safe ends, primary inlet and outlet nozzles, primary manway (includes pad and cladding), primary manway cover and insert, primary manway cover bolting, secondary closure bolting, secondary closure covers, secondary manway (includes pad), secondary side shell penetrations, secondary side shell, stay rod, steam flow limiter, steam outlet nozzle, support pads, tube bundle wrapper, tube plugs, tube support plates, tubesheet and cladding, and the U-tubes. These subcomponents are periodically inspected in accordance with ASME Section XI, Subsections IWB and IWC requirements and the plant TS. Primary system piping connected to the steam generators is addressed in Sections 3.1.1 of the LRAs, whereas secondary system piping attached to the steam generator is addressed in Section 3.4 of the LRAs.

OF the steam generator subcomponents that are considered within the scope of the license renewal, all have the passive function of providing a pressure boundary with the following exceptions. The anti-vibration bars, the stay rod, support pads, tube bundle wrapper, and tube support plates have the intended function of providing structural and/or functional support for in-scope equipment; the channel head divider plate has the intended function of providing flow distribution; and the steam flow limiter has the intended function of restricting steam flow in the event of a main steam line break.

3.4.5.1.1 Aging Effects

The materials of construction for the steam generators that are subject to aging management review are in the carbon steel/low-alloy steel material group and include the channel head, secondary side shell, stay rod, nozzles, manways, tubesheet, tube bundle wrapper, support pads, and bolting. All surfaces exposed to borated primary coolant are clad with stainless steel or nickel-based alloys. Stainless steel subcomponents include the anti-vibration bars, primary inlet and outlet nozzle safe ends, and tube support plates. Nickel-based alloy components include the channel head divider plate, steam flow limiter, steam generator tubes, and tube plugs. The primary-side subcomponents are exposed to borated (primary) water conditions, the secondary-side subcomponents to a mixture of treated (secondary) water and steam, and the external surfaces of the steam generator are exposed to air, and possibly borated water leakage conditions.

In Section 3.1.5 of the LRAs, the applicant listed the following aging effects that will require management:

- cracking of carbon steel, low-alloy steel, stainless steel, and nickel-based alloy subcomponents in treated water, steam, or air environments
- loss of material from carbon steel, low-alloy steel, stainless steel, and nickel-based alloy subcomponents in treated water or steam environments
- loss of material from low-alloy steel subcomponents in a borated leakage environment
- loss of pre-load of ASME Class 1 low-alloy steel bolting in an air environment

3.4.5.1.2 Aging Management Programs

The applicant specifies the following AMPs as being applicable to the steam generators:

- chemistry control program for primary systems
- chemistry control program for secondary systems
- boric acid corrosion surveillance
- steam generator inspections

The applicant concluded that these AMPs will ensure that aging effects associated with the steam generator subcomponents will be managed so that there is reasonable assurance that the intended functions will be maintained consistent with the CLB during the period of extended operation. Table 3.1.5-1 of the LRA lists the steam generator subcomponents that require aging management together with their intended functions, applicable aging effects, and the AMPs designed to manage these aging effects.

Fatigue cracking of steam generator subcomponents is evaluated as a TLAA on metal fatigue in Section 4.3 of the LRAs. The analyses for the steam generator include ASME Code, Section III, Class 1 evaluations of the CUF for subcomponents. A staff review of this TLAA is given in Section 4.3 of this SER.

3.4.5.2 Staff Evaluation

In accordance with 10 CFR 54.21(a)(3) and (c)(1), the staff reviewed the information included in Section 3.1.5 (Table 3.1.5-1) as supplemented by RAI responses by the applicant, and pertinent sections of LRA Appendices A and B, regarding the applicant's demonstration that the effects of aging will be adequately managed so that the intended functions of subcomponents in the steam generators will be maintained consistent with the CLB under all design loading conditions during the period of extended operation.

Both North Anna and Surry have long operating experience; Surry has been operating since 1972/1973 and North Anna since 1978/1980. Originally, all of them were designed with Westinghouse model 51 recirculating, feed ring type steam generators. These steam generators had carbon steel tube support plates with drilled round holes. During the seventies, all steam generators had experienced significant degradation of their steam generator tubes, tube support plates and other internal components, and had undergone an extensive repair program. In accordance with Section 2.3.1.5 of the LRAs, this repair program consisted of refurbishment of the upper assembly in addition to replacement of the lower assembly (including the channel head, U-tubes, tubesheet, and lower shell section). During 1980-1981, Surry replaced the lower section of their steam generators with Westinghouse model 51F components and during 1993-1995, North Anna replaced the lower section of their steam generators with Westinghouse model 54F components. Both replacement Westinghouse models 51F and 54F have stainless steel and trefoil or quatrefoil broached-type tube support plates, which are resistant to the erosion-corrosion and cracking that were experienced in model 51 steam generators. These enhanced models use hydraulically expanded, thermally treated Alloy 600 tubing and 405 stainless steel tube support plates.

In response to the NRC Generic Letter 97-06, the Westinghouse owners group conducted a survey on the degradation susceptibility of steam generator internal components. In accordance with the plant responses delineated in WCAP-15031, several components within the steam generator internals of the two replacement Westinghouse models (i.e., 51F and 54F) were observed to have some degradation, while several other components were determined to have low susceptibility to some other degradation. Erosion-corrosion in moisture separators, and feed ring/J-tubes, and cracking in the transition cone girth welds were observed in some steam generators. Also, the survey determined that there exists low susceptibility to cracking of tube support plate ligaments and wrapper near its supports (and hence wrapper drop). The licensees have adopted appropriate inspection and maintenance activities to address these known degradations in steam generator internals. There are no near-term changes in the steam generator inspection program that are thought to be necessary at this time. However, for a long-term solution to these age-related degradation the licensee intends to implement, as appropriate, the recommended inspection activities given in WCAP-15031 and WCAP-15104.

With regard to maintaining the pressure boundary of steam generator tubes, the applicant stated that less than 1% of the total number of tubes are plugged at Surry and only one tube was plugged at each North Anna unit since their steam generator replacements.

3.4.5.2.1 Aging Effects

The aging effects identified by the applicant in Table 3.1.5-1 of the LRAs as being applicable to the steam generators include the following:

- cracking
- loss of material
- loss of pre-load (applicable to ASME Class 1 subcomponents only)

The applicant stated in Section 3.1.5 of the LRAs that cracking due to fatigue is evaluated for the steam generator as a TLAA. Also, in Section 4.3 of the LRA, the applicant states that steam generator components have been analyzed using the methodology of the ASME B&PV Code, Section III, Class 1. The steam generator components within the scope of license renewal belong to both ASME Class 1 and 2 classification. In response to RAI Item 3.1.5.2.1-1(a), the applicant stated that both Class 1 and Class 2 components were evaluated for fatigue using the methodology for Class 1 components. The 40-year CUFs bound the periods of extended operation since the number of design cycles assumed for 40-years is bounding for 60-years of operation.

In Table 3.1.5-1 of the LRA, each steam generator component within the scope of license renewal is subject to the loss of material due to crevice corrosion, pitting, and general corrosion requiring aging management. The tube support plates are not subject to flow-accelerated corrosion since they are fabricated of stainless steel.

Based on these considerations, the staff finds the aging effects identified by the applicant for the steam generator components to be consistent with industry experience, therefore, the staff finds this to be acceptable.

3.4.5.2.2 Aging Management Programs

The staff's evaluation of the applicant's AMPs focused on the program elements rather than details of specific plant procedures. The staff's evaluation of each program and/or activity used to manage the applicable aging effects is described in Section 3.3 of this SER.

The AMPs being used by the applicant to manage the aging effects associated with the steam generators are listed in the application as:

- chemistry control program for primary systems
- chemistry control program for secondary systems
- boric acid corrosion surveillance
- steam generator inspections

The chemistry control program for primary systems is described in Section B2.2.4 of the LRAs. Its purpose is to provide reasonable assurance that water quality is compatible with the materials of construction in plant systems and equipment in order to minimize loss of material and cracking. This AMP is based on the applicant's technical specifications and Electric Power Research Institute (EPRI) guidelines provided in technical report TR-105714, "Primary Water Chemistry Guidelines." Steam generator materials included in this AMP include stainless steels susceptible to cracking and loss of material in treated water environments, and North Anna nickel-based 82/182 alloys in treated water environments. The coolant chemistry is monitored and trended so that timely indication of abnormal chemistry conditions is possible. Corrective action is taken if abnormal trends are detected so that water chemistry is maintained within acceptable limits. A staff review of the chemistry control for primary systems AMP is given in Section 3.3.1.4 of this SER.

The chemistry control program for secondary systems is described in Section B2.2.5 of the LRAs. Its purpose is to provide reasonable assurance that water quality is compatible with the materials of construction in the plant systems and equipment in order to minimize loss of material and cracking. This program is stated by the applicant to provide an environment that minimizes material degradation, maintains material integrity, and reduces the amount of corrosion product that could interfere with equipment operation and heat transfer. This AMP is based on EPRI guidelines provided in technical report TR-102134, "PWR Secondary Water Chemistry Guidelines". These guidelines reflect industry operating experience to optimize plant chemistry control. The applicant's chemistry control program is revised to maintain consistency with the EPRI guidelines. A staff review of the chemistry control for secondary systems AMP is given in Section 3.3.1.5 of this SER.

The boric acid corrosion surveillance AMP is described in Section B2.2.3 of the LRAs. It is relevant to carbon and low-alloy steel subcomponents of the steam generator as described in Table 3.1.5-1 of the application. Subcomponents that are managed by this AMP include the channel head, feedwater inlet nozzle, primary inlet and outlet nozzles, primary manway (including pad and cladding), primary manway cover and insert, primary manway cover bolting, secondary closure cover bolting, secondary closure covers, secondary manway, secondary side shell penetrations, secondary side shell, steam outlet nozzle, and support pads. The aging effect to be detected is loss of material from susceptible components due to leakage from borated water systems. Inspection of these systems is performed in compliance with the requirements of NRC Generic Letter 88-05 and ASME Section XI. A staff review of the boric acid corrosion surveillance AMP is given in Section 3.3.1.3 of this SER.

The steam generator inspections AMP is described in Section B2.2.18 of the LRAs. The applicant stated that this AMP is carried out in accordance with the individual ISI programs for each of the four units . In accordance with 10 CFR 50.55a, the inspections are implemented to meet the requirements of Subsections IWB and IWC of ASME Section XI. Primary side inspections are focused on the following areas:

- general inspection of the full length of the tubes
- special interest inspections of suspected anomalous indications in accordance with site-specific guidelines
- U-bend areas of anti-vibration bar contact points
- critical area inspections at the U-bend transition of Row 1 tubes
- critical area inspections of the hot leg top-of-tubesheet expansion area
- video inspections for general condition assessment of the tubesheet and tubesheet plugs
- weld inspections
- bolting

Secondary side inspections are focused on:

- inner radii inspections of feedwater and main steam nozzles
- weld inspections
- supports
- routine video inspections of the tubesheet area and the annulus area, as necessary, to detect the presence of deposits, sludge, foreign material, or other general degradation

The secondary side inspections exclude the wrappers, tube support plates, and transition cone girth welds as suggested by the owners group in its responses to GL 97-06. A staff review of this AMP is given in Section 3.3.1.18 of this SER.

In addition to the above-mentioned AMPs, the applicant listed in Section B2.2.1 of the LRAs two augmented inspection activities for the steam generator that are performed in addition to ASME Section XI ISIs. These are VT-1 inspections of the steam generator supports every 40 months for North Anna, and UT or supplemental RT of the feedwater nozzles every refueling outage for both plants.

On the basis of the evaluations of the AMPs identified above, the staff concludes that these AMPs are acceptable for managing the pertinent aging effects and providing assurance that the intended functions of the steam generator components will be maintained consistent with the CLB throughout the period of extended operation.

3.4.5.3 Conclusions

The staff has reviewed the information included in Section 3.1.5 of the LRAs, as supplemented by the RAI responses. On the basis of this review, the staff concludes that the applicant has demonstrated that the effects of aging associated with the steam generator components will be managed so that there is reasonable assurance that these components will perform their intended functions in accordance with the CLB throughout the period of extended operation.

3.5 Aging Management of Engineered Safety Features

In the North Anna and Surry LRAs, Section 2.3.2, "Engineered Safeguards Scoping and Screening," the applicant describes the results of the scoping and screening of the engineered safety features (ESFs) SSCs that are within the scope of license renewal and the ESF SCs that are subject to an AMR. The applicant describes its AMR for the ESF SCs in Section 3.2, "Aging Management of Engineered Safety Features Systems" of each LRA. The various AMPs used to manage the aging of the ESF SCs are described in each LRA, Appendix B, as applicable.

The NRC staff review of the scoping and screening results for NAS 1/2 and SPS 1/2 ESFs systems are described in Section 2.3.2 of this SER. The staff's review of the applicant's AMR activities for the NAS 1/2 and SPS 1/2 ESFs are the subject of this section of the SER. This review is being performed to determine whether the applicant has demonstrated that the effects of aging for the SCs of the ESFs that are subject to an AMR will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation in accordance with 10 CFR 54.21(a)(3).

3.5.1 Summary of Technical Information in the Application

In the North Anna and Surry LRAs, Section 2.3.2, "Engineered Safeguards Scoping and Screening," the applicant identified five systems that are within the scope of license renewal in accordance with the requirements of 10 CFR 54.4. The five systems include the quench spray (QS)/containment spray (CS) systems, fuel pit cooling (FC), recirculation spray (RS), residual heat removal (RH), and safety injection (SI) systems. A brief description of the systems is provided in the LRA and is given below.

3.5.1.1 Systems Descriptions

<u>Quench Spray/Containment Spray Systems</u>

Each Unit of the NAS has a quench spray (QS) system. The SPS 1/2 each has an equivalent system referred to as the containment spray (CS) systems. These systems are identical for the purpose of an AMR for license renewal. In North Anna LRA, Section 2.3.2.1, "Quench Spray," and the Surry LRA, Section 2.3.2.1, "Containment Spray," the applicant describes the SCs of the QS/CS systems that are within the scope of license renewal and subject to an AMR for both NAS and SPS. The QS/CS systems are designed to pump cool, borated water from the refueling water storage tank (RWST), mixed with a sodium hydroxide solution from the chemical addition tank (CAT), through spray ring headers and nozzles into the Containment. The spray solution absorbs heat from the Containment atmosphere to reduce pressure and prevent challenging the structural integrity of the Containment. In addition, the spray reduces the airborne iodine concentration in the post-LOCA Containment atmosphere to maintain accident-dose within limits. The RWST also provides the source of water to the safety injection (SI) system for the injection phase of design basis accident mitigation. Therefore, the major flowpaths of the QS/CS systems are within the scope of license renewal and subject to an AMR. The QS/CS SCs that require an AMR are listed in Tables 3.2-1 of each LRA.

Fuel Pit Cooling System

In the North Anna and Surry LRAs, Section 2.3.2.2, "Fuel Pit Cooling," the applicant describes the SCs of the NAS 1/2 and SPS 1/2 fuel pit cooling (FC) systems that are within the scope of license renewal and subject to an AMR. The NAS 1/2 and SPS 1/2 FC systems are identical for the purpose of an AMR for license renewal and there are no notable differences. At both North Anna and Surry, the FC systems transfer heat from spent fuel pools to component cooling (CC) system. The NAS and SPS FC systems also provide a means for water chemistry control for the spent fuel pools. The FC systems are used to circulate borated water from the spent fuel pools through the FC heat exchangers and back to the pools. The FC systems pump suction connects to the spent fuel pools at an elevation that would prevent the pools from draining below the limiting water level in the event of a leak in the FC systems. A bypass purification loop associated with each FC system provides the capability to filter and demineralize the spent fuel pool water. The portions of the FC system that are subject to an AMR consist primarily of the SCs that support the capability to remove heat from the spent fuel pool. The FC SCs that require an AMR are listed in Tables 3.2-2 of each LRA.

Recirculation Spray System

In the North Anna and Surry LRAs, Section 2.3.2.3, "Recirculation Spray," the applicant describes the components of the NAS 1/2 and SPS 1/2 recirculation spray (RS) systems that are within the scope of license renewal and subject to an AMR. The NAS 1/2 and SPS 1/2 RS systems are similar.

The RS systems are designed to provide long-term heat removal from the Containment atmosphere and core cooling water following a design basis loss-of-coolant accident (LOCA). The RS system transfers heat from the reactor core, via coolant spilled from the break, and from the containment atmosphere to the service water (SW) system through the RS heat exchangers. Water collected in the containment sump is pumped through the heat exchangers, then through spray ring headers and nozzles, into the Containment atmosphere. The RS system is designed to return the post-LOCA Containment to sub-atmospheric pressure and to maintain sub-atmospheric conditions for the duration of the accident recovery, thus preventing out-leakage of fission products. The cooled water in the Containment sump is pumped back through the reactor core by the SI system.

For the NAS 1/2, the RS casing cooling components also provide a source of cool borated water to the suction of the RS pumps located outside of containment. This ensures that the NAS RS pumps will have adequate net positive suction head (NPSH) when called upon for service. The SPS 1/2 RS systems do not perform this function.

The major flowpaths of the RS systems are within the scope of license renewal and subject to an AMR. The RS SCs that require an AMR are listed in Tables 3.2-3 of each LRA.

Residual Heat Removal System

In the North Anna and Surry LRAs, Section 2.3.2.4, "Residual Heat Removal," the applicant describes the components of the NAS 1/2 and SPS 1/2 residual heat removal (RH) systems that are within the scope of license renewal and subject to an AMR. The NAS 1/2 and SPS 1/2 RH systems are identical for the purpose of an AMR for license renewal and there are no notable differences. The primary function of the RH systems is to transfer heat from the RCSs to the component cooling (CC) systems during reactor shutdown conditions. Water is drawn from the RCSs, pumped through the RH heat exchangers, and returned to the RCSs to control primary system temperatures. The NAS 1/2 and SPS 1/2 RH systems are in service only when RCS temperatures and pressures have been reduced to 350°F and 450 psig, respectively. In addition, the RH systems provide the capability to pump the reactor cavity water back to the refueling water storage tank following refueling operations. The RH systems also are relied upon in the 10 CFR Part 50, Appendix R Fire Protection design basis for heat removal to reach cold shutdown conditions. Portions of RH system piping and certain valves are within the ASME Class 1 reactor coolant system pressure boundary. The major flowpaths of the RH systems are within the scope of license renewal and subject to an AMR. The RH SCs that require an AMR are listed in Tables 3.2-4 of each LRA.

<u>Safety Injection (SI) System</u>

In the North Anna and Surry LRAs, Section 2.3.2.5, “Safety Injection,” the applicant describes the components of the NAS 1/2 and SPS 1/2 safety injection (SI) systems that are within the scope of license renewal and subject to an AMR. The NAS 1/2 and SPS 1/2 SI systems are identical for the purpose of an AMR for license renewal and there are no notable differences. The functions of the SI systems are to provide emergency cooling to the reactor core and to provide an adequate shutdown margin in the event of a loss-of-coolant accident (LOCA). The SI systems include high-head injection pumps, low-head injection pumps, and hydro-pneumatic accumulator tanks that provide injection of borated water into the reactor coolant system. The pumps also provide the capability to remove reactor core decay heat for extended periods following an accident. This is accomplished by recirculating coolant, as cooled by the RS system, from the containment sump through the core.

The high-head SI pumps provide a dual function as charging pumps as described in Section 2.3.3.1, Chemical and Volume Control (CH), of the applications, and are evaluated for the effects of aging with the CH system components (see Section 3.3.1, “Primary Process Systems” of each LRA). Portions of SI system piping and certain SI valves are within the ASME Class 1 reactor coolant system pressure boundary.

The major flowpaths of the SI systems are within the scope of license renewal and subject to an AMR. The SI SCs that require an AMR are listed in Tables 3.2-5 of each LRA.

3.5.1.2 Aging Effects

In both North Anna and Surry LRAs, Section 3.2, the applicant provides a summary of the results of the AMR for the SCs of the ESF systems. The AMR results are listed in each LRA on Tables 3.2-1 through 3.2-5. The tables provide the following information related to each component commodity group: (1) the “passive functions”, (2) the material group, (3) the environment, (4) the aging effects requiring management, and (5) the specific activities that manage the identified aging effects.

Materials

The materials of construction for the ESF components that are subject to AMR include brass, carbon steel, low-alloy steel, stainless steel, and titanium. Copper alloys and nickel-based alloy materials are also used.

Environments

In the North Anna and Surry LRAs, Table 3.0-1, "Internal Service Environment," and Table 3.0-2, "External Service Environment," the applicant states that the ESF components, subjected to an AMR, are exposed to the following environments; air, atmosphere/weather, borated water leakage, gas, raw water, soil, and treated-water.

In both North Anna and Surry LRAs, Section 3.2, the applicant states the following four aging effects that need to be managed for the ESF SCs for the periods of extended operations:

- cracking
- loss of material
- loss of pre-load (applicable to Class 1 bolting exposed to an air environment)
- reduction in fracture toughness (applicable to cast austenitic stainless steel [CASS] components in a high-temperature treated-water environment)

The applicant uses Tables 3.2-1, 3.2-2, 3.2-3, 3.2-4, and 3.2-5 to identify which of these aging effects will specifically need to be managed for each of the material of fabrication and environmental condition combinations that apply to the ESF component commodity groups that are subject to an AMR.

Applicable Aging Effects

In the North Anna and Surry LRAs, Section 3.2, the applicant states that it has reviewed site-specific operating experience, and industry-wide experience to support its determination of applicable aging effects for the ESF systems. The applicant identified the following applicable aging effects associated with the materials and environments described above for the ESF components that are within the scope of license renewal and subject to an AMR:

- in the North Anna and Surry LRAs, Tables 3.2-1, the applicant identified the following four applicable aging effects for the material and environmental conditions that exist for NAS 1/2 and SPS 1/2 QS/CS components: loss of material, cracking, loss of preload, or reduction of fracture toughness
- in the North Anna and Surry LRAs, Tables 3.2-2, the applicant identified the following four applicable aging effects for the material and environmental conditions that exist for NAS 1/2 and SPS 1/2 FC components: loss of material, cracking, loss of preload, or reduction of fracture toughness
- in the North Anna and Surry LRAs, Tables 3.2-3, the applicant identified the following four applicable aging effects for the material and environmental conditions that exist for NAS 1/2 and SPS 1/2 RS components: loss of material, cracking, loss of preload, or reduction of fracture toughness
- in the North Anna and Surry LRAs, Tables 3.2-4, the applicant identified the following four applicable aging effects for the material and environmental conditions that exist for

NAS 1/2 and SPS 1/2 RH components: loss of material, cracking, loss of preload, or reduction of fracture toughness

- in the North Anna and Surry LRAs, Tables 3.2-5, the applicant identified the following four applicable aging effects for the material and environmental conditions that exist for NAS 1/2 and SPS 1/2 SI components: loss of material, cracking, loss of preload, or reduction of fracture toughness

3.5.1.3 Aging Management Programs

In both the North Anna and Surry LRAs, Section 3.2, the applicant identified the following programs that will be used to manage the applicable aging effects for the ESF SCs that are within the scope of license renewal and subject to an AMR. The materials, environments, aging effects and AMPs are listed in Tables 3.2-1, 3.2-2, 3.2-3, 3.2-4, and 3.2-5 of each LRA for the QS, FC, RS, RH, and SI system components, respectively).

- boric acid corrosion surveillance program (refer to each LRA Section B2.2.3)
- buried piping and valve inspection activities (refer to each LRA Section B2.1.1)
- chemistry control program for primary systems (refer to each LRA Section B2.2.4)
- general-condition-monitoring activities (refer to each LRA Section B2.2.9)
- infrequently accessed area inspection activities (refer to each LRA Section B2.1.2)
- ISI program - component and component support inspections (refer to each LRA Section B2.2.11)
- tank inspection activities (refer to each LRA Section B2.1.3)
- work control process (refer to each LRA Section B2.2.19)

For SPS 1/2, the applicant also credits the augmented inspection activities (Section B2.2.1 of the LRA) to manage cracking of those SPS ESF components that are fabricated from sensitized stainless steel materials. These sensitized stainless steel materials are not used at NAS 1/2 and, therefore, the additional augmented inspection activities are not used at NAS 1/2.

3.5.2 Staff Evaluation

The staff has reviewed the information in the North Anna and Surry LRAs, Sections 2.3.2, and 3.2, and the portions of Appendix B that apply to the ESF systems to determine whether the applicant has demonstrated compliance with the requirements of 10 CFR 54.21(a)(3). In addition, the staff reviewed the applicable portions of the North Anna and Surry UFSARs, plant and industry (as applicable) operating history, the license renewal system drawings provided with each LRA, and other applicable portions of Appendix A, Appendix B, and Appendix C of each LRA. The staff also had a telecommunication with the applicant on August 9, 2001, to discuss the information provided to, and reviewed by the staff. The clarifications and supplemental information provided by the applicant during the telecommunication is documented and docketed in a letter to the applicant dated October 11, 2001. No request for additional information was needed for the staff to complete its review of the ESF systems.

The staff's review and evaluation of the specific scope of ESF SCs included by the applicant as being within the scope of license renewal and subject to an AMR are provided in Section 2.3.4 of this SER. In addition, the staff's review and evaluation of the different aging management activities credited by the applicant to manage the applicable aging effects of the ESF systems are provided in Section 3.3 of this SER. The staff's review and evaluation of the applicant's AMR for the ESF systems are provided in this section of the SER.

3.5.2.1 Aging Effects

All of the ESF components (i.e., the QS, FC, RS, RH and SI components within the scope of license renewal and subject to an AMR as identified in Tables 3.2-1, 3.2-2, 3.2-3, 3.2-4, and 3.2-5, respectively) are fabricated from austenitic stainless steel materials (including cast austenitic stainless steel [CASS]) with the following exceptions:

- ESF bolting is fabricated from carbon or low alloy steel
- spray nozzles are fabricated from brass (only at NAS)
- residual heat removal system pump seal cooler shells are fabricated from carbon or low-alloy steel

For SPS 1/2, the SPS pump seal cooler tubes are fabricated from copper-nickel alloy in lieu of stainless steel, and the SPS recirculation spray cooler channel heads, and tubes are fabricated from titanium in lieu of stainless steel. In addition, for some of the SPS QS and RH piping, the applicant differentiates if the stainless steel material used to fabricate the piping was procured in a sensitized condition.

The applicant has identified that the following aging effects are applicable to the ESF components within the scope of license renewal:

- loss of material in carbon or low-alloy steel components exposed to borated water leakage environments or treated-water environments
- loss of material or loss of material and cracking in non-CASS stainless steel components exposed to treated-water environments (As discussed in Appendix C, Section C3.2.1 and C3.2.2 of each LRA, the piping in question is maintained below 140°F to eliminate stress corrosion cracking as a concern. The piping in question is outside of the ASME Class 1 boundary such that flaw initiation and growth is not a concern)
- loss of material in stainless steel components exposed to raw water, intermittent wet/dry air, or atmosphere/weather environments
- loss of material, cracking, and reduction of fracture toughness in CASS valve bodies

The applicable aging effects identified by the applicant are consistent with current industry practices and industry operating experiences and are acceptable to the staff.

For SPS 1/2 RS systems, the applicant identified loss of material as an applicable aging effect for the copper-nickel alloy RS pump sealer tubes when exposed to borated water leakage or treated-water environments. The applicant has conservatively identified that both loss of material and cracking are applicable aging effect for those portions of the SPS ESF piping that are fabricated from stainless steel in the sensitized condition and exposed to treated-water. Identifying loss of material and cracking as applicable aging effects for the material and environment combinations in question are conservative with respect to standard industry practices and are acceptable to the staff.

The applicant has not identified any aging effects associated with titanium, brass, stainless steel, or carbon/low-alloy steel components in a dry air environment. On the basis of current industry knowledge and industry operating experience, dry air on metal will not result in aging that will be of concern during the period of extended operation. Therefore, the staff did not identify any concerns with the applicant's conclusions that there are no applicable aging effects for metal in a dry air environment.

On the bases of the AMR methodology, the applicant identified the aging effects discussed above. In the North Anna and Surry LRAs, Tables 3.2-1 through, 3.2-5, the applicant listed the applicable aging effects associated with the different components, component functions, materials, and environments, and the applicable aging management activities. In the North Anna and Surry LRAs, Appendix C, the applicant also describes its plant-specific, and its industry-wide operating experience review to support the applicable aging effects identified for the ESF systems. The staff reviewed and verified that the material, environmental, and aging effect combinations are consistent with published literature and industry operating experience, and that there is reasonable assurance that all applicable aging effects have been identified.

In RAI 2.1-3, the staff addressed the Seismic II/I emerging safety issue as it pertains the Surry/North Anna LRA. In this RAI, the staff asked the applicant to identify those non-safety-related (NSR) systems whose spatial orientation and failure could effect the structural integrity and safety functions of safety-related (SR) systems within the scope of license renewal. The applicant's response to RAI 2.1-3, dated February 1, 2002, has increased the license renewal boundary for four of the ESF systems within the scope of license renewal: (1) QS/CS, (2) RH, (3) FC, and (4) SI. In the response to RAI 2.1-3, the applicant provided the AMRs for the expanded portions of the QS/CS, RH, FC, and SI systems brought within the scope of license renewal as part of the applicant's efforts to resolve the Seismic II/I issue for the Surry/North Anna LRA. The applicant has identified that the following aging affects are applicable for the expanded portions of the QS/CS, RH, FC, and SI systems brought within the scope of license renewal:

- loss of material and cracking in stainless steel components exposed to treated water at temperatures above 140°F
- loss of material in stainless steel components exposed to treated water at temperatures at or below 140°F
- loss of material from the external surfaces of stainless steel components exposed to air

The applicant's identification of the materials of fabrication, internal and external environments, and aging effects identified for the expanded portions of the QS/CS, FC, RH, and SI systems brought within the scope of license renewal are consistent with the applicant's identification of aging effects for components with corresponding materials of fabrication/environmental condition combinations originally identified by the applicant in Tables 3.2-1, 3.2-2, 3.2-4, and 3.2-5 of the application, respectively. The applicant's identification of aging effects for these fabrication/environmental condition combinations have been evaluated and found to be acceptable by the staff, as discussed previously in this section.

3.5.2.2 Aging Management Programs

The applicant has identified 8 AMAs for managing the applicable aging effects of the ESF SCs. In each LRA, Tables 3.2-1 through 3.2-5, the applicant identified each of the following AMA and its applications to the SCs and the associated aging effects:

- boric acid corrosion surveillance program to manage loss of material in carbon steel components exposed to borated water leakage for ESF components subject to aging management inside Containment
- general-condition-monitoring activities to manage loss of material in carbon steel components exposed to borated water leakage for ESF components subject to aging management outside Containment
- general-condition-monitoring activities to manage loss of material in stainless steel components (other than piping or tanks) that are exposed externally to atmosphere/weather or intermittent wet/dry air environments
- buried piping and valve inspection activities to manage loss of material from the external surfaces of buried stainless steel piping or valves
- chemistry control program to manage loss of material or cracking in stainless steel components exposed internally to treated-water
- ISI program as an additional program to manage loss of pre-load in ASME Code Class 1 bolting exposed to air environments, cracking in ASME Class 1 stainless steel piping exposed internally to treated-water, or reduction of fracture toughness in ASME Class 1 CASS valves exposed internally to treated-water at temperatures above 482°F (In accordance with 10 CFR 50.55a, to the applicant is required to perform all ISI and IST on ASME Code Class 1, 2 or 3 ESF components that are currently required by its CLB.)
- tank inspection activities as an additional program for managing loss of material of those ESF stainless steel tanks that are exposed internally to treated-water and externally to atmosphere/weather conditions
- infrequent accessed area inspection activities for managing loss of material in stainless steel piping and sump screens exposed to raw water in the containment sump
- work control process as an additional program for managing loss of material in stainless steel piping and valve bodies that are located in the containment sump and exposed internally to raw water, and in stainless steel ESF components that are exposed internally to intermittent wet/dry air environments

For SPS 1/2, the applicant also credits the chemistry control program for primary systems as an additional program for managing loss of material in SPS sensitized stainless steel ESF piping that is exposed internally to treated-water, and both the chemistry control program for primary systems and the augmented inspection activities as additional program for managing cracking in these components. In addition, the applicant identified the following programs to manage cracking or loss of material in the SPS copper-nickel SI pump seal cooler tubes:

- work control process to manage cracking in the external surfaces of the tubes under air environments
- general-condition-monitoring activities to manage loss of material from the external surfaces when exposed to borated water leakage environments
- work control process to manage loss of material from the internal surfaces when exposed to treated-water

The applicant's response to RAI 2.1-3, dated February 1, 2002, has increased the license renewal boundary for four of the ESF systems within the scope of license renewal: (1) QS/CS, (2) RH, (3) FC, and (4) SI. In the response to RAI 2.1-3, the applicant provided the AMRs for the expanded portions of the QS/CS, RH, FC, and SI systems brought within the scope of license renewal as part of the applicant's efforts to resolve the Seismic II/I issue for the

Surry/North Anna LRA. The applicant has identified that the following aging management activities or programs will be used to manage loss of material and/or cracking in the expanded portions of the QS/CS, RH, FC, and SI systems brought within the scope of license renewal:

- general condition monitoring activities and infrequently accessed area inspection activities to manage loss of material from the external surfaces of the stainless steel components
- chemistry control program for primary systems and the work control process to manage loss of material and/or cracking in stainless steel components exposed to treated water

The detailed review performed by staff on individual AMAs and its ability to effectively manage the applicable aging effects is provided in Sections 3.3.1 and 3.3.4 of this SER. However, as part of its review of the applicant's AMR, the staff did verify that the AMAs assigned to the different ESF SCs were consistent with the applicable aging effects. As a result of this review, the staff verified that the AMAs credited for managing the applicable aging effects for the ESF components are consistent with current industry practices. No omissions or concerns were identified with AMAs used to manage the ESF systems.

3.5.3 Conclusions

On the basis of the review described above, the staff concludes that the applicant has performed an AMR that adequately identifies the applicable aging effects for the ESF SCs. In combination with the staff's scoping review, as documented in Section 2.3.2 of this SER, and the staff's aging management activities reviews, as documented in Sections 3.3.1 and 3.3.4 of this SER, the staff concludes that the applicant has demonstrated that there is reasonable assurance that the effects of aging on ESF systems will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation.

3.6 Aging Management of Auxiliary Systems

The applicant described its aging management review (AMR) of the primary process systems, open water systems, closed-water systems, diesel generator support systems, air and gas systems, and ventilation and vacuum systems for license renewal in nine separate sections of each LRA Section 3.3.1, “Primary Process Systems”; Section 3.3.2, “Open Water Systems”; Section 3.3.3, “Closed-water Systems”; Section 3.3.4, “Diesel Generator Support Systems”; Section 3.3.5, “Air and Gas Systems”; Section 3.3.6, “Ventilation and Vacuum Systems”; Section 3.3.7, “Drain and Liquid Processing Systems”; Section 3.3.8, “Vent and Gaseous Processing System”; and 3.3.9, “Fire Protection and Supporting Systems,” of the LRA. Appendices A, B, and C to the LRA also contain supplementary information related to the AMR of the auxiliary systems. The staff reviewed Section 3.3 of each LRA to determine whether the applicant has demonstrated that the effects of aging on these systems will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

During its review of the summary of the results of the AMR for these systems, the staff determined the need for clarification on the following:

- loss of material is listed as an applicable aging effect for stainless steel components exposed to air (water-laden or intermittent exposure to water)
- the IS program - component and component support inspections is credited for managing the loss of pre-load for bolting
- no aging effects were identified in the application for carbon steel and low-alloy steel components exposed to an external air environment as found in Tables 3.3.7, 3.3.8, and 3.3.9 in both applications

During a telecommunication with the applicant on July 31, and August 8, 2001 (as documented in telecommunication summaries dated August 8, and October 11, 2001) the applicant clarified that:

- the applicant has no operating history of aging of stainless steel components in an air environment (water-laden or intermittently exposed to water); however, these components are managed for potential loss of material to ensure a conservative approach to detect such aging in the period of extended operation
- the intent of crediting the ISI program - component and component support inspections for bolting is to detect gross loss of pre-load (loose bolts) through visual inspections not for detection in a reduction of torque
- the external air environment in Tables 3.3.7, 3.3.8, and 3.3.9 in both applications are sheltered, non-wetted air environments that would not lead to a loss of material for carbon steel and low-alloy steel components

Based on the information provided by the applicant, the staff concluded that the responses are acceptable and that additional information will not be required.

3.6.1 Primary Process Systems

3.6.1.1 Summary of Technical Information in the Application

The applicant described the results of its AMR of the primary process systems for license renewal in Section 3.3.1, “Primary Process Systems,” of the LRAs. The staff reviewed this section of each LRA to determine whether the applicant has demonstrated that the effects of aging on the primary process systems (PPS) will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

The PPS is described in the following sections of the LRAs: Section 2.3.3.1 of both LRAs, “Chemical and Volume Control (CH) system”; Section 2.3.3.2 of NAS LRA, “High Radiation Sampling System (HRSS)”; Section 2.3.3.2 of SPS LRA, “Incore Instrumentation (IC) system”; Section 2.3.3.3 of NAS LRA, “Incore Instrumentation (IC) system”; Section 2.3.3.3 of SPS LRA, “Reactor Cavity Purification (RL) system”; Section 2.3.3.4 of NAS LRA, “Refueling Purification (RP) system”; Section 2.3.3.4 of SPS LRA, “Sampling (SS) system”; and Section 2.3.3.5 of NAS LRA, “Sampling (SS) system”.

3.6.1.1.1 Aging Effects

The materials of construction for the PPS systems, structures, and components (SSCs) are stainless steel (including cast austenitic stainless steel) with carbon steel, low-alloy steel, cast iron and copper alloys.

In addition, for SPS 1/2 only, nickel-based alloy components are also used and the fabrication process for the PPS piping systems resulted in sensitization of some of the stainless steel material.

A description of the internal environments is provided in Table 3.0-1 of each LRA. The PPS components are exposed to one or more of the following internal environments:

- borated water
- gas
- treated-water
- ambient air
- raw water and lubricating oil for the charging pump lubricating oil cooler (NAS 1/2 only)
- raw water (brackish) and lubricating oil for the charging pump lubricating oil cooler (SPS 1/2 only)

The PPS SSCs external surfaces that require aging management review are located in various indoor areas of the plant including containment. These components are exposed to containment air and sheltered-air environments. The containment air and sheltered-air environments are as indicated in Table 3.0-2 of each LRA.

The following aging effects, associated with PPS SSCs require management:

- change in material properties of copper alloy components in a raw water environment
- cracking of stainless steel (including CASS) components in treated-water, steam or oil environments

- loss of material from carbon steel, low-alloy steel, cast iron, copper alloy, and stainless steel (including CASS) components in raw water, treated-water, steam, oil, or air environments
- loss of material from carbon steel, low-alloy steel, cast iron, and copper alloy components in a borated-water leakage environment
- heat transfer degradation of heat transfer surfaces in a raw water environment
- loss of pre-load of Class 1 bolting exposed to an air environment
- reduction in fracture toughness of CASS components in a high-temperature treated-water environment
- thermal fatigue of piping

In addition, the following aging effects are applicable only for SPS 1/2:

- cracking and loss of material from sensitized stainless steel components in a treated-water environment
- loss of material from nickel-based alloy components in a treated-water environment

3.6.1.1.2 Aging Management Programs

The following aging management activities manage aging effects for the PPS SSCs:

- boric acid corrosion surveillance
- chemistry control program for secondary systems
- chemistry control program for primary systems
- general-condition-monitoring activities
- ISI program - component and component support inspections
- work control process
- augmented inspection activities (SPS 1/2 only)

A description of these aging management programs and activities, along with the demonstration that the identified aging effects will be effectively managed for the period of extended operation, is provided in the following sections of each LRA: Section B2.2.3, "Boric Acid Corrosion Surveillance"; Section B2.2.5, "Chemistry Control Program for Secondary Systems"; Section B2.2.4, "Chemistry Control Program for Primary Systems"; Section B2.2.9, "General-condition-monitoring activities"; Section B2.2.11, "ISI Program - Component and Component Support Inspections"; Section B2.2.19, "Work Control Process"; and Section B2.2.1, "Augmented Inspection Activities." The staff reviewed these sections of each LRA to determine whether the applicant has demonstrated that the effects of aging on the PPS SSCs will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.6.1.2 Staff Evaluation

3.6.1.2.1 Aging Effects

The aging effects that result from contact of PPS SSCs to environments as shown in Table 3.3.1 are consistent with industry experience for these combinations of materials and environments. The staff finds that the aging effects listed are appropriate for the combinations of materials and environments listed.

3.6.1.2.2 Aging Management Programs

The aging management programs have been evaluated in Sections 3.3.1 and 3.3.4 of this SER and have been found to be acceptable for managing the aging effects identified for the PPS SSCs.

3.6.1.3 Conclusion

The staff reviewed the information in Section 3.3.1, "Primary Process Systems." On the basis of this review, the staff concludes that the applicant has demonstrated that the aging effects associated with the PPS SSCs will be adequately managed so that there is reasonable assurance that these systems will perform their intended functions in accordance with the CLB during the period of extended operation.

3.6.2 Open Water Systems

3.6.2.1 Summary of Technical Information in the Application

The applicant described the results of its AMR of the open water systems for license renewal in Section 3.3.2, "Open Water Systems," of each LRA. The staff reviewed this section of each LRA to determine whether the applicant has demonstrated that the effects of aging on the open water systems will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

The open water systems are described in the following sections of each LRA: Section 2.3.3.21 of NAS LRA, "Heating and ventilation (HV) system"; Section 2.3.3.14 of NAS LRA, "Instrument Air (IA) system"; Section 2.3.3.6 of NAS LRA, "Service water (SW) system"; Section 2.3.4.2 of SPS LRA, "Blowdown (BD) system"; Section 2.3.3.5 of SPS LRA, "Circulating Water (CW) system"; Section 2.3.3.6 of SPS LRA, "Service Water (SW) system"; Section 2.3.3.20 of SPS LRA, "Vacuum Priming (VP) system"; and Section 2.3.3.21 of SPS LRA, "Ventilation (VS) system."

3.6.2.1.1 Aging Effects

The materials of construction for the open water systems SSCs are carbon steel, low-alloy steel, cast iron, stainless steel, copper alloys, and elastomers (rubber). In addition, for SPS 1/2 only, the open water systems SSCs include aluminum, fiberglass, titanium, and nickel-based alloy materials.

A description of the internal environments is provided in Table 3.0-1 of each LRA. The open water systems SSCs are exposed to one or more of the following internal environments:

- raw water
- air
- gas (refrigerant)
- treated-water
- raw water (fresh water) treated to inhibit biological growth and minimize corrosion as the source for HV system chiller condenser cooling water and instrument air compressor cooling water (NAS 1/2 only)

In addition, the following internal environments are applicable only for SPS 1/2:

- raw water (brackish water of the James River) as the source for the CW and SW (including VS chiller condenser cooling water) systems
- fuel oil, lubricating oil, and treated-water (diesel cooling) for SW system diesel engines and auxiliaries
- treated-water for main condenser components
- steam environment on shell-side of the main condenser tubes and tubesheets

The open water systems SSCs external surfaces that require aging management review are located in various indoor areas of the plant including containment. These components are exposed to containment air and sheltered-air environments. In addition, external surfaces of open water systems SSCs may be exposed to borated water leakage conditions and portions of open water systems piping are buried in soil or encased in concrete. These environments, are as indicated in Table 3.0-2 of each LRA.

In addition, some open water systems SSCs found only in NAS 1/2 are externally exposed to the outdoor (atmosphere/weather) environment as indicated in Table 3.0-2. In addition, portions of the SW system piping at the service water reservoir at NAS 1/2 are continually submerged and other piping and components are intermittently wetted by evaporative cooling spray.

The following aging effects, associated with open water systems SSCs require management:

- change in material properties and cracking of elastomeric components in an air environment
- change in material properties of copper alloy components in a raw water environment
- loss of material from carbon steel, low-alloy steel, cast iron, stainless steel, or copper alloy components in raw water or air environments
- heat transfer degradation of heat transfer surfaces in a raw water environment
- loss of material from carbon steel, low-alloy steel, and copper alloy components in a borated water leakage environment

The following aging effects are applicable only for open water systems SSCs at NAS 1/2:

- loss of material from stainless steel components in a treated-water environment
- loss of material from copper alloy components in an atmosphere/weather environment

In addition, the following aging effects are applicable only for open water systems SSCs in SPS 1/2:

- change in material properties and loss of material from copper alloy components in a soil (buried) or treated-water/steam environment
- loss of material from buried stainless steel components in a soil environment
- loss of material from carbon steel, low-alloy steel, cast iron, copper alloy components in an oil environment
- loss of material from nickel-base alloy components in a raw water environment
- loss of material from carbon steel, low-alloy steel, cast iron, or titanium components in treated-water or steam environments

3.6.2.1.2 Aging Management Programs

The following aging management activities manage aging effects for the open water systems SSCs:

- boric acid corrosion surveillance
- buried piping and valve inspection activities
- general-condition-monitoring activities
- infrequently accessed area inspection activities
- service water system inspections
- work control process
- chemistry control program for secondary systems (SPS 1/2 only)
- fuel oil chemistry (SPS 1/2 only)
- tank inspection activities (SPS 1/2 only)

A description of these aging management programs and activities, along with the demonstration that the identified aging effects will be effectively managed for the period of extended operation, is provided in the following sections of each LRA: Section B2.2.3, "Boric Acid Corrosion Surveillance"; Section B2.1.1, "Buried Piping and Valve Inspection Activities"; Section B.2.2.9, "General-condition-monitoring activities"; Section B.2.1.2, "Infrequently Accessed Area Inspection Activities"; Section B2.2.17, "Service Water System Inspections"; Section B2.2.19, "Work Control Process"; Section B2.2.5, "Chemistry Control Program for Secondary Systems"; Section B2.2.8, "Fuel Oil Chemistry"; and Section B2.1.3, "Tank Inspection Activities." The staff reviewed these sections of each LRA to determine whether the applicant has demonstrated that the effects of aging on the open water systems SSCs will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.6.2.2 Staff Evaluation

3.6.2.2.1 Aging Effects

The aging effects that result from contact with open water system SSCs to environments as shown in Table 3.3.2 are consistent with industry experience for these combinations of materials and environments. The staff finds that the aging effects are appropriate for the combinations of materials and environments listed.

3.6.2.2.2 Aging Management Programs

The aging management programs have been evaluated in Sections 3.3.1 and 3.3.4 of this SER and have been found to be acceptable for managing the aging effects identified for the open water systems SSCs.

3.6.2.3 Conclusion

The staff reviewed the information in Section 3.3.2, "Open Water System." On the basis of this review, the staff concludes that the applicant has demonstrated that the aging effects associated with the open water systems SSCs will be adequately managed so that there is reasonable assurance that these systems will perform their intended functions in accordance with the CLB during the period of extended operation.

3.6.3 Closed-water Systems

3.6.3.1 Summary of Technical Information in the Application

The applicant described the results of its AMR of the closed-water systems for license renewal in Section 3.3.3, “Closed-water Systems,” of each LRA. The staff reviewed this section of each LRA to determine whether the applicant has demonstrated that the effects of aging on the closed-water systems SSCs will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

The closed-water systems are described in the following sections of each LRA: Section 2.3.3.7 of NAS LRA, “Chilled water (CD) system”; Section 2.3.3.8 of NAS LRA, “Component cooling (CC) system”; Section 2.3.3.17 of NAS LRA, “Containment vacuum (CV) system”; Section 2.3.3.21 of NAS LRA, “Heating and ventilation (HV) system”; Section 2.3.3.9 of NAS LRA, “Neutron shield tank cooling (NS) system”; Section 2.3.1.1 of NAS LRA, “Reactor coolant (RC) system”; Section 2.3.3.7 of SPS LRA, “Bearing Cooling BC) system”, Section 2.3.3.8 of SPS LRA, “Component Cooling (CC) system”; Section 2.3.3.14 of SPS LRA, “Instrument Air (IA) system”; Section 2.3.3.9 of SPS LRA, “Neutron Shield Tank Cooling (NS) system”; Section 2.3.3.10 of SPS LRA, “Primary Grade Water (PG) system”; Section 2.3.1.1 of SPS LRA, “Reactor Coolant (RC) system”; and Section 2.3.3.21 of SPS LRA, “Ventilation (VS) system.”

3.6.3.1.1 Aging Effects

The materials of construction for the closed-water systems SSCs are carbon steel, low-alloy steel, cast iron, stainless steel, copper alloys, and titanium.

A description of the internal environments is provided in Table 3.0-1 of each LRA. The closed-water systems SSCs are exposed to one or more of the following internal environments:

- treated-water (bearing cooling/chilled water)
- treated-water (component cooling)
- raw water
- gas (refrigerant)

The closed-water systems SSCs external surfaces that require aging management review are located in indoor areas of the plant including containment. These components are exposed to air and Containment air environments. The sheltered-air and Containment air environments, are indicated in Table 3.0-2 of each LRA. External surfaces of closed-water systems SSCs may also be exposed to borated water leakage conditions.

The following aging effects, associated with closed-water systems SSCs require management:

- loss of material from carbon steel, low-alloy steel, cast iron, stainless steel, titanium, and copper alloy components in treated-water or air environments
- loss of material from carbon steel and low-alloy steel components in a raw water environment

- loss of material from carbon steel, low-alloy steel, cast iron, and copper alloy components in a borated-water leakage environment
- heat transfer degradation of heat transfer surfaces in a raw water environment
- loss of material from stainless steel and copper alloy components in a raw water environment. (NAS 1/2)

3.6.3.1.2 Aging Management Programs

The following aging management activities manage aging effects for the closed-water systems SSCs:

- boric acid corrosion surveillance
- chemistry control program for secondary systems
- chemistry control program for primary systems
- general-condition-monitoring activities
- infrequently accessed area inspection activities
- service water system inspections
- work control process

A description of these aging management programs and activities, along with the demonstration that the identified aging effects will be effectively managed for the period of extended operation, is provided in the following sections of each LRA: Section B2.2.3, "Boric Acid Corrosion Surveillance"; Section B2.2.5, "Chemistry Control Program for Secondary Systems"; Section B2.2.4, "Chemistry Control Program for Primary Systems"; Section B2.2.9, "General-condition-monitoring activities"; Section B2.1.2, "Infrequently Accessed Area Inspection Activities"; Section B2.2.17, "Service Water System Inspections"; and Section B2.2.19, "Work Control Process." The staff reviewed these sections of each LRA to determine whether the applicant has demonstrated that the effects of aging on the closed-water systems SSCs will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.6.3.2 Staff Evaluation

3.6.3.2.1 Aging Effects

The aging effects that result from contact of closed-water systems SSCs to environments as shown in Table 3.3.3 are consistent with industry experience for these combinations of materials and environments. The staff finds that the aging effects are appropriate for the combinations of materials and environments.

3.6.3.2.2 Aging Management Programs

The aging management programs have been evaluated in Sections 3.3.1 and 3.3.4 of this SER and have been found to be acceptable for managing the aging effects identified for the closed-water systems SSCs.

3.6.3.3 Conclusion

The staff reviewed the information in Section 3.3.3, "Closed-water Systems." On the basis of this review, the staff concludes that the applicant has demonstrated that the aging effects associated with the closed-water systems SSCs will be adequately managed so that there is reasonable assurance that these systems will perform their intended functions in accordance with the CLB during the period of extended operation.

3.6.4 Diesel Generator Support Systems

3.6.4.1 Summary of Technical Information in the Application

The applicant described the results of its AMR of the diesel generator support systems for license renewal in Section 3.3.4, "Diesel Generator Support Systems," of each LRA. The staff reviewed this section of each LRA to determine whether the applicant has demonstrated that the effects of aging on the diesel generator support systems (DGSS) will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

The DGSS are described in the following sections of each LRA: Section 2.3.3.10, "Alternate AC (AAC) Diesel Generator Systems"; Section 2.3.3.11, "Emergency Diesel Generator (EDG) Systems"; and Section 2.3.3.13, "Security (SEC) System".

3.6.4.1.1 Aging Effects

The materials of construction for the DGSS SSCs are carbon steel, low-alloy steel, cast iron, stainless steel, copper alloys, and aluminum.

A description of the internal environments is provided in Table 3.0-1 of each LRA. The DGSS SSCs are exposed to one or more of the following internal environments:

- compressed air
- lubricating or fuel oil
- treated-water (diesel cooling)
- raw water
- ambient air

The DGSS SSCs external surfaces that require aging management review are located in indoor and outdoor areas of the plant. These components are exposed to air, and atmosphere/weather environments. The sheltered-air and outdoor (atmosphere/weather) environments are as indicated in Table 3.0-2 of each LRA. Portions of DGSS piping are buried in soil and are exposed to a soil environment.

The following aging effects, associated with DGSS SSCs require management:

- cracking of copper alloy components in an air environment
- loss of material from carbon steel, low-alloy steel, cast iron, stainless steel, and copper alloy components in oil, air, treated-water, raw water, soil, or atmosphere/weather environments
- cracking of copper alloy components in an atmosphere/weather environment (SPS 1/2)

3.6.4.1.2 Aging Management Programs

The following aging management activities manage aging effects for the DGSS SSCs:

- buried piping and valve inspection activities
- chemistry control program for secondary systems
- fuel oil chemistry
- general-condition-monitoring activities
- tank inspection activities
- work control process

A description of these aging management programs and activities, along with the demonstration that the identified aging effects will be effectively managed for the period of extended operation, is provided in the following sections of each LRA: Section B2.1.1, “Buried Piping and Valve Inspection Activities”; Section B2.2.5, “Chemistry Control Program for Secondary Systems”; Section B2.2.8, “Fuel Oil Chemistry”; Section B2.2.9, “General-condition-monitoring activities”; Section B2.1.3, “Tank Inspection Activities”; and Section B2.2.19, “Work Control Process.” The staff reviewed these sections of each LRA to determine whether the applicant has demonstrated that the effects of aging on the DGSS SSCs will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.6.4.2 Staff Evaluation

3.6.4.2.1 Aging Effects

The aging effects that result from contact of DGSS SSCs to environments as shown in Table 3.3.4 of each LRA are consistent with industry experience for these combinations of materials and environments. The staff finds that the aging effects are appropriate for the combinations of materials and environments.

3.6.4.2.2 Aging Management Programs

The aging management programs for the DGSS SSCs have been evaluated in Sections 3.3.1 and 3.3.4 of this SER and have been found to be acceptable for managing the aging effects identified for the DGSS SSCs.

3.6.4.2.3 Conclusion

The staff reviewed the information in Section 3.3.4, “Diesel Generator Support Systems.” On the basis of this review, the staff concludes that the applicant has demonstrated that the aging effects associated with the DGSS SSCs will be adequately managed so that there is reasonable assurance that these systems will perform their intended functions in accordance with the CLB during the period of extended operation.

3.6.5 Air and Gas Systems

3.6.5.1 Summary of Technical Information in the Application

The applicant described the results of its AMR of the air and gas systems for license renewal in Section 3.3.5, “Air and Gas Systems,” of each LRA. The staff reviewed this section of each LRA to determine whether the applicant has demonstrated that the effects of aging on the air and gas systems will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

The air and gas systems are described in the following sections of each LRA: Section 2.3.3.13, “Compressed air (CA) system”; Section 2.3.4.4, “Feedwater (FW) system”; Section 2.3.3.21, “Heating and ventilation (HV) system”; Section 2.3.3.14, “Instrument air (IA) system”; Section 2.3.3.15, “Primary and secondary plant gas supply (GN) system”; and Section 2.3.1.1, “Reactor coolant (RC) system”; and Section 2.3.3.16, “Service air (SA) system.

3.6.5.1.1 Aging Effects

The materials of construction for the air and gas systems SSCs are rubber, carbon steel, low-alloy steel, stainless steel, copper alloys, and aluminum.

The air and gas system SSCs are exposed to one or more of the internal environments described in Table 3.0-1 of each LRA.

The internal environment for the air and gas systems SSCs is compressed dry air or gas, with the exception of SA system components environment which is considered moisture-laden air since there are no dryers in the system. The air and gas systems SSCs that require aging management review are located in the containment and other indoor areas of the plant, and are exposed to an air environment. The containment air environment, and the sheltered-air environment used for areas outside containment, are as indicated in Table 3.0-2 of each LRA.

External surfaces of air and gas systems SSCs may also be exposed to borated water leakage conditions.

The following aging effects, associated with the air and gas systems, require management:

- cracking and change in material properties of rubber components in an air environment
- loss of material from carbon steel, low-alloy steel, and copper alloy components in a borated water leakage environment
- loss of material from stainless steel components in an air environment (NAS 1/2)
- loss of material from copper alloy components in an air environment (SPS 1/2)

3.6.5.1.2 Aging Management Programs

The following aging management activities manage aging effects for the air and gas systems SSCs:

- boric acid corrosion surveillance
- general condition monitoring
- work control process

A description of these aging management programs and activities, along with the demonstration that the identified aging effects will be effectively managed for the period of extended operation, is provided in the following sections of each LRA: Section B2.2.3, "Boric Acid Corrosion Surveillance"; Section B2.2.9, "General-condition-monitoring activities"; and Section B2.2.19, "Work Control Process." The staff reviewed these sections of each LRA to determine whether the applicant has demonstrated that the effects of aging on the air and gas systems SSCs will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.6.5.2 Staff Evaluation

3.6.5.2.1 Aging Effects

The aging effects that result from contact of air and gas systems SSCs to environments as shown in Table 3.3.5 of each LRA are consistent with industry experience for these combinations of materials and environments. The staff finds that the aging effects are appropriate for the combinations of materials and environments listed.

3.6.5.2.2 Aging Management Programs

The aging management programs for the air and gas systems SSCs have been evaluated in Section 3.3.1 of this SER and have been found to be acceptable for managing the aging effects identified for the air and gas systems SSCs.

3.6.5.2.3 Conclusion

The staff reviewed the information in Section 3.3.5, "Air and Gas Systems." On the basis of this review, the staff concludes that the applicant has demonstrated that the aging effects associated with the air and gas systems will be adequately managed so that there is reasonable assurance that these systems will perform their intended functions in accordance with the CLB during the period of extended operation.

3.6.6 Ventilation and Vacuum Systems

3.6.6.1 Summary of Technical Information in the Application

The applicant described the results of its AMR of the ventilation and vacuum systems for license renewal in Section 3.3.6, "Ventilation and Vacuum Systems," of each LRA. The staff reviewed this section of each LRA to determine whether the applicant has demonstrated that the effects of aging on the ventilation and vacuum systems will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

The ventilation and vacuum systems are described in the following sections of each LRA: Section 2.3.3.17, "Containment Vacuum (CV) system"; Section 2.3.3.18, "Leakage monitoring

(LM) system”; Section 2.3.3.19, “Secondary Vent (SV) system”; Section 2.3.3.20, “Vacuum priming (VP) system”; and Section 2.3.3.21, “Heating and ventilation (HV) system.”

3.6.6.1.1 Aging Effects

The materials of construction for the ventilation and vacuum systems SSCs are carbon steel, low-alloy steel, copper alloys, stainless steel, and elastomeric (rubber) materials. Aluminum is used in the ventilation and vacuum systems at NAS 1/2. Cast iron is also used at SPS 1/2 in ventilation and vacuum systems SSCs.

The internal environment for the ventilation and vacuum systems SSCs is air or gas, with the exception of the HV system chiller compressors which are subjected to a refrigerant (freon gas) internal environment. A description of internal environments is provided in Table 3.0-1 of each LRA.

The ventilation and vacuum systems SSCs that require aging management review are located in the containment and other indoor areas of the plant, and outdoors. These components are exposed to an air environment. The containment air environment, and the sheltered-air and outdoor (atmosphere/weather) environments are as indicated in Table 3.0-2 of each LRA.

External surfaces of ventilation and vacuum systems SSCs may also be exposed to borated water leakage conditions.

The following aging effects, associated with the ventilation and vacuum systems SSCs, require management:

- loss of material from carbon steel, low-alloy steel, and copper alloy components in a borated water leakage environment
- loss of material from carbon steel and low-alloy steel components in an air or atmosphere/weather environment
- cracking and change in material properties of rubber components in an air or atmosphere/weather environment

In addition, the following aging effects require management only at SPS 1/2:

- loss of material from carbon steel and low-alloy steel components in an air or atmosphere/weather environment
- loss of material from cast iron components in an air environment

3.6.6.1.2 Aging Management Programs

The following aging management activities manage aging effects for the ventilation and vacuum systems SSCs:

- boric acid corrosion surveillance
- general condition monitoring
- work control process

A description of these aging management programs and activities, along with the demonstration that the identified aging effects will be effectively managed for the period of extended operation, is provided in the following sections of each LRA: Section B2.2.3, "Boric Acid Corrosion Surveillance"; Section B2.2.9, "General-condition-monitoring activities"; and Section B2.2.19, "Work Control Process." The staff reviewed these sections of each LRA to determine whether the applicant has demonstrated that the effects of aging on the ventilation and vacuum systems SSCs will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.6.6.2 Staff Evaluation

3.6.6.2.1 Aging Effects

The aging effects that result from contact of ventilation and vacuum systems SSCs to environments as shown in Table 3.3.6 are consistent with industry experience for these combinations of materials and environments. The staff finds that the aging effects are appropriate for the combinations of materials and environments listed.

3.6.6.2.2 Aging Management Programs

The aging management programs have been evaluated in Section 3.3.1 of this SER and have been found to be acceptable for managing the aging effects identified for the ventilation and vacuum systems SSCs.

3.6.6.2.3 Conclusion

The staff reviewed the information in Section 3.3.6, "Ventilation and Vacuum Systems." On the basis of this review, the staff concludes that the applicant has demonstrated that the aging effects associated with the ventilation and vacuum systems will be adequately managed so that there is reasonable assurance that these systems will perform their intended functions in accordance with the CLB during the period of extended operation.

3.6.7 Drain and Liquid Processing Systems

3.6.7.1 Summary of Technical Information in the Application

The applicant described the results of its AMR of the drain and liquid processing systems for license renewal in Section 3.3.7, "Drain and Liquid Processing Systems," of each LRA. The staff reviewed this section of each LRA to determine whether the applicant has demonstrated that the effects of aging on the drain and liquid processing systems will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

The drain and liquid processing systems are described in the following sections of each LRA: Section 2.3.3.22 of SPS LRA, "Boron Recovery System"; Section 2.3.3.23 of SPS LRA, "Drains-Aerated System"; Section 2.3.3.24 of SPS LRA, "Drains-Gaseous System"; Section 2.3.3.25 of SPS LRA, "Plumbing System"; Section 2.3.3.22 of NAS LRA, "Boron Recovery (BR) system"; Section 2.3.3.23 of NAS LRA, "Drains - Aerated (DA) system"; Section 2.3.3.24 of NAS LRA, "Drains - Building Services (DB) system"; Section 2.3.3.25 of NAS LRA, "Drains - Gaseous

(DG) system"; Section 2.3.3.26 of NAS LRA, "Liquid and Solid Waste (LW) system" and Section 2.3.3.27 of NAS LRA, "Radwaste (RW) system."

3.6.7.1.1 Aging Effects

The materials of construction for the drain and liquid processing system components are stainless steel, carbon steel, and low-alloy steel. For SPS 1/2, fiberglass material is also used.

A description of the internal environments to the drain and liquid processing systems is provided in Table 3.0-1 of each LRA. The system components are exposed internally to one or more of the following environments:

- treated-water (borated water)
- gas
- treated-water (component cooling)
- air
- steam

External surfaces of the drain and liquid processing system structures and components that require aging management review are exposed to the containment air environment and sheltered-air environment for areas outside containment. The external surfaces of the system component may also be exposed to borated water leakage conditions. These environments are discussed in Table 3.0-2 of each LRA.

The applicant identified the following aging effects associated with the drain and liquid processing systems that require management:

- cracking of stainless steel components in a steam environment
- loss of material from carbon steel, low-alloy steel, and stainless steel components in air, gas, raw water, steam, or treated-water environments
- loss of material from carbon steel and low-alloy steel components in a borated water leakage environment

3.6.7.1.2 Aging Management Programs

The applicant identified the following aging management activities to manage aging effects for the drain and liquid processing systems:

- boric acid corrosion surveillance
- chemistry control program for primary systems
- general-condition-monitoring activities
- work control process

A description of these aging management programs and activities, along with the demonstration that the identified aging effects will be effectively managed for the period of extended operation, is provided in the following sections of each LRA: Section B2.2.3, "Boric Acid Corrosion Surveillance"; Section B2.2.4, "Chemistry Control Program for Primary Systems"; Section B2.2.9, "General-condition-monitoring activities"; and Section B2.2.19, "Work Control Process". The staff reviewed these sections of the LRAs to determine whether the applicant has demonstrated that the effects of aging on the drain and liquid processing system structures and components will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.6.7.2 Staff Evaluation

3.6.7.2.1 Aging Effects

The aging effects that result from contact of the drain and liquid processing system structures and components to environments as shown in Table 3.3.7 of each LRA are consistent with industry experience for these combinations of materials and environments. The staff finds that the aging effects are appropriate for the combinations of materials and environments listed.

3.6.7.2.2 Aging Management Programs

The aging management programs for the drain and liquid processing systems SSCs have been evaluated in Section 3.3.1 of this SER and found to be acceptable for managing the aging effects identified for the drain and liquid processing systems SSCs.

3.6.7.3 Conclusion

The staff reviewed the information in Section 3.3.7, “Drain and Liquid Processing Systems,” of each LRA. On the basis of this review, the staff concludes that the applicant has demonstrated that the aging effects associated with the drain and liquid processing system structures and components will be adequately managed so that there is reasonable assurance that these systems will perform their intended functions in accordance with the CLB during the period of extended operation.

3.6.8 Vent and Gaseous Processing Systems

3.6.8.1 Summary of Technical Information in the Application

The applicant described the results of its AMR of the vent and gaseous processing systems for license renewal in Section 3.3.8, “Vent and Gaseous Processing Systems,” of each LRA. The staff reviewed this section of each LRA to determine whether the applicant has demonstrated that the effects of aging on the vent and gaseous processing systems will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

The vent and gaseous processing systems are described in the following sections of each LRA: Section 2.3.3.26 of SPS LRA, “Gaseous Waste System”; Section 2.3.3.27 of SPS LRA, “Radiation Monitoring System”; Section 2.3.3.28 of SPS LRA, “Vents-Aerated System”; Section 2.3.3.29 of SPS LRA, “Vents-Gaseous System; Section 2.3.3.28 of NAS LRA, “Post-Accident Hydrogen Removal (HC) system”; Section 2.3.3.29 of NAS LRA, “Radiation Monitoring (RM) system”; and Section 2.3.3.30 of NAS LRA, “Vents – Gaseous (VG) systems.”

3.6.8.1.1 Aging Effects

The materials of construction for the vent and gaseous processing system components are carbon steel, low-alloy steel, and stainless steel. In addition, for SPS 1/2, the copper alloy materials are also used.

A description of internal environments for the vent and gaseous processing systems is provided in Table 3.0-1 of each LRA. The vent and gaseous processing systems components are exposed internally to air, and vent gases from various process systems, and air from the containment atmosphere. In addition, the system components in SPS 1/2 are exposed internally to treated-water (component cooling).

External surfaces of the vent and gaseous processing systems components that require aging management review are exposed to containment air environment, and the sheltered-air environment used for indoor areas outside containment. External surfaces of the system components may also be exposed to borated water leakage conditions. The external environments are indicated in Table 3.0-2 of each LRA.

The applicant identified loss of material from carbon steel and low-alloy steel components as the applicable aging effect associated with the vent and gaseous processing systems which requires management.

In addition, the following aging effects are applicable to the vent and gaseous processing systems only at SPS 1/2:

- loss of material from stainless steel components in a treated-water environment
- loss of material from copper alloy components in a borated water leakage environment

3.6.8.1.2 Aging Management Programs

The applicant identified the following aging management activities to manage aging effects for the vent and gaseous processing systems:

- boric acid corrosion surveillance
- chemistry control program for primary systems (applicable to SPS 1/2 only)
- general-condition-monitoring activities

A description of these aging management programs and activities, along with the demonstration that the identified aging effects will be effectively managed for the period of extended operation, is provided in the following sections of each LRA: Section B2.2.3, “Boric Acid Corrosion Surveillance”; Section B2.2.4, “Chemistry Control Program for Primary Systems”; and Section B.2.2.9, “General-condition-monitoring activities”. The staff reviewed these sections of each LRA to determine whether the applicant has demonstrated that the effects of aging on the vent and gaseous processing system components will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.6.8.2 Staff Evaluation

3.6.8.2.1 Aging Effects

The aging effects that result from exposing the vent and gaseous processing system components to environments as shown in Table 3.3.8 of each LRA are consistent with industry experience for these combinations of materials and environments. The staff finds that the aging effects are appropriate for the combinations of materials and environments listed.

3.6.8.2.2 Aging Management Programs

The aging management programs for the vent and gaseous processing systems SSCs have been evaluated in Section 3.3.1 of this SER and have been found to be acceptable for managing the aging effects identified for the vent and gaseous processing systems SSCs.

3.6.8.3 Conclusion

The staff reviewed the information in Section 3.3.8, “Vent and Gaseous Processing Systems,” of each LRA. On the basis of this review, the staff concludes that the applicant has demonstrated that the aging effects associated with the vent and gaseous processing system structures and components will be adequately managed so that there is reasonable assurance that these systems will perform their intended functions in accordance with the CLB during the period of extended operation.

3.6.9 Fire Protection and Supporting Systems

3.6.9.1 Summary of Technical Information in the Application

The applicant described the results of its AMR of the fire protection and supporting systems for license renewal in Section 3.3.9, “Fire Protection and Supporting Systems,” of each LRA. The staff reviewed this section of each LRA to determine whether the applicant has demonstrated that the effects of aging on the fire protection and supporting system structures and components will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

The fire protection and supporting systems are described in the following sections of each LRA: Section 2.3.3.30 of SPS LRA, “Fire Protection System”; Section 2.3.3.31 of SPS LRA, “Hydrogen Gas System”; Section 2.3.3.31 of NAS LRA, “Post-accident Hydrogen Removal (HC) system”; and Section 2.3.1.1 of NAS LRA, “Reactor Coolant (RC) system: RCP Oil Collection.”

3.6.9.1.1 Aging Effects

The materials of construction for the fire protection and supporting system components are carbon steel, low-alloy steel, cast iron, stainless steel, and copper alloys.

A description of the internal environments for the fire protection and supporting systems is provided in Table 3.0-1 of each LRA. The system structures and components are exposed internally to raw water, treated-water (diesel cooling), gas, air, lubricating oil, and fuel oil.

The external surfaces of the fire protection and supporting system components that require aging management review are exposed to containment air, sheltered-air, and outdoor (atmosphere/weather) environments. Portions of the fire protection and supporting system piping and valves are buried and are exposed to a soil environment. The components may also be exposed to borated water leakage conditions. These external environments are discussed in Table 3.0-2 of each LRA.

The applicant identified the following aging effects associated with the fire protection and supporting systems that require management:

- loss of material from carbon steel, low-alloy steel, cast iron, stainless steel, and copper alloy components in raw water, treated-water, oil, gas, air, atmosphere/weather, or soil environments
- loss of material from carbon steel, low-alloy steel, and copper alloy components in a borated water leakage environment
- heat transfer degradation of heat transfer surfaces in a raw water environment

3.6.9.1.2 Aging Management Programs

The applicant identified the following aging management activities to manage aging effects for the fire protection and supporting systems:

- boric acid corrosion surveillance
- buried piping and valve inspection activities
- general-condition-monitoring activities
- fuel oil chemistry
- fire protection program
- tank inspection activities

A description of these aging management programs and activities, along with the demonstration that the identified aging effects will be effectively managed for the period of extended operation, is provided in the following sections of each LRA: Section B2.1.1, “Buried Piping and Valve Inspection Activities”; Section B2.1.3, “Tank Inspection Activities”; Section B2.2.3, “Boric Acid Corrosion Surveillance”; Section B2.2.7, “Fire protection program”; Section B2.2.8, “Fuel Oil Chemistry”; and Section B2.2.9, “General-condition-monitoring activities”. The staff reviewed these sections of each LRA to determine whether the applicant has demonstrated that the effects of aging on the fire protection and supporting system structures and components will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.6.9.2 Staff Evaluation

3.6.9.2.1 Aging Effects

The aging effects that result from contact of the fire protection and supporting system structures and components with the environments shown in Table 3.3.9-1 of each LRA, are consistent with industry experience for these combinations of materials and environments. The staff finds that the aging effects are appropriate for the combinations of materials and environments listed.

3.6.9.2.2 Aging Management Programs

The aging management programs for the fire protection and supporting system components have been evaluated in Section 3.3.1.7 of this SER and have been found to be acceptable for managing the aging effects identified for the fire protection and supporting system components.

3.6.9.3 Conclusion

The staff reviewed the information in Section 3.3.9, “Fire Protection and Supporting Systems,” of each LRA. On the basis of this review, the staff concludes that the applicant has demonstrated that the aging effects associated with the fire protection and supporting system structures and components will be adequately managed so that there is reasonable assurance that these systems will perform their intended functions in accordance with the CLB during the period of extended operation.

3.6.10 Criterion 2 Components

The staff requested the applicant to address non-safety-related (NSR) piping systems which are not connected to safety-related (SR) piping but have a spatial relationship such that their failure could adversely impact the performance of an intended safety function. In RAI 2.1-3, the staff presented two options to address this concern when performing this scoping evaluation; i.e., a mitigative option or a preventive option.

To utilize the mitigative option, the applicant should demonstrate that the mitigating devices are adequate to protect SR systems, structures, and components (SSCs) from failures of NSR piping segments at any location where age-related degradation is plausible. The preventive option requires that the entire NSR piping system be brought into the scope of license renewal (LR) and an aging management review (AMR) be performed on the components within the piping system.

In its response, the applicant modified the scope of license renewal to include NSR SSCs that have a spatial relationship with SSCs within the scope of LR based on 10 CFR 54.4(a)(1) and whose failure could impact the performance of an intended safety function. In addition, the NSR SSCs are included within the scope of LR using the preventive option described in the staff’s RAI. No new material/environment combinations or aging management activities were identified as a result of the expanded scope. This information is documented in the applicant’s February 1, May 22, and August 23, 2002, supplemental responses to RAI 2.1-3. Details on the SSCs added into the scope of the LRA as a result of this reevaluation are provided in Section 2.3.5 of this SER.

3.6.10.1 Summary of Technical Information

Table 2.1.3-2, “Systems with Increased License Renewal Boundary Due to Expansion of Criterion 2 Scope,” in the response to RAI 2.1-3, identifies systems that were previously within the scope of license renewal and for which the boundary has been extended to include additional components.

For NAS 1/2, the boundaries of the following systems were expanded:

- Primary Process Systems
  - chemical and volume control system
  - high radiation sampling system
  - sampling system

- Open Water Systems
  - service water system

- Closed Water Systems
  - component cooling system
  - chilled water system
  - containment vacuum system
  - reactor coolant system

- Vent and Gaseous Processing System
  - gaseous waste system

- Drain and Liquid Processing Systems
  - boron recovery system
  - plumbing

For SPS 1/2, the boundaries of the following systems were expanded:

- Primary Process Systems
  - chemical and volume control system
  - sampling system

- Open Water Systems
  - service water system

- Closed Water Systems
  - component cooling system
  - containment vacuum system

- Ventilation and Vacuum Systems
  - vacuum priming system

- Drain and Liquid Processing Systems
  - boron recovery system

For NAS 1/2, the following systems were added to the auxiliary systems due to expansion of the LR scope:

- bearing and cooling system
- gaseous waste system
- decontamination system

For SPS 1/2, the following systems were added to the auxiliary systems due to expansion of the LR scope:

- chilled water system
- decontamination system
- liquid waste system

The staff reviewed the supplemental information to determine whether the applicant has demonstrated that the effects of aging on the components in these systems will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

The applicant's AMR for these systems added to the auxiliary systems is found in the following LRA tables: Table N3.3.3-7, "Closed Water Systems - Bearing Cooling: Additional Criterion 2 (Spatial Orientation) In-Scope Components"; Table N3.3.8-4, "Vent and Gaseous Processing Systems - Gaseous Waste: Additional Criterion 2 (Spatial Orientation) In-Scope Components"; Table N3.3.10, "Decontamination Systems: Additional Criterion 2 (Spatial Orientation) In-Scope Components"; Table S3.3.3-8, "Closed Water Systems - Chilled Water: Additional Criterion 2 (Spatial Orientation) In-Scope Components"; Section S3.3.10, "Decontamination Systems: Additional Criterion 2 (Spatial Orientation) In-Scope Components"; and Table S3.3.11, "Liquid Waste Systems: Additional Criterion 2 (Spatial Orientation) In-Scope Components." The letters "N" and "S" before the table numbers stand for NAS and SPS.

3.6.10.1.1 Aging Effects

The aging effects for components in those systems whose boundaries have been extended as a result of the reevaluation are documented in the original submittal and discussed in Sections 3.6.1 through 3.6.9 of this SER.

The aging effects associated with the Criterion 2 components added to the auxiliary systems are discussed below.

For NAS 1/2 only:

- The materials of construction in the bearing cooling system of the closed water systems are carbon steel, low-alloy steel, cast iron, copper alloys, and stainless steel. These components are exposed internally to treated water and externally to air. The aging effect that requires management for this system is loss of material.

- The materials of construction in the gaseous waste system of the vent and gaseous processing systems are stainless steel, carbon steel, low-alloy steel, cast iron, and copper alloys. These components are exposed internally to gas and externally to air and/or borated water leakage. The aging effect that requires management for this system is loss of material.

For SPS 1/2 only:

- The materials of construction in the chilled water system of the closed water systems are carbon steel, low-alloy steel, cast iron, copper alloys, and stainless steel. These components are exposed internally to treated water/steam and externally to air or borated water leakage. The aging effect that requires management for this system is loss of material.

- The material of construction in the liquid waste systems is stainless steel. These components are exposed internally to treated or raw water and externally to air. The aging effect that requires management for this system is loss of material.

The material of construction for Criterion 2 components in the NAS 1/2 and SPS 1/2 decontamination system is stainless steel. These components are exposed internally to raw water and externally to air. The aging effect that requires management for this system is loss of material.

3.6.10.1.2 Aging Management Programs

The aging management activities for those systems whose boundaries have been extended due to the reevaluation are described in the original submittal and discussed in Sections 3.6.1 through 3.6.9 of this SER.

One or more of the following aging management activities manage aging effects for Criterion 2 components added to the auxiliary systems:

- general condition monitoring activities
- chemistry control for primary systems
- work control process
- infrequently accessed area inspection activities

Descriptions of these aging management programs and activities along with demonstrations that the identified aging effects will be effectively managed for the period of extended operation are provided in the following sections of the LRA: Section B2.2.5, “Chemistry Control Program for Secondary Systems”; Section B2.2.4, “Chemistry Control Program for Primary Systems”; Section B2.2.9, “General Condition Monitoring Activities”; Section B2.1.2, “Infrequently Accessed Area Inspection Activities”; and Section B2.2.19, “Work Control Process.” The staff reviewed these sections of the LRA to determine whether the applicant has demonstrated that the effects of aging on the Criterion 2 components will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.6.10.2 Staff Evaluation

3.6.10.2.1 Aging Effects

For those systems whose boundaries have been extended as a result of the reevaluation, the staff’s findings are provided in Sections 3.6.1 through 3.6.9 of this SER.

The aging effects that result from the components added to the auxiliary systems as shown in the supplemental tables are, in general, consistent with industry experience for these combinations of materials and environments. The staff finds that the aging effects discussed in Section 3.6.10.1.1 are appropriate for the combinations of materials and environments listed.

3.6.10.2.2 Aging Management Programs

The aging management programs are evaluated in 3.3.1 and 3.3.4 of this SER and have been found to be acceptable for managing the aging effects identified for the Criterion 2 components as discussed in Section 3.6.10.1.2.

3.6.10.3 Conclusion

The staff reviewed the supplemental information related to RAI 2.1-3. On the basis of this review, the staff concludes that the applicant has demonstrated that the aging effects associated with the Criterion 2 components will be adequately managed so that there is reasonable assurance that these systems will perform their intended functions in accordance with the CLB during the period of extended operation.

3.7 Aging Management of Steam and Power Conversion Systems

In the North Anna and Surry LRAs, Section 2.3.4, “Steam and Power Conversion Systems,” the applicant describes the results of the scoping and screening of the steam and power conversion system (SPCS) SSCs that are within the scope of license renewal and the SPCS SCs that are subject to an AMR. The applicant described its AMR for the SPCS SCs in Section 3.4, “Steam and Power Conversion Systems” of its LRAs. The various AMAs used to manage the aging of the SPCS SCs are described in Appendix B of each LRA as applicable.

The staff review of the scoping and screening results for NAS 1/2 and SPS 1/2 SPCS systems are described in Section 2.3.4 of this SER. The staff’s review of the applicant’s AMR activities for the NAS 1/2 and SPS 1/2 SPCS systems are the subject of this section of the SER. This review is being performed to determine if the applicant has demonstrated that the effects of aging for the SCs of the SPCSs that are subject to an AMR will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation in accordance with 10 CFR 54.21(a)(3).

3.7.1 Summary of Technical Information in the Application

In the North Anna and Surry LRAs, Section 2.3.4, “Steam and Power Conversion Systems,” the applicant identified seven systems that are within the scope of license renewal in accordance with the requirements of 10 CFR 54.4. The seven systems are auxiliary steam (AS), blowdown (BD), condensate (CN), feedwater (FW), main steam (MS), steam drain, and steam generator water treatment (WT). A brief description of the systems is provided in each LRA and is given below.

Auxiliary Steam System: The AS system supplies low pressure, saturated steam to various plant systems. The portion of the AS system subject to AMR includes the steam pressure regulating valve and associated bypass and isolation valves that are credited with providing a main steam system pressure boundary function in the event of a station blackout (SBO) event or severe fire (Appendix R) event. The component groups for this system that require an AMR are listed in Table 2.3.4-1, Auxiliary Steam. The table identifies the “passive functions” and a reference to the applicable AMR section in each LRA for each component group.

Blowdown System: The BD system provides a flowpath for the continuous blowdown flow from the steam generator secondary-side to maintain acceptable steam generator water chemistry. The BD system isolates flow for containment isolation, to maintain steam generator inventory during transients, and in the event of a high-energy-line break. The portion of the BD system subject to AMR consists of the components from the steam generator to the first manual isolation valves downstream of the outboard containment isolation valves. The portion of the BD system that provides the CC system pressure boundary at the BD system vent condenser is also subject to AMR. The component groups for this system that require an AMR are listed in Table 2.3.4-2, Blowdown. The table identifies the “passive functions” and a reference to the applicable AMR section in each LRA for each component group.

Condensate System: The primary purpose of the CN system is to provide chemically treated-water to the suction of the main feedwater pumps at sufficient pressure to support main feedwater pump operation. The CN system also provides the piping, valves, water storage, and make-up supply for auxiliary feedwater. An emergency condensate storage tank is provided for each Unit. Each tank supplies water to the three auxiliary feedwater pumps through individual lines. These tanks and the associated components up to the suction of the pumps comprise the portion of the CN system that is subject to AMR. The component groups for this system that require an AMR are indicated in Table 2.3.4-3, Condensate. The table identifies the “passive functions” and a reference to the applicable AMR section in each LRA for each component group.

Feedwater System: The FW system is comprised of main feedwater and auxiliary feedwater. Main feedwater provides treated-water to maintain inventory in the steam generators (SG) for the production of steam and to provide a heat sink for the reactor coolant system. Main feedwater components provide a flowpath for auxiliary feedwater flow to the steam generator and provide isolation of main feedwater flow in response to plant transients. Auxiliary feedwater provides an emergency source of water to the SG for reactor heat removal. Auxiliary feedwater provides a heat sink during design basis accidents including loss of power conditions.

The portion of the FW system subject to AMR includes the components from the high-energy line break (HELB) outside of the Containment downstream to the SG feedwater nozzle, and the auxiliary feedwater pumps and discharge line components up to the feedwater piping connection. In addition, back-up compressed air components required for the functioning of selected feedwater isolation valves are subject to an AMR. The component groups for this system that require AMR are identified in Table 2.3.4-4, “Feedwater.” The table provides the “passive functions” and a reference to the applicable AMR section in each LRA for each component group.

The auxiliary feedwater system consists of three auxiliary feedwater pumps and associated components. The source of water is provided from the emergency condensate storage tank in the condensate (CN) system. The auxiliary feedwater pumps lubricating oil and seal cooling components support the intended function of those pumps and are also subject to AMR. Because auxiliary feedwater is needed to respond to design basis events, this system is within the scope of license renewal.

Main Steam System: The MS system transports the steam produced in steam generators to the main turbine for the production of electricity. Additionally, the MS system:

- provides motive steam to the turbine-driven auxiliary feed pump
- removes heat from the reactor coolant system via the code safety valves, sg power-operated relief valves (PORVs), and/or condenser steam dump valves
- isolates steam flow to the main turbine following a reactor trip or during accident conditions to prevent an excessive cooldown that could have an adverse effect on the reactor

The major flowpaths of the MS system from the steam generator outlet nozzle to the turbine stop valves and the condenser steam dump valves are subject to AMR. The evaluation boundary extends beyond the safety-related boundary of the system based on high-energy line break (HELB), station blackout (SBO), and Appendix R requirements. The component groups for this system that require an AMR are indicated in Table 2.3.4-5, “Main Steam”. The table identifies the “passive functions” and a reference to the applicable AMR section in each LRA for each component group.

Steam Drain System: The SD system provides a flowpath for returning condensate drips from various steam sources to the CN system. The portions of the SD system that are subject to AMR are steam trap drain line piping sections that form the MS system pressure boundary upstream of the main steam trip valves. The component groups for this system that require an AMR are indicated in Table 2.3.4-6, Steam Drains. The table identifies the “passive functions” and a reference to the applicable AMR section in each LRA for each component group.

Steam Generator Water Treatment System: The purpose of the WT system is to provide a means of recirculating water in the steam generator during periods of wet layup to help maintain steam generator water chemistry within limits and to provide the capability for water transfer from the steam generator. The portion of the WT system that is subject to AMR provides the steam generator pressure boundary and the Containment pressure boundary. The component groups for this system that require an AMR are indicated in Table 2.3.4-7, Steam Generator Water Treatment. The table identifies the “passive functions” and a reference to the applicable AMR section in each LRA for each component group.

3.7.1.1 Aging Effects

In the North Anna and Surry LRAs, Section 3.4, the applicant provides a summary of the results of the AMR for the SCs of the SPCSs. The AMR results are listed in each LRAs on Tables 3.4-1 through 3.4-7. The tables provide the following information related to each component commodity group: (1) the “passive functions”, (2) the material group, (3) the environment, (4) the aging effects requiring management, and (5) the specific activities that manage the identified aging effects.

Materials

The materials of construction for the SPCS components that are subject to AMR include carbon steel, low-alloy steel, and stainless steel. Copper alloys and nickel-based alloy materials are also used.

Environments

In the North Anna and Surry LRAs, Table 3.0-1, “Internal Service Environment,” and Table 3.0-2, “External Service Environment,” the applicant states that SPCS components, subjected to an AMR, are exposed to the following environments:

Internal Environments

The normal internal operating conditions for the SPCS components that require an AMR are as follows:

- condensate and auxiliary feedwater components are exposed to treated-water with saturated oxygen concentrations at ambient temperature with typically stagnant flow conditions. Auxiliary feedwater lubricating oil components are exposed to oil at ambient temperature during auxiliary feedwater standby conditions, but may experience elevated temperatures during system operation. Low points in the system may experience water-pooling
- main feedwater and blowdown components are exposed to treated-water (secondary) with low oxygen concentrations at high temperature and typically high flowrate conditions
- steam generator water treatment components are exposed to treated-water (secondary) with low oxygen concentrations at ambient temperature with typically stagnant flow conditions
- main steam, steam drains, and auxiliary steam components are exposed to steam with low oxygen concentrations at high temperature

External Environment

- The SPCS components that require AMR are located in the Containment, other indoor areas of the plant, and outdoor areas of the plant. These components are exposed to an air or atmosphere/weather environment. External surfaces of SPCS components may also be exposed to borated water leakage conditions.

Applicable Aging Effects

In the North Anna and Surry LRAs, Section 3.4, the applicant states that it has reviewed site-specific operating experience and industry-wide experience to support its determination of applicable aging effects for the SPCSs. The applicant identified the following applicable aging effects associated with the materials and environments described above for the SPCS components that are within the scope of license renewal and subject to an AMR:

- cracking of carbon steel, low-alloy steel, and stainless steel components in treated-water, steam, or potentially water-contaminated lubricating oil environments
- cracking of nickel-based alloys in a steam environment, and copper alloys in an air environment
- loss of material from carbon steel, low-alloy steel, and stainless steel components in treated-water, steam, or potentially water-contaminated lubricating oil environment
- loss of material from carbon steel and low-alloy steel components exposed to atmosphere/weather

- loss of material from carbon steel and low-alloy steel components in an air environment
- loss of material from nickel-based alloy in a steam environment and copper alloy components in a treated-water environment
- loss of material from carbon steel and low-alloy steel components resulting from potential borated water leakage onto the external surface of the components

3.7.1.2 Aging Management Programs

In the North Anna and Surry LRAs, in Tables 3.4-1 through 3.4-7, the applicant identified 10 aging management programs used to manage the effects of aging associated with the SCs of SPCS components that are subject to an AMR. These aging management programs and activities include augmented inspection activities, boric acid corrosion surveillance programs, chemistry control program for primary systems, chemistry control program for secondary systems, general-condition-monitoring activities, infrequently accessed area inspection activities, ISI Program - component and component support inspections, secondary piping and component inspections, tank inspection activities, and the work control process. In the North Anna and Surry LRAs, Appendix B, the applicant provides a detailed description of each of the above programs. In addition, the applicant demonstrates each program's effectiveness to manage the applicable aging effects for the period of extended operation.

3.7.2 Staff Evaluation

The staff reviewed the information in the North Anna and Surry LRAs, Sections 2.3.4, and 3.4, and the portions of Appendix B that apply to the SPCS components to determine if the applicant has demonstrated compliance with the requirements of 10 CFR 54.21(a)(3). In addition, the staff reviewed the applicable portions of the NAS and SPS UFSARs, plant and industry (as applicable) operating history, license renewal system drawings provided with each LRA, and other applicable portions of Appendix A, Appendix B, and Appendix C of each LRA. The staff also conducted a telephone conference call with the applicant on October 09, 2001, to discuss the information provided to, and reviewed by, the staff. The information provided by the applicant during that telephone conference is documented and docketed in a letter to the applicant dated October 25, 2001. No request for additional information was needed by the staff to complete its review of the SPCS components.

During its review of the North Anna Unit 1 and 2 and Surry Unit 1 and 2 LRAs, the staff forwarded to the applicant a request for additional information (RAI) that related to non-safety-related (NSR) piping systems which are connected to the safety-related (SR) piping or are in close proximity such that their failure could adversely impact the intended safety function. The RAI (RAI 2.1-3) was sent to the applicant in order to obtain information about this issue and thus ascertain that NSR piping in proximity to SR piping would not adversely affect the safety-related function of systems that are within the scope of license renewal.

In response to this RAI the applicant provided Tables 2.1-3-4 and 2.1-3-5. Table 2.1-3-4 identified the aging management results for systems within the expanded scope of license renewal for North Anna Units 1 and 2. Table 2.1-3-5 identified the aging evaluation results for systems within the expanded scope of license renewal for Surry Units 1 and 2. The applicant also included Table N3.4-8, “Steam and Power Conversion System - Extraction Steam: Additional Criterion 2 (Spatial Orientation) In-Scope Components,” to document the fact that the extraction steam system was added to the scope of license renewal as a result of the staff's RAI. The tables documented the results of the applicant's aging management evaluation for materials and aging effects included within the expanded scope and identified the aging management programs that will manage the aging effects during the period of extended operation.

The staff reviewed the information included in Tables 2.1-3-4, 2.1-3-5 and N3.4-8 to ascertain that the expanded scope of license renewal has identified the materials and aging effects and that the proposed aging management programs will manage those aging effects during the period of extended operation. The review revealed that cast iron material was added to the expanded scope of license renewal. Loss of material was identified as the aging effect requiring management for cast iron material during the period of extended operation. The aging management programs that will manage loss of material of cast iron are the boric acid corrosion surveillance programs, the chemistry control programs for primary and secondary systems, general-condition-monitoring activities, infrequently accessed area inspection activities, secondary piping and component inspections, service water systems inspections, and the work control process. These aging management programs have been described in Sections 3.3.1 through 3.3.4 of this SER. Based upon its review of the information included in Tables 3.1-3-4, 2.1-3-5, and N3.4-8, the staff concluded that the applicant has adequately addressed the impact of NSR piping on SR piping in the steam and power conversion systems.

The staff's review and evaluation of the specific scope of SPCS SCs included by the applicant as being within the scope of license renewal and subject to an AMR are provided in Section 2.3.4 of this SER. In addition, the staff's review and evaluation of the different aging management activities credited by the applicant to manage the applicable aging effects of the SPCS systems are provided in Sections 3.3.1 and 3.3.4 of this SER. The staff's review and evaluation of the applicant's AMR for the SPCSs are provided in this section of the SER.

3.7.2.1 Aging Effects

The staff's review verified that the components of the SPCSs are constructed from carbon steel, low-alloy steel, stainless steel, and copper and nickel-based alloys. A review of each LRA, system drawings, the UFSARs, and system documentation confirmed that these components are exposed to outdoor environments, plant spaces, and containment ambient conditions, and are potentially exposed to boric acid water leakage. Internally, the staff reviewer confirmed that the SPCS components are exposed to treated water, steam, and lubricating oil environments.

In Appendix C of the North Anna and Surry LRAs, the applicant describes the methodology it used to perform an AMR and provides a discussion of the potential aging effects based on materials and environments. As part of its methodology, the applicant concluded that aging management is required for any applicable aging effects that can result in the loss of intended functions for any passive or long-lived SC during the period of extended operation. The staff reviewed the applicable information in Appendix C, and determined that it is consistent with the rule and no omissions were identified.

Using the AMR methodology, the applicant identified the aging effects discussed above. In Tables 3.4-1 through 3.4-7 of the North Anna and Surry LRAs, the applicant listed the applicable aging effects associated with the various components, component functions, materials, and environments, and the applicable aging management activities. In Appendix C of its LRAs, the applicant also describes its plant-specific and industry-wide operating experience review to support its identification of applicable aging effects for the SPCSs. The staff reviewed and verified that the material, environmental, and aging effect combinations are consistent with published literature and industry operating experience, and that there is reasonable assurance that all applicable aging effects have been identified.

3.7.2.2 Aging Management Programs

The applicant has identified 10 aging management programs for managing the applicable aging effects of the SPCS SCs. In each LRA, Tables 3.4-1 through 3.4-7, the applicant identified each program and its application(s) to the SCs and the associated aging effects. The applicant states that the programs were developed from industry-wide data, industry-developed methodologies, NRC documents, and the applicant's own experience.

The staff's detailed review of aging management activities performed to manage the applicable aging effects is provided in Sections 3.3.1 and 3.3.4 of this SER. However, as part of its AMR, the staff did verify that the aging management activities applicable to different SPCS SCs were consistent with the applicable aging effects. As a result of this review, the staff verified that the AMAs credited for managing applicable aging effects for SPCS components are consistent with current industry practices. No omissions or concerns as to AMAs used to manage the SPCSs were identified.

3.7.3 Conclusion

On the basis of the review described above, the staff concludes that the applicant has performed an AMR that adequately identifies the applicable aging effects for the SPCS SCs. In combination with the staff's scoping review, as documented in Section 2.3.4 of this SER, and the staff's aging management activities reviews, as documented in Sections 3.3.1 and 3.3.4 of this SER, the staff finds 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.

3.8 Aging Management of Structures and Component Supports

3.8.1 Containment

3.8.1.1 Summary of Technical Information in the Application

Section 3.5.1 of each LRA provides the applicant's aging management review of the containment. Table 3.5.1-1 of each LRA summarizes the applicant's aging management review of the containment structural members by providing (1) the passive function, (2) the material group, (3) the environment, (4) the aging effects requiring management, and (5) the specific aging management activities that manage the aging effects.

The materials of construction for the containment structural members, which are subject to aging management review, are (1) concrete, (2) low-alloy steel, (3) stainless steel, and (4) elastomers. The applicant states that the containment has been designed and constructed in accordance with American Concrete Institute (ACI) 318-63, "Building Code Requirements for Structural Concrete." The cement used in the concrete is consistent with specifications of the American Society for Testing and Materials (ASTM) C150 and the aggregates in the concrete mix conform to ASTM C33. Also, the applicant states that it has used the proper arrangement and distribution of reinforcement to control cracking in accordance with ACI 201.2R-67, "Guide to Durable Concrete." Similar concrete materials are used for the grout. In addition, the applicant states that

- testing of the aggregates used in the concrete was performed in accordance with the testing methods identified in ASTM C295 OR ASTM C227
- porous concrete was used under the base mat to provide drainage for the containment structure
- leaching of calcium hydroxide is non-significant for the containment structure since it is not exposed to flowing water

The different environments for the containment structural members are (1) atmosphere/weather, (2) soil, (3) treated-water, (4) raw water, (5) containment air, and (6) the sheltered-air environment inside buildings other than containment. These environments, with the exception of the localized temperatures described below, are as indicated in Table 3.0-2 in each LRA. The applicant states that the air temperature varies throughout the containment according to location and elevation. General air temperatures in some specific cases can be found to be higher than 125°F, but not greater than 150°F. The containment hot pipe penetrations may be subject to elevated localized temperatures, but not greater than 200°F, and these temperatures do not affect the overall integrity of the containment. The applicant states that the containment structural members may also be exposed to groundwater, if they are located below the groundwater elevation. The results of recent groundwater analyses, which are discussed in Appendix C of each LRA, indicate that the groundwater chemistry is non-aggressive at both the North Anna and Surry sites. The fuel transfer tube and its enclosure (including expansion joints) normally are exposed to ambient air; however, when the fuel transfer tube blind flange is removed and the refueling cavity is flooded, the fuel transfer tube is exposed to treated-water (borated water). The temperature of this treated-water is maintained to be less than 140°F. Additionally, systems within the containment contain borated water. Therefore, structural members and penetrations in the containment could be exposed to a borated water leakage environment.

3.8.1.1.1 Aging Effects

In Section 3.5.1 of each LRA, the applicant identified the following applicable aging effects for structural members inside the containment:

- loss of material for carbon steel and low-alloy steel structural members in air or atmosphere/weather environments
- loss of material for stainless steel structural members in treated-water (borated water) or raw water environments
- loss of material for carbon steel and low-alloy steel structural members in a borated water leakage environment
- cracking and change in material properties for elastomers in an air environment

3.8.1.1.2 Aging Management Programs

The applicant credits the following aging management activities with managing the identified aging effects for the structural members of the containment:

- civil engineering structural inspection
- boric acid corrosion surveillance
- chemistry control program for primary systems
- IS program - containment inspection
- general-condition-monitoring activities
- infrequently accessed area inspection activities
- work control process

A description of these aging management activities is provided in Appendix B of each LRA. The applicant concludes that the effects of aging associated with the containment will be adequately managed by these aging management activities such that there is reasonable assurance that the intended functions will be maintained consistent with the current licensing basis during the period of extended operation.

3.8.1.2 Staff Evaluation

In addition to Section 3.5.1 of each LRA, the staff reviewed the pertinent information provided in Section 2.4, "Scoping and Screening Results - Structures" and the applicable aging management activity descriptions provided in Appendix B of each LRA to determine whether the aging effects for the containment structural members have been properly identified and will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.8.1.2.1 Aging Effects

In Section 3.5.1 of each LRA, the applicant provides an aging management review of the containment and interior structural components. The methodology used to perform the aging management review for specific aging effects is described in Appendix C of each LRA. This section of the SER provides the staff's evaluation of the applicant's aging management review for aging effects and the applicant's aging management programs credited for the containment structural members at North Anna and Surry. The staff's evaluation includes a review of the aging effects considered and the basis for applicant's elimination of certain aging effects. In addition, the staff has evaluated the applicability of the aging management programs that are credited for managing the identified aging effects for containment structural members.

The aging effects identified by the applicant that could cause loss of intended functions for the containment structural members are (1) loss of material for carbon steel and low-alloy steel components in air, atmosphere/weather, or borated water leakage environments, (2) loss of material properties for stainless steel structural members in treated or raw water environments, and (3) change in material properties and cracking of elastomers in an air environment.

Concrete: Appendix C of each LRA lists (1) loss of material, (2) cracking, and (3) change in material properties as plausible aging effects for containment concrete components.

For the loss of material aging effect, the applicant identified the following plausible aging mechanisms: (1) aggressive chemical attack, (2) freeze-thaw, (3) elevated temperatures, and (4) corrosion of embedded steel. The applicant briefly describes each of the above aging mechanisms in Appendix C of each LRA and states that each mechanism was evaluated during the aging management reviews. Table 3.5.1-1 of each LRA does not list loss of material as an aging effect requiring management for any of the concrete structural members located in either air or soil environments.

For the cracking aging effect, the applicant identified the following plausible aging mechanisms: (1) settlement, (2) freeze-thaw, (3) aggressive chemical attack, (4) alkali-aggregate reaction, (5) corrosion of embedded steel, and (6) elevated temperatures. The applicant briefly describes each of the above aging mechanisms in Appendix C of each LRA and states that each mechanism was evaluated during the aging management reviews. Table 3.5.1-1 of each LRA does not list cracking as an aging effect requiring management for any of the concrete structural members located in either air or soil environments.

For the change in material properties aging effect, the applicant identified the following plausible aging mechanisms: (1) aggressive chemical attack, (2) alkali-aggregate reaction, (3) elevated temperatures, and (4) leaching of calcium hydroxide. The applicant briefly describes each of the above aging mechanisms in Appendix C of each LRA and states that each mechanism was evaluated during the aging management reviews. Table 3.5.1-1 of each LRA does not list change in material properties as an aging effect requiring management for any of the concrete structural members located in either air or soil environments.

The staff considers each of the above aging effects (loss of material, cracking, and change in material properties) to be both plausible and applicable for containment concrete and containment interior concrete components. Industry experience indicates that age-related degradation of concrete structures has occurred at a number of plants, demonstrating the need for aging management of concrete nuclear structures. As such, in RAIs 3.5-3 and 3.5-7 the staff requested that the applicant identify the aging management program that will be used to manage the aging effects for containment concrete and containment interior concrete components. In response, the applicant stated that its aging management review for the containment concludes that there are no aging effects requiring management for concrete structural members. However, based on discussions with the NRC staff and the staff's position on concrete aging discussed in a letter to Florida Power and Light dated October 30, 2001, the applicant committed to credit the examinations specified by ASME Section XI, Subsection IWL, Examination Category L-A to manage the potential aging effects of concrete structural members of the containment. The applicant stated that these examinations will be added to the ISI Program - Containment Inspections aging management activity, which is covered in Section B2.2.12 of each LRA. For the containment internal concrete components, the applicant stated that it will use the Civil Engineering Structural Inspection aging management activity to manage the potential aging effects. The Civil Engineering Structural Inspection aging management activity is covered in Section B2.2.6 of each LRA. Once incorporated, as committed in this response, the staff considers this issue to be resolved.

The staff also considers each of the above aging effects (loss of material, cracking, and change in material properties) to be plausible for containment concrete located below groundwater elevation. In Section 3.5.1 of each LRA, the applicant indicates that the containment concrete structural members located below the local groundwater elevation are not exposed to aggressive chemicals on the basis of recent chemical analyses of the groundwater, which is described in Appendix C of each LRA. For both North Anna and Surry, groundwater samples taken over the past 5 to 8 years indicate that the chloride and sulfate concentrations are well below the threshold values for aggressive chemical attack. In addition, the pH level of the groundwater samples is well above the threshold (pH < 5.5) for aggressive chemical attack. Consequently, the staff concludes that the aging effects such as loss of material, cracking, and change in material properties due to aggressive chemical attack are not expected to be significant for below grade exterior concrete regions.

In addition, loss of material and cracking due to corrosion of embedded steel, is not expected to be significant for below grade exterior concrete regions. The applicant, however, did not provide a technical basis for ensuring that the groundwater remains non-aggressive during the period of extended operation. In RAI 3.5-2, the staff requested that the applicant to indicate what method (e.g., periodic monitoring of groundwater chemistry) will be used to ensure that the groundwater remains non-aggressive during the period of extended operation. In response, the applicant stated that there is currently not enough historical groundwater sampling data available to develop a groundwater chemistry trend. Although the applicant does not expect the groundwater at either North Anna or Surry to become aggressive, routine monitoring of the groundwater chemistry at both sites is presently being conducted and will be conducted on an annual basis during the period of extended operation. In addition, the applicant has committed to monitor the groundwater chemistry at a different time each year so that any seasonal variations in the groundwater chemistry may be detected. Monitoring of groundwater chemistry will be performed as part of the applicant's Civil Engineering Structural Inspection aging management activity. In its letter dated July 25, 2002, the applicant stated that the UFSAR Supplement Section 18.2.6, "Civil Engineering Structural Inspections" has been modified to include annual monitoring of groundwater chemistry. Additionally, Section 18.2.6 specifies that groundwater chemistry should be considered as part of engineering evaluations of inspection results. Since the applicant has completed this action, the staff considers confirmatory action 3.8.1-1 closed.

Section 3.5.1 of each LRA states that porous concrete is used under the base mat to provide drainage for the containment structure, and that the use of Type II, low-alkali, portland cement (not calcium aluminate cement) in the porous concrete prevents any erosion from concrete and minimizes cracking due to settlement. This issue has been discussed in Information Notice (IN) 98-26, which proposes a structure monitoring program to manage this aging effect. In addition, if a de-watering system is relied upon for control of erosion of cement from porous concrete subfoundations and/or relied on to control settlement, then proper functioning of the de-watering system must be ensured through the period of extended operation. In RAI 3.5-1, the staff requested that the applicant provide justification for not including an aging management review of the de-watering system for control of hydrostatic pressure to the containment liner plate. Furthermore, if a de-watering system is relied on for control of hydrostatic pressure, then the de-watering system needs to be included within the scope of license renewal and subject to an aging management review. In response, the applicant stated that,

> The foundation mats of the Surry and North Anna Containments are located below the ground water table. The below-grade foundation and exterior wall design includes a waterproof membrane and high-density, low-permeability concrete that significantly reduces the likelihood of groundwater migration to the Containment liner. Therefore, the occurrence of hydrostatic pressure on the Containment liner due to groundwater is unlikely. In addition to design features, a non-safety related Containment subsurface drainage system was installed to further reduce the potential for hydrostatic pressure on the liner.
>
> The subsurface drainage system was originally determined not to be within the scope of license renewal. However, further review has determined, in consideration of the importance of the Containment liner, that the drainage system will be conservatively included within the scope of license renewal to ensure its operability through the extended period of operation.
>
> An aging management review has been completed for the subsurface drainage system components, the associated component supports, and the associated concrete access shafts. The pump casings, valve bodies and piping associated with the system are subject to loss of material and will be managed by the Work Control Process activity described in Section B2.2.19 of the applications. Component supports are subject to loss of material, and will be managed by the Infrequently Accessed Area Inspection activity described in Section B2.1.2. Although the aging management review has concluded that there are no aging effects requiring management for the concrete access shafts, the potential aging effects of loss of material, cracking, and change in material properties will be managed, as discussed In its response to RAI 3.5-7, with the Infrequently Accessed Areas Inspection activity.

In its letter dated July 25, 2002, the applicant stated that the subsurface drainage systems around the containments have been incorporated into the license renewal scope for both Surry and North Anna. The UFSAR Supplement Section 18.1.2, “Infrequent Accessed Area Inspection Activities,” has been modified to include the structures associated with these systems. The UFSAR Supplement Section 18.2.19, “Work Control Process” encompasses the mechanical portions of the system. Since the applicant has completed this action, the staff considers confirmatory action 3.8.1-2 closed.

Steel: Appendix C of each LRA lists loss of material and cracking as plausible aging effects for containment steel structural members.

For the loss of material aging effect, the applicant identified the following plausible aging mechanisms: (1) corrosion, (2) wear, (3) boric acid wastage, and (4) fretting. The applicant briefly describes each of the above aging mechanisms in Appendix C of each LRA and states that each mechanism was evaluated during the aging management reviews. Table 3.5.1-1 of each LRA identifies loss of material for carbon and low-alloy steel structural members in air, atmosphere/weather, and borated water leakage environments as an aging effect requiring management.

For the cracking aging effect, the applicant identified the following plausible aging mechanisms: (1) stress-corrosion cracking and (2) flaw initiation and growth. The applicant briefly describes each of the above aging mechanisms in Appendix C of each LRA and states that each mechanism was evaluated during the aging management reviews. Table 3.5.1-1 of each LRA does not list cracking as an aging effect requiring management for any of the containment steel structural members.

In a letter dated May 22, 2002 (Serial No. 02-277), the staff requested that the applicant provide the technical basis for not considering the following aging effects for containment steel components:

- loss of material due to corrosion in inaccessible areas (e.g. embedded containment steel liner) where examination of accessible areas may not be indicative of degradation in inaccessible areas
- cracking of steel due to stress-corrosion cracking and flaw initiation and growth
- reduction in fracture toughness due to neutron embrittlement

For loss of material due to corrosion in inaccessible areas, the applicant stated that inaccessible areas, such as embedded containment steel liner, were included in an AMR (refer to Table 3.5.1-1), and is managed by the containment ISI Program (IWE) and the 10 CFR Part 50, Appendix B, corrective action program. In addition, the applicant recently excavated portions of the Surry Unit 1 containment floor to inspect and verify that aging was not occurring in the inaccessible area of the interior liner plate. On the basis of more than 30 years of operating history and the inspection finding, the applicant believes that, if operating conditions remain the same, there is reasonable assurance that aging will not occur. If operating condition change, the applicant would be obligated to reassess the potential for aging to the inaccessible areas as part of its 10 CFR Part 50, Appendix B, corrective actions that apply to any failures that may occur in containment. In addition, if IWE inspections reveal findings associated with the accessible containment liner wall, the applicant again would be obligated to reassess the potential effects to the inaccessible areas as part of its 10 CFR Part 50, Appendix B, corrective actions that apply to these AMAs. For the exterior inaccessible liner plate wall, the applicant has committed to periodic monitoring of the groundwater in its response to RAI 3.5-2. The staff found the applicant’s response to be adequate.

For cracking of steel due to stress-corrosion cracking, and flaw initiation and growth, the applicant explained that flaw initiation and growth are limited to Class 1 piping components and do not apply to any stainless steel structural components. For stress corrosion cracking, the stainless-steel structural components of concern in the containment are the fuel transfer tube, refueling cavity liner and electrical penetrations. With regard to the stainless steel transfer tube and refueling cavity liner, temperatures are maintained below 140°F, as required by the applicant’s technical specification, eliminating the potential for stress-corrosion cracking. With regard to the stainless steel electrical penetration, these components are in an air environment, which also eliminates the potential for stress-corrosion cracking. The staff found the applicant's response to be adequate.

For reduction in fracture toughness due to neutron embrittlement, the applicant stated that the only component with sufficient neutron fluence for embrittlement to be a potential concern is the neutron shield tank, which is evaluated in the AMR for the NSSS supports. The staff acknowledged the applicant's response, and evaluated this aging effect in its review of NSSS supports (LRA Section 3.5.9).

The staff found the applicant's approach for evaluating the applicable aging effects for the containment structural steel components to be reasonable and acceptable. The staff concludes that the applicant has properly identified the aging effects for containment structural steel components.

Elastomers: Appendix C of each LRA lists (1) cracking, (2) reduction in fracture toughness and (3) change in material properties as plausible aging effects for containment elastomer components.

For the cracking aging effect, the applicant identified the following plausible aging mechanisms: (1) irradiation, (2) thermal exposure, and (3) ultraviolet radiation and ozone. The applicant briefly describes each of the above aging mechanisms in Appendix C of each LRA and states that each mechanism was evaluated during the aging management reviews. Table 3.5.1-1 of each LRA identifies cracking of elastomers in an air environment as an aging effect requiring management.

For the reduction in fracture toughness aging effect, the applicant identified neutron embrittlement as a plausible aging mechanism. The applicant briefly describes neutron embrittlement in Appendix C of each LRA and states that this aging mechanism was evaluated during the aging management reviews. Table 3.5.1-1 of each LRA does not list reduction in fracture toughness as aging effect requiring management for any of the elastomer components in the containment.

For the change in material properties aging effect, the applicant identified (1) irradiation and (2) thermal exposure as plausible aging mechanisms. The applicant briefly describes each of the above aging mechanisms in Appendix C of each LRA and states that each mechanism was evaluated during the aging management reviews. Table 3.5.1-1 of each LRA identifies change in material properties of elastomers in an air environment as an aging effect requiring management.

The staff found the applicant's approach for evaluating the applicable aging effects for the containment elastomer components to be reasonable and acceptable. The staff concludes that the applicant has properly identified the aging effects for containment elastomer components.

3.8.1.2.2 Aging Management Programs

The aging management activities used by the applicant to manage the above aging effects are the Civil Engineering Structural Inspection, Boric Acid Corrosion Surveillance, Chemistry Control Program for Primary Systems, ISI Program - Containment Inspection, General-condition-monitoring activities, Infrequently Accessed Area Inspection Activities, and Work

Control Process. Within a given category of structural members, the aging management utilized by the applicant depends on the environment. For example, for access doors, the General-condition-monitoring activities AMA is used for doors in an air environment, while the Boric Acid Corrosion Surveillance AMA is used for doors that may be exposed to a borated water leakage environment. This breakdown is defined for each containment structural member in Table 3.5.1-1 of each LRA. A complete evaluation of the above aging management activities is found in Sections 3.3.1 and 3.3.4 of this SER. In this section, the staff reviewed the applicability of the above aging management activities to the containment structural members. The staff has identified the following issues related to the ISI Program - Containment Inspection aging management activity.

The scope of Subsection IWE inspections included in the ISI Program - Containment Inspection aging management activity is identified in LRA Section B2.2.12 as Categories E-A (containment surfaces), E-C (containment surfaces requiring augmented inspections), E-G (pressure-retaining bolting, and E-P (all pressure-retaining components). Categories E-B and E-F are identified as being optional in accordance with 10 CFR 50.55a(b)(2)(ix)(C). However, Category E-D (seals, gaskets, and moisture barriers) is not identified within the scope of this aging management activity. In RAI 3.5.4, the staff requested that the applicant explain why this category is not included within the scope of the ISI Program - Containment Inspection AMA. In response, the applicant stated that it uses the Work Control Process AMA to manage the aging of containment seals and gaskets since that activity involves more thorough and more frequent inspection of the seals and gaskets than do inservice inspections, which are required only once per 10-year interval. Table 3.5.1-1 of each LRA confirms the use of the Work Control Process to manage aging effects for seals and gaskets (identified as O-rings in the table). Regarding moisture barriers, there are no such barriers that are within the scope of ISI-IWE, Category E-D inspections incorporated into the design of the containment structures for Surry or North Anna. The staff considers the applicant's response to be acceptable.

The ISI Program - Containment Inspection aging management activity also includes Category E-P (all pressure-retaining components), which refers to 10 CFR Part 50, Appendix J, Option B. However, there is no description of the 10 CFR Part 50, Appendix J leak rate testing activity as an aging management program. It is not clear whether the applicant is crediting the complete requirements of 10 CFR Part 50, Appendix J as part of the ISI Program - Containment Inspection. In RAI 3.5-5, the staff requested that the applicant describe the scope of the 10 CFR Part 50, Appendix J program that is being credited for license renewal. In response, the applicant stated that containment leak rate testing is performed as required by Surry Technical Specification 4.4 (Containment Tests) and North Anna Technical Specification 3.6.1.2 (Containment Leakage). These technical specifications invoke the testing requirements of 10 CFR Part 50, Appendix J, Option B. Containment leak rate testing, in accordance with the ISI Program - Containment Inspection AMA described in Section B2.2.12 of the application, is credited with managing the aging of containment pressure-retaining components. The applicant also stated that compliance with identified testing requirements and acceptance standards confirms that the management of aging effects for sealing surfaces is effective to ensure the integrity of the containment pressure boundary. The staff found the applicant's response to RAI 3.5-5 to be acceptable.

On the basis of the information discussed above and the review of the aging management activities in Sections 3.3.1 and 3.3.4 of this SER, the staff concludes that the applicant has demonstrated that the aging effects for containment structural members will be adequately managed during the period of extended operation.

3.8.1.3 Conclusions

The staff has reviewed the information in Section 3.5.1 of each LRA and the applicable aging management activity descriptions in Appendix B of each LRA. On the basis of this review, the staff concludes that the applicant has demonstrated that the aging effects associated with the containment structural members will be adequately managed so that there is reasonable assurance that these structural components will perform their intended functions in accordance with the CLB during the period of extended operation.

3.8.2 Other Structures

3.8.2.1 Summary of Technical Information in the Application

Sections 3.5.2 through 3.5.8 of each LRA provides the applicant's aging management review of several structures outside containment. The structures covered in Sections 3.5.2 through 3.5.8 of each LRA are listed below:

- auxiliary building structure - North Anna (auxiliary building, cable vault, cable tunnel, pipe tunnel, hydrogen recombiner vault, rod drive room)
- auxiliary building structure - Surry (auxiliary building, cable vault, cable tunnel, pipe tunnel, motor control center room)
- other class I structures - North Anna (safeguards building; main steam valve house; quench spray pump house; fuel oil pump house; auxiliary feedwater pump house and tunnel; casing cooling pump house; and service water pump house, pipe expansion joint enclosure, valve house, and tie-in vault)
- other class I structures - Surry (safeguards building, main steam valve house, containment spray pump building, fuel oil pump house, fire pump house)
- fuel building
- miscellaneous structures - North Anna (turbine building, service building, station blackout building, security diesel building, maintenance building)
- miscellaneous structures - Surry (turbine building, service building, station blackout building, security diesel building, black battery building, condensate polishing building, radwaste facility)
- intake structures - North Anna (intake structure, discharge tunnels and seal pit)
- intake structures - Surry (low-level intake structure, high-level intake structure, concrete circulating water pipe, discharge tunnel and seal pit)
- yard structures - North Anna (tank foundations and missile barriers, manholes, fuel oil storage tank dike, transformer firewalls/dikes, duct banks, security lighting poles, domestic water treatment building, auxiliary service water expansion joint enclosure, yard valve pit, containment mat sub-surface pump access shaft)
- yard structures - Surry (tank foundations and missile barriers, manholes, fuel oil storage tank dike, transformer firewalls/dikes, duct banks, security lighting poles, containment mat sub-surface pump access shaft)
- earthen structures - North Anna (service water reservoir, floodwall west of the turbine building)
- earthen structures - Surry (intake canal, discharge canal)

The structural members for each of these structures are listed in Tables 3.5.2 through 3.5.8 of each LRA. Each of these tables summarizes the applicant's aging management review of the structural members by providing (1) the passive function, (2) the material group, (3) the environment, (4) the aging effects requiring management, and (5) the specific aging management activities that manage the aging effects.

The different materials of construction and environments for the structural members contained in the structures listed in Tables 3.5.2 through 3.5.8 of each LRA are given below:

Structure	Materials	Environments
Auxiliary Building Structure	concrete, carbon steel, low-alloy steel	atmosphere/weather, sheltered-air, soil, borated water leakage
Other Class I Structures - North Anna	concrete, carbon steel, low-alloy steel	atmosphere/weather, sheltered-air, soil, borated water leakage, raw water
Other Class I Structures - Surry	concrete, carbon steel, low-alloy steel	atmosphere/weather, sheltered-air, soil, borated water leakage
Fuel Building	concrete, carbon steel, low-alloy steel, stainless steel	atmosphere/weather, sheltered-air, soil, borated water leakage, treated-water
Miscellaneous Structures - North Anna	concrete, carbon steel, low-alloy steel, stainless steel, aluminum	atmosphere/weather, sheltered-air, soil
Miscellaneous Structures - Surry	concrete, carbon steel, low-alloy steel, stainless steel, aluminum, elastomers	atmosphere/weather, sheltered-air, soil
Intake Structures - North Anna	concrete, carbon steel, low-alloy steel, aluminum	atmosphere/weather, sheltered-air, soil, raw water (brackish)
Intake Structures - Surry	concrete, carbon steel, low-alloy steel, rubber	atmosphere/weather, sheltered-air, soil, raw water (brackish)
Yard Structures - North Anna	concrete, carbon steel, low-alloy steel, galvanized steel	atmosphere/weather, sheltered-air, soil
Yard Structures - Surry	concrete, carbon steel, low-alloy steel	atmosphere/weather, sheltered-air, soil

Earthen Structures - North Anna	concrete, soil, carbon steel	atmosphere weather, raw water, soil
Earthen Structures - Surry	concrete, soil, rubber, polysulfide sealant	atmosphere weather, raw water, soil

External service environments for air, atmosphere/weather, borated water leakage, and soil are specified in Table 3.0-2 in each LRA. Deviations from the environments described in Table 3.0-2 for the structures outside containment in each LRA are as follows:

- maximum temperature in upper level of main steam valve house for North Anna is 160°F (LRA Section 3.5.3 - Other Class 1 Structures)
- maximum temperature in upper level of main steam valve house for Surry is 140°F (LRA Section 3.5.3 - Other Class 1 Structures)
- minimum temperature in the emergency diesel generator room is 20°F (LRA Section 3.5.5 - Miscellaneous Structures)

3.8.2.1.1 Aging Effects

The applicable aging effects, as determined by the applicant, for different material/environment combinations for the structural members listed in Tables 3.5.2 through 3.5.8 of each LRA are given below. For the Auxiliary Building Structure (LRAs Section 3.5.2), the aging effects requiring management are:

- cracking of masonry block walls in an air environment
- loss of material from carbon steel and low-alloy steel in air, atmosphere/weather, or borated water leakage environments

For Other Class I Structures (LRAs Section 3.5.3), the aging effects requiring management are:

- loss of material from carbon steel and low-alloy steel in air, atmosphere/weather, or borated water leakage environments
- cracking of masonry block walls in an air environment (NAS 1/2)
- cracking of concrete in soil (NAS 1/2)

For the Fuel Building (LRAs Section 3.5.4), the aging effects requiring management are:

- cracking of masonry block walls in an air environment
- loss of material from carbon steel and low-alloy steel in air, atmosphere/weather, or borated water leakage environments
- loss of material from stainless steel structural members in the treated-water (borated water) environment of the spent fuel pool

For the Miscellaneous Structures (LRAs Section 3.5.5), the aging effects requiring management are:

- cracking of masonry block walls in an air environment
- loss of material from carbon steel and low-alloy steel in an air environment

- cracking and change in material properties of elastomers in an air environment (Surry)

For the Intake Structures (LRAs Section 3.5.6), the aging effects requiring management are:

- cracking of concrete in an air or atmosphere/weather environments
- loss of material from carbon steel and low-alloy steel structural members in air or atmosphere/weather environments
- loss of material from carbon steel and low-alloy steel structural members in a raw water environment (NAS 1/2)
- change in material properties of concrete in raw water (brackish) or atmosphere/weather environments (SPS 1/2)
- cracking of concrete in a raw water (brackish) environment (SPS 1/2)
- loss of material from concrete in a raw water (brackish) environment (SPS 1/2)
- change in material properties and cracking of elastomers in an air environment (SPS 1/2)
- loss of material from carbon steel and low-alloy steel structural members in a raw water (brackish) environment (SPS 1/2)
- loss of material from concrete in an atmosphere/weather environment (SPS 1/2)

For the Yard Structures (LRA Section 3.5.7), the aging effects requiring management are:

- loss of material from carbon steel and low-alloy steel structural members in air or atmosphere/weather environments
- cracking of concrete in an atmosphere/weather environment
- loss of material from concrete in an atmosphere/weather environment (NAS 1/2)
- loss of material from galvanized steel structural members in an atmosphere/weather environment (NAS 1/2)
- change in material properties of concrete in air, soil, or atmosphere/weather environments (SPS 1/2)
- cracking of concrete in air or soil environments (SPS 1/2)

For the Earthen Structures (LRA Section 3.5.8), the aging effects requiring management are:

- loss of material and loss of form of soil in an atmosphere/weather environment
- loss of material from carbon and low-alloy steel in a soil environment (NAS 1/2)
- loss of material and loss of form of soil in a raw water environment (SPS 1/2)
- change in material properties of concrete in a raw water (brackish) environment (SPS 1/2)
- cracking of concrete in raw water (brackish) or atmosphere/weather environments (SPS 1/2)
- loss of material from concrete in raw water (brackish) or atmosphere/weather environments (SPS 1/2)
- cracking and change in material properties of the elastomers exposed to an atmosphere/weather environment (SPS 1/2)

3.8.2.1.2 Aging Management Programs

The applicant credits the following aging management activities with managing the identified aging effects for the structural members listed in Tables 3.5.2 through 3.5.8 of each LRA:

- civil engineering structural inspection
- chemistry control program for primary systems
- buried piping and valve inspection activities
- general-condition-monitoring activities
- infrequently accessed area inspection activities
- work control process

A description of these aging management activities is provided in Appendix B of each LRA. The applicant concludes that the effects of aging associated with the structural members listed in Tables 3.5.2 through 3.5.8 of each LRA will be adequately managed by these aging management activities such that there is reasonable assurance that the intended functions will be maintained consistent with the current licensing basis during the period of extended operation.

3.8.2.2 Staff Evaluation

In addition to Sections 3.5.2 through 3.5.8 of each LRA, the staff reviewed the pertinent information provided in Section 2.4, “Scoping and Screening Results - Structures,” and the applicable aging management activity descriptions provided in Appendix B of each LRA to determine whether the aging effects for the various structural members in LRA Sections 3.5.2 to 3.5.8 have been properly identified and will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.8.2.2.1 Aging Effects

In Section 3.5.2 through 3.5.8 of each LRA, the applicant provides an aging management review of several structures outside containment. The methodology used to perform the aging management review for specific aging effects is described in Appendix C of each LRA. This section of the SER provides the staff’s evaluation of the applicant’s aging management review for aging effects and the applicant’s aging management programs credited for the structures outside containment at North Anna and Surry. The staff’s evaluation includes a review of the aging effects considered and the basis for the applicant’s elimination of certain aging effects. In addition, the staff has evaluated the applicability of the aging management programs that are credited for managing the identified aging effects for the structures outside containment.

Concrete: Appendix C of each LRA lists (1) loss of material, (2) cracking, and (3) change in material properties as plausible aging effects for concrete components.

For the loss of material aging effect, the applicant identified the following plausible aging mechanisms: (1) aggressive chemical attack, (2) freeze-thaw, (3) elevated temperatures, and (4) corrosion of embedded steel, (5) abrasive erosion and cavitation. The applicant briefly describes each of the above aging mechanisms in Appendix C of each LRA and states that each mechanism was evaluated during the aging management reviews. Tables 3.5.2 through 3.5.8 of each LRA identify loss of material as an aging effect requiring management for some concrete components in a raw water (brackish) and atmosphere/weather environments. A list of the structures that identify loss of material as an applicable aging effect for their concrete components is provided in Section 3.8.2.1.1 of this SER.

For the cracking aging effect of concrete components, the applicant identified the following plausible aging mechanisms: (1) settlement, (2) freeze-thaw, (3) aggressive chemical attack, (4) alkali-aggregate reaction, (5) corrosion of embedded steel, and (6) elevated temperatures. The applicant briefly describes each of the above aging mechanisms in Appendix C of each LRA and states that each mechanism was evaluated during the aging management reviews. Tables 3.5.2 through 3.5.8 of each LRA identify cracking as an aging effect requiring management for some concrete components in soil, air, atmosphere/weather, and raw water (brackish) environments. A list of the structures that identify cracking as an applicable aging effect for their concrete components is provided in Section 3.8.2.1.1 of this SER.

For the cracking aging effect of masonry block walls, the applicant identified the following plausible aging mechanisms: (1) dry shrinkage, (2) expansion/contraction, (3) improper joint isolation, and (4) poor mortar durability. The applicant briefly describes each of the above aging mechanisms in Appendix C of each LRA and states that each mechanism was evaluated during the aging management reviews. Tables 3.5.2 through 3.5.8 of each LRA identify cracking as an aging effect requiring management for masonry block walls in an air environment. A list of the structures that identify cracking as an applicable aging effect for masonry block walls is provided in Section 3.8.2.1.1 of this SER.

For the change in material properties aging effect, the applicant identified the following plausible aging mechanisms: (1) aggressive chemical attack, (2) alkali-aggregate reaction, (3) elevated temperatures, and (4) leaching of calcium hydroxide. The applicant briefly describes each of the above aging mechanisms in Appendix C of each LRA and states that each mechanism was evaluated during the aging management reviews. Table 3.5.2 through 3.5.8 of each LRA identify change in material properties as an aging effect requiring management for the air, atmosphere/weather, soil, and raw water (brackish) environments. A list of the structures that identify change in material properties as an applicable aging effect for their concrete components is provided in Section 3.8.2.1.1 of this SER.

The staff considers each of the above aging effects (loss of material, cracking, and change in material properties) to be both plausible and applicable for concrete components, including masonry block walls, in all of the environments listed by the applicant. Industry experience indicates that age-related degradation of concrete structures has occurred at a number of plants, demonstrating the need for aging management of concrete nuclear structures. As such, in RAI 3.5-7 the staff requested that the applicant identify the aging management program that will be used to manage the aging effects for concrete components. In initial discussions with the applicant on this issue, the applicant proposed to use any observed aging of the containment concrete structural components, through its ISI Program - Containment Inspection AMA, as an indicator for the aging of concrete components outside containment. The staff stated in RAI 3.5-7 that this approach was unacceptable since an extrapolation of the structural aging of the containment structure to other structures outside containment cannot be assumed. In response to RAI 3.5-7, the applicant stated that there are certain specific concrete structures or concrete structural members for which the applicant has identified aging effects requiring management. For these structures, an aging management activity has been identified in the applications to manage the effects of aging. However, the applicant stated that for the majority of the concrete structures within the scope of license renewal, they have concluded that there are no aging effects requiring management. However, based on discussions with the NRC staff and the staff's position on concrete aging discussed in a letter to Florida Power and Light dated October 30, 2001, the applicant committed to credit its Civil Engineering Structural Inspection

AMA to manage the potential aging effects of all in-scope concrete components in structures outside containment. The applicant states that these examinations will be added to the Civil Engineering Structural Inspection AMA and Infrequently Accessed Area Inspection Activity AMA, which are covered in Sections B2.2.6 and B2.1.2, respectively, in each LRA. As noted earlier in Section 3.5.1.2.1 for the containment internal concrete components, the applicant stated that it would also use the Civil Engineering Structural Inspection AMA to manage the potential aging effects. Once incorporated, as committed in this response, the staff considers this issue to be resolved.

Steel: Appendix C of each LRA lists loss of material and cracking as plausible aging effects for carbon, low-alloy, galvanized, and stainless steel components.

For the loss of material aging effect, the applicant identified corrosion and boric acid wastage as plausible aging mechanisms for steel components in structures outside containment. The applicant briefly describes both of the above aging mechanisms in Appendix C of each LRA and states that each mechanism was evaluated during the aging management reviews. Tables 3.5.2 through 3.5.8 of each LRA, identify loss of material as an aging effect requiring management for each of the carbon steel or low-alloy steel components in either air, atmosphere/weather, raw water (brackish), borated water leakage, and soil environments. The applicant also identifies loss of material as an applicable aging effect for stainless steel structural members in the treated-water (borated water) environment of the spent fuel pool and for galvanized steel structural members in an atmosphere/weather environment. A list of the structures that identify loss of material as an applicable aging effect for their steel components is provided in Section 3.8.2.1.1 of this SER.

For the cracking aging effect, the applicant identified stress corrosion cracking (SCC) as a plausible aging mechanism for the stainless steel structural members in a borated water environment in the fuel building. The applicant briefly describes SCC in Appendix C of each LRA and states that SCC was evaluated during the aging management reviews. The staff considers SCC to be a plausible aging effect for stainless steel in borated water and requested that the applicant provide a technical basis for excluding cracking of stainless steel as an aging effect requiring management. In its response, in a letter dated May 22, 2002 (Serial No. 02-277), the applicant stated that the potential for SCC is eliminated since temperatures are maintained below 140°F, as required by the applicant's technical specifications. The staff found the applicant's response to be acceptable.

The staff found the applicant's approach for evaluating the applicable aging effects for the steel components in structures outside containment to be reasonable and acceptable. The staff concludes that the applicant has properly identified the aging effects for steel components in structures outside containment.

Aluminum: Only a few of the in-scope components in structures outside containment are made of aluminum. This includes the control room ceiling and louvers roof in both the North Anna and Surry service buildings. In addition, the fire pump house roof access cover in the North Anna intake structure is made of aluminum. The applicant does not identify any aging effects for aluminum and the staff concurs with this finding.

Elastomers: Appendix C of each LRA lists cracking and change in material properties as plausible aging effects for elastomer materials used in structures outside containment.

For the cracking aging effect, the applicant identified thermal exposure and ultraviolet radiation as plausible aging mechanisms for elastomer materials in structures outside containment. The applicant briefly describes both of the above aging mechanisms in Appendix C of each LRA and states that these aging mechanisms were evaluated during the aging management reviews. Tables 3.5.5, 3.5.6 and 3.5.8 of each LRA identify cracking as an aging effect requiring management for elastomers in an air environment.

For the change in material properties aging effect, the applicant identified thermal exposure as a plausible aging mechanism for elastomer materials in structures outside containment. The applicant briefly describes thermal exposure in Appendix C of each LRA and states that this mechanism was evaluated during the aging management reviews. Tables 3.5.5, 3.5.6 and 3.5.8 of each LRA identify change in material properties as an aging effect requiring management for elastomers in an air environment.

The staff concurs with the above conclusions for North Anna and Surry, except it is not clear why the change in material properties and cracking of elastomers is limited to an air environment. Rubber material is used in the circulating water pipe at Surry as a concrete pipe joint gasket. The circulating water in the pipe is a raw water (brackish) environment. In RAI 3.5.6-3, the staff requested the applicant to provide the technical basis for determining that aging effects for elastomers are limited to an air environment. In response, the applicant stated that they performed an aging management review of the circulating water pipe rubber gaskets and the concrete culvert rubber gaskets in a raw water environment. Exposure to ultraviolet radiation, ozone, and temperatures exceeding 95°F (thermal exposure) are considered to be the only aging mechanisms that can result in the aging effects for rubber in a raw water environment. The conclusion of the aging management review indicates that there are no aging effects on these rubber gaskets in a raw water environment because these gaskets are not exposed to ultraviolet radiation, ozone, or temperatures exceeding 95°F. Additionally, a review of technical literature, and site and industry operating experience, has not identified any concerns related to aging of rubber in these applications. Therefore, there are no aging effects requiring management for these rubber gaskets in a raw water environment. The staff found the applicant’s response to be acceptable based on the applicant’s aging management review.

The staff found the applicant’s approach for evaluating the applicable aging effects for the elastomer material components in structures outside containment to be reasonable and acceptable. The staff concludes that the applicant has properly identified the aging effects for elastomers in structures outside containment.

Soil: Appendix C of each LRA lists loss of material and loss of form as plausible aging effects for the soil used in the earthen structures at North Anna and Surry.

For the loss of material aging effect, the applicant identified the following plausible aging mechanisms: (1) erosion, (2) subsurface flow (seepage), (3) rain impact, (4) surface flow, (5) wave action and (6) wind erosion. The applicant briefly describes each of the above aging mechanisms in Appendix C of each LRA and states that each mechanism was evaluated during the aging management reviews. Table 3.5.8 of each LRA identifies loss of material as an aging effect requiring management for the soil found in atmosphere/weather (North Anna and Surry) or raw water (SPS 1/2) environments and used in the earthen structures.

For the loss of form aging effect, the applicant identified the following plausible aging mechanisms: (1) frost action, (2) sedimentation, (3) settlement, (4) subsurface flow (seepage), and (5) surface flow. The applicant briefly describes each of the above aging mechanisms in Appendix C of each LRA and states that each mechanism was evaluated during the aging management reviews. Table 3.5.8 of each LRA identifies loss of form as an aging effect requiring management for the soil found in atmosphere/weather (North Anna and Surry) or raw water (SPS 1/2) environments and used in the earthen structures.

The staff found that Section 3.5.8 of the North Anna LRA does not provide information to explain why the aging effects loss of material and loss of form of soil in a raw water environment do not require aging management. Loss of material and loss of form may occur to the soil due to the various aging mechanisms described above (e.g., erosion, sedimentation, subsurface flow, etc.). In RAI 3.5.8-2, the staff requested the applicant to provide the technical basis why loss of material and loss of form of the soil in a raw water environment are not included as aging effects requiring management for the North Anna Earthen Structures. In response, the applicant stated,

> The earthen structure exposed to a raw water environment, as described in the North Anna application, Section 3.5.8, is the Service Water Reservoir (SWR). The SWR embankment dike consists of a wide core of compacted random fill, fine and coarse filters, and a wide outside zone of compacted rockfill. The core is protected on the upstream side by a select fill (2-foot clay liner with a permeability of 1 x 10^{-6} cm/sec) and on the downstream side by the fine and course filters that extend beneath the compacted rockfill. The clay liner on the upstream slopes is protected with a layer of dumped rockfill.
>
> The entire bottom of the SWR is lined with the same 2-foot clay liner that protects the core of the embankment dike. The insitu material (saprolite) in the bottom of the SWR, below the clay liner, is estimated to have the same permeability (1 x 10^{-6} cm/sec) as the clay liner. Although the insitu material was not installed and compacted to the same standards of the clay liner, its low permeability further reduces the seepage of water from the bottom of the SWR.
>
> Loss of material from the SWR embankment dike in a raw water environment could occur from wave action. However, the clay liner on the waterside slope of the dike embankment is protected from loss of material due to wave action by a 2-foot layer of dumped rockfill.
>
> The clay liner that is installed on the bottom of the SWR could experience loss of material and loss of form in a raw water environment from the following two conditions:
>
> - flow of water over the surface of the liner in the area of the service water pump house (SWPH) service water intake
> - flow of water over the surface of the liner as a result of the operation of the winter bypass headers at the service water valve house (SWVH)

Tests performed at Massachusetts Institute of Technology (MIT) on the clay liner material from the North Anna SWR indicate that flow rates greater than 0.55 fps are necessary to initiate erosion of the liner. A concrete liner, which has been designed and installed around the intake to the SWPH, reduces the maximum flow rate expected across the impervious clay liner to 0.20 fps.

The clay liner could experience loss of material and loss of form as a result of the operation of the underwater bypass headers at the SWVH. However, the winter bypass system is designed so that exit velocities are minimized. A coarse aggregate erosion apron, which has been placed on the reservoir bottom in the vicinity of the bypass piping discharge, is sized to ensure that velocities over the clay liner are less than 0.55 fps.

Loss of material and loss of form of the SWR embankment dike in a raw water environment could occur from subsurface flow. Subsurface flow (seepage) is the process by which excess ground water moves from the soil mass and exits to the closest available drainage path. Seepage is generally a problem during the initial filling of a reservoir or water control structure. Seepage may lead to the migration of soil fines out of the soil mass. This phenomenon is known as piping. The following techniques have been incorporated into the SWR embankment dike to prevent piping:

- construction of the impervious lining of the dike with materials that, by their nature, have a high resistance to piping
- the introduction, into the downstream portion of the dike, of filters that form a transition in gradation
- stringent requirements for uniformly compacted embankments, with emphasis on control of water content and density during construction

Another source of piping-type failures is along conduits built into or under an embankment. Such a failure is not possible at the SWR because all service water system piping is above the normal saturation level within the core section of the embankment.

The SWR could experience a loss of form from a sedimentation buildup, which could limit the storage capacity required for emergency cooling. However, sedimentation or sludge depth of up to 4 feet can be tolerated without impacting the thermal performance of the 30-day cooling water inventory of the SWR. After twenty years of operation, only 1 foot of sludge-buildup has occurred in the SWR. Therefore, sludge-buildup will not result in loss of form for the period of extended operation.

Because of the protective measures that have been provided in the design and construction of the SWR, loss of material and loss of form of soil exposed to raw water environment is not aging effects that require aging management.

Additionally, a review has determined that there is no North Anna operating experience to support a concern for loss of material or loss of form of soil in Earthen Structures exposed to a raw water environment.

In the SER with open items issued in June 2002, the staff found the applicant's response to RAI 3.5.8-2 to be acceptable, except for the potential aging effect loss of form due to sedimentation (sludge) buildup in the North Anna Service Water Reservoir (SWR). The applicant states that up to 4 feet of sludge buildup can be tolerated before loss of function, and through 20 years of operation, 1-foot of sludge buildups has occurred in the SWR. Using linear extrapolation, there would be 3 feet of sludge buildup after 60 years. However, there is no specific basis for linear extrapolation. Considering the relatively small margin for error, a one-time inspection prior to entering the period of extended operation would be appropriate. In discussing the applicant's response to RAI 3.5.8-2, the applicant committed, in a letter dated May 22, 2002 (Serial No. 02-277), to do a one-time inspection of the North Anna SWR to determine the level of sludge buildups. In its letter dated July 25, 2002, the applicant stated that the UFSAR Supplement Section 18.2.17, "Service Water System Inspections," has been modified to include the required sludge buildup measurement. Since the applicant has completed this action, the staff considers confirmatory action 3.8.2-1 closed.

Considering the applicant's AMR of the soil used in earthen structures at North Anna and Surry and the applicant's commitment to do a one-time inspection of the North Anna SWR, The staff found the applicant's approach for evaluating the applicable aging effects for the soil used in the earthen structures at both North Anna and Surry to be reasonable and acceptable. The staff concludes that the applicant has properly identified the aging effects for the soil used in the earthen structures at both North Anna and Surry.

3.8.2.2.2 Aging Management Programs

The aging management activities used by the applicant to manage the above aging effects are the Civil Engineering Structural Inspection, Chemistry Control Program for Primary Systems, Buried Piping and Valve Inspection Activities, General-condition-monitoring activities, Infrequently Accessed Area Inspection Activities, and Work Control Process. Within a given category of structural members, the aging management utilized by the applicant depends on the environment. For example, for steel beams, the Civil Engineering Structural Inspection AMA is used for beams in an air environment, while the General-condition-monitoring activities AMA is used for beams that may be exposed to a borated water leakage environment. This breakdown is defined for each structural member in Tables 3.5.2 through 3.5.8 of each LRA. A complete evaluation of the above aging management activities is found in Sections 3.3.1 and 3.3.4 of this SER. In this section, the staff reviewed the applicability of the above aging management activities to the components in structures outside containment. The staff has identified the following issue related to the Work Control Process and Civil Engineering Structural Inspection AMAs.

The Work Control Process and Civil Engineering Structural Inspection AMAs are credited with managing cracking and change in material properties for elastomer materials used in structures outside containment; however, neither of these AMAs identify the inspection of elastomer materials to be within their program scopes. In RAIs 3.5.5-1 and 3.5.6-4 the staff requested the applicant to describe how these two AMAs manage the aging of elastomer materials. In response, the applicant stated that although elastomer materials are not specifically listed in the Work Control Process activity description in Section B2.2.19 of both applications, they are included in this activity as non-metallic materials in air and in atmosphere/weather environments, as clarified In its response to RAI B2.2.19-3. In addition, the applicant stated that although not specifically stated in the program description, the rubber gaskets used in the intake structures and the polysulfide sealant material used in the earthen structures are within the scope of the Civil Engineering Structural Inspection AMA. The Civil Engineering Structural Inspection activity relies on preventive maintenance activities initiated through the Work Control Process AMA for the inspection and management of the rubber gaskets used in the intake structures. In addition, the Civil Engineering Structural Inspection AMA relies on surveillance test activities initiated through the Work Control Process AMA for the inspection and management of the polysulfide sealant material used in the earthen structures. The applicant stated that the scope of the Civil Engineering Structural Inspection AMA will be clarified to include elastomers and their associated aging effects in the revised program summary description for the UFSAR Supplement that will be presented to the NRC staff in a future submittal. In its letter dated July 25, 2002, the applicant stated that the UFSAR Supplement Section 18.2.6, Civil Engineering Structural Inspections has been modified to include change in material properties as an aging effect for both concrete and elastomer sealant and/or gasket materials.

Since the applicant has completed this action, the staff finds the clarification given by the applicant concerning the aging management of elastomer materials by the Civil Engineering Structural Inspection and Work Control Process AMAs to be acceptable.

On the basis of the information discussed above and the review of the aging management activities in Sections 3.3.1 and 3.3.4 of this SER, the staff concludes that the applicant has demonstrated that the aging effects for the components in structures outside containment will be adequately managed during the period of extended operation.

3.8.2.3 Conclusions

The staff has reviewed the information in Sections 3.5.2 through 3.5.8 of each LRA and the applicable aging management activity descriptions in Appendix B of each LRA. On the basis of this review, the staff concludes that the applicant has demonstrated that the aging effects associated with the components in structures outside containment will be adequately managed so that there is reasonable assurance that these structural components will perform their intended functions in accordance with the CLB during the period of extended operation.

3.8.3 NSSS Equipment Supports

3.8.3.1 Summary of Technical Information in the Application

Section 3.5.9 of each LRA provides the applicant’s aging management review of the NSSS equipment supports. Table 3.5.9-1 of each LRA summarizes the applicant’s aging management review of the structural members that comprise the NSSS equipment supports by providing (1) the passive function, (2) the material group, (3) the environment, (4) the aging effects requiring management, and (5) the specific aging management activities that manage the aging effects. A description of the NSSS equipment supports is provided in Section 2.4.9 of each LRA.

The applicant states in Section 3.5.9 of each LRA that it utilized the Westinghouse Owners Group Life Cycle Management and License Renewal Program Topical Report, WCAP-14422, “License Renewal Evaluation: Aging Management for Reactor Coolant System Supports,” in its aging management evaluation of the NSSS equipment supports. The applicant states that the scope of the NSSS supports described in the topical report bound the installed NSSS supports with the following clarifications:

- the generic parameters for temperature, environments, materials, and support configurations contained in the topical report were not used by the applicant for the aging management review of the NSSS supports. Instead, the applicant used actual values and configurations applicable to the installed NSSS equipment supports
- the topical report for the reactor coolant system supports included the pressurizer surge line supports. The applicant evaluates the aging effects for the pressurizer surge line supports in Section 3.5.10 of each LRA
- the topical report states that the NSSS equipment supports are not generally designed to specifically use bolted joint connections requiring pre-load. The applicant's review has determined that there are situations where pre-loading has been utilized and has included these situations in the aging management review of the NSSS equipment supports

The materials of construction for the NSSS equipment support structural members, which are subject to aging management review, are (1) carbon steel, (2) low-alloy steel, (3) maraging steel, (4) stainless steel, and (5) bronze. In addition, some of the NSSS support structural members have been impregnated with a low-friction lubricant (Lubrite).

The NSSS equipment supports are located in the containment and exposed to the containment air environment. In addition, the applicant states that the external surfaces of the NSSS equipment supports may also be exposed to borated water leakage conditions. The only NSSS equipment support structural member within the scope of license renewal that is in contact with fluids is the internal surfaces of the neutron shield annular tank. The applicant states that the tank is filled with treated-water with an operating temperature of 120°F.

3.8.3.1.1 Aging Effects

In Section 3.5.9 of each LRA, the applicant identified the following applicable aging effects for the NSSS support structural members:

- loss of material from carbon steel, low-alloy steel, maraging steel, and bronze structural members in a borated water leakage environment
- loss of material from carbon steel, low-ally steel, and maraging steel structural members in treated-water or air environments
- cracking of high strength maraging steel bolting in an air environment

3.8.3.1.2 Aging Management Programs

The applicant credits the following aging management activities with managing the identified aging effects for the NSSS support structural members:

- infrequently accessed area inspection activities
- chemistry control program for primary systems
- ISI program - component and component support inspections
- boric acid corrosion surveillance

A description of these aging management activities is provided in Appendix B of each LRA. The applicant concludes that the effects of aging associated with the NSSS equipment supports will be adequately managed by these aging management activities such that there is reasonable assurance that the intended functions will be maintained consistent with the current licensing basis during the period of extended operation. A description of the general structural supports is provided in Section 2.4.10 of each LRA.

3.8.3.2 Staff Evaluation

In Section 3.5.9 of each LRA, the staff reviewed the pertinent information provided in Section 2.4, “Scoping and Screening Results - Structures,” and the applicable aging management activity descriptions provided in Appendix B of each LRA to determine whether the aging effects for the NSSS equipment support structural members have been properly identified and will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.8.3.2.1 Aging Effects

In Section 3.5.9 of each LRA, the applicant provides an aging management review of the NSSS equipment support structural members. The methodology used to perform the aging management review for specific aging effects is described in Appendix C of each LRA. This section of the SER provides the staff’s evaluation of the applicant’s aging management review for aging effects and the applicant’s aging management programs credited for the NSSS equipment support structural members. The staff’s evaluation includes a review of the aging effects considered and the basis for the applicant’s elimination of certain aging effects. In addition, the staff has evaluated the applicability of the aging management programs that are credited for managing the identified aging effects for the NSSS equipment supports.

Steel: Appendix C of each LRA lists (1) loss of material, (2) cracking, (3) loss of pre-load, and (4) reduction in fracture toughness as plausible aging effects for carbon, low-alloy, maraging, and stainless steel NSSS equipment support structural members.

For the loss of material aging effect, the applicant identified corrosion and boric acid wastage as plausible aging mechanisms for the steel NSSS equipment support structural members. The applicant briefly describes both of the above aging mechanisms in Appendix C of each LRA and states that each mechanism was evaluated during the aging management reviews. Table 3.5.9 of each LRA, identifies loss of material as an aging effect requiring management for carbon steel, low-alloy steel, and maraging steel structural members in air, treated-water, and borated water leakage environments.

For the cracking aging effect, the applicant identified stress-corrosion cracking (SCC) as a plausible aging mechanism for the steel NSSS equipment support structural members. The applicant briefly describes SCC in Appendix C of each LRA and states that SCC was evaluated during the aging management reviews. Table 3.5.9 of each LRA, identifies cracking as an aging effect requiring management for high strength maraging steel bolting in an air environment.

Bronze: Only the NSSS equipment support bearing plate is made of bronze. The applicant identified loss of material due to borated water leakage as the only aging effect requiring management for bronze material.

Lubrite: Lubrite is identified by a footnote to Table 3.5.9 of each LRA. Footnote 1 to Table 3.5.9 of each LRA states that the bronze bearing plate is impregnated with Lubrite lubricant. The applicant states that Lubrite has been evaluated for the worst case fluence levels at the reactor vessel sliding supports. There are no aging effects requiring management for Lubrite since it is essentially pure graphite with some trace amounts of metallic oxides to enhance its lubricity.

For each of the above material (steel, bronze, and lubrite) the staff identified the following RAIs:

Footnote 2 in Table 3.5.9-1 of each LRA identifies other high-strength bolting used in NSSS equipment supports. However, cracking is not identified as an applicable aging effect by the applicant for the other high-strength bolting. Footnote 2 indicates that for the neutron shield tank support structure and the reactor coolant pumps, steam generator, and pressurizer support structures, the carbon steel and low-alloy steel material group includes high-strength bolting. This high-strength bolting is potentially susceptible to SCC and may require aging management. In RAI 3.5.9-4, the staff requested that the applicant provide a technical justification for this omission. In response, the applicant stated the following:

> Stress corrosion cracking (SCC) is the aging mechanism that results in cracking of high strength bolting. As discussed in each LRA, Section C3.2.1, SCC requires the simultaneous action of a corrosive environment, sustained tensile stress, and a susceptible material. Elimination of any one of these elements will eliminate the susceptibility to SCC. Additionally, the susceptibility of materials to SCC is dependent on the magnitude of these elements. In other words, the greater the tensile stress, the greater the yield strength of the material, or the more severe the environment; the more susceptible a given material is to SCC.
>
> Although the industry has experienced instances of cracking of carbon steel and low-alloy steel bolting due to SCC, these failures have been attributed to high yield strength materials (>150 ksi). For the carbon and low-alloy steel high-strength bolting utilized in the supports (identified by Footnote 2 in Table 3.5.9-1 and Footnote 3 in Table 3.5.10-1 of the application), the material yield strength ranges from 140 to 160 ksi. Therefore, the yield strengths for these materials only marginally exceed the threshold at which materials are considered susceptible to SCC. These bolts are located in a sheltered-air environment that is not corrosive and, therefore, is not conducive to initiation of SCC in these materials. Therefore, there is reasonable assurance that cracking of the carbon and low-alloy steel high-strength bolting of the Surry and North Anna NSSS equipment supports and general structural supports is not an aging effect that requires management. In addition, a review of plant-specific operating experience did not identify cracking of these bolting materials in support applications.

After reviewing the applicant's response to RAI 3.5.9-4, the staff requested further information in a supplemental RAI pertaining to the specific yield strengths for the other high-strength bolting used in the NSSS equipment supports. In a letter dated May 22, 2002 (Serial No. 02-163), the applicant listed yield strengths for eight different high-strength bolt materials. OF the eight bolt materials, only three have yield strengths higher than 150 ksi; the other five have yield strengths near to or below 130 ksi. In addition, the applicant reiterated its response to RAI 3.5.9-4 that stated that SCC requires the simultaneous action of a corrosive environment, sustained tensile stress, and a susceptible material. Elimination of any one of these elements will eliminate susceptibility to SCC. Since the other high-strength bolts used for the NSSS equipment supports are in a hot and dry environment, the staff concurs with the applicant that SCC is not an applicable aging mechanism.

The staff review of the applicant's use of the Westinghouse Owners Group (WOG) Generic Technical Report (GTR), WCAP-14422, for the NSSS equipment supports focused on deviations listed by the applicant from the GTR recommendations. Section 4.1 of the NRC staff's safety evaluation of the WOG GTR on NSSS equipment supports identifies 16 applicant-action-items which staff required from the applicant in order to conclude that the aging of the components of the RCS supports, within the scope of the WOG GTR, will be adequately managed. The staff received the applicant's AMR of the NSSS equipment supports with respect to each of the action items and, in particular, focused on action item 16. The action item #16 requests that the plant-specific programs that deviate from the WOG GTR recommended aging management programs be identified and justified. In RAI 3.5.9-1 the staff requested that the applicant provide more information on the following deviations from the WOG GTR.

1. The WOG GTR recommends an aging management program (AMP-1.2) for concrete local to reactor coolant system (RCS) support concrete embedments. The applicant responded to the action items 1, 10, 13, 14, 15, and 16, and indicated that the concrete portion of RCS-supports are evaluated under Containment, and that there are no aging effects that require management for concrete structural members within Containment. The applicant should identify this as a deviation to the WOG GTR and provide technical justification for concluding that the aging effects due to aggressive chemical attack and corrosion as described in the WOG GTR do not require management.

2. The WOG GTR recommends an aging management program to manage aging effects due to aggressive chemical attack and corrosion in RCS support steel components (AMP-1.1). The program includes IWF inspections, leakage identification walkdowns, and leakage monitoring. In response to Applicant Action Items 10 and 14, the applicant did not provide any detailed information on a leakage monitoring program. If a leakage monitoring program is not credited for managing these aging effects, this should be identified as a deviation from the WOG GTR and a technical justification for its omission should be provided.

3. Materials of construction of NSSS supports identified in LRA Section 3.5.9 include "maraging" steel. This material is not included in the WOG GTR. The applicant should identify this as a deviation to the WOG GTR, and provide a description and results of a plant-specific aging management review for components fabricated from this material.

4. LRA Table 3.5.9-1 identifies bronze as a bearing plate material. This material is not included in the WOG GTR. Section 2.3 of the WOG GTR indicates that the type of base material used for the Lubrite plates is ASTM A-48. The applicant should identify

this as a deviation to the WOG GTR, and provide a description and results of a plant-specific aging management review for components fabricated from bronze.

In response to the four items listed in RAI 3.5.9-1, the applicant stated:

> As discussed in Section 3.5.9 of the application, the applicant has performed a plant-specific aging management review for the NSSS Supports at Surry and North Anna. As such, the applicant has provided sufficient information in the license renewal application to document the plant-specific aging management review results, as required by 10 CFR 54.21, without sole reliance on the conclusions of the WOG GTR. Although the WOG GTR was used as a technical reference for the aging management review, deviations from the WOG GTR were not specifically identified in the application, and are not addressed in the response to RAI 3.5.9-1. However, the applicant has addressed the Applicant Action Items resulting from the NRC FSER for this GTR and included this information in the application in Table 3.5.9-W1 to aid the NRC staff review:
>
> - the aging effects of loss of material, change in material properties, and cracking of concrete local to RCS support concrete embedments will be managed as described In its response to RAI 3.5-7
> - loss of material due to boric acid wastage for the RCS supports is managed with the Boric Acid Corrosion Surveillance activities described in Section B2.2.3 of the application. These activities include inspections for evidence of borated water leakage, reviews of inspection results, and evaluations of the effects of leakage. Inspections for borated water leakage are performed at a frequency of each refueling outage. These inspections are performed to comply with the requirements of NRC Generic Letter 88-05. If leakage is found, evaluation of the affected components, including NSSS Supports as applicable, are initiated in accordance with the Corrective Action System. Therefore, the leakage monitoring is performed in accordance with the Boric Acid Corrosion Surveillance activity
> - Section 2.4.1 and Table 2-4 of the WOG GTR identify the materials most commonly specified for the RCS supports. Although not identified in Section 2.4.1 and Table 2-4, the potential for stress-corrosion cracking of maraging steel is discussed in WOG GTR, Section 3.2.1. A plant-specific aging management review has been performed for maraging steel in accordance with the methodology outlined in Appendix C of the application. The results of this plant-specific aging management review are provided in LRA Table 3.5.9-1
> - Section 2.4.1 and Table 2-4 of the WOG GTR identify the materials most commonly specified for the RCS supports. Bronze is not identified in this section or table and is not discussed elsewhere in the WOG GTR. A plant-specific aging management review has been performed for bronze in accordance with the methodology outlined in Appendix C of the application. The results of this plant-specific aging management review are provided in LRA Table 3.5.9-1

The staff found the applicant's responses to each part of RAI 3.5.9-1 to be acceptable. The applicant is correct that the WOG GTR does discuss high-nickel maraging steel in Section 3.2.1 under "Aging Effect Evaluation" for stress corrosion cracking. In addition, the applicant provides for aging of concrete local to RCS support concrete embedments, management of loss of material due to boric acid wastage for the RCS supports, and a plant-specific AMR for bronze as a bearing plate material.

Section 4.1 of the WOG GTR states that RCS support components are not generally designed to use bolted joint connections requiring pre-load. However, it also states that in the event that pre-load is important for a specific support design, a locking mechanism can be used to ensure that the pre-load is not lost. If a locking mechanism is not used, a plant-specific CLB inspection program may include an inspection of the connection for loss of preload, if deemed necessary. Applicant action item 16 of the staff's SER on the WOG GTR also requires that the applicant identify a program to ensure that proper pre-load is retained for the component supports within the scope of the WOG GTR. Section 3.5.9 of each LRA indicates that preloading has been utilized, but it did not indicate that locking mechanisms were used or that an inspection program is in place. Therefore, the staff requested in RAI 3.5.9-2 that the applicant identify the specific supports which rely on bolt pre-load to remain functional, identify the bolt materials, and provide technical justification for not providing a locking mechanism or performing inspections.

In response to RAI 3.5.9-2 the applicant stated that based on the NSSS supports materials and environment at Surry and North Anna, loss of bolt pre-load is not an aging effect requiring management. As described in the response to applicant action item 16, Part 4 of 7 (Page 3-365 of the Surry LRA and Page 3-361 of the North Anna LRA), the maximum temperature to which the bolting is exposed is less than the threshold temperature for stress relaxation that could result in loss of pre-load. Therefore, there are no bolting applications where loss of pre-load is an aging effect requiring management for NSSS Supports.

The staff initially considered the applicant's response to RAI 3.5.9-2 to be unacceptable. Section 4.1 of the WOG GTR is not related to stress relaxation, caused by elevated temperature, as the cause of loss of bolt preload. Where preload is necessary to meet intended function but a locking mechanism is not used, the WOG GTR recommends inspection for loss of preload. However, the staff recognized that the applicant is already managing these high-strength bolts for cracking and loss of material and considers this to be sufficient.

The staff found the applicant's approach for evaluating the applicable aging effects for the NSSS equipment support structural members to be reasonable and acceptable. The staff concludes that the applicant has properly identified the aging effects for the structural members comprising the NSSS equipment supports.

3.8.3.2.2 Aging Management Programs

The aging management activities used by the applicant to manage the above aging effects are the Infrequently Accessed Area Inspection Activities, Chemistry Control Program for Primary Systems, ISI Program - Component and Component Support Inspections, and Boric Acid Corrosion Surveillance. Within a given category of structural members, the aging management utilized by the applicant depends on the environment. For example, for the neutron shield tank, the Infrequently Accessed Area Inspection Activities AMA is used for the portion of the tank in air, the Boric Acid Corrosion Surveillance AMA is used for the portion of the tank exposed to borated water leakage, and the Chemistry Control Program for Primary Systems AMA is used for the portion of the tank exposed to treated-water. This breakdown is defined for each structural member in Table 3.5.9 of each LRA. A complete evaluation of the above aging management activities is found in Sections 3.3.1 and 3.3.4 of this SER. In this section, the staff reviewed the applicability of the above aging management activities to the NSSS equipment support structural members. The staff has identified the following issue related to the ISI Program - Component and Component Support Inspections AMA.

The staff notes that the ISI Program - Component and Component Support Inspections (IWF Category F-A) is credited for managing cracking of high strength maraging steel bolting in an air environment. The staff has a concern about the adequacy of VT-3 visual inspection, which is required by Category F-A, to detect cracking in high strength bolting before there is loss of function. In RAI 3.5.9-5, the staff requested that the applicant provide additional technical justification on the adequacy of this inspection method for managing stress corrosion cracking in high strength support bolts.

In response, the applicant stated that the provisions of ASME Section XI, Subsection IWF constitute the current licensing basis requirements for inspection of supports for ASME Class 1, 2, 3, and MC components for Surry and North Anna. These requirements are the current industry standards for inspection of nuclear component supports. In addition, the NRC staff has accepted the inspection provisions of ASME Section XI, Subsection IWF as an effective aging management program for cracking of structural bolting in its Safety Evaluation Reports for Calvert Cliffs (NUREG-1705) and Arkansas Nuclear One Unit 1 (NUREG-1743) license renewal applications. Therefore, the aging management approach for NSSS Supports described in the license renewal applications for Surry and North Anna is consistent with the current licensing basis requirements and NRC staff accepted methodologies for license renewal.

The staff recognizes that the visual VT-3 examinations specified by ASME Section XI, Subsection IWF, may be inadequate to directly detect the degradation of bolts by SCC; however, the staff has determined that the VT-3 examinations will detect conditions of any leakage or other contaminants that may cause degradation of bolts by SCC. The staff has previously accepted visual VT-3 examination for high-strength bolting, which constitutes the applicant's current licensing basis, as a means for detecting conditions to SCC. The acceptance of a visual VT-3 examination is based on the applicant's prior completion of a baseline evaluation of the bolts, as described in Section 4.2.2 of the WOG GTR. During the baseline evaluation, the structural integrity of the bolts in the RCS supports was examined by the applicant. In a letter to the staff on May 22, 2002 (Serial No. 02-163), the applicant stated that the evidence of SCC was not observed during the baseline inspection and, as stated in its response RAI 3.5.9-4, SCC requires the simultaneous action of a corrosive environment, sustained tensile stress, and a susceptible material. Elimination of any one of these elements will eliminate susceptibility to SCC. Since the high-strength bolts (> 150 ksi) used for the NSSS equipment supports are in a normally hot and dry environment, the staff concurs with the applicant that a VT-3 visual examination is sufficient to detect any changes to the bolting environment, which may lead to SCC of the high-strength bolts. Thus, the applicant's response to RAI 3.5.9-5 is acceptable to the staff.

On the basis of the information discussed above and the review of the aging management activities in Sections 3.3.1 and 3.3.4 of this SER, the staff concludes that the applicant has demonstrated that the aging effects for the NSSS equipment support structural members will be adequately managed during the period of extended operation.

3.8.3.3 Conclusions

The staff has reviewed the information in Section 3.5.9 of each LRA and the applicable aging management activity descriptions in Appendix B of each LRA. On the basis of this review, the staff concludes that the applicant has demonstrated that the aging effects associated with the NSSS equipment support structural members will be adequately managed so that there is reasonable assurance that these components will perform their intended functions in accordance with the CLB during the period of extended operation.

3.8.4 General Structural Supports

3.8.4.1 Summary of Technical Information in the Application

Section 3.5.10 of each LRA provides the applicant's aging management review of the general structural supports. Table 3.5.10-1 of each LRA summarizes the applicant's aging management review of the general structural support components by providing (1) the passive function, (2) the material group, (3) the environment, (4) the aging effects requiring management, and (5) the specific aging management activities that manage the aging effects.

The materials used for general structural supports are (1) carbon steel, (2) low-alloy steel, (3) stainless steel, (4) aluminum, (5) and copper alloys. Structural support items include structural plates, sheet steel, clamps, brackets, cable trays, conduits, struts, and spring hangers. Most of the structural support items are made from carbon steel and low-alloy steel; however, aluminum is used for cable trays and conduits inside buildings, except for containment. Also, stainless steel structural support items include sliding pipe supports and supports that are submerged in borated water.

The different environments for the structural supports include (1) containment air, (2) other indoor areas of the plant, (3) outdoors, (4) borated water, and (5) raw water.

3.8.4.1.1 Aging Effects

In Section 3.5.10 of each LRA, the applicant identified the following applicable aging effects for general structural supports:

- loss of material from carbon steel and low-alloy steel support components in an air or atmosphere/weather environment
- loss of material from carbon steel and low-alloy steel support components in a raw water environment
- loss of material from stainless steel supports in a treated-water (borated water) environment
- loss of material from carbon steel and low-alloy steel support components in a borated water leakage environment

3.8.4.1.2 Aging Management Programs

The applicant credits the following aging management activities with managing the identified aging effects for general structural supports:

- augmented inspection activities
- battery rack inspections
- boric acid corrosion surveillance
- chemistry control program for primary systems
- ISI program - component and component support inspections
- general-condition-monitoring activities
- infrequently accessed area inspection activities

A description of these aging management activities is provided in Appendix B of each LRA. The applicant concludes that the effects of aging associated with the general structural supports will be adequately managed by these aging management activities such that there is reasonable assurance that the intended functions will be maintained consistent with the current licensing basis during the period of extended operation.

3.8.4.2 Staff Evaluation

In addition to Section 3.5.10 of each LRA, the staff reviewed the pertinent information provided in Section 2.4, “Scoping and Screening Results - Structures,” and the applicable aging management activity descriptions provided in Appendix B of each LRA to determine whether the aging effects for the components comprising the general structural supports have been properly identified and will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.8.4.2.1 Aging Effects

In Section 3.5.10 of each LRA, the applicant provides an aging management review of several components which comprise the general structural supports. The methodology used to perform the aging management review for specific aging effects is described in Appendix C of each LRA. This section of the SER provides the staff’s evaluation of the applicant’s aging management review for aging effects and the applicant’s aging management programs credited for the components which comprise the general structural supports and the basis for the applicant’s elimination of certain aging effects. In addition, the staff has evaluated the applicability of the aging management programs that are credited for managing the identified aging effects for the components which comprise the general structural supports.

Steel: Appendix C of each LRA lists loss of material and cracking as plausible aging effects for carbon, low-alloy, and stainless steel components which comprise the general structural supports.

For the loss of material aging effect, the applicant identified corrosion and boric acid wastage as plausible aging mechanisms for the components which comprise the general structural supports. The applicant briefly describes both of the above aging mechanisms in Appendix C of each LRA and states that each mechanism was evaluated during the aging management reviews. Table 3.5.10 of each LRA, identifies loss of material as an aging effect requiring management for carbon steel and low-alloy steel components in air, atmosphere/weather, borated water leakage, and raw water environments. Loss of material is also identified as an aging effect requiring management for stainless steel supports in a treated-water environment.

For the cracking aging effect, the applicant identified stress-corrosion cracking (SCC) as a plausible aging mechanism for the components which comprise the general structural supports. The applicant briefly describes SCC in Appendix C of each LRA and states that SCC was evaluated during the aging management reviews. Table 3.5.10 of each LRA, does not identify cracking as an aging effect requiring management for any of the components which comprise the general structural supports. The staff's evaluation of potential cracking due to SCC of high-strength bolting used for the general structural supports is discussed in RAI 3.5.9-4, which is covered in previous section of this SER. In response to RAI 3.5.9-4, the applicant demonstrated that cracking of the high-strength bolting used for general structural support is not an aging effect that requires management. The staff concurs with the applicant's finding.

Aluminum: Only the electrical cable trays are made of aluminum. The applicant does not identify any aging effects requiring management for the aluminum cable trays. The staff concurs with the applicant's finding.

Bronze: The applicant identified loss of material due to borated water leakage as the only aging effect requiring management for bronze. The Surry RHR pump support bearing plate is the only component made of bronze that is exposed to boric acid environment. The staff concurs with the applicant's finding.

Lubrite: Lubrite is identified by a footnote to Table 3.5.10 of each LRA. Footnote 1 to Table 3.5.10 of each LRA states that the bronze bearing plate is impregnated with Lubrite lubricant. The applicant states that Lubrite has been evaluated for the worst case fluence levels at the reactor vessel sliding supports. There are no aging effects requiring management for Lubrite since it is essentially pure graphite with some trace amounts of metallic oxides to enhance its lubricity.

While the staff concurs with the applicant's identification of the above aging effects for the components which comprise the general structural supports, the staff identified two areas where clarifications and additional information was required. In RAI 3.5.10-1, the staff requested further information regarding two issues.

1. In each LRA Section 3.5.9 and 3.5.10, the applicant recognizes the need to manage supports for the purpose of maintaining the intended functions of the associated SCs under design load conditions. However, the applicant did not identify the need to manage those supports that are within the scope of license renewal and perform the functions of allowing for thermal expansion and seismic restraint. Buildup of debris or material on the non-moving surface can cause an obstruction that can impede the ability to expand and, therefore, prohibit the ability to allow for thermal expansion. As such, the staff requests that the applicant include fouling of the component surface as an applicable aging effect for these supports and to identify the AMA that will be used to manage this fouling.

2. In each LRA Section 2.4.10, the applicant indicates that supports for mechanical equipment (e.g., fans) are within the scope of the general structural support AMR. Fans and other mechanical equipment are often mounted on vibration isolating supports,

which employ various non-metallic materials to absorb equipment vibration. The staff considers change in material property and cracking as aging effects requiring management for vibration isolation supports. However, the applicant's AMR does not identify any non-metallic materials, and does not specifically indicate that vibration isolating supports are within the scope of the AMR for general structural supports. Therefore, the staff requests that the applicant: (1) clarify whether there are any vibration isolating supports within the scope of license renewal and (2) describe the AMR for vibration isolating supports, including the materials and environments, the applicable aging effects, and the AMAs credited to manage aging.

In response to the two items requested by the staff in RAI 3.5.10-1, the applicant stated:

- there are supports within the scope of license renewal that are designed to restrain components in certain directions while allowing thermal expansion in the other directions. Although fouling of the component surface is not identified in each LRA as an aging effect requiring management, such degradation would be identified by aging management activities relied on for managing the effects of aging for these supports. Therefore, fouling of component support surfaces that could affect the function to allow thermal expansion will be managed by the ISI Program – Component and Component Support Inspections, General-condition-monitoring activities, and Infrequently Accessed Area Inspection Activities
- there are supports within the scope of license renewal that are designed for vibration isolation which utilize non-metallic materials. These support elements are considered to be an integral part of the overall structural support component and are not uniquely identified in the application. Degradation associated with these non-metallic support elements would be identified by aging management activities relied on for managing the entire structural support assembly. Therefore, aging effects of non-metallic materials used in vibration isolating supports are managed by the ISI Program – Component and Component Support Inspections, General-condition-monitoring activities, and Infrequently Accessed Area Inspection Activities

Since the applicant has committed to manage fouling of support component surfaces as an applicable aging effect through its ISI Program – Component and Component Support Inspections, General-condition-monitoring activities, and Infrequently Accessed Area Inspection Activities AMAs, the staff found the applicant's response to the first item in RAI 3.5.10-1 to be acceptable. In addition, the staff finds that the applicant's response to the second item in RAI 3.5.10-1 to be acceptable since the applicant stated that the inspection of the non-metallic support elements, although not uniquely identified in the applications, is part of the AMAs used for managing the aging effects of the entire structural support assembly.

In RAI 3.5.10-2, the staff requested that the applicant address the potential for reduction in concrete anchor capacity due to degradation of the embedded portion of the steel anchor or the degradation of the concrete and grout surrounding the anchor. In response to RAI 3.5.10-2, the applicant stated that the potential aging effects for the portion of the steel anchor embedded in concrete, or potential aging effects for the concrete and grout surrounding the anchor, are evaluated along the associated structure concrete. The applicant stated that the aging effects of loss of material, cracking, and change in material properties will be managed for concrete components as described in response to RAI 3.5-7. Thus, the applicant's commitment to manage concrete aging, in response to RAI 3.5-7, will include managing potential degradation of the embedded portion of the steel anchor as well as degradation of the concrete and grout surrounding the anchor. Therefore, the applicant's response to RAI 3.5.10-2 is acceptable to the staff.

3.8.4.2.2 Aging Management Programs

The aging management activities used by the applicant to manage the above aging effects are the Augmented Inspection Activities, Battery Rack Inspections, Boric Acid Corrosion Surveillance, Chemistry Control Program for Primary Systems, ISI Program - Component and Component Support Inspections, General-condition-monitoring activities, and the Infrequently Accessed Area Inspection Activities. Within a given category of structural members, the aging management utilized by the applicant depends on the environment. This breakdown is defined for each structural member in Table 3.5.10 of each LRA. A complete evaluation of the above aging management activities is found in Sections 3.3.1 and 3.3.4 of this SER. In this section, the staff reviewed the applicability of the above aging management activities to the components which comprise the general structural supports. On the basis of the review of the aging management activities in Sections 3.3.1 and 3.3.4 of this SER, the staff concludes that the applicant has demonstrated that the aging effects for the components which comprise the general structural supports will be adequately managed during the period of extended operation.

3.8.4.3 Conclusions

The staff has reviewed the information in Section 3.5.10 of each LRA and the applicable aging management activity descriptions in Appendix B of each LRA. On the basis of this review, the staff concludes that the applicant has demonstrated that the aging effects associated with the components which comprise the general structural supports will be adequately managed so that there is reasonable assurance that these components will perform their intended functions in accordance with the CLB during the period of extended operation.

3.8.5 Miscellaneous Structural Commodities

3.8.5.1 Summary of Technical Information in the Application

Section 3.5.11 of each LRA provides the applicant's aging management review of the miscellaneous structural commodities. Table 3.5.11-1 of each LRA summarizes the applicant's aging management review of the miscellaneous structural commodities by providing (1) the passive function, (2) the material group, (3) the environment, (4) the aging effects requiring management, and (5) the specific aging management activities that manage the aging effects.

The materials of construction for the miscellaneous structural members are (1) carbon steel, (2) low-alloy steel, (3) galvanized steel, (4) stainless steel, (5) aluminum, (6) a variety of ceramics and polymers, and (7) elastomers.

The different environments for the miscellaneous structural members are (1) atmosphere/weather, (2) sheltered-air, and (3) containment air. In addition, the applicant states that miscellaneous structural commodities may be located in areas with piping systems that contain boric acid and could be exposed to a borated water leakage environment.

3.8.5.1.1 Aging Effects

In Section 3.5.11 of each LRA the applicant identified the following applicable aging effects for the miscellaneous structural members:

- change in material properties of ceramics and polymers in an air environment
- change in material properties of elastomers in an atmosphere/weather environment
- cracking of elastomers in an atmosphere/weather environment
- loss of material from carbon steel and low-alloy steel components in air, atmosphere/weather, or borated water leakage environments
- loss of material from ceramics and polymers in an air environment
- separation and cracking/delamination of ceramics and polymers in an air environment

3.8.5.1.2 Aging Management Programs

The applicant credits the following aging management activities with managing the identified aging effects for the miscellaneous structural members:

- fire protection program
- boric acid corrosion surveillance
- general-condition-monitoring activities
- work control process

A description of these aging management activities is provided in Appendix B of each LRA. The applicant concludes that the effects of aging associated with the miscellaneous structural members will be adequately managed by these aging management activities such that there is reasonable assurance that the intended functions will be maintained consistent with the current licensing basis during the period of extended operation.

3.8.5.2 Staff Evaluation

In addition to Section 3.5.11 of each LRA, the staff reviewed the pertinent information provided in Section 2.4, “Scoping and Screening Results - Structures,” and the applicable aging management activity descriptions provided in Appendix B of each LRA to determine whether the aging effects for the components comprising the miscellaneous structural commodities have been properly identified and will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.8.5.2.1 Aging Effects

In Section 3.5.11 of each LRA, the applicant provides an aging management review of several components which comprise the miscellaneous structural commodities. The methodology used to perform the aging management review for specific aging effects is described in Appendix C of each LRA. This section of the SER provides the staff’s evaluation of the applicant’s aging management review for aging effects and the applicant’s aging management programs credited for the components which comprise the miscellaneous structural commodities and the basis for the applicant's elimination of certain aging effects. In addition, the staff has evaluated the applicability of the aging management programs that are credited for managing the identified aging effects for the components which comprise the miscellaneous structural commodities.

Steel and Aluminum: Appendix C of each LRA lists loss of material as the only plausible aging effect for carbon steel, low-alloy steel, stainless steel, galvanized steel, and aluminum components which comprise the miscellaneous structural commodities.

For the loss of material aging effect, the applicant identified corrosion and boric acid wastage as plausible aging mechanisms for the components which comprise the miscellaneous structural commodities. The applicant briefly describes both of the above aging mechanisms in Appendix C of each LRA and states that each mechanism was evaluated during the aging management reviews. Table 3.5.11 in each LRA identifies loss of material as an aging effect requiring management for carbon steel and low-alloy steel components in air, atmosphere/weather, and borated water leakage environments. Loss of material is also identified as an aging effect requiring management for galvanized steel components in atmosphere/weather or borated water leakage environments.

Ceramics, Polymers, and Elastomers: Appendix C of each LRA lists (1) loss of material, (2) cracking, and (3) change in material properties as plausible aging effects for the components which comprise the miscellaneous structural commodities.

For the loss of material aging effect, the applicant identified abrasion and flaking as plausible aging mechanisms for the components which comprise the miscellaneous structural commodities. The applicant briefly describes both of the above aging mechanisms in Appendix C of each LRA and states that each mechanism was evaluated during the aging management reviews. Table 3.5.11 in each LRA identifies loss of material as an aging effect requiring management for ceramics and polymers in an air environment (NAS 1/2 only).

For the cracking aging effect, the applicant identified (1) irradiation, (2) thermal exposure, (3) ultraviolet radiation, (4) differential movement, (5) shrinkage, and (6) vibration as plausible aging mechanisms for the components which comprise the miscellaneous structural commodities. The applicant briefly describes each of the above aging mechanisms in Appendix C of each LRA and states that each mechanism was evaluated during the aging management reviews. Table 3.5.11 in each LRA identifies cracking as an aging effect requiring management for ceramics and polymers in an air environment. Also, cracking is identified as an aging effect requiring management for elastomers in an atmosphere/weather environment.

For the change in material properties aging effect, the applicant identified irradiation and thermal exposure as plausible aging mechanism for the components which comprise the miscellaneous structural commodities. The applicant briefly describes both of the above aging mechanisms in Appendix C of each LRA and states that each mechanism was evaluated during the aging management reviews. Table 3.5.11 in each LRA identifies change in material properties as an aging effect requiring management for ceramics and polymers in an air environment. Also, change in material properties is identified as an aging effect requiring management for elastomers in an atmosphere/weather environment and an air environment (SPS 1/2 only).

The staff concurs that these are the applicable aging effects requiring management for the ceramic, polymer and elastomer structural members comprising the miscellaneous structural commodities. However, the staff notes that Section 3.5.11 of the North Anna LRA indicates that 3M E53A mats and mineral wool bats used for fire wraps and gypsum boards, which serves a fire protection function, do not require aging management. The staff requested further clarification on this issue in RAI 3.5.11-1.

In response to RAI 3.5.11-1, the applicant stated that:

> Intermittent wetting in an air environment has been considered during the assessment of the aging of structural steel members. As identified in Table 3.0-2 of the license renewal application, structural steel members associated with mechanical system components may have the potential for condensation or intermittent wetting. Therefore, structural members have been generally assumed to be subject to an intermittently wetted environment. When there is no potential for condensation or other source of intermittent wetting, such as for bus duct enclosures, electrical component supports, panels and cabinets, and switchgear enclosures in the control room, the switchgear rooms, and the vicinity of the electrical equipment, an exception to this general application of an intermittent wetting environment is taken and documented in the application.

The staff concurs that these are the applicable aging effects requiring management for the ceramic, polymer, and elastomer structural members comprising the miscellaneous structural commodities. However, in RAI 3.5.11-1, the staff requested further information concerning the following three items.

> In both LRAs, Table 3.5.11-1, the applicant states (in Footnote 1) that carbon and low-alloy steel bus duct enclosures, electrical component supports, panels and cabinets, and switchgear enclosures in an air environment do not require aging management because they are not subject to intermittent wetting. This statement implies that intermittent wetting is a prerequisite for loss of material from carbon and low-alloy steel in an air environment. This does not appear to be consistent with the applicant's previous determinations that carbon steel and low-alloy steel plant components in an air environment require aging management for loss of material. Therefore, the staff requests that the applicant provide additional information concerning intermittent wetting as a prerequisite for causing loss of material, and also to describe how humidity was addressed in the North Anna and Surry AMRs.
>
> The staff also notes that the applicant identified a borated water leakage environment for junction, terminal, and pull boxes, and for panels and cabinets, but not for bus duct enclosures, electrical component supports (inside panels and cabinets), and switchgear enclosures. Therefore, the staff requests that the applicant provide an explanation for excluding a borated water leakage environment for bus duct enclosures, electrical component supports (inside panels and cabinets), and switchgear enclosures.
>
> The applicant's AMR for North Anna identifies 3M E53A mats and mineral wool bats as materials used for fire wraps and also identifies gypsum boards, which

serve a fire protection function. In NAS LRA, Table 3.5.11-1, the applicant has indicated that these materials in an air environment do not require aging management. No basis for this conclusion is provided in the LRA. Therefore, the staff requests that the applicant provide a technical justification for this conclusion and to specifically address the potential effect of humidity on degradation of the fire protection function of these materials.

As discussed in Section C3.1.1 of the application, external surfaces of carbon and low-alloy steel piping and components, located within structures, have not experienced corrosion degradation that would affect the intended function of components due to humidity in the absence of cyclic or intermittent wetting.

The bus duct enclosures and switchgear enclosures that are within the scope of license renewal are located in normal and emergency switchgear rooms within the Service Building. There are no piping systems that contain boric acid in normal and emergency switchgear rooms. Therefore, the bus duct and switchgear enclosures are not evaluated for boric acid wastage.

The electrical component supports that are within panels and cabinets are not subjected to boric acid leakage because the panels and cabinets are enclosed, and there are no piping systems that contain boric acid within the panels and cabinets.

The applicant considered humidity in the evaluation of potential aging effects for 3M E53A mats, mineral wool batts, and gypsum boards and concluded that, based on a review of manufacturers technical information, humidity does not result in aging effects requiring management. The potential for condensation due to humidity was also considered. The 3M E53A mats and mineral wool batts are wrapped in water-resistant foil with seams sealed with foil tape. The gypsum board is W/R Type C board, which is water-resistant. Therefore, the evaluation concluded that condensation due to humidity would not result in aging effects requiring management. Additionally, a review of operating experience has identified no issues related to degradation of these materials due to humidity.

The staff found the applicant’s response to RAI 3.5.11-1 to be comprehensive in describing the AMRs for these components and, thus considers the applicant’s response to be acceptable.

3.8.5.2.2 Aging Management Programs

The aging management activities used by the applicant to manage the above aging effects are the Fire protection program, General-condition-monitoring activities, Boric Acid Corrosion Surveillance, and Work Control Process. Within a given category of structural members, the aging management utilized by the applicant depends on the environment. This breakdown is defined for each structural member in Table 3.5.11 of each LRA. A complete evaluation of the above aging management activities is found in Section 3.3.1 of this SER. In this section, the staff reviewed the applicability of the above aging management activities to the components which comprise the miscellaneous structural commodities. On the basis of the review of the aging management activities in Section 3.3.1 of this SER, the staff concludes that the applicant has demonstrated that the aging effects for the components which comprise the miscellaneous structural commodities will be adequately managed during the period of extended operation.

3.8.5.3 Conclusions

The staff has reviewed the information in Section 3.5.11 of each LRA and the applicable aging management activity descriptions in Appendix B of each LRA. On the basis of this review, the staff concludes that the applicant has demonstrated that the aging effects associated with the components which comprise the miscellaneous structural commodities will be adequately managed so that there is reasonable assurance that these components will perform their intended functions in accordance with the CLB during the period of extended operation.

3.8.6 Load-handling Cranes and Devices

3.8.6.1 Summary of Technical Information in the Application

Section 3.5.12 of each LRA provides the applicant's aging management review of the load-handling cranes and devices. Table 3.5.12-1 of each LRA summarizes the applicant's aging management review of the load-handling cranes and devices by providing (1) the passive function, (2) the material group, (3) the environment, (4) the aging effects requiring management, and (5) the specific aging management activities that manage the aging effects.

The materials of construction used for load-handling cranes and devices are (1) carbon steel, (2) low-alloy steel, and (3) stainless steel.

The different environments for the load-handling cranes and devices are (1) containment air, (2) sheltered-air, and (3) outdoor environments. The applicant indicates that the surfaces of certain load-handling cranes and devices may also be exposed to borated water leakage conditions. Also, the new fuel transfer elevator is attached to the liner of the spent fuel pool an is submerged in treated-water. The spent fuel pool cooling system maintains the temperature of the spent fuel pool water between 75°F and 100°F.

3.8.6.1.1 Aging Effects

In Section 3.5.12 of each LRA, the applicant identified the following applicable aging effects for the load-handling cranes and devices:

- loss of material from carbon steel and low-alloy steel load-handling cranes and devices components in an air or atmosphere/weather environment
- loss of material from stainless steel components in a treated-water environment
- loss of material from carbon steel and low-alloy steel components in a borated water leakage environment

3.8.6.1.2 Aging Management Programs

The applicant credits the following aging management activities with managing the identified aging effects for the load-handling cranes and devices:

- general-condition-monitoring activities

- boric acid corrosion surveillance
- chemistry control program for primary systems
- inspection activities - load-handling cranes and devices

A description of these aging management activities is provided in Appendix B of each LRA. The applicant concludes that the aging effects associated with the load-handling cranes and devices will be adequately managed by these aging management activities such that there is reasonable assurance that the intended functions will be maintained consistent with the current licensing basis during the period of extended operation.

3.8.6.2 Staff Evaluation

In addition to Section 3.5.12 of each LRA, the staff reviewed the pertinent information provided in Section 2.4, "Scoping and Screening Results - Structures," and the applicable aging management activity descriptions provided in Appendix B of each LRA to determine whether the aging effects for the components comprising the load-handling cranes and devices have been properly identified and will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.8.6.2.1 Aging Effects

In Section 3.5.12 of each LRA, the applicant provides an aging management review of several components which comprise the load-handling cranes and devices. The methodology used to perform the aging management review for specific aging effects is described in Appendix C of each LRA. This section of the SER provides the staff's evaluation of the applicant's aging management review for aging effects and the applicant's aging management programs credited for the components which comprise the load-handling cranes and devices and the basis for the applicant's elimination of certain aging effects. In addition, the staff has evaluated the applicability of the aging management programs that are credited for managing the identified aging effects for the components which comprise the load-handling cranes and devices.

Steel: Appendix C of each LRA lists loss of material and cracking as the plausible aging effects for carbon steel, low-alloy steel, and stainless steel components which comprise the load-handling cranes and devices.

For the loss of material aging effect, the applicant identified corrosion and boric acid wastage as plausible aging mechanisms for the components which comprise the load-handling cranes and devices. The applicant briefly describes both of the above aging mechanisms in Appendix C of each LRA and states that each mechanism was evaluated during the aging management reviews. Table 3.5.12 of each LRA, identifies loss of material as an aging effect requiring management for carbon steel and low-alloy steel components in air, atmosphere/weather, and borated water leakage environments. Loss of material is also identified as an aging effect requiring management for stainless steel components in a treated-water environment.

The staff found the applicant's approach for evaluating the applicable aging effects for the steel components comprising the load-handling cranes and devices to be reasonable and acceptable. The staff concludes that the applicant has properly identified the aging effects for steel components which comprise the load-handling cranes and devices.

3.8.6.2.2 Aging Management Programs

The aging management activities used by the applicant to manage the above aging effects are the Chemistry Control Program for Primary Systems, General-condition-monitoring activities, Boric Acid Corrosion Surveillance, and Inspection Activities - Load-handling Cranes and Devices. Within a given category of structural members, the aging management utilized by the applicant depends on the environment. This breakdown is defined for each structural member in Table 3.5.12 of each LRA. A complete evaluation of the above aging management activities is found in Section 3.3.1 of this SER. In this section, the staff reviewed the applicability of the above aging management activities to the components which comprise the load-handling cranes and devices. On the basis of the review of the aging management activities in Section 3.3.1 of this SER, the staff concludes that the applicant has demonstrated that the aging effects for the components which comprise the load-handling cranes and devices will be adequately managed during the period of extended operation.

3.8.6.3 Conclusions

The staff has reviewed the information in Section 3.5.12 of each LRA and the applicable aging management activity descriptions in Appendix B of each LRA. On the basis of this review, the staff concludes that the applicant has demonstrated that the aging effects associated with the components which comprise the load-handling cranes and devices will be adequately managed so that there is reasonable assurance that these components will perform their intended functions in accordance with the CLB during the period of extended operation.

3.9 Aging Management of Electrical and Instrumentation and Controls

In the North Anna and Surry LRAs, the applicant describes its AMR results for electrical/I&C components requiring an AMR at North Anna and Surry in Section 3.6, “Aging Management of Electrical and Instrument and Controls.” The staff reviewed this section of the applications to determine whether the applicant has demonstrated that the effect of aging on the electrical/I&C components will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

On the basis of this review, the staff requested additional information in letters to the applicant dated October 11, 2001, (Ref. 3.9-1) and October 22, 2001 (Ref. 3.9-2). The applicant responded to the request for additional information in letters dated November 30, 2001 (Ref. 3.9-3), and February 1, 2002 (Ref. 3.9-4). The applicant also provided AMR material in its July 11, 2002 letter (Ref 3.9-12) on the additional system (offsite power) brought into scope, as discussed in Section 2.5 of this report. The AMR material in the July 11, 2002 letter that relates to electrical components is evaluated here, along with the applicant’s other electrical/I&C AMRs.

3.9.1 Bus Duct, Aluminum Tube Bus, Aluminum Bus Bars, and Ceramic Insulators

In the North Anna and Surry LRAs, Section 2.5.1, “Bus Duct,” the applicant identified certain non-segregated bus ducts that are within the scope of license renewal and require an AMR. Section 2.5.1.3 of this SER provides the staff’s evaluation of Section 2.5.1 of the LRAs and concludes that the applicant has appropriately identified the bus ducts that require an AMR. This section of our SER evaluates the applicant’s AMR of those bus ducts.

In its July 11, 2002 letter the applicant identified certain electrical components that are within the scope of license renewal (offsite power system recovery under SBO) and require an AMR. The components are aluminum tube bus, aluminum bus bars, ceramic insulators, bare distribution conductors, and insulated cables and connectors. The aluminum tube bus, aluminum bus bars, and ceramic insulators are evaluated in this section of the SER. Bare distribution conductors and insulated cables and connectors are evaluated in Section 3.9.2, “Cables and Connectors.”

3.9.1.1 Summary of Technical Information in the Application - Bus Duct

3.9.1.1.1 Aging Effects

Table 3.6.1-1 in Section 3.6.1 of the North Anna and Surry LRAs identifies the bus duct components that have been evaluated for aging management. The components of the bus duct are identified as the bus assembly and the bus support assembly. The table indicates the bus assembly’s function is to conduct electricity. Its materials are metal conductors and organic compounds, and it operates in an air environment. The bus support assembly’s function is to provide structural and/or functional support to the bus assembly. It is made of organic compounds and it also operates in an air environment.

Section 3.6.1 in the North Anna LRA indicates that the specific organic compound used in the North Anna bus duct components is fiberglass-reinforced polyester resin (glastic). The specific type of metal conductor used at North Anna is aluminum bar.

Section 3.6.1 in the Surry LRA indicates that the specific organic compounds used in the Surry bus duct components are fiberglass reinforced polyester resin (glastic) and noryl. The specific type of metal conductor used at Surry is copper bar.

The bus assembly bars at North Anna and Surry are covered with molded insulation. The connection areas are silver-plated and use stainless steel bolting. All bus connections are insulated with splice boots without the use of tape or filler material. In each LRA Section 3.6.1, the applicant indicates that, at both sites, the bus duct construction is in compliance with ANSI C37.20 which specifies an allowable hottest-spot conductor and splice temperature rise of 65 °C (117 °F) in a 40 °C (104 °F) ambient environment.

The applicant has evaluated the environment in which the bus ducts operate at North Anna and Surry. In the North Anna and Surry LRAs, Section 3.6.1, the applicant indicates that, at both sites, the bus ducts are located in the emergency switchgear room and the normal switchgear room and are exposed to an air environment.

At North Anna the emergency switchgear room temperature varies between 70 °F and 85 °F and the relative humidity is normally 50%. The normal switchgear room temperature varies between 70 °F and 120 °F. The 60-year design ionizing dose is 390 rads during normal operation.

At Surry the emergency switchgear room temperature is maintained at approximately 80°F and the relative humidity ranges from 35% to 50%. The normal switchgear room temperature varies between 70 °F and 104 °F. The 60-year design ionizing dose is 390 rads during normal operation.

In each LRA Section 3.6.1, the applicant indicates that the stated temperature range includes worst-case upper limits that are not typical of “normal” operation and that “normal” ambient temperature in a sheltered-air environment is not in excess of 40 °C (104°F.) Higher temperatures are expected only during periods when outside ambient air is at seasonal highs and then only when area ventilation is not operating. Each LRA states that bus ducts in sheltered-air environments will, in fact, operate in an ambient temperature below 40 °C (104°F) for a significant portion of their 60-year operating life. The applicant therefore has used this ambient value to determine the 60-year serviceability of bus ducts.

3.9.1.1.2 Aging Management Programs

The applicant concludes in Section 3.6.1 of the North Anna and Surry LRAs that there are no aging effects on the bus ducts within the scope of license renewal that require management during the period of extended operation. Thus, the intended functions of the bus ducts will be maintained consistent with the current licensing basis during the period of extended operation.

The conclusion that there are no aging effects requiring management during the period of extended operation is based on the applicants review of the environment of the bus duct installation and the materials of construction.

3.9.1.2 Staff Evaluation - Bus Duct

The staff evaluated the information on aging management of bus ducts presented in Section 3.6.1 of the North Anna and Surry LRAs. The evaluation was conducted to determine if the applicant has demonstrated that the effects of aging on the bus ducts will be adequately managed consistent with its CLB throughout the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.9.1.2.1 Aging Effects

As indicated above, the North Anna and Surry LRAs state that the bus duct construction is in compliance with ANSI C37.20, which specifies an allowable hottest-spot conductor and splice temperature rise of 65°C (117°F) in a 40°C (104°F) ambient environment. With the exception of the North Anna normal switchgear room, the bus ducts subject to an AMR are all located in an air environment with a temperature range that is within the ANSI C37.20 specified ambient environment of 104°F.

The applicant states in the LRA that the North Anna normal switchgear room temperature varies between 70°F and 120°F. This is in excess of the ANSI C37.20 specified ambient environment of 104°F. The LRA indicates, however, that this temperature range includes worst-case upper limits that are not typical of “normal” operation; and “normal” ambient temperature in a sheltered-air environment is not in excess of 104 °F. The North Anna LRA states that higher temperatures are expected only during periods when outside ambient air is at seasonal highs and then only when area ventilation is not operating. The LRA states that bus ducts in sheltered-air environments will, in fact, operate in an ambient temperature below 104 °F for a significant portion of their 60-year operating life. The applicant therefore has used this ambient value to determine the 60-year serviceability of bus ducts.

The staff agrees with the applicant’s use of 104°F as the ambient value to determine the 60-year serviceability of the bus ducts that are subject to an AMR. This is based upon the statements that the bus ducts will operate in an ambient temperature below 104°F for a significant portion of their 60-year operating life, and higher temperatures only occur when area ventilation is not operating and outside ambient air is at seasonal highs.

3.9.1.2.2 Aging Management Programs

In the North Anna and Surry LRAs, the applicant states that based on a review of the environment of the bus duct installation and the materials of construction, there are no aging effects requiring management during the period of extended operation for the bus ducts within the scope of license renewal. The staff agrees with the applicant’s assessment based upon the use of the 104°F ambient environment discussed above.

3.9.1.3 Staff Evaluation - Aluminum Tube Bus, Aluminum Bus Bars, and Ceramic Insulators

In its July 11, 2002 letter, the applicant identified certain electrical components that are within the scope of license renewal (required for offsite power system recovery under SBO) and require an AMR. The aluminum tube bus, aluminum bus bars, and ceramic insulators are evaluated here.

Aluminum Tube Bus and Aluminum Bus Bars

Aluminum tube buses and aluminum bus bars are in the offsite power path to the transfer buses at North Anna, both in an outdoor environment. Aluminum tube buses are in the Surry power path for offsite power at the reserve station service transformers and are also located in an outdoor environment.

The applicant states that the only material of construction for the bus components that is subject to an aging management review is aluminum and that aluminum in an outdoor environment is not a new combination in the North Anna or Surry LRA; however, it was not previously evaluated as an electrical conductor. The applicant further indicates that both North Anna and Surry are located in an area that is mostly agricultural with no significant industries nearby that could contribute to adverse/corrosive air quality conditions. The applicant therefore concludes there are no aging effects for aluminum bus components requiring management for the period of extended operation.

The staff finds that since the aluminum bus components are not exposed to corrosive air, they do not require management for the period of extended operation.

Ceramic Insulators

The applicant indicates that ceramic material is not new to the Surry LRA, but was not previously evaluated as an electrical insulator. Aging effects for insulators requiring evaluation are surface contamination and loss of material. There are two types of insulators in service at Surry on the portion of the offsite power path within scope: post insulators and strain/suspension insulators. Only post insulators are used at North Anna in the portion of the offsite power path within scope.

The applicant states that loss of material due to mechanical wear is not a concern for the post insulators because they are fixed and have no moving pivot points. The applicant states, however, that loss of material may be a potential aging effect for strain/suspension insulators if they are subjected to significant movement. The strain/suspension insulators are designed with joints to allow movement when the wind swings the supported conductor wires. If frequent enough, this swinging can cause wear in the metal contact points of the insulator string and between an insulator and the supporting hardware. The applicant states that wind loading that could cause strain/suspension insulator wear is not a concern for the overhead conductors at Surry because of the low-elevation, and short-span construction. This aging mechanism is more of a concern for transmission conductors that are installed in longer and higher spans that are more susceptible to wind loading. The applicant concludes that loss of material, due to wear of the Surry and North Anna insulators, is not an aging effect requiring management for the period of extended operation.

The staff finds that since there are no moving pivot points in post insulators and wind loading is not a concern for strain/suspension insulators used on low-elevation, and short-span overhead conductors, neither type of insulator requires management for loss of material over the period of extended operation.

With regard to surface contamination of the ceramic insulators, the applicant states that airborne particulate materials such as dust and industrial effluents can contaminate insulator surfaces. A large buildup of contamination enables the conductor voltage to track along the surface more easily and can lead to insulator flashover. The buildup of surface contamination is gradual and adhesion is minimized by the glazed insulator surface. Contamination of this type is washed away by rain. The applicant states that both North Anna and Surry receive sufficient annual rainfall to remove contamination buildup. The National Weather Surface 30-year average rainfall for the North Anna area is greater than 43 inches annually and for Surry it is greater than 44 inches annually. The applicant concludes that surface contamination of insulators at North Anna and Surry is not an aging effect requiring management for the period of extended operation.

The staff agrees that normal rainfall at North Anna and Surry will wash away any surface contamination on the ceramic insulators before the buildup leads to insulator flashover. The staff therefore concludes that surface contamination is not an aging effect requiring management for the period of extended operation for North Anna and Surry insulators.

3.9.1.4 Conclusions

The staff agrees with the applicant's conclusion that no aging effects for the bus duct, aluminum tube bus, aluminum bus bars, and ceramic insulators within the scope of license renewal at North Anna and Surry require management during the period of extended operation.

3.9.2 Cables and Connectors

In the North Anna and Surry LRAs, Section 2.5.2, "Cables and Connectors," the applicant identified certain cables and connectors that are within the scope of license renewal and require an AMR. Section 2.5.2.3 of this SER provides the staff's evaluation of Section 2.5.2 of the LRAs and concludes that the applicant has appropriately identified the cables and connectors that require an AMR. This section of our SER evaluates the applicant's AMR of those cables and connectors.

In its July 11, 2002 letter the applicant identified certain electrical components that are within the scope of license renewal (required for offsite power system recovery from an SBO event) and require an AMR. The components are aluminum tube bus, aluminum bus bars, ceramic insulators, bare distribution conductors, and insulated cables and connectors. The aluminum tube bus, aluminum bus bars, and ceramic insulators are evaluated above in Section 3.9.1.3. Bare distribution conductors and insulated cables and connectors are evaluated here.

3.9.2.1 Summary of Technical Information in the Application

3.9.2.1.1 Aging Effects

Table 3.6.2-1 in Section 3.6.2 of the North Anna and Surry LRAs identifies the characteristics of cables and connectors used in their AMR. The table indicates the function of the cables and connectors is to conduct electricity. The materials are metal conductors and organic compounds. The cables and connectors operate in air, raw water, and soil environments.

In the North Anna and Surry LRAs, Section 3.6.2, the applicant listed the following organic compounds used in the construction of cables and connectors at both sites:

- cross-linked polyethylene (XLPE)
- ethylene propylene rubber (EPR)
- kevlar (fiber optic)
- phenolic
- polyamide (nylon)
- polyolefin (Raychem)
- polyimide (Kapton)
- polyvinyl chloride (PVC)
- silicone rubber (SiR)
- cellulose-filled melamine
- mylar

Section 3.6.2 in the North Anna LRA lists polysulfone as an additional organic compound used in the construction of cables and connectors at the North Anna site but not used at Surry. The applicant's July 11, 2002 letter identifies tree-retardant (TR) XLPE as an additional organic compound used in the 34.5 kV circuit at Surry, but not used at the North Anna site.

Section 3.6.2 in the North Anna and Surry LRAs lists the following metal conductors used in the construction of cables and connectors at both sites:

- copper/copper alloys
- aluminum/aluminum alloys
- copper-constantan
- iron-constantan
- chromel-alumel

With regard to the environment, Section 3.6.2 in the North Anna and Surry LRAs states that cables and connectors are installed throughout plant buildings and yard areas in various raceway configurations and/or direct buried. They are exposed to atmosphere/weather, containment air, sheltered air, and soil environments. Section 3.6.2 states that the aging management reviews for power and I&C cables and connectors used the most severe plant cable environments and considered design values for normal operation in evaluating each component group.

Section 3.6.2 in the North Anna and Surry LRAs states that Table 3.0-2 in each LRA provides environmental conditions for areas containing cables and conductors, with some exceptions discussed below . This table provides details of the external service environment used in the AMRs. The external service environment is broken down into four categories in the table. The four categories are:

- air
  - sheltered-air
  - containment air
- atmosphere/weather
- borated water leakage
- soil

The North Anna LRA identified an exception to the radiation limit specified for a sheltered air environment in Table 3.0-2. It states that the Table 3.0-2 radiation limit is applicable to the volume control tank area of the Surry auxiliary building only. The North Anna LRA also identified an exception to the Table 3.0-2 temperature limits for power and I&C cables located in the upper elevations of the main steam valve house. The applicant has defined North Anna-specific radiation and temperature limits for cables in these areas.

The Surry LRA identified an exception to the radiation limit specified for a sheltered air environment in Table 3.0-2. It states that the Table 3.0-2 radiation limit is applicable to the volume control tank area of the Surry auxiliary building only and that no cables are in that area of the auxiliary building. The Surry LRA also identified an exception to the Table 3.0-2 temperature limits for power and I&C cables located in the upper elevations of the main steam valve house and the emergency service water pump house. The applicant has defined Surry-specific radiation and temperature limits for cables in these areas.

The applicant also states in the North Anna and Surry LRAs that the ambient temperature ranges shown in Table 3.0-2 for sheltered-air environments include worst-case upper limits that are not typical of “normal” operation. The applicant states that “normal” ambient temperature in a sheltered-air environment is not in excess of 40°C/104°F. Higher temperatures would be expected only during periods when outside ambient air is at seasonal highs and then only when area ventilation is not operating. Each LRA states that cables in sheltered-air environments will, in fact, operate in an ambient temperature below 40°C/104°F for a significant portion of their 60-year operating life. The applicant therefore has used this ambient value to determine the 60-year serviceability of cables in all areas at North Anna and Surry except the containment, main steam valve house, and emergency service water pump house (this last is Surry specific).

3.9.2.1.2 Aging Management Programs

In the North Anna and Surry LRAs, Section 3.6.2, the applicant states that the 60-year exposure of cable and connectors to the effects of heat, radiation, and operating environments was evaluated. The evaluation included a review of radiation tests data to evaluate radiation aging effects and the use of Arrhenius methodology. The applicant determined that none of the cable materials supporting intended functions are exposed to 60-year thermal or radiation operating environments that are in excess of the material 60-year thermal or radiation service limits. They concluded therefore that no aging effect resulting from heat or radiation require management.

With regard to the effects of water, Section 3.6.2 states that medium-voltage cables have been evaluated for the formation of water trees. Water treeing is a degradation and long-term failure phenomenon that has been documented for medium-voltage electrical cable with certain extruded polyethylene and EPRI insulations. Water treeing can occur in energized cables that are subjected to long-term wetting. The applicant states that no continuously energized medium voltage cables in the scope of license renewal are subjected to long-term wetting. Section 3.6.2 concludes, therefore, that no aging effects associated with formation of water trees require aging management through the period of extended operation.

Finally, the applicant states that a review of plant-specific operating experience at North Anna and Surry was conducted to identify any cable and connector aging effects that had not previously been addressed. The review did not identify any additional aging effects, and no licensee event reports on this subject identified.

3.9.2.2 Staff Evaluation

The staff evaluated the information on aging management presented in the North Anna and Surry LRAs, Section 3.6, and in the applicant's response to the staff RAIs dated November 30, 2001 (Ref 3.9-3), and February 1, 2002 (Ref 3.9-4). In its July 11, 2002 letter (Ref 3.9-12), the applicant identified additional electrical components that are within the scope of license renewal (require for offsite power system recovery under SBO) and require an AMR. The applicant indicated that the cable insulation type and operating environment combinations of the new non-EQ cables and connectors are covered in the Surry and North Anna LRAs, with only a few exceptions. The exceptions are evaluated in the following Section 3.9.2.2.1 under the topic "July 11, 2002 letter." The remaining combinations are already included in the LRAs are evaluated under the subheading "North Anna and Surry LRAs" along with the other LRA-covered non-EQ cable AMR topics. The staff evaluation was conducted to determine if there is reasonable assurance that the applicant has demonstrated that the effects of aging will be adequately managed consistent with the plant's CLB throughout the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.9.2.2.1 Aging Effects

<u>North Anna and Surry LRAs</u>

In the North Anna and Surry LRAs, Section 3.6.2, the applicant does not identify any applicable aging effects for non-environmentally-qualified (non-EQ) cables. Industry operating experience indicates that aging of cables requires aging management. The staff therefore discussed this issue with the applicant in a June 19, 2001, telephone conference (Ref 3.9-5). The applicant agreed to consider developing an aging management program for cables and later informed the staff it intended to propose such a program. The staff spoke with the applicant about the contents of two draft aging management activities later provided by the applicant. In a letter dated October 11, 2001 (Ref 3.9-1), the staff formally requested the applicant to perform an aging management review of non-EQ cables consistent with industry operating experience, and submit aging management activities that demonstrate the applicable aging effects will be managed throughout the period of extended operation. The applicant responded in a letter dated November 30, 2001 (Ref 3.9-3), with a North Anna and Surry aging management activity for non-EQ cables and connectors within the scope of license renewal. Section 3.6.2.2.2 (Aging Management Programs) provides the staff's evaluation of this aging management activity.

In each LRA, Table 3.0-2, regarding the external service environments exposed to borated water leakage, the applicant states that "[t]his environment is not considered for in-scope cables and connectors since cables are insulated, splices are sealed, and terminations are protected by enclosures." With regard to electrical terminations protected by enclosures, operating experience has shown that water and borated water have migrated into enclosures and terminations by following cables or moving through conduits. As a result the staff asked the applicant (Ref 3.9-2) whether the cables and conduit that penetrate enclosures credited for protecting terminations are sealed to prevent the intrusion of borated water into the enclosure.

In a letter dated February 1, 2002, the applicant responded that the practice used at Surry and North Anna is to seal enclosures, and the cables and conduits that penetrate enclosures, to eliminate the possibility of borated water intrusion. The applicant has performed an operating experience review and has determined this to be an effective practice to eliminate this concern. The staff finds this response acceptable. This item is therefore closed.

In the North Anna and Surry LRAs, Section 3.6.2, the applicant identified polyimide (Kapton) as one of the organic compounds used in the construction of cables and connectors. Kapton insulation has a well-known vulnerability to moisture (e.g., Ref 3.9-6, Table 4-2, Note 6). However, the cable and connector aging management activity that the applicant committed to in its November 30, 2001, letter, only addresses wetted conditions for medium-voltage cables (water treeing). In an October 4, 2001, conference call (Ref 3.9-7), the applicant was asked to verify that the North Anna and Surry aging management activities address wetting of Kapton insulation or to provide the technical basis for not doing so.

The applicant stated that Section 3.6.2 in the North Anna and Surry LRAs is in error in identifying Kapton as one of the organic compounds used in the construction of non-EQ cables and connectors. The applicant explained that Kapton insulation is only used in the construction of EQ cables and connectors at North Anna and Surry and is not used in the construction of non-EQ cables and connectors. The staff finds this response acceptable. The staff's evaluation of EQ components is contained in Section 4.4 of this evaluation.

<u>July 11, 2002 letter</u>

In its July 11, 2002 letter (Ref 3.9-12), the applicant identified additional non-EQ cables and connectors in the offsite power path that are within the scope of license renewal (require for offsite power system recovery under SBO) and require an AMR. The applicant indicated that the cable insulation type and operating environment combinations of the additional non-EQ cables and connectors are covered in the Surry and North Anna LRAs, with only several exceptions. The exceptions are an additional power cable insulation material and bare overhead conductors at Surry and the operation of parts of the offsite circuits at Surry and North Anna at a high-voltage level of 34.5 kV. The staff's evaluation of the applicant's AMR of these new items follows.

<u>34.5 kV Insulated Power Cable and Additional Cable Insulation Material</u>

Sections of the offsite circuits newly in scope operate at 34.5 kV. These are the sections between the 34.5 kV circuit breakers in the North Anna and Surry switchyards and their respective RSSTs. The materials of construction for the insulated power cables in these circuits include materials previously evaluated in the North Anna and Surry LRAs; but not evaluated for application at the 34.5 kV voltage level. In addition one new cable type, a tree-retardant cross-linked polyethylene (TR XLPE) cable, is used in these circuits at Surry and has not previously been evaluated. As a result the applicant provided the results of its AMR of these 34.5 kV cables in its July 11, 2002 letter.

The applicant states that the exposed portions of the 34.5 kV cables are ultraviolet (UV) stabilized; therefore, UV damage is not an aging effect that requires management. The staff agrees that UV damage is not an aging effect requiring management for cables that are UV stabilized.

The applicant states that there are no potential adverse thermal environments in the 34.5 kV cable runs, and radiation in the area of these cables is negligible. The applicant has also provided information indicating that the sizing of the 34.5 kV cables would result in operation ranging from 39% to 69% of rated capacity under maximum RSST or transfer bus duct loading. Under normal operating conditions the cables would be loaded from 7% to 50% of their rated capacity. The applicant concludes that ohmic heating is not a concern, and thermal or radiation embrittlement of the cable insulation is not an aging effect that requires management. The staff agrees that, at the levels of thermal and radiation environments indicated, thermal or radiation embrittlement of the 34.5 kV cable insulation is not an aging effect requiring management.

Portions of the 34.5 kV insulated cable runs at North Anna and Surry are installed in conduit, duct bank, and cable trench with a sand bed, and direct buried, with various manholes. These runs are inaccessible except at the manholes and may be exposed to condensation and wetting at manholes. Staff guidance used in past license renewal reviews is that medium-voltage cables in the range of 5 kV to 15 kV in such an environment, under certain conditions, could be prone to water treeing or a decrease of dielectric strength of the conductor insulation. This can potentially lead to electrical failure. With respect to the offsite circuits that are now included within the scope of license renewal, these underground circuits on the primary side of the startup transformers will operate at voltages higher than 15 kV. “Electrical Cable and Termination Aging Management Guideline,” SAND96-0344 (Ref 3.9-6, page 4-25) states that “water treeing has historically been more prevalent in higher voltage cables; proportionately few occurrences have been noted for cables operated below 15 kV.” On this basis the staff concludes that the higher voltage cables are also prone to these aging effects, and past guidance used for inaccessible medium-voltage cables is also applicable to inaccessible cables operated at voltages greater than 15 kV.

For the inaccessible 34.5 kV cables at North Anna and Surry, the licensee states in its July 11, 2002 letter:

> Intermittent wetting of cables due to precipitation and drainage is not considered significant wetting. Manholes are subject to wetting from entry of precipitation and groundwater. If water collects in manholes and places cable in a standing water condition, then the potential for significant wetting exists.

The applicant concludes that intermittent wetting of the inaccessible 34.5 kV cables at North Anna and Surry alone would not warrant aging management. However, the applicant concludes that significant wetting of the inaccessible 34.5 kV cables is an aging effect that requires management. The staff agrees that intermittent wetting of the inaccessible 34.5 kV cables does not warrant aging management but that significant wetting of these cables does require management. The applicant’s definition of significant wetting is consistent with the definition of “significant moisture” (e.g., cable in standing water) used in staff guidance. The applicant’s definition of intermittent wetting is also consistent with the staff’s understanding of what is not considered to be significant moisture (i.e., normal rain and drain). The staff evaluation of the applicant’s aging management program in this area is contained in the following Section 3.9.2.2.2.

<u>Overhead Bare Distribution Conductors</u>

Overhead bare distribution conductors are used in a portion of the newly scoped-in 34.5 kV offsite power circuits, between the 34.5 circuit breakers in the Surry switchyard and RSST A and RSST B. The applicant states in its July 11, 2002 letter that the aging effects for bare distribution conductors in an outdoor environment that require evaluation are loss of conductor material resulting from corrosion and aeolian (wind) vibration. The Surry overhead bare distribution conductors are 477 kcmil all-aluminum cables and are designed and installed in accordance with the National Electrical Safety Code. The applicant states that the most prevalent mechanism contributing to loss of material of an all-aluminum cable is aluminum strand pitting corrosion. The applicant states that corrosion of an all-aluminum cable is a very slow acting aging mechanism, depending largely on air quality, and states that Surry is located in an area that is mostly agricultural with no significant nearby industries that could contribute to adverse/corrosive air quality. The applicant concludes that loss of material due to corrosion, therefore, is not an aging effect requiring management for the period of extended operation.

The staff finds that since severe air quality is not a concern at Surry, all-aluminum cables do not require management for the period of extended operation.

With regard to aeolian vibration of the overhead conductors, the applicant states this can be caused by wind loading over large unprotected spans. The Surry overhead conductors utilize low-elevation and short-span construction. The applicant states that this aging mechanism is more of a concern for transmission conductors that are installed in longer and higher spans which are more susceptible to wind loading. Thus, the applicant concludes that loss of material as a result of conductor vibration or sway is not an aging effect requiring management for the period of extended operation.

The staff finds that, because the Surry overhead conductors utilize low-elevation and short-span construction, they do not require management for loss of material due to aeolian vibration or sway over the period of extended operation.

3.9.2.2.2 Aging Management Programs

The applicant provided an aging management activity for non-EQ cables and connectors within the scope of license renewal in a letter dated November 30, 2001 (Ref 3.9-3.) The applicant described the aging management activity in terms of the aging management program attributes provided in the Standard Review Plan for License Renewal. The staff reviewed the 10 program attributes in the applicant's aging management activity, utilizing guidance provided in the GALL Report for the attributes. The staff found that the submitted aging management activity is essentially a visual inspection program that addresses age-related degradation of cable jackets and connector coverings that can result from exposure to high temperature or radiation or to wetting. The visual inspection program covers equipment categories that are addressed under three separate programs in the GALL Report. The three GALL Report programs are XI.E1, "Electrical Cables and Connections not Subject to 10 CFR 50.49 Environmental Qualification Requirements," XI.E2, "Electrical Cables not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits," and XI.E3, "Inaccessible Medium-voltage Cables not Subject to 10 CFR 50.49 Environmental Qualification Requirements." [The following portion of our evaluation is arranged according to the guidance provided in the three GALL programs, in order to identify and evaluate the overriding technical issues involved.]

GALL Program XI.E1, "Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements"

The purpose of GALL Program XI.E1 is to provide reasonable assurance that the intended functions of non-EQ electrical cables and connections that are exposed to adverse localized environments caused by heat, radiation, or moisture will be maintained consistent with the current licensing basis through the period of extended operation. (The cables covered by this program do not include sensitive, low-signal-level instrumentation circuits or medium-voltage power cables exposed to moisture, which are included in GALL programs XI.E2 and XI.E3 respectively.) In this program a representative sample of accessible electrical cables and connections in adverse localized environments is visually inspected for cable and connection jacket surface anomalies. If an unacceptable condition or situation is identified for a cable or connection in the inspection sample, a determination is made as to whether the same condition or situation is applicable to other accessible or inaccessible cables or connections.

The applicant's aging management activity for non-EQ cables and connectors within the scope of license renewal is consistent with the guidance contained in GALL program XI.E1. The staff therefore finds the aging management activity acceptable for the purpose of providing reasonable assurance that the intended functions of non-EQ electrical cables and connections (not including those types covered by GALL programs XI.E.2 and XI.E3) that are exposed to adverse localized environments caused by heat, radiation, or moisture will be maintained consistent with the current licensing basis through the period of extended operation.

GALL Program XI.E2, "Electrical Cables not Subject to Environmental Qualification Requirements used in Instrumentation Circuits"

The purpose of GALL program XI.E2 is to provide reasonable assurance that the intended functions of non-EQ electrical cables that are used in circuits with sensitive, low level signals exposed to adverse localized environments caused by heat, radiation, or moisture will be maintained consistent with the current licensing basis through the period of extended operation. In this program routine calibration tests performed as part of the plant surveillance test program are used to identify the potential existence of aging degradation. When an instrumentation loop is found to be out of calibration during routine surveillance testing, troubleshooting is performed on the loop, including the instrumentation cable.

The aging management activity submitted by the applicant does not utilize the calibration approach for non-EQ electrical cables used in low-level-signals sensitive circuits. Instead, these cables are simply combined with all other non-EQ cables under the visual inspection activity. The staff believed, however, that visual inspection alone would not necessarily detect reduced insulation resistance (IR) levels in cable insulation before the intended function is lost. Exposure of electrical cables to adverse localized environments caused by heat or radiation can result in reduced IR. A reduction in IR will cause an increase in leakage currents between conductors and from individual conductors to ground, and is a concern for low-level-signals sensitive circuits such as radiation and nuclear instrumentation circuits since it may contribute to inaccuracies in the instrument loop. Because low-level-signal instrumentation circuits may operate with signals that are normally in the low milliamp range or less, they can be affected by extremely low levels of leakage current. Routine calibration tests performed as part of the plant surveillance test program can be used to identify the potential existence of this aging degradation.

The staff was not convinced that aging of these cables will initially occur on the outer casing resulting in sufficient damage that visual inspection will be effective in detecting the degradation before IR losses lead to a loss of intended function, particularly if the cables are also subject to moisture. Therefore, in a letter dated October 22, 2001 (Ref 3.9-2), the applicant was asked to provide a technical justification that will demonstrate that visual inspections will be effective in detecting damage before current leakage can affect instrument loop accuracy.

In a letter dated February 1, 2002, the applicant reiterated its view that, because these circuits operate with currents in the milliampere range or less, degradation of the conductor insulation would have to occur from externally applied stressors of heat or radiation. This would result in external degradation of the cable jacket that would likely be detected by visual inspection prior to loss of cable intended function. The applicant stated that a review of operating experience indicates that no instrument cables failures have occurred due to aging and that visual inspection would be effective in detecting cable degradation. The applicant also stated that the "Electrical Cable and Termination Aging Management Guideline," SAND96-0344, concludes in Section 1.4 that " . . . reliance on visual inspection techniques for the assessment of low-voltage cable and termination aging appears warranted since these techniques are effective at identifying degraded cables."

In addition to the applicant's response, the staff undertook its own review of several aging management references. Page 3-52 of the SAND96-0344 report (Ref 3.9-6) referenced by the applicant identified polyethylene-insulated instrumentation cables located in close proximity to fluorescent lighting that had developed spontaneous circumferential cracks in exposed portions of the insulation. For some of the affected cables the cracking was severe enough to expose the underlying conductor; however, no operational failures were documented as a result of this degradation.

The reason no operational failures were documented may be explained by information in the book, *Aging and Life Extension of Major Light Water Reactor Components*, edited by V.N. Shaw and P.E. MacDonald (Ref 3.9-9). On page 855 the book states that breaks in insulation systems that are dry and clean are normally not detectable with insulation resistance tests of 1000 V or less. On the same page the book also states insulation resistance tests can detect some types of gross insulation damage, cracking of insulation, and the breach of connector seals, provided there is enough humidity or moisture to make the exposed leakage surfaces conductive.

Electric Power Research Institute EPRI report TR-103834-P1-2 (Ref 3.9-10) also supports the above view. The report states, on page 1.4-8, that normal or high insulation resistance may not indicate undamaged insulation in that a throughwall cut or gouge filled with dry air may not significantly affect the insulation resistance. The SAND96-0344 report, on page 3-51, states that instances of low-voltage cable and wire shorting to ground induced by moisture (as indicated in the LERs) may, in fact, be due to moisture intrusion through preexisting cracks caused by thermal and/or radiation exposure.

In summary, it appears from this literature that visual inspection of low-voltage, low-signal-level instrumentation circuits can be an effective means to detect age-related degradation due to adverse localized environments. Because a moist environment can apparently hasten the failure of these circuits if they have previously undergone age-related degradation, the disposition of a degraded cable should consider the potential for moisture in the area of the degradation. The revised Corrective Actions attribute of the North Anna and Surry non-EQ cable monitoring activity provided in the applicant's July 11, 2002 letter indicates that the engineering evaluation called for in that attribute will consider the potential for moisture in the area of any anomalies. This is acceptable because the engineering evaluation will consider the potential for moisture in the area of the degradation.

The staff notes that the above finding on low-voltage instrumentation circuits is not necessarily the case for neutron monitoring system cables and radiation monitoring cables. The SAND96-0344 report (Ref 3.9-6) referenced by the applicant states on page 3-36 that neutron monitoring systems (including source, intermediate, and power range monitors) were put into a separate category based on (1) their substantial differences from a typical low- and medium-voltage power, control, and instrumentation circuits, and (2) the relatively large number of reports related to these devices in the database. The report states that neutron detectors are frequently energized at what is commonly referred to as "high" voltage, usually between 1 kV and 5 kV. This is not high voltage in the sense of power transmission voltage, but rather elevated with respect to other portions of the detecting circuit. The report included the lower voltage non detector portion of typical neutron monitoring equipment in the low-voltage equipment category, but put the 1 kV to 5 kV neutron detectors into a separate category that included neutron monitor cables and connectors.

The high-voltage portion of the neutron monitoring systems would appear to be a worst-case subset of the low-signal-level instrumentation circuit category. These circuits operate with low-level logarithmic signals and so are sensitive to relatively small changes in signal strength, and they operate at a high voltage, which could create larger leakage currents if that voltage is impressed across associated cables and connectors. Radiation monitoring cables have also been found to be particularly sensitive to thermal effects. NRC Information Notice 97-45, Supplement 1, describes this phenomenon. The neutron monitoring circuits and radiation monitors, therefore, might be candidates for the calibration approach but not necessarily the visual inspection approach. The calibration approach was used for these circuits at the Calvert Cliffs Nuclear Power Plant. Page 6.1-22 of the Calvert Cliff's license renewal application (Ref 3.6-11) on states:

> The IR reduction effect can be a concern for circuits with sensitive, low level signals such as current transmitters, resistance temperature detectors, and thermocouples. It is especially a concern for channels with logarithmic signals such as radiation monitors and neutron monitoring instrumentation. The IR reduction effect contributes to inaccuracies in the instrument loop current signal (e.g., 4-20 ma) such that the measurement of the process variable (e.g., rads/hour) becomes more uncertain.

The North Anna and Surry applicant subsequently responded to this issue in a letter dated July 25, 2002 (Ref 3.9-13). The letter stated:

> The applicant has reviewed the neutron monitoring instrumentation cables and radiation monitoring cables installed at Surry and North Anna Power Stations which operate between 1 kV and 5 kV and transmit signals supporting a license renewal intended function. Results of this review have determined that the source, intermediate, and power range neutron detector cables are the only

> cables meeting the above criteria that are not included in the environmental qualification program (i.e. non-EQ cable).
>
> The source, intermediate, and power range neutron detector cables are frequently energized in the "high" voltage range, (i.e., 1 kV and 5 kV), and a reduction in insulation resistance (IR) could be a concern for these cables since reduced IR may contribute to inaccuracies in the instrument loop. The routine calibration tests performed as part of the plant surveillance test program will be used to identify the potential existence of this aging degradation. Separate correspondence (Serial No. 02-297 dated July 11, 2002) on this subject provided a supplemental response to RAI 3.6.2-1 which credits the normal calibration frequency specified in the plants' Technical Specifications to provide reasonable assurance that severe aging degradation will be detected prior to loss of the cables' intended function.

The staff finds the above response acceptable because the calibration approach will be used to identify the potential existence of aging degradation.

<u>GALL Program XI.E3, "Inaccessible Medium-Voltage Cables not Subject to 10 CFR 50.49 Environmental Qualification Requirements"</u>

The purpose of GALL program XI.E3 is to provide reasonable assurance that the intended functions of inaccessible non-EQ medium-voltage cables that are exposed to adverse localized environments caused by moisture while energized will be maintained consistent with the current licensing basis through the period of extended operation. When an energized medium-voltage cable is exposed to wet conditions for which it is not designed, water treeing or a decrease in dielectric strength of the conductor insulation can occur. This can potentially lead to electrical failure. In this program periodic actions are 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 necessary. If in-scope medium voltage cables are simultaneously exposed to significant moisture and significant voltage, the program calls for periodic testing to provide an indication of the condition of the conductor insulation. Significant moisture is defined as periodic exposure to moisture for more than a few days (e.g., cable in standing water). Periodic exposure to moisture for less than a few days (i.e., normal rain and drain) is not considered significant. Significant voltage exposure is defined as being subjected to system voltage more than 25% of the time.

The aging management activity submitted by the applicant combines the cable and connector visual inspection activity with visual inspection for "wetted conditions." The applicant, however, does not expect to find "wetted conditions" during the associated visual inspections. The aging management activity description states:

> Evaluations for cables at Surry and North Anna that are within the scope of license renewal indicate the expected absence of wetted conditions. This expectation is substantiated by the absence of any direct-buried medium voltage cable that is exposed to significant voltage (i.e., subjected to system voltage more than 25 percent of the time) at Surry and North Anna, and the design of manholes that contain in-scope medium voltage cables.

GALL program XI.E3 only calls for periodic testing of inaccessible medium-voltage cables that are exposed to significant moisture while *simultaneously* being exposed to significant voltage. Therefore, based upon the above statement regarding “the absence of any direct-buried medium voltage cable that is exposed to significant voltage,” it appears that no cables at Surry and North Anna require periodic testing under the GALL program criteria. However, the aging management activity description also contains the following passage:

> The only non-EQ, medium-voltage cables of concern for potentially wetted conditions are the power cables for the service water pump motors at North Anna. Engineered features were installed to prevent these non-EQ medium-voltage cables from being exposed to significant moisture. The existence of drain holes in the bottom of manholes and the seals that were placed at manhole covers provide reasonable assurance that the cable will not become submerged. Periodic inspections will confirm the absence of standing water in the affected manholes.

It is not clear from this passage whether the cables for the service water pump motors at North Anna are subjected to system voltage more than 25% of the time (definition of significant voltage) or are of concern only because they can be exposed to significant moisture. If they are subjected to system voltage more than 25% of the time and are also simultaneously subjected to significant moisture (periodic exposure to moisture for more than a few days), the cables should be periodically tested consistent with GALL program XI.E3 guidance or a technical basis provided for why they are not. The acceptance criterion contained in the applicant’s aging management activity is as follows:

> The acceptance criterion with respect to wetted conditions is the absence of exposure to significant moisture. Cable found to be submerged in standing water for more than a few days will be subject to an engineering evaluation and corrective action. Inspection results for the condition of non-EQ cables and connectors will be summarized in a documented engineering evaluation. Any anomalies resulting from the inspections will be dispositioned by Engineering. Occurrence of an anomaly that is adverse to quality will be entered into the Corrective Action System.

The implied definition of significant moisture in this excerpt (cable found to be submerged in standing water for more than a few days) is consistent with the GALL program XI.E3 definition of significant moisture. However, it still remains unclear whether the subject cables are exposed to significant voltage at the same time they are being subjected to significant moisture. If not, the cables do not require periodic testing under the criterion contained in GALL program XI.E3. The applicant’s aging management activity in this regard would therefore be acceptable.

If the subject cables are, in fact, simultaneously exposed to significant voltage and moisture, then, consistent with the guidance provided in GALL under the third program attribute (Parameters Monitored or Inspected), the cables should be periodically tested or a technical basis provided for why they are not. The staff notes that the engineering evaluation required by the program attributes of the applicant’s cable management activity for cables that do not meet the visual inspection acceptance criteria is consistent with the guidance in GALL program XI.E1 but not program XI.E3. GALL program XI.E3 provides that cables be periodically tested if they are simultaneously exposed to significant voltage and significant moisture. An engineering evaluation is performed following the periodic tests when the test acceptance criteria are not met. It is not performed in lieu of doing the testing when the visual inspection criteria are not met.

In a February 1, 2002 letter (Ref 3.9-4), the applicant provided a response to a staff question on significant moisture related to the medium-voltage cable issue. The response references a report (Ref 3.9-6) indicating EPR cables submerged in 90 °C water have a 47-month time to failure. The response reiterates that an engineering evaluation will be performed if the cables are found submerged, regardless of the potential duration; and the evaluation would consider performing a test to determine the condition of the cable insulation. The response did not resolve the issues addressed above, including the testing issue.

The applicant subsequently readdressed the above issues in its July 11, 2002, and July 25, 2002 letters. With regard to the question of whether the service water system cables are simultaneously exposed to significant voltage and significant moisture the July 25, 2002 letter states:

> In the LRAs, the applicant identified a medium-voltage cable in the service water system at North Anna that had the potential for wetting, but did not associate the cable with water treeing because the environment of the cable was being maintained in a dry condition. Subsequent to the initial submittal of the LRAs, additions in the license renewal scope associated with Station Blackout have been made for high-voltage cables that are also subject to potential wetted conditions. Per applicant's revised response to RAI 2.5-1 (Serial No. 02-297 dated July 11, 2002) the cable environment for these high-voltage power cables will also be maintained in the dry condition at both Surry and North Anna.

It is clear from the above that the applicant did not associate the service water system cables with significant moisture because the applicant intends to maintain the cables in a dry condition. This is also the case for the additional underground cables introduced as part of the expanded scope due to the offsite power/station blackout resolution. With regard to the disposition of the cables if they are found in a wetted condition in spite of the applicant's best efforts to keep them dry, the applicant's July 25, 2002 letter also speaks to this issue. It indicates that the corrective action attribute of the Non-EQ Cable Monitoring program has been revised to provide for performing appropriate tests of cables determined to have been wetted for a significant period of time. The applicant's July 11, 2002 letter provides a complete revision of the program attributes for the Non-EQ Cable Monitoring program previously provided in the applicant's November 30, 2001, letter. Following are the 10 revised attributes and the staff evaluation of each attribute.

<u>Scope</u>

Cables that are within the scope of license renewal and subject to aging effects requiring management, but not designated as Environmentally Qualified (EQ), are categorized as three different cable types.

Type E1 includes accessible electrical cables that may experience adverse conditions caused by high values of heat or radiation. Reviews have shown that previously evaluated environments do not cause aging effects requiring management for cable jackets and connector coverings that are within the scope of licensed renewal. However, since plant conditions can change and create a new possibility for an adverse environment, the applicant plans an additional activity to provide confirmation of these evaluations for the period of extended operation. A detailed review of Surry and North Anna facilities will be performed to determine areas of high temperature or radiation for possible age-related degradation of cable jackets and connector coverings in a potentially adverse environment.

Type E2 cables are used in low-voltage instrumentation loops for high-voltage components such as nuclear instrumentation and radiation monitors. For Surry and North Anna, this situation may lead to aging effects requiring management for the nuclear source, intermediate, and power range instruments. The instrument loops for the source, intermediate, and power range components are susceptible to induced currents from high voltage power supply if insulation resistance diminishes.

Type E3 cables are inaccessible, medium-voltage cables that are energized more than 25% of the time and are potentially exposed to significant moisture (i.e. long term wetting). For Surry and North Anna, this category includes underground cables that supply power to the Reserve Station Service Transformers (RSST). For North Anna only, this category also includes cables supplying power to the service water pump motors. Periodic exposures to moisture lasting less than a few days (e.g., normal rain and drain) do not result in any additional cables being subjected to aging effects requiring management.

Implementation of the Non-EQ Cable Monitoring activities will be completed prior to year 40 of operation.

The staff finds the above acceptable because it appropriately divides the scope of the Non-EQ Cable Monitoring program into three separate categories of cables on the basis of the activities that will be required to manage the aging of each category. It also commits to completing implementation of the Non-EQ Cable Monitoring activities prior to year 40 of operation, in time for the period of extended operation.

Preventive Actions

The Non-EQ Cable Monitoring activities for Type E1 and E2 are designated *condition monitoring.* No preventive actions are performed.

For Type E3 cables, design features that prevent cables from being wetted for significant lengths of time include drains and sump pumps. These features are considered to be preventive actions.

The staff finds the above acceptable because it appropriately identifies the preventive actions necessary to be taken for each category of the Non-EQ Cable Monitoring program identified in the program scope. The Type E1 activity is an inspection activity and no preventative actions are necessary as part of this activity, beyond the inspection activity itself, to prevent or mitigate aging degradation. The Type E2 activity is a surveillance testing program and no preventative actions are necessary as part of this program, outside of the surveillance activity itself, to prevent or mitigate aging degradation. Periodic actions or design features that prevent inaccessible medium-voltage cables (Type E3) from being exposed to significant moisture are considered appropriate because prolonged exposure to moisture and voltage is required to induce the water treeing aging mechanism.

Parameters Monitored or Inspected

For Type E1 cables, an inspection plan will be developed to visually examine representative samples of accessible, non-EQ cable jackets and connector coverings for surface indications such as cracking, discoloration, or bulging. EPRI document TR-109619 will be used for guidance in performing the inspections.

For Type E2 cables, routine calibration tests are performed, based on technical specifications requirements, for indication of possible age-related degradation of insulation that could affect instrumentation loops.

For Type E3 cable, concerns related to water treeing of potentially wetted cables are eliminated by maintaining the cables in a dry condition. Cable manholes will be inspected for water collection.

This attribute is similar to the program attribute immediately below. Additional information on the parameters monitored is also found under the monitoring and trending attribute. The staff finds the information on the parameters monitored acceptable because it includes the parameters that are necessary to be monitored/inspected in order to identify potential aging degradation for each cable type identified as within the scope of the program.

Detection of Aging Effects

For Type E1 cables, visual inspections for representative samples of accessible, non-EQ cable jackets and connector coverings determine the presence of cracking, discoloration, or bulging that would indicate aging effects requiring management. These effects can result from high values of temperature or radiation.

For Type E2 cables, routine calibration tests performed as part of the plant surveillance program will be used to identify the potential existence of age-related degradation.

For Type E3 cables, the environment which could lead to water-treeing in medium-voltage cables will be visually monitored for the presence of water around cables.

The staff finds the above acceptable because it identifies the appropriate means used to identify potential aging degradation for each cable type identified as within the scope of the program. Visual inspection of Type E1 cables has been found to be an acceptable means of identifying potential aging degradation of these cables and connectors. Routine calibration tests for Type E2 cables (source, intermediate, and power range neutron detector cables) are an acceptable means for identifying potential aging degradation of these cables as discussed earlier in this section. Verifying that Type E3 cables (medium-voltage inaccessible cables) are kept dry through periodic inspections for water accumulation is an acceptable means for precluding aging degradation due to water treeing. Cables found to be submerged in standing water will be subject to testing as outlined under acceptance criteria.

Monitoring and Trending

For Type E1 cables, visual inspections for surface anomalies on non-EQ cable jackets and connector coverings can identify indications of age-related degradation due to excessive heat or radiation. Initial visual inspections for representative samples of non-EQ insulated cables and connectors will be performed as a Licensee Follow-up Action between year 30 and the end of the current operating license. Subsequent inspections will be performed at least once per 10 years during the period of extended operation.

For Type E2 cables, routine calibration testing can detect variations on signals in instrumentation loops that are susceptible to induced currents (from high-voltage power supplies) caused by reduced insulation resistance due to aging.

For Type E3 cables, periodic visual inspections for water collection in manholes containing in-scope cables (i.e., the power cables for the service water pump motors at North Anna, and the cables supplying power to the RSST's at Surry and North Anna) will be performed at frequencies ranging from bi-weekly to annually depending upon the design features that exist to mitigate water intrusion into specific manholes.

The staff finds the above acceptable for Type E1 cables and connectors because it commits to initial visual inspection for representative samples of these cables prior to the end of the current operating license and at least once per 10 years during the period of extended operation. This is consistent with the staff position on visual inspections. The Type E2 cables are acceptable because the calibration approach, based on technical specification requirements (see parameters monitored or inspected attribute), is consistent with the staff position. The Type E3 cables are acceptable because manholes containing these cables are periodically inspected for water collection. The staff position on these cable types (medium-voltage inaccessible cables) recognizes that keeping the cables dry through periodic inspections for water accumulation is an acceptable means for precluding aging degradation due to water treeing.

Acceptance Criteria

For Type E1 cables, the acceptance criterion for the condition of accessible, non-EQ cable jackets and connector coverings is the absence of anomalous indications that are signs of degradation. Such indications include cracking, discoloration, or bulging.

For Type E2 cables, acceptance criteria are specified in calibration procedures for source, intermediate, and power range instrumentation. These acceptance criteria are specified in terms of voltage and current limits.

For Type E3 cables, the acceptance criterion with respect to wetted conditions is the absence of exposure to significant wetting. In-scope cable found to be submerged in standing water for an extended period of time will be subject to an engineering evaluation and corrective action. The evaluation will be based on appropriate testing (using available technology consistent with NRC positions) of cables that are determined to be wetted for a significant period of time. The test will use a proven methodology for detecting deterioration of the insulation system due to wetting.

Any anomalies resulting from visual inspections will be dispositioned by Engineering. Occurrence of an anomaly that is adverse to quality will be entered into the Corrective Action System.

The acceptance criterion for Type E1 cables is acceptable because it includes the absence of anomalous indications such as cracking, discoloration, or bulging. This is consistent with staff guidance on this issue. The acceptance criteria for Type E2 cables are acceptable because the acceptance criteria are specified in the calibration procedures for the instrumentation associated with these cables. This is consistent with staff guidance on this issue. The acceptance criterion for Type E3 cables is acceptable because it includes the absence of exposure to significant wetting. The staff has found the applicant's definition of significant wetting is consistent with the terminology "significant moisture" used in the staff guidance for these types of cables. The applicant's acceptance criterion also calls for an evaluation that is based on appropriate testing of cables that are determined to be wetted for a significant period of time. This is consistent with the staff guidance that calls for testing of cables exposed to significant moisture.

Corrective Actions

Corrective actions for conditions that are adverse to quality are performed in accordance with the Corrective Action System as part of the Quality Assurance Program. The engineering evaluation of visual inspection results for the representative samples of accessible cables and connectors will consider whether the observed condition is applicable for other accessible and inaccessible cables and connectors. This engineering evaluation also will consider the potential for moisture in the area of any anomalies. Corrective action for anomalous calibration results for instrumentation loops will lead to adjustments of electronics and may involve component evaluation/replacement. The engineering evaluation of cables found to be wetted for a significant period of time will be based on an appropriate test of the cable and will consider the age, condition, material, and construction of the cables. Testing frequency will be consistent with the guidelines of NUREG-1801 for significantly wetted cables. Any resultant maintenance, repair, or replacement activities will be performed in accordance with the Work Control Process. The corrective action process provides reasonable assurance that deficiencies adverse to quality are either promptly corrected or are evaluated to be acceptable. Where evaluations are performed without repair or replacement, engineering analysis reasonably assures that the component intended function is maintained consistent with the current licensing basis. If the deficiency is assessed to be significantly adverse to quality, the cause of the condition is determined, and an action plan is developed to preclude repetition. The Corrective Action System identifies repetitive discrepancies and initiates additional corrective action to preclude recurrence.

The corrective actions specified for visual inspection results are acceptable because they consider whether the condition observed in the representative sample inspected is applicable to other accessible and inaccessible cables and connectors. The corrective actions further specify that the engineering evaluation will consider the potential for moisture in the area of any anomalies. These corrective actions are consistent with existing staff guidance in this area and the staff finding on low-voltage instrumentation circuits that carry sensitive low-level-signals. The corrective actions specified for anomalous calibration results are acceptable because they include recalibration and potential evaluation and replacement. This is consistent with existing staff guidance. The corrective actions identified for significantly wetted cables are acceptable because they specify that an engineering evaluation, based on test results and other cable parameters, will be performed for these cables. They also indicate that the testing frequency will be consistent with the guidelines of NUREG-1801. These corrective actions are consistent with existing staff guidance on inaccessible medium-voltage cables. The remaining areas of the corrective actions attribute address aspects of the quality assurance program and work control process and are evaluated in Sections 3.3.1.19.2 and 3.3.2 of this SER.

> Confirmation Process
>
> The confirmation process for Non-EQ Cable Monitoring involves the Work Control Process to monitor cable conditions on an ongoing basis.

The work control process is evaluated in Section 3.3.1.19.2 of this SER.

> Administrative Controls
>
> Administrative and implementation procedures are reviewed, approved, and maintained as controlled documents in accordance with the procedure control process and the Quality Assurance Program.

The quality assurance program is evaluated in Section 3.3.2 of this SER.

> Operating Experience
>
> The Non-EQ Cable Monitoring activity is new and has no operating experience. However, the applicant's operating experience has shown that cable jacket anomalies have occurred, and have been evaluated and corrected to maintain intended functions at both Surry and North Anna. Wetted conditions for underground cables also have occurred and corrective actions have been implemented to mitigate the water intrusion.

The staff concludes that the aging management activities identified in the above Non-EQ Cable Monitoring Program should be effective in identifying and correcting the cable jacket anomalies and water intrusion problems identified in the operating experience.

FSAR Supplement

The staff has reviewed the North Anna and Surry revised UFSAR supplements, Section 18.1.4 Non-EQ Cable Monitoring, provided by the applicant in its July 25, 2002 letter (Ref 3.9-13). The staff has confirmed that they contain the applicable elements of the program for non-EQ insulated cables and connectors.

3.9.2.3 Conclusions

On the basis of its review, the staff concludes that the applicant adequately identified the aging effects associated with non-EQ cables and connectors at North Anna and Surry. The staff further concludes that the applicant has demonstrated that these aging effects will be adequately managed so there is reasonable assurance that the components will perform their intended functions in accordance with the CLB during the period of extended operation, as required by 10 CFR 54.21 (a)(3).

3.9.3 References for Section 3.9

3.9-1 NRC letter to Virginia Electric and Power Company, dated October 11, 2001, Adams No. ML012860003

3.9-2 NRC Letter to Virginia Electric and Power Company, dated October 22, 2001, Adams No. ML013040164

3.9-3 Virginia Electric and Power Company letter (Serial No. 01-647) to the NRC, dated November 30, 2001

3.9-4 Virginia Electric and Power Company letter (Serial No. 01-685) to the NRC, dated February 1, 2002

3.9-5 NRC telecommunication with Virginia Electric Power Company, dated June 28,2001, Adams No. ML011790454

3.9-6 Sandia Contractor Report SAND96-0344, "Aging Management Guideline for Commercial Nuclear Power Plants-Electrical Cable and Terminations", prepared by Ogden Environmental and Energy Services, Inc., printed September 1996

3.9-7 NRC telecommunication with Virginia Electric and Power Company, dated October 3, 2001, Adams No. ML013020127

3.9-8 Virginia Electric and Power Company letter (Serial No. 01-685A) to the NRC, dated February 1, 2002

3.9-9 *Aging and Life Extension of Major Light Water Reactor Components*, edited by V.N. Shaw and P.E. MacDonald, 1993, Elsevier Science Publishers

3.9-10 Electric Power Research Institute report, EPRI TR-103834-P1-2, "Effects of Moisture on the Life of Power Plant Cables", Part 1, "Medium-Voltage Cables", Part 2, "Low-Voltage Cables", prepared by Ogden Environmental and Energy Services Company, final report, August 1994

3.9-11 Calvert Cliffs Nuclear Power Plant Application for License Renewal, Appendix A, "Technical Information," 6.1, "Cables"

3.9-12 Virginia Electric and Power Company letter (Serial No. 02-297) to the NRC, dated July 11, 2002

3.9-13 Virginia Electric and Power Company letter (Serial No. 02-360) to the NRC, dated July 25, 2002

4.0 Time-limited Aging Analyses

4.1 Identification of Time-Limited Aging Analyses

The applicant described its identification of time-limited aging analyses (TLAAs) in Section 4.1 of the North Anna and Surry LRAs. The staff reviewed this section of each LRA to determine whether the applicant identified the TLAAs as required by 10 CFR 54.21(c).

4.1.1 Summary of Technical Information in the Application

To identify the TLAAs, the applicant evaluated calculations for NAS and SPS against the six criteria specified in 10 CFR 54.3. The applicant indicated that calculations that meet the six criteria were identified by searching the current licensing basis, which includes the UFSAR, engineering calculations, technical reports, engineering work requests, licensing correspondence, and applicable Westinghouse reports. The applicant listed the following TLAAs in LRA Table 4.1-1 for each station:

- reactor vessel neutron embrittlement including analyses for upper shelf energy, pressurized thermal shock, and pressure-temperature limits
- metal fatigue, including analysis of ASME Section III Class 1 components, reactor vessel underclad cracking, and ANSI B31.1 piping (for NAS, the ASME Section III Class 1 component analyses include the reactor coolant pressure boundary; for SPS, the only piping analyses included are for the pressurizer surge lines)
- environmental equipment qualification calculations
- containment liner analyses
- crane load cycle limit
- reactor coolant pump flywheel analysis
- leak-before-break analyses
- spent fuel pool liner analysis
- piping subsurface indication analyses
- reactor coolant pump Code Case N-481 analysis

Pursuant to 10 CFR 54.21(c)(2), the applicant stated that no exemptions granted under 10 CFR 50.12 and based on a TLAA as defined in 10 CFR 54.3 were identified.

4.1.2 Staff Evaluation

As indicated by the applicant, TLAAs are defined in 10 CFR 54.3 as analyses that meet the following six criteria:

- involve systems, structures, and components within the scope of license renewal as delineated in Section 54.4(a)
- consider the effects of aging
- involve time-limited assumptions defined by the current operating term (for example, 40 years)
- were determined to be relevant by the applicant in making a safety determination

- involve conclusions or provide the basis for conclusions related to the capability of the system, structure, and component to perform its intended functions, as delineated in Section 54.4(b)
- are contained, or incorporated by reference in the CLB

The applicant did not identify postulated pipe breaks locations based on the cumulative usage factor (CUF) as a TLAA for either plant. Section 3A.46 of the NAS UFSAR describes the criterion used to provide protection against pipe whips inside the containment. The criterion specifies the postulation of pipe breaks at locations where the CUF exceeds 0.1. Although the applicant identified the fatigue usage factor calculation as a TLAA, the applicant did not identify the pipe break criterion as a TLAA. The usage factor calculation used to identify postulated pipe break locations meets the definition of a TLAA as specified in 10 CFR 54.3. In RAI 4.1-1, the staff requested the applicant to provide a description of the TLAA performed to address the pipe break criterion for NAS. In addition the staff requested the applicant to identify any postulated pipe breaks locations based on CUF at SPS and describe the TLAA performed for these locations.

The applicant's January 16, 2002 response indicated that pipe breaks had been postulated at locations where the CUF exceeds 0.1 at NAS. The applicant also indicated that it did not expect the number of design transients assumed in these CUF calculations to be exceeded in 60 years of plant operation. Therefore, the CUF calculations which form the basis for the NAS pipe break postulations remain valid for the period of extended operation. The applicant's evaluation provides an acceptable TLAA for NAS in accordance with the requirements of 54.21(c)(1). The applicant indicated that the only pipes analyzed to ASME Class 1 rules at SPS are the pressurizer surge lines. The applicant indicated that it did not expect the number of design transients assumed in these CUF calculations to be exceeded during the period of extended operation. Therefore, the SPS pipe break postulations remain valid for the period of extended operation in accordance with the requirements of 54.21(c)(1).

4.1.3 Conclusions

The staff has reviewed the information provided in Section 4.1 of the NAS and SPS LRAs. The NRC staff concludes that, with the inclusion of the pipe break criteria as described above, the applicant has adequately identified the TLAAs as required by 10 CFR 54.21(c), and that no 10 CFR 50.12 exemptions have been granted on the basis of the TLAA as defined in 10 CFR 54.3.

4.2 Reactor Vessel Neutron Embrittlement

The three TLAAs described in Sections 4.2 and A3.1 of the LRAs evaluate the effects of neutron irradiation on the integrity of the reactor vessels. Specifically, they determine the ability of the vessels to (a) maintain acceptable Charpy upper shelf energy (C_VUSE) values during the period of extended operation, (b) resist failure during a pressurized thermal shock (PTS) event, and (c) operate safely using guidance from calculated pressure-temperature (P-T) operating limit curves.

In Section 4.2 of the LRAs, the applicant provides a general overview of its activities to address the three TLAAs mentioned above. The applicant states that it actively participated in the Westinghouse Owners Group (WOG) effort to develop evaluations to demonstrate that the aging effects on reactor vessel (RV) components will be adequately managed during the period of extended operation.

4.2.1 Upper Shelf Energy

4.2.1.1 Summary of Technical Information in the Application

The RV beltline fluences applicable to the postulated 20-year period of extended operating time have been calculated using the NRC-approved Virginia Electric and Power reactor vessel fluence analysis methodology topical report (VEP-NAF-3-A). The methodology therein was stated to be in accordance with Regulatory Guide DG-1053, “Calculational and Dosimetry Methods for Determining Pressure Vessel Neutron Fluence.” These methodologies were benchmarked using a combination of Dominion surveillance capsule data, RV simulator measurements, and Surry 1 cavity dosimetry measurements.

In LRAs Sections 4.2.1 and A3.1.1, the applicant describes the general procedure for estimating Charpy USE values for the NAS 1/2 and SPS 1/2 RV beltline materials. The USE requirements are included in 10 CFR Part 50, Appendix G, “Fracture Toughness Requirements”. One of the requirements is that the licensee must submit an analysis of the fracture toughness at least 3 years before the USE of any of the RV materials drops below 67.8 joules (50 ft-lb). When two or more credible surveillance data sets are available, they may be used to determine the USE of the surveillance material. These data are then used in conjunction with Regulatory Guide 1.99, Revision 2, “Radiation Embrittlement of Reactor Pressure Vessel Materials,” to predict the change in the vessel USE due to irradiation.

In the LRA for North Anna, the applicant stated that RV calculations demonstrated that the USE values of limiting RV beltline materials (welds) at the end of the period of extended operation meet Appendix G requirements. On the other hand, for the Surry reactor vessels, compliance with the Appendix G requirements was demonstrated through an equivalent margin analysis. Thus, two different procedures were used for the NAS 1/2 and SPS 1/2 vessels to demonstrate compliance with applicable regulatory requirements.

In an electronic submittal on August 22, 2002 (ADAMS Accession Number ML022670644), and in a letter dated October 15, 2002 (ADAMS Accession Number ML022960411), the applicant submitted supplemental equivalent margin analyses (EMAs) for the Surry 1 and 2 RV beltline materials for which either (1) initial, unirradiated USE values were not known and, hence, for which projected USE values could not be determined at the end of the extended period of operation, or (2) initial, unirradiated USE values was available and the beltline materials' USE at the end of the extended period of operation were projected to fall below the 50 ft-lb criterion specified in Section IV.A.1. of 10 CFR Part 50, Appendix G. The applicant's supplemental EMAs were contained in topical report BAW-2323, "Low Upper-Shelf Toughness Fracture Mechanics Analysis of Reactor Vessels of Surry Units 1 and 2 for Extended Life Through 48 Effective Full Power Years." The applicant's supplemental EMAs demonstrated that, for those Surry 1 and 2 RV beltline materials for which either criterion 1 or 2 above applied, margins of safety against fracture equivalent to those required by Appendix G of Section XI of the ASME Code would be maintained through the units' period of extended operation.

4.2.1.2 Staff Evaluation

The staff reviewed the USE evaluations contained in Sections 4.2.1 and A3.1.1 of the LRAs. During the review of the LRAs, the staff found that the information provided is a general description of the procedures for addressing USE concerns. The staff requested that the applicant provide additional information to clarify the procedures used for the North Anna and Surry RVs.

In response to RAI 4.2.1-1, the applicant in a conference call held in October 2001, as documented in its May 22, 2002 letter, stated that the North Anna USE evaluation involved (a) performance of RG 1.99 Revision 2 Position 1.2 USE calculations and (b) comparison of measured and predicted reductions in USE for North Anna 1 and 2 surveillance materials to confirm that Position 1.2 calculations are conservative.

The beltline fluence values were calculated using the NRC-approved Virginia Power reactor vessel fluence analysis methodology. Best-estimate copper content values were determined by averaging the values obtained from original vessel fabrication and surveillance capsule analysis reports. Measured values of the initial USE for each beltline material were obtained from Westinghouse material certification test reports.

Similarly, in response to RAI 4.2.1-2, the applicant stated during the October 2001 conference call that the Surry USE EMA analyses were performed for ASME Levels A, B, C, and D service loadings based on the evaluation acceptance criteria of Section XI, Appendix K. For Levels A and B service loadings, the low upper shelf fracture mechanics evaluation was performed according to the evaluation procedures contained in Section XI, Appendix K. Level C and D service loadings were evaluated using the one-dimensional, finite element, thermal and stress models and linear elastic fracture mechanics methodology of Framatome Technologies' PCRIT computer code to determine stress intensity factors for a worst case pressurized thermal shock transient.

In accordance with 10 CFR Part 50, Appendix G, Section IV.A.1., the following requirement must be met for RV material USE:

> Reactor vessel beltline materials must have Charpy upper-shelf energy, in the transverse direction for base metals and along the weld for weld materials according to the ASME Code, of no less than 75 ft-lb (102 J) initially and must maintain Charpy upper-shelf energy throughout the life of the vessel of no less than 50 ft-lb (68 J), unless it demonstrated . . . that lower values of Charpy upper-shelf energy

will provide margins of safety against fracture equivalent to those required by Appendix G of Section XI of the ASME Code.

By letter dated October 15, 2002, the applicant submitted the neutron fluences for the Surry 1 and 2 and North Anna 1 and 2 RV beltline materials as projected through the expiration of the extended periods of operation for the units. In this letter, the applicant also provided the USE assessments for the limiting USE forging, plate, and weld materials, as projected through the extended periods of operation for the units.

The staff performed independent analyses of the USE TLAAs for the North Anna 1 and 2 and Surry 1 and 2 RV beltline materials. The staff's independent USE analyses were predicated on meeting the USE requirements specified in Section IV.A.1 of 10 CFR Part 50, Appendix G, and were calculated in accordance with the recommended methods of RG 1.99, Revision 2, for determining reductions in USE. For beltline forgings and weld materials represented in the reactor vessel material surveillance programs for North Anna 1 and 2 and Surry 1 and 2 (i.e., surveillance programs implemented in accordance with 10 CFR Part 50, Appendix H), the staff's USE assessments incorporated surveillance data that were derived from the results of Charpy impact tests performed on test specimens removed from pertinent irradiated reactor vessel material surveillance capsules.

With regard to the staff's independent USE analysis for the North Anna 1 and 2 beltline materials, the staff confirmed that the two most limiting beltline forging materials, and the most limiting beltline circumferential weld material were the same as those identified by the applicant for the RVs.[1] 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 confirmed that the USE values for the North Anna beltline materials will remain at or above the 50 ft-lb acceptance criteria of 10 CFR Part 50, Appendix G, through the extended periods of operation for the units.

For North Anna 1, the staff determined that the 60-year USE assessment for the RV beltline materials is bounded (limited) by the USE value for lower shell forging 03 (material heat 990400/292332). The staff calculated the projected USE value for lower shell forging 03 to be 55 ft-lb at the end of the extended period of operation for the unit. This material meets the staff's end-of-life 50 ft-lb acceptance criterion for USE. Based on the staff's independent USE calculations for North Anna 1, the staff concludes that the North Anna 1 RV beltline materials will have adequate USE through the extended period of operation for the unit.

For North Anna 2, the staff determined that the 60-year USE assessment for the RV beltline materials is bounded (limited) by the USE value for intermediate shell forging 04 (material heat 990496/292424). The staff calculated the projected USE value for intermediate shell forging 04 to be 50 ft-lb through the expiration of the extended period of operation for the unit. Based on the staff's independent USE calculations for North Anna 2, the staff concludes that the North

1 Since the North Anna RV shells are fabricated from cylindrical forgings, the RV shell designs do not include axial welds. Therefore, for license renewal purposes, the applicant's USE analyses for the North Anna 1 and 2 beltline materials included USE analyses of the two most limiting beltline forgings and the most limiting circumferential weld in each North Anna RV.

Anna 2 RV beltline materials will have adequate USE through the extended period of operation for the unit.

With regard to the staff's independent USE analysis of the RV beltline materials for Surry 1 and 2, the staff confirmed that the most limiting beltline materials were evaluated for compliance with Section IV.A.1 of 10 CFR Part 50, Appendix G, using EMAs. For these RV materials, EMAs were required because either (1) initial, unirradiated USE values were not available for the beltline materials and, hence, projected USE values could not be determined at the end of the extended period of operation, or (2) initial, unirradiated USE values were available and the beltline materials' USE at the end of the extended period of operation was projected to fall below the 50 ft-lb criterion specified in Section IV.A.1 of 10 CFR Part 50, Appendix G.[2]

The NRC staff examined the list of Surry 1 and 2 RV beltline materials for which EMAs analyses were required. Since EMAs require the use of applied loadings in the fracture mechanics analyses, the NRC staff divided the Surry 1 and 2 beltline materials into circumferential and axial welds (between which the loadings due to pressure differ by a factor of two) and sought to identify one bounding axial weld and one bounding circumferential weld for which the NRC staff would perform independent EMAs. Based on information about the beltline materials' best-estimate copper content, projected neutron fluence at the end of the extended period of operation, and initial, unirradiated USE (when available), the NRC staff agreed with the applicant's conclusion that Surry 1 RV lower shell axial weld SA-1526 (weld wire heat 299L44) and Surry 1 RV intermediate-to-lower-shell circumferential weld SA-1585 (weld wire heat 72445) were the bounding beltline materials for the Surry 1 and 2 EMAs.

The NRC staff performed independent an EMAs using the methodologies and models specified in Regulatory Guide 1.161, "Evaluation of Reactor Pressure Vessels With Charpy Upper-Shelf Energy Less Than 50 ft-lb," NUREG/CR-5729, "Multivariable Modeling of Pressure Vessel and Piping J-R Data," and Appendix K to Section XI of the ASME Code, "Assessment of Reactor Vessels With Lower Upper Shelf Energy Charpy Impact Energy Levels." Although the detailed results from the NRC staff's analyses differed from those provided by the applicant in topical report BAW-2323, the NRC staff confirmed the applicant's conclusion that, based on EMAs, the identified Surry 1 and 2 RV beltline materials would have margins of safety against fracture equivalent to those required by Appendix G of Section XI of the ASME Code through the units' period of extended operation.

4.2.1.3 FSAR Supplement

Pursuant to the requirements of 10 CFR 54.21(d), the applicant provided a summary description of the TLAA for USE in Section 3.1.1 of the FSAR supplements for Surry 1 and 2 and North Anna 1 and 2. In the FSAR Supplement descriptions for the USE TLAAs, the applicant states that reactor vessel calculations demonstrated that the upper shelf energy values of limiting reactor vessel beltline materials at the end of the period of extended operation

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2 The Surry Unit 1 RV materials for which EMAs were required included: nozzle beltline to intermediate shell circumferential weld J726 (weld wire heat 25017), intermediate to lower shell circumferential weld SA-1585 (weld wire heat 72445), lower shell axial welds SA-1526 (weld wire heat 299L44), and lower and intermediate shell axial welds SA-1494 (weld wire heat 8T1554). The Surry Unit 2 RV materials for which EMAs were required included: nozzle beltline to intermediate shell circumferential weld L737(weld wire heat 4275 and lower and intermediate shell axial welds WF-4 (weld wire heat 8T1762).

meet Appendix G requirements and that the TLAA has been projected to the end of the period of extended operation and is adequate. Based on the NRC staff's review of the applicant's USE determination and EMA result, the NRC staff finds the applicant's FSAR supplements statement to be acceptable.

4.2.1.4 Conclusions

The staff has reviewed the TLAA information in Sections 4.2.1 and A3.1.1 of the LRAs, the applicant's responses to RAIs, the applicant's August 22, 2002 electronic submittal, and the supplemental information submitted in the applicant's letter dated October 15, 2002. All these submissions described the applicant's methodology, results, and conclusions regarding the compliance of the North Anna 1 and 2 and Surry 1 and 2 RV beltline materials with the Charpy USE requirements specified Section IV.A.1 of 10 CFR Part 50, Appendix G, though the period of extended operation. Through independent evaluations, the NRC staff confirmed the applicant's conclusion that all North Anna 1 and 2 and Surry 1 and 2 RV beltline materials, through the period of extended operation, would (1) maintain Charpy USE values above 50 ft-lbs, or (2) have margins of safety against fracture equivalent to those required by Appendix G to Section XI of the ASME Code. Therefore, the staff finds that the applicant's TLAA regarding USE for the North Anna 1 and 2 and Surry 1 and 2 RV beltline materials meets the provisions of 10 CFR 54.21(c)(1)(ii).

4.2.2 Pressurized Thermal Shock

4.2.2.1 Summary of Technical Information in the Application

The applicant addressed pressurized thermal shock (PTS) in Sections 4.1.2 and A3.1.2 of the LRAs. The applicant stated that PTS may occur during postulated events such as a loss of coolant accident (LOCA) or a steam line break. The transients that may challenge the integrity of the RV include the following conditions: severe overcooling of the inside surface of the vessel followed by high repressurization; significant degradation of vessel material toughness caused by neutron irradiation; and, the presence of a critical-size defect in the vessel wall. The LRAs note that in 10 CFR 50.61, "Fracture Toughness Requirements for Protection Against Pressurized Thermal Shock Events," the NRC established screening criteria for PWR RV embrittlement, as measured by the maximum value of reference temperature (RT_{PTS}) at end-of-life fluence for the limiting beltline materials. RT_{PTS} is the reference temperature for a material's transition from ductility to nil ductility. Screening values were set for beltline axial welds, forgings, or plates, and for beltline circumferential weld seams for plant operation to the end of plant license.

The LRAs state that calculations were performed using the methodology described in an in-house report (VEP-NAF-3-A) to estimate RT_{PTS}. The calculations demonstrated that the limiting beltline materials will be less than the applicable screening criteria established in 10 CFR 50.61 at the end of the period of extended operation. The applicant, therefore, concluded that the TLAA is adequate for the period of extended operation.

4.2.2.2 Staff Evaluation

The staff reviewed the PTS evaluations contained in Sections 4.2.2 and A3.1.2 of the LRAs. The staff requested additional information in order to obtain details of the PTS evaluations for all four reactor vessels. In response to RAI Item 4.2.2-1, the applicant stated during the October 2001 conference call that the beltline fluence values were calculated using the NRC-approved Virginia Power reactor vessel fluence analysis methodology.

By letter dated April 27, 2001, the applicant submitted an update to the NRC's Reactor Vessel Integrity Database (RVID). This submittal included the most recently acquired and analyzed reactor vessel integrity data for North Anna 1 and 2. The applicant submitted a similar update to the RVID for Surry 1 and 2 in November 19, 1999.

In accordance with 10 CFR 50.61(b)(1), the following requirement must be met in order to assure that the RVs for PWR-type light-water reactor facilities will have adequate protection against PTS events:

> For each pressurized water nuclear power reactor for which an operating license has been issued, . . . the licensee shall have projected values of RT_{PTS}, accepted by the NRC, for each reactor vessel beltline material for the EOL fluence of the material.

As established in 10 CFR 50.61(b)(2), the acceptance criteria (screening criteria) are 270 °F for plates, forgings, and axial weld materials and 300 °F for circumferential weld materials.

As established in 10 CFR 50.61(b)(3), the following requirement must be met for evaluating the RT_{PTS} values for the beltline RV materials against the PTS screening criteria:

> For each pressurized water nuclear power reactor for which the value of RT_{PTS} for any material is projected to exceed the PTS screening criterion using EOL fluence, the licensee shall implement those flux reduction programs that are reasonably practical to avoid exceeding the PTS screening criterion . . . .

For applicants applying for renewal of the operating licenses of their PWRs, the projected end-of-life (EOL) neutron fluences for the RV beltline materials are the neutron fluences that are projected for the beltline materials at the expiration of the extended periods of operation for the reactor units.

By letter dated October 15, 2002, the applicant submitted the neutron fluences for the Surry 1 and 2 and North Anna 1 and 2 RV beltline materials as projected through the extended periods of operation for the units. In this letter, the applicant also provided the PTS assessment calculations and RT_{PTS} values for the limiting forging, plate, and weld materials, as projected through the extended periods of operation for the units.

The staff performed independent RT_{PTS} value calculations for the North Anna 1 and 2 and Surry 1 and 2 RV beltline materials, as projected using the neutron fluences for the materials at the expiration of the extended periods of operation for the reactor units. The staff's independent RT_{PTS} value calculations were predicated on meeting the PTS requirements specified 10 CFR 50.61 and were calculated in accordance with the required calculation methods in the rule. For beltline forgings and weld materials represented in the reactor vessel material surveillance programs for North Anna 1 and 2 and Surry 1 and 2 (i.e., surveillance programs implemented in accordance with 10 CFR Part 50, Appendix H), the staff's PTS assessments incorporated surveillance data derived from the results of Charpy impact tests performed on test specimens removed from pertinent irradiated reactor vessel material surveillance capsules.

With regard to the staff's independent PTS analysis for the North Anna beltline materials, the staff confirmed that the two most limiting beltline forging materials and the most limiting beltline circumferential weld material for the North Anna 1 and 2 RVs were the same as those identified by the applicant for the RVs.[3] Although the staff's calculated RT_{PTS} values for the limiting RV beltline materials were not always consistent with the applicant's calculated RT_{PTS} values, both the staff's and the applicant's PTS analyses confirmed that the RT_{PTS} values for the North Anna beltline materials will remain below the screening criteria of 10 CFR 50.61 through the end of the extended operating periods for the units.

For North Anna 1, the staff determined that the 60-year PTS assessment for the RV beltline materials is bounded (limited) by lower shell forging 03 (material heat 990400/292332). The staff calculated the projected RT_{PTS} value for lower shell forging 03 to be 191 °F through the expiration of the extended period of operation for the unit. For North Anna 2, the staff determined that the 60-year PTS assessment for the RV beltline materials is also bounded by lower shell forging 03 (material heat 990533/297335). The staff calculated the RT_{PTS} value for lower shell forging 03 to be 228 °F through the expiration of the extended period of operation for the unit. These materials meet the staff's end-of-life 270°F PTS screening criterion for RV beltline forging materials. Based on these independent calculations, the staff concludes that the North Anna 1 and 2 RVs will have adequate protection against PTS events until the end of the extended periods of operation.

For the Surry 1 limiting weld material, the staff requested additional information from the licensee to: (1) confirm that the neutron fluence methodology applied to the surveillance capsule results and the neutron fluence determinations for the Surry 1 RV beltline materials were consistent with the methodology specified in RG 1.190, and (2) confirm that the use of a chemistry factor from Table 1 in 10 CFR 50.61 was an acceptable basis for calculating the RT_{PTS} value for the axial weld fabricated from weld heat 299L44.

In a letter dated October 15, 2002, the applicant provided updated neutron fluence values that were consistent with the methodology in RG 1.190, and an evaluation of the surveillance data for all surveillance weld material fabricated using weld wire heat 299L44. Applying the criteria and methodology outlined in RG 1.99, Revision 2, the applicant determined that the surveillance data was not credible; therefore, it should not be used to determine the beltline chemistry factor. Instead, the applicant determined the chemistry factor for the Surry 1 beltline weld using the 10 CFR 50.61 Table 1 chemistry factors and provided analyses of the data to confirm this conclusion.

The applicant compared the adjusted increase in transition temperature for each surveillance capsule weld to the predicted value. The adjusted value was determined by normalizing the

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3 Since the North Anna RV shells are fabricated from cylindrical forgings, the RV shell designs do not include axial welds. Therefore, for license renewal purposes, the applicant's PTS analyses for the North Anna 1 and 2 beltline materials included PTS analyses of the two most limiting beltline forgings and the most limiting circumferential weld in each North Anna RV. For the Surry RVs, the applicant's PTS evaluations included PTS evaluations of the limiting plate, axial weld, and circumferential weld material in each Surry RV.

measured increase in transition temperature to the average surveillance capsule irradiation temperature and the average surveillance capsule weld chemistry. The predicted value was determined based on the capsule neutron fluence and the average surveillance capsule weld chemistry. The applicant also included an analysis that compared the predicted increase in the transition temperature for each capsule weld based on neutron fluence, percent copper, percent nickel, and the associated 10 CFR 50.61 Table 1 chemistry factors to the measured increase in transition temperature for the capsule weld data. The staff believes this method of analysis is more appropriate for evaluating whether the 10 CFR 60.61 Table 1 chemistry factors should be used to evaluate the beltline welds than the normalization (adjustment) procedure since this method provides a direct comparison of predicted and measured values and the normalization method requires an extrapolation.

Table A identifies all surveillance capsules that contained weld metal fabricated using weld wire heat 299L44. The table identifies the neutron fluence, the percent copper, the percent nickel, the irradiation temperature, the measured increase in transition temperature (ΔRT_{NDT}), the predicted ΔRT_{NDT}, and the measured minus predicted ΔRT_{NDT} values for each capsule weld. The predicted value is the value based on its neutron fluence, percent copper, percent nickel, and the associated 10 CFR 50.61 Table 1 chemistry factors. Table A indicates that all the absolute values of measured minus predicted ΔRT_{NDT} values are less than two standard deviations (2X28 °F=56 °F), except for the Surry-2W1 capsule data. In addition, a few of the measured minus predicted ΔRT_{NDT} values have large positive values.

As a result, the staff performed a statistical analysis of this data to determine whether it was appropriate to utilize the chemistry factor from 10 CFR 50.61 Table 1 and a standard deviation for the shift in transition temperature of 28°F. A z-test was performed on the measured minus predicted ΔRT_{NDT} values listed in Table A. The staff was able to confirm from the results of the z-test that at the 5% significance level that the surveillance data for welds fabricated using weld wire heat 299L44 are consistent with the data used to develop the 10 CFR 50.61 Table 1 chemistry factors. Therefore, based on statistical analysis of the surveillance data, it is appropriate to utilize the chemistry factor from 10 CFR 50.61 Table 1 and the standard deviation for the transition temperature of 28 °F for evaluating the impact of irradiation temperature on welds fabricated using weld wire heat 299L44. Because in its assessment of the Surry 1 beltline weld, which is fabricated from weld wire heat 299L44, the applicant utilized the chemistry factor from Table 1 in 10 CFR 50.61 (PTS Rule) and the standard deviation for the transition temperature of 28 °F, the applicant has acceptably evaluated the impact of irradiation on lower shell axial weld L2.

The staff's independent PTS analysis for the Surry beltline materials confirmed that the most limiting beltline axial weld materials for the Surry 1 and 2 RVs were the same as those identified by the applicant for the RVs. For Surry 1, the staff determined that the 60-year PTS assessment for the RV beltline materials is bounded by lower shell axial weld L2 (weld wire heat 299L44). The staff calculated the RT_{PTS} value for lower shell axial weld L2 to be 268.5 °F through the extended period of operation for the unit. For Surry 2, the staff determined that the 60-year PTS assessment for the RV beltline materials is bounded (limited) by lower shell axial welds L1, L2 and L4 (weld wire heat 8T1762). The staff calculated the RT_{PTS} value for lower shell axial welds L1, L2 and L3 to be 219.2 °F at the end of the extended period of operation for the unit. These materials meet the staff's end-of-life 270°F PTS screening criterion for RV beltline forging materials. Based on the statistical analysis of the surveillance data and its independent calculations, the staff concludes that the Surry 1 and 2 RVs will have adequate protection against PTS events through the extended periods of operation.

4.2.2.3 FSAR Supplement

Pursuant to the requirements of 10 CFR Part 54.21(d), the applicant provided a summary description of the TLAAs for PTS in Section 3.1.2 of the FSAR Supplements for Surry 1 and 2 and North Anna 1 and 2. In the FSAR Supplement descriptions for the PTS TLAAs, the applicant states that the reference temperature for pressurized thermal shock (RT_{PTS}) is defined in 10 CFR 50.61 and that the RT_{PTS} values for the limiting reactor vessel materials at the end of the period of extended operation have been recalculated by the applicant. In the FSAR supplement descriptions for the PTS TLAAs, the applicant also states that, at the end of the period of extended operation, the calculated RT_{PTS} values for the beltline materials are less than the applicable screening criteria established in 10 CFR 50.61; therefore, the TLAA has been projected to the end of the period of extended operation and is found to be adequate.

4.2.2.4 Conclusions

The staff reviewed the TLAA information in the LRA Sections 4.2.2 and A3.1.2, which describe the results for estimating end-of-life RT_{PTS} values for the limiting RV beltline materials and demonstrate that they are below the screening criteria given in 10 CFR 50.61. For the reasons set forth above, the staff concludes that the PTS analyses for the NAS 1/2 and SPS 1/2 RV beltline materials demonstrate that the NAS 1/2 and SPS 1/2 RVs comply with the regulatory screening criteria in 10 CFR 50.61, and that the PTS evaluations for the RV are valid through the extended periods of operation for the Surry and North Anna reactor units and are in compliance with the requirements of 10 CFR 54.21(c)(1)(ii).

4.2.3 Pressure-Temperature Limits

4.2.3.1 Summary of Technical Information in the Application

Sections 4.2.3 and A3.1.3 of the LRAs address pressure-temperature limits for the North Anna 1 and 2 and Surry 1 and 2 reactor vessels. The LRAs include a description of NRC General Design Criteria 14 and 31 which, respectively, specify that there should be an extremely low probability of abnormal leakage (or rapid failure) and of gross rupture in the reactor coolant pressure boundary, and that the pressure boundary should behave in a nonbrittle manner with the probability of rapidly propagating fracture being minimized. The information in the LRAs also includes statements that the heatup and cooldown limit curves are calculated using the most limiting value of the material properties in the beltline vessel region of the reactor vessel. This limiting value is determined by using the unirradiated value for the materials' fracture toughness properties and estimating the shift in the estimated nil-ductility reference temperature ΔRT_{NDT}. From the adjusted reference temperature values, the applicant obtained P-T limit curves in accordance with the requirements of 10 CFR Part 50, Appendix G, "Fracture Toughness Requirements", as augmented by ASME Code Section XI, Appendix G, "Rules for Inservice Inspection of Nuclear Power Plant Components."

The LRAs state that the RV estimated fluence values and beltline material properties at the end of the period of extended operation were used to determine the limiting value of RT_{NDT} using the methods described in Regulatory Guide 1.99, Revision 2. The limiting value of RT_{NDT} was then used to calculate pressure-temperature (P-T) limits that are valid through the period of extended operation. Maximum allowable low-temperature overpressure protection system (LTOPS) power-operated relief valve (PORV) lift setpoints were then developed on the basis of the P-T limits applicable to the period of extended operation. The LRAs state that revised P-T limit curves and LTOPS setpoints will be submitted for review and approval prior to expiration of existing limits, in order to maintain compliance with requirements in Appendix G of 10 CFR Part 50. The applicant concluded that the P-T limits will be maintained during the period of extended operation.

4.2.3.2 Staff Evaluation

The staff reviewed the information in LRA Sections 4.2.3 and A3.1.3, which describe the general procedure for calculating P-T curves for the RV beltline materials through the period of extended operation. This limiting value is stated to be determined by using the unirradiated value for the materials' fracture toughness properties and estimating ΔRT_{NDT}. From the adjusted reference temperature values the applicant obtained P-T limit curves in accordance with the requirements of 10 CFR Part 50, Appendix G, as augmented by ASME Code Section XI, Appendix G. The LRAs also stated that the RV estimated fluence values and beltline material properties at the end of the period of extended operation were used to determine the limiting value of RT_{NDT} using the methods described in RG 1.99, Revision 2. The limiting value of RT_{NDT} was then used to calculate P-T limits that are valid through the period of extended operation.

The applicant also stated that the maximum allowable LTOPS PORV lift setpoints were developed on the basis of the P-T limits applicable to the period of extended operation. Existing technical specification (TS) reactor coolant system P-T limits and the associated LTOPS setpoints are valid to cumulative burnup values (i.e., effective full power years) corresponding to the end of the current license period. The applicant will request that the TS be amended to include revised P-T limit curves and LTOPS setpoints applicable to the period of extended operation, and this request will be submitted for NRC review and approval prior to the expiration of the existing TS limits in order to remain in compliance with the requirements of 10 CFR Part 50, Appendix G. The staff will evaluate the end-of-extended-period-of-operation P-T limit curves for Surry 1 and 2 and North Anna 1 and 2 in accordance with the P-T limit requirements of 10 CFR Part 50, Appendix G, when the applicant submits them for approval pursuant to the license amendment requirements of 10 CFR 50.90.

4.2.3.3 FSAR Supplement

Pursuant to the requirements of 10 CFR 54.21(d), the applicant has provided a summary description of the TLAAs for the Surry 1 and 2 and North Anna 1 and 2 P-T limits in Section 3.1.3 of the FSAR supplements for Surry 1 and 2 and North Anna 1 and 2. In the FSAR supplement descriptions for the TLAAs on the P-T limits, the applicant states, in part, that the RV neutron fluence values corresponding to the end of the period of extended operation and RV beltline material properties were used to determine the limiting value of the reference nil ductility reference temperature (RT_{NDT}), and to calculate RCS P-T operating limits valid through the end of a period of extended operation, and that maximum allowable LTOPS PORV lift setpoints have been developed on the basis of the P-T limits applicable to the period of extended operation. In the FSAR Supplement descriptions for the TLAAs on the P-T limits, the applicant also states, in part, that the revised RCS P-T limit curves and LTOPS setpoints will be submitted for review and approval prior to the expiration of the existing technical specification limits in order to maintain compliance with the governing requirements of 10 CFR Part 50, Appendix G, and that the TLAAs for P-T limits have been projected to the end of the period of extended operation and have been found to be adequate. The staff will evaluate the P-T limits for the extended periods of operation when submitted to the staff for evaluation pursuant to the license amendment requirements of 10 CFR 50.90. Based on these considerations, the staff concludes that the applicant's FSAR supplement summary descriptions for the TLAAs on the P-T limits are acceptable.

4.2.3.4 Conclusions

The staff reviewed the TLAA information in Sections 4.2.3 and A3.1.3 of the LRAs, which describe the applicant's approach in developing the P-T limits for the RV beltline materials. The staff finds that the analyses demonstrate that North Anna and Surry RVs comply with the regulatory requirements in 10 CFR Part 50, Appendix G, and 10 CFR 54.21(c)(1)(ii).

Table A

Surveillance Capsule Irradiation Data Used to Evaluate the Surry 1 Axial Weld Fabricated Using Weld Wire Heat 2994L44

Surveillance Capsule	Neutron Fluence ($x10^{19}$ n/cm^2)	%Copper	% Nickel	Irradiated Temperature (°F)	Measured ΔRT_{NDT} (°F)	Predicted ΔRT_{NDT} (°F)	Measured-Predicted ΔRT_{NDT} (°F)
TMI-2LGI	0.830	0.37	0.70	556.0	216	222	-6
CR-3LGI	0.755	0.36	0.70	556.0	202	212	-10
TMI-2LGI	0.968	0.33	0.67	556.0	226	213	+13
TMI-1C	0.882	0.33	0.67	556.0	166	208	-42
TMI-1E	0.097	0.33	0.67	556.0	74	88	-14
Surry-2WI	0.669	0.36	0.70	546.3	262	205	+57
Surry-IT	0.292	0.23	0.64	533.9	171	117	+54
Surry-IV	1.992	0.23	0.64	538.8	250	209	+41
Surry-IX	1.599	0.23	0.64	542.0	234	199	+35

4.3 Metal Fatigue

A metal component subjected to cyclic loads may crack and fail at a load magnitude less than its ultimate load capacity as a result of metal fatigue. The fatigue life of a component is a function of its material, its environment, and the number and magnitude of the applied cyclic loads. Fatigue was a design consideration for plant mechanical components in the SPS and NAS facilities and, consequently, fatigue is part of the current licensing basis for these components. The applicant addresses the TLAA evaluations performed to address thermal and mechanical fatigue of plant mechanical components in Section 4.3 of each LRA. The staff reviewed this section of each LRA to determine whether the applicant evaluated the TLAA in accordance with the requirements of 10 CFR 54.21(c)(1).

4.3.1 Summary of Technical Information in the Application

The applicant discussed the criteria used for the design of reactor coolant loop components in Section 4.3.1 of each LRA. The applicant indicated that the reactor vessels, steam generators, pressurizers, reactor coolant pumps, control rod drive mechanisms, and pressurizer surge lines were analyzed using the methodology of the ASME Boiler and Pressure Vessel Code, Section III, Class 1. In addition, the remaining reactor coolant pressure boundary piping, including loop stop valves, of the NAS facility was analyzed using the ASME Code Class 1 methodology. Fatigue analyses were performed for critical locations in these components using conservative assumptions regarding the anticipated plant operational cycles. The applicant stated that a review of the SPS and NAS plant operating histories indicated that the existing design transients and cycle frequencies are conservative and bounding for the period of extended operation. The applicant concluded that, with the exception of the reactor vessel closure studs and the NAS loop stop valves, the existing fatigue analyses remain valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i). The applicant further indicated that the reactor pressure vessel closure studs and the NAS loop stop valves had been reanalyzed and were projected to remain valid for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(ii).

The applicant referenced the Transient Cycle Counting Program (TCCP) as a program that assures the number of cycles does not exceed the design limit during the period of extended operation. The TCCP is described in Appendix B of each LRA.

The applicant discussed the evaluation of reactor vessel underclad cracking in Section 4.3.2 of each LRA. Grain boundary separation perpendicular to the direction of the cladding weld overlay was identified in the heat-affected zone of a European-manufactured reactor vessel base metal in 1971. The acceptability of this condition was demonstrated by a generic fracture mechanics evaluation for the 40-year plant life. The applicant indicated that this evaluation has been projected to the end of the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii).

The applicant described the criteria used for the reactor coolant loop piping and balance-of-plant piping in Section 4.3.3 of each LRA. For SPS, this piping, except for the pressurizer surge lines, was designed to the requirements the ANSI B31.1, “Power Piping.” For NAS, the reactor coolant pressure boundary piping, including the loop stop valves, was analyzed using the ASME Code Class 1 methodology. The pressurizer surge lines of both stations were designed to the Class 1 requirements of the ASME Code. These lines are covered in the applicant's fatigue assessment discussed in Section 4.3.1 of each LRA. For NAS, the applicant indicated that the balance-of-plant piping was designed to the requirements of ANSI B31.1. The applicant indicated that piping had been evaluated to the requirements of ANSI B31.1 and determined to remain valid for the period of extended operation in accordance with either 10 CFR 54.21(c)(i) or (ii).

In Section 4.3.4 of each LRA, the applicant described the actions taken to address the issue of environmentally assisted fatigue. The applicant described its evaluation of the following fatigue sensitive component locations:

- reactor vessel shell and lower head
- reactor vessel inlet and outlet nozzles
- pressurizer surge line (including the pressurizer and hot-leg nozzles)
- reactor coolant system piping charging nozzle
- reactor coolant system piping safety injection nozzle
- residual heat removal system Class 1 piping

4.3.2 Staff Evaluation

As discussed in the previous section, the components of the RCS at both SPS and NAS were designed to the Class 1 requirements of the ASME Code. The Class 1 requirements contain explicit criteria for the fatigue analysis of components. Consequently, the applicant identified the fatigue analysis of these components as TLAAs. The staff reviewed the applicant's evaluation of the ASME Class 1 RCS components for compliance with the provisions of 10 CFR 54.21(c)(1).

The specific design criterion for ASME Class 1 components involves calculating the CUF. The fatigue damage in the component caused by each thermal or pressure transient depends on the magnitude of the stresses caused by the transient. The CUF sums the fatigue damage resulting from each transient. The design criterion requires that the CUF not exceed 1.0. The applicant stated that a review of the NAS and SPS plant operating histories indicated that the number of cycles and the severity of the transients assumed in the design of these components envelops the expected transients during the period of extended operation. In RAI 4.3-1, the staff requested that the applicant provide the following data:

- the current number of operating cycles and a description of the method used to determine the number and severity of the design transients from the operating history
- the number of operating cycles estimated for 60 years of plant operation and a description of the method used to estimate the number of cycles at 60 years
- a comparison of the design transients listed in the UFSAR to the transients monitored by the TCCP as shown in Section B3.2 of each LRA

The applicant's January 16, 2002, response to the staff's RAI indicated that the NAS TCCP has been ongoing since the initial startup of each unit. The SPS TCCP was initiated in January of 2000, and operational data since the initial startup of each unit has been included in the program. The applicant provided comparisons of the number of design transients with the number of transients projected for 60 years of plant operation for each unit in Tables 4.3-1-1 through 4.3-1-4 of the January 16, 2002 letter. The applicant performed a linear extrapolation of the number of operating cycles of most transients to obtain the 60-year estimates. The applicant indicated that the linear extrapolation of the number of heatup, cooldown, and reactor trip transients for SPS was overly conservative because of the large number of these events in the first 10 years of operation. Consequently, the applicant used the most recent 10 years of plant operation as the basis for projecting the future number of cycles of these transients to obtain the 60-year estimates. The staff considers the method described by the applicant to estimate the number of transient cycles for 60 years of plant operation to be reasonable. The applicant's TCCP will continue to track the number of these cycles during the period of extended operation.

The applicant also identified the design transients listed in SPS UFSAR Table 4.1-8 and NAS UFSAR Table 5.2-4 that are not tracked by the TCCP. The applicant indicated that the estimated number of design cycles associated with loading and unloading at 5% of full power was based on the assumption of load-follow operation, whereas the plant is operated in the base-load mode. The staff agrees that the number of design cycles listed in the UFSAR tables for these transients is conservative based on the information presented in NUREG/CR-6260 for an older vintage Westinghouse plant. The applicant also indicated that the hydrostatic test listed in SPS UFSAR Table 4.1-8 is not tracked because no further tests are expected to be performed. The staff finds that the TCCP tracks the significant design transients listed in the UFSARs.

Although the applicant indicated that the existing design transients and cycle frequencies are conservative and bounding for the period of extended operation, the applicant also indicated that the NAS RPV closure studs and RCS loop stop valves were reanalyzed. In RAI 4.3-2, the staff requested that the applicant describe the additional analyses that were required for these components in light of the previous statement that design transients and frequencies are conservative and bounding for the period of extended operation. The applicant's January 16, 2002, response indicated that the RPV closure studs were originally analyzed for 57 events of tensioning and detensioning. The applicant analyzed the closure studs for 200 events of tensioning and detensioning to be consistent with the number of heatup and cooldown cycles. Since the RPV closure studs are not tensioned and detensioned during every heatup and cooldown cycle, the staff considers that this analysis provides a conservative basis for tracking closure stud fatigue based on the number of heatup and cooldown cycles. The applicant also indicated that the RCS loop stop valves were originally analyzed for one steam generator tube rupture event. The applicant indicated that, since there was a tube rupture event at NAS, the analysis was upgraded to include five steam generator tube rupture events. The staff considers the assumption of five steam generator tube events to be conservative.

NRC Bulletin (BL) 88-11, "Pressurizer Surge Line Thermal Stratification," identified a concern regarding potential temperature stratification and thermal striping in the pressurizer surge line. The applicant indicated that the pressurizer surge lines were analyzed in response to the bulletin, and that this analysis considered insurge/outsurge events that were not considered in the original analysis. BL 88-08, "Thermal Stresses in Piping Connected to Reactor Coolant Systems," identified a concern regarding the potential for temperature stratification or temperature oscillations in unisolable sections of piping attached to the RCS. In RAI 4.3-3, the staff requested the applicant to describe the actions taken to address BL 88-08 during the period of extended operation. The applicant's January 16, 2002, response to the staff's RAIs indicated that no fatigue calculations had been performed to address BL 88-08. Therefore, no additional actions are required to address this bulletin during the period of extended operation.

The Westinghouse Owners Group (WOG) issued topical report WCAP-14575-A, "License Renewal Evaluation: Aging Management Evaluation for Class 1 Piping and Associated Pressure Boundary Components," to address aging management of the RCS piping. When reviewing the topical report, the NRC staff identified action items for license renewal applicants to take. In Section 3.1.1 of each LRA, the applicant addressed the applicability of WCAP-14575-A to NAS and SPS. Table 3.1.1-W1 of each LRA provides the response to the renewal applicant action items developed during the staff review of the topical report. Renewal Applicant Action Item 8 requests that the applicant address components labeled I-M and I-RA in Tables 3-2 through 3-16 of WCAP-14575. The applicant indicated that the components in Tables 3-2 through 3-16 were addressed by an aging management activity, plant-specific fatigue evaluation, or code evaluation. However, the applicant did not provide details on each component. In RAI 4.3-4, the staff requested the applicant to provide a summary of the resolution of the components labeled I-M and I-RA in Tables 3-2 through 3-16. The applicant's March 27, 2002, supplemental response indicated that the design transients used in the analysis of piping components envelop the projected transients for 60 years of operation. As discussed above, the applicant relies on the TCCP to monitor the number of design transients during the period of extended operation. The staff agrees that the fatigue analyses of these piping components will remain valid if the number of transient cycles assumed in the fatigue analyses is not exceeded during the period of extended operation. The staff review of the TCCP is contained in Section 3.3.3.2 of this SER.

The WOG issued topical report WCAP-14574-A to address aging management of pressurizers. In Section 3.1.4 of each LRA, the applicant discussed the applicability of WCAP-14574-A to NAS and SPS. Table 3.1.4-W1 of each LRA provides the response to the renewal applicant action items developed as a result of the staff's review of the topical report. Renewal Applicant Action Item 1 requests that the applicant demonstrate that the pressurizer subcomponent CUFs remain below 1.0 for the period of extended operation. Table 2-10 of WCAP-14574-A indicates that the ASME Code Section III Class 1 fatigue CUF criterion could be exceeded at several pressurizer subcomponent locations during the period of extended operation. WCAP-14574-A also identified recent unanticipated transients that were not considered in the original ASME Code Section III Class 1 fatigue analyses. In RAI 4.3-5, the staff requested that the applicant provide the following information:

- confirm that the additional transients discussed in WCAP-14574-A, not considered in the original design, have been addressed at NAS and SPS

- list the ASME Code Section III Class 1 CLB CUFs for the applicable subcomponents of the NAS and SPS pressurizers specified in Table 2-10 of WCAP-14574-A and the corresponding CUFs for the extended period of operation

- discuss the impact of the environmental fatigue correlations provided in NUREG/CR-6583, "Effects of LWR Coolant Environments on Fatigue Design Curves of Carbon and Low-Alloy Steels," and NUREG/CR-5704, "Effects of LWR Coolant Environments on Fatigue Design Curves of Austenitic Stainless Steels," on the above results

The applicant's January 16, 2002, response indicated that plant-specific NAS and SPS analyses were performed based on the recommendations made in WCAP-14574-A. The applicant further indicated that the plant-specific analyses include the effects of all additional transients discussed in WCAP-14574-A that were not considered in the original design. The applicant provided the CLB CUFs applicable through the period of extended operation in Table 4.3-5-1 of its response. These CUFs are all below the ASME Code limit of 1.0 for the period of extended operation.

The CLB CUFs did not include consideration of environmental effects on the fatigue curves. The applicant estimated the maximum effect of environmental fatigue correlations on the pressurizer subcomponent CLB CUFs and presented the results in Tables 4.3-5-1 and 4.3-5-2 of the response. The applicant's evaluation identified that the following subcomponents required further evaluations:

- surge nozzle
- spray nozzle
- lower head and heater well
- upper head and shell
- instrument nozzle

For the analyses of the spray nozzle, lower head and heater well, upper head and shell, and instrument nozzle, the applicant's further evaluation consisted of qualitative discussions of the conservatism. The applicant indicated that the pressurizer spray operates continuously and, therefore, the NAS and SPS pressurizers are not expected to experience the transients that contribute to the high-fatigue usage in the design calculations. The applicant indicated that conservative stress intensification factors were used in the analysis of the lower head and heater well resulted in an artificially high CUF value. The applicant further argued that a detailed finite-element analysis of this sub-component would significantly reduce the calculated CUF. On the basis of the finite-element analyses reported in NUREG/CR-6260, the staff agrees with this qualitative assessment. The applicant's evaluation of the upper head and shell relied on the results of a 1989 Westinghouse study to determine that the pressurizer spray transient does not impinge directly on the upper shell, as assumed in the fatigue analysis. The applicant indicated that the fatigue usage is negligible without direct impingement. The applicant stated that environmental fatigue concerns regarding the instrument nozzle would be bounded by the surge nozzle.

The applicant indicated that the surge-line-to-hot-leg pipe connection is a limiting location from a fatigue perspective for both NAS and SPS when considering reactor water environmental effects. The applicant has committed to additional actions regarding this location during the period of extended operation, as discussed later in this section. The staff considers the surge line a bounding example to represent the effects of the reactor water environment on the fatigue life of pressurizer components during the period of extended operation.

The staff considers the applicant's evaluations a satisfactory method of identifying the most limiting component associated with the pressurizer, the surge line hot-leg nozzle, for further evaluation during the period of extended operation. If further evaluation identifies the need for additional actions for the period of extended operation, then the applicant should reassess the fatigue evaluation of the pressurizer components as part of its corrective action. This reassessment should quantify the conservatism in the analyses as discussed above.

The WOG issued topical report WCAP-14577, Revision 1-A, to address aging management of the reactor vessel internals. Table 3.1.3-W1 of each LRA provides the response to Renewal

Applicant Action Item 11 regarding fatigue TLAA of the reactor vessel internals. Each LRA indicates that the TCCP will assure that the transients will remain within their design values for the period of extended operation. In RAI 4.3-1 the staff requested that the applicant list the transients that contribute to the fatigue usage for each component listed in Table 3-3 of WCAP-14577, Revision 1-A, and discuss how the TCCP monitors these transients. The applicant's January 16, 2002, response indicated that the SPS and NAS internals were designed to the Westinghouse criteria. The applicant further indicated that the Westinghouse criteria contained no TLAAs and that pressure load calculations were performed instead of fatigue calculations. The applicant indicated that the design and design transients for the SPS and NAS internals were similar to those of plants designed to ASME Code Section III Subsection NG criteria. The applicant concluded that the TCCP will monitor the number of design transients to provide reasonable assurance that the design cycles are not exceeded. The implication of the applicant's response is that fatigue of the reactor vessel internals is not a concern for the period of extended operation if the number of transients assumed in the design of other RCS components is not exceeded during the period of extended operation. Since the applicant stated that the design of the SPS and NAS reactor vessel internals did not contain a TLAA, the staff concludes that no TLAA evaluation for the period of extended operation is required by 10 CFR 54.21(c)(1). The aging management of the reactor vessel internals is discussed in Section 3.3.1.15 of this SER.

The applicant indicated that the steam generators, pressurizers, reactor vessels, reactor coolant pumps, CRDMs, and all RCS boundary (NAS) and pressurizer surge lines (SPS) have been evaluated and remain valid for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(i). In addition, the applicant indicated that the reactor vessel closure studs and the NAS loop stop valves had been reanalyzed and projected to remain valid for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(ii). The applicant further indicated that the TCCP will continue during the period of extended operation and will assure that design cycle limits are not exceeded. The applicant's TCCP tracks transients and cycles of RCS components that have explicit design transient cycles to assure that these components stay within their design basis. Generic Safety Issue (GSI) 166, "Adequacy of the Fatigue Life of Metal Components," raised concerns regarding the conservatism of the fatigue curves used in the design of the RCS components. Although GSI-166 was resolved for the current 40-year design life of operating components, the staff identified GSI-190, "Fatigue Evaluation of Metal Components for 60 year Plant Life," to address license renewal. The NRC closed GSI-190 in December of 1999, concluding:

> The results of the probabilistic analyses, along with the sensitivity studies performed, the iterations with industry (NEI and EPRI), and the different approaches available to the applicants 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, applicants should address the effects of coolant environment on component fatigue life as aging management programs are formulated in support of license renewal.

The applicant evaluated the component locations listed in NUREG/CR-6260 that are applicable to an older vintage Westinghouse plant for the effect of the environment on the fatigue life of the components. The applicant indicated that the results reported in NUREG/CR-6260 were used to scale up the plant-specific usage factors for the same locations to account for environmental effects. The applicant also indicated that the later environmental fatigue correlations contained in NUREG/CR-6583 and NUREG/CR-5704 were considered in the evaluation. In RAI 4.3-6, the staff requested that the applicant provide the results of the usage factor evaluation for each of the six component locations listed in NUREG/CR-6260. The staff also requested that the applicant discuss how the factors used to scale up the NUREG/CR-6260 usage factors were derived and how the environmental data provided in NUREG/CR-6583 and NUREG/CR-5704 were factored in the evaluations.

In the January, 16, 2002, response, the applicant provided NAS- and SPS-specific usage factors that include environmental effects for the RPV shell at the core support pads and the RPV inlet and outlet nozzles (see Table 4.3-6-2 of the response). The applicant calculated the maximum environmental factor using the equations presented in NUREG/CR-6583 for low-alloy steels in a low-oxygen environment, and applied the factor to the design usage factors at NAS and SPS. The results indicate that the usage factors are less than 1.0. The staff notes that the applicant's assessment of the maximum environmental factors as a function of temperature shown in Tables 4.3-6-2 and 4.3-6-3 is incorrect. The environmental factor should be a constant value for low-oxygen environments. However, since the applicant used the highest calculated environmental factor, the applicant's evaluation is conservative. The staff finds acceptable the applicant's evaluation of the effect of the environment on the RPV shell at the core support pads and the RPV inlet and outlet nozzles.

The applicant used the results presented in NUREG/CR-6260 for an older vintage Westinghouse plant to estimate the impact of the environment on fatigue usage for the charging and safety injection nozzles. The results presented in NUREG/CR-6260 were based on detailed finite-element analyses of the charging and safety injection nozzles at the Turkey Point facility. The staff asked the applicant to discuss the applicability of these detailed finite-element analyses to NAS and SPS. By e-mailed supplemental responses dated March 27 and April 22, 2002, the applicant provided additional detailed technical information to justify using the NUREG/CR-6260 finite-element analyses. The applicant's e-mail response to staff's questions is docketed and available to public. The applicant indicated that no fatigue analysis had been performed for the SPS nozzles. Therefore, the applicant used its assessment of the NAS nozzles to represent the SPS nozzles. The applicant's fatigue analysis of NAS was based on the simplified piping rules. The applicant's assessment of the NAS nozzles consisted of scaling the stresses shown in NUREG/CR-6260 for the ASME Code Section III NB-3600 analysis by a sufficient amount to account for the differences between the design CUF at NAS and the CUF reported in NUREG/CR-6260. That scaling factor was then applied to the detailed finite-element results presented in NUREG/CR-6260 to obtain equivalent stresses for the NAS evaluation. The evaluation involved several qualitative assessments as described below:

- The NAS and SPS nozzles have different thicknesses, different shapes in the transition region, and, in the case of NAS safety injection nozzles, a different nozzle size than the nozzles modeled in NUREG/CR-6260. The applicant argued that these differences have no significant impact on the finite-element analysis results. While the staff agrees that these differences will not have a large impact on the results, it is difficult to quantify the impact of these differences without specific calculations.

- The NAS nozzles do not contain thermal sleeves, whereas the nozzles modeled in NUREG/CR-6260 contain thermal sleeves. The thermal sleeve moderates the impact of thermal shocks in the nozzle bore area. The applicant argues that previous Westinghouse finite-element analyses of nozzles with and without thermal sleeves have demonstrated that the critical location remains at the nozzle-to-pipe weld upstream of the thermal sleeve. The applicant further argues that the NUREG/CR-6260 analyses will provide conservative results because the thermal sleeve creates a temperature discontinuity that is not present in the NAS nozzles. The staff does not have sufficient information to make a judgment on this issue. The applicant's supplemental responses do not indicate whether the thermal sleeve design used in the Westinghouse analysis is the same as the thermal sleeve design in the NUREG/CR-6260 analysis. It would be easier to judge the assessment of the environmental effects on the NAS nozzles, if the applicant based its assessment directly on the Westinghouse finite-element analyses.

- The applicant did not use the strain rates used in NUREG/CR-6260 to obtain the environmental adjustment factors. Instead, the applicant used a methodology from the published literature to estimate strain rates. These estimated strain rates are much higher than the strain rates used in the NUREG/CR-6260 evaluations. The impact of using the higher strain rates is to obtain a much lower value for the environmental correction factor than would be obtained using the strain rates used in the NUREG/CR-6260 evaluations. On the basis of the discussion in Section 3.4 of NUREG/CR-6260, the staff considers the strain rate estimate of 1.23%/sec for the safety injection nozzle to be unrealistically high.

On the basis of the above discussion the staff identified the evaluation of the charging and safety injection nozzles as Open Item 4.3-1 in the SER with open items, dated June 2002. The staff requested that the applicant provide an assessment of these nozzles that is directly applicable to NAS and SPS.

The applicant provided an additional assessment of the NAS charging and safety injection nozzles in a June 13, 2002, submittal. The applicant employed finite-element models of the NAS charging and safety injection nozzles to obtain the stresses for the various design load conditions, including thermal transients. The applicant indicated that the stress for each load was calculated separately and the results combined in a conservative manner. The calculated fatigue usage included the effect of the environment. The applicant indicated that the most limiting location for both nozzles is the safe end region. Although the reported CUFs are below the ASME limit of 1.0, the applicant used an adjusted environmental correction factor to compute the CUF. The adjusted environmental correction factor credits the current ASME fatigue curves for accounting for moderate environmental effects. The adjusted environmental correction factor is calculated by dividing the environmental correction factor obtained using equations provided in NUREG/CR-6583 and NUREG/CR-5704 by a Z-factor. The environmental correction factor is the ratio of the fatigue life in air (basis of the ASME fatigue curves) to the fatigue life in the reactor water environment. The Z-factor is the credit taken in the ASME design curves to account for moderate environmental effects. The staff identified technical issues regarding the use of the Z-factor in a June 26, 2002 letter to the Nuclear Energy Institute regarding the staff review of EPRI Technical Report, "Guidelines for Addressing Fatigue Environmental Effects in a License Renewal Application (MRP-47)." As a consequence, the staff does not currently endorse the use of the Z-factor.

The applicant's October 1, 2002, response to the staff committed to manage the environmental fatigue of the charging and safety injection nozzles for NAS and SPS using one or more of the following options prior to the period of extended operation:

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

The applicant indicated that, if the fourth option is selected, the inspection details, including scope, qualification, method, and frequency, will be provided to the NRC for review and approval prior to the period of extended operation. An aging management program under this option would be a departure from the design basis CUF evaluation, described in the UFSAR supplements and, therefore, would require a license amendment pursuant to 10 CFR 50.59. In view of the above, the staff finds the applicant's proposed program to be an acceptable plant-specific approach to address environmentally assisted fatigue during the period of extended operation in accordance with 10 CFR 54.21(c)(1). On the basis of the above discussion, the staff considers open item 4.3-1 closed.

The applicant evaluated the NAS RHR tee location using the stainless steel environmental fatigue correlation provided in NUREG/CR-5704. The applicant applied the environmental factor applicable to temperatures less than 200 °C to the NAS calculated design value. The applicant indicated that the temperatures for the controlling RHR transient are less than 200 °C. The applicant's evaluation of the effect of the environment on fatigue indicates a usage factor less than 1.0. The applicant indicated that no fatigue calculations were performed at this location for SPS. The applicant indicated that the geometry and material of the RHR tee at SPS are similar to those at NAS. The applicant further indicated that the transient stresses are expected to be similar in NAS and SPS. On the basis of the applicant's assertion that the RHR tees at NAS and SPS are similar, the staff considers the applicant's evaluation of NAS adequate to represent SPS for fatigue evaluation.

The applicant indicated that the pressurizer surge line required further evaluation for environmental fatigue during the period of extended operation. The applicant further indicated that it would use an aging management program to address fatigue of the surge line during the period of extended operation. The aging management program would rely on augmented inspections to address surge line fatigue during the period of extended operation. As indicated in the safety evaluation for WCAP-14575-A, the NRC has not endorsed a procedure on a generic basis which allows for ASME Section XI inspections in lieu of meeting the fatigue usage criteria. In RAI 4.3-7, the staff requested that the applicant provide a detailed technical evaluation which demonstrates the proposed inspections provide an adequate technical basis for detecting fatigue cracking before such cracking leads to through-wall cracking or pipe failure. The staff indicated that, as an alternative to the detailed technical evaluation, the applicant could provide a commitment to monitor the fatigue usage, including environmental effects, during the period of extended operation and to take corrective actions, as approved by the staff, if the usage is projected to exceed 1.0.

The applicant's January 16, 2002, response indicated that the surge line weld at the hot-leg pipe connection will be included in an augmented inspection program. The applicant further indicated the results of these inspections and the results of planned research by the EPRI-sponsored Materials Reliability Program (MRP) will be utilized to assess the appropriate approach for addressing environmentally assisted fatigue of the surge lines. The applicant indicated that the approach developed could include one or more of the following:

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

The applicant indicated that, if the fourth option is selected, the inspection details, including scope, qualification, method, and frequency, will be provided to the NRC for review and approval prior to the period of extended operation. An aging management program under this option would be a departure from the design basis CUF evaluation, described in the UFSAR supplements and, therefore, would require a license amendment pursuant to 10 CFR 50.59. In view of the above, the staff finds the applicant's proposed program to be an acceptable plant-specific approach to address environmentally assisted fatigue during the period of extended operation in accordance with 10 CFR 54.21(c)(1).

ANSI B31.1 requires that a reduction factor be applied to the allowable bending-stress range if the number of full-range thermal cycles exceeds 7,000. The applicant indicates that its review of plant operating practices found that most B31.1 systems operate continuously in a steady state and are only subjected to plant heatup and cooldown cycles. Therefore, the applicant concluded that the analyses of these piping components remained valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i). However, the applicant indicated that the NAS hot- and cold-leg sample lines will be subjected to greater than 7,000 cycles during the period of extended operation. The applicant indicated that an evaluation considering stress range reduction factors demonstrates that these lines are qualified for 22,500 cycles, which exceeds the number of cycles expected during the period of extended operation. Therefore, the applicant concluded that these analyses had been evaluated and determined to remain valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii). The staff found the applicant's evaluation acceptable.

The applicant indicated that a generic evaluation of underclad cracks had been extended to 60 years using fracture mechanics evaluations based on a representative set of design transients with the occurrences extrapolated to cover 60 years of service. The applicant indicated that this generic analysis is documented in WCAP-15338, "A Review of Cracking Associated with Weld Deposited Cladding in Operating PWR Plants (MUHP-6110)," which was submitted by the WOG by letter dated March 1, 2001. This report describes the fracture mechanics analysis the impact of 60 years of operation on reactor vessel underclad crack growth and reactor vessel integrity. The pressurized-thermal-shock portion of the analysis applies to three-loop Westinghouse plants. Since NAS and SPS are three-loop plants, the staff considers the analysis applicable to NAS and SPS. The staff's October 15, 2001, safety evaluation of WCAP-15338 identified two renewal applicant action items to be addressed in the plant-specific license renewal application when incorporating the WCAP-15338 report in a renewal application. The first renewal action item requires the license renewal applicant to verify that its plant is bounded by the WCAP-15338 report (e.g., to verify that the number of design cycles and transients assumed in WCAP-15338 bounds 60 years of operation of the three-loop plant). The applicant indicated that the plant-specific design transients are bounded by the representative set used in the WCAP-15338 evaluation. The second renewal action item requires that the license renewal applicant referencing WCAP-15338 for RPV components provide a summary description of the TLAA evaluation in the FSAR supplement. The applicant's July, 25, 2002, response, provided a revised UFSAR supplements for NAS and SPS which referenced WCAP-15338. The staff found the applicant's TLAA evaluation of underclad cracking acceptable in accordance with the requirements of 10 CFR 54.21(c)(1).

4.3.3 FSAR Supplement

The applicant's FSAR supplement for metal fatigue is provided in Section A3.2 of each LRA. The applicant describes the TLAA evaluations and the TCCP. Open item 4.3-2 indicated that the applicant should update the FSAR supplement to provide a more detailed discussion of its proposed program to address environmental fatigue effects. The applicant provided a discussion of its evaluation of its evaluation of environmentally assisted fatigue in Section 18.3.2.4 of the revised UFSAR supplements for NAS and SPS. The applicant's revised UFSAR supplements for NAS and SPS contains a discussion of the proposed approach to manage environmentally assisted fatigue for the surge line hot-leg pipe connection and the safety injection and charging nozzles. As discussed in Section 4.2.2 of this SER, additional inspection is one of the alternative methods proposed for addressing environmental fatigue of the surge line hot-leg connection, safety injection, and charging nozzles. The applicant provided a further discussion of its proposed augmented inspection plan for the pressurizer surge line hot-leg nozzle in Section 18.2.1 of the revised UFSAR supplements for NAS and SPS. If the applicant selects the inspection option to manage environmentally assisted fatigue, the inspection details must be submitted to the staff prior to the period of extended operation and the method must be accepted by the staff. The applicant indicated that the inspection details regarding scope, frequency, qualifications, methods, etc., will be submitted to the NRC. On the basis of the applicant's revised UFSAR supplement, as clarified above, the staff considers this part of open item 4.3-2 closed.

The applicant provided a summary description of the reactor vessel underclad cracking TLAA in Section A3.2.2 of the UFSAR supplement. The summary description did not reference WCAP-15338. Open item 4.3-2 also indicated that the applicant should include a reference to the WCAP-15338 evaluation in the UFSAR description to provide the technical basis for the TLAA evaluation. The applicant included the reference to WCAP-15338 in its updated UFSAR supplement for both NAS and SPS. Therefore, this part of open item 4.3-2 is closed.

On the basis of its review of the Section 18.3.2 of the revised UFSAR supplements for NAS and SPS, the staff concludes that the UFSAR supplements contain a summary description of the evaluation of time-limited aging analysis as required by 10 CFR 54.21(d).

4.3.4 Conclusions

On the basis of its evaluations of NAS and SPS components, the applicant concluded that the fatigue analysis of RCS components and B31.1 piping remains valid for the period of extended operation. In addition, the applicant has projected the reactor vessel underclad cracking analysis to a 60-year period of operation. The applicant also has a TCCP to maintain a record of the transients used in the fatigue analyses of RCS components, and that process will continue during the period of extended operation. The staff concludes the applicant's actions and commitments satisfy the requirements of 10 CFR 54.21(c)(1).

4.4 Environmental Qualification of Electric Equipment

The NAS 1/2 and SPS 1/2, 10 CFR 50.49 Environmental Qualification (EQ) Program, has been identified as a time-limited aging analysis (TLAA) for the purpose of license renewal. The EQ Program is applicable to the following equipment:

- safety-related electrical and electronic equipment that is relied on to remain functional during and following a design basis accident
- non-safety-related electric equipment whose failure under postulated environmental conditions could impede a safety function
- certain necessary post-accident monitoring equipment

The staff has reviewed NAS and SPS LRA Section 4.4, "Environmental Qualification of Electric Equipment," to determine whether the applicant has demonstrated compliance with the requirement for TLAAs set forth in 10 CFR 54.21(c)(i) for environmentally qualified SCs. The staff also reviewed the following EQ guidance documents, as applicable: RG 1.97, "Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident," Rev. 3, Information and Enforcement Bulletin (IEB) 79-01B, "Environmental Qualification of Class 1E Equipment," and NUREG-0588 (Category II), "Interim Staff Position on Environmental Qualification of Safety-Related Electrical Equipment."

4.4.1 Summary of Technical Information in the Application

In Section 4.4 of each LRA, the applicant describes its TLAA evaluation for EQ components. In this description the applicant states that the TLAAs for EQ components were evaluated in accordance with 10 CFR 54.21(c)(1), Option iii. The applicant credits its EQ Program, as described in each LRA, Appendix B, Section B3.1, to meet the demonstration required by Option iii. Therefore, the applicant is required to demonstrate that the effects of aging on the intended functions of EQ components will be adequately managed for the period of extended operation through analysis, testing, refurbishment, or replacement.

In accordance with 10 CFR 50.49, aging analyses were developed to establish the qualified life of the EQ equipment. In each LRA, Section 4.4, the applicant concludes that the aging analyses that are based on, or developed for, the current operating term (typically 40 years) or longer are considered to be TLAAs for the purpose of license renewal. Equipment with a qualified life of less than the current operating term is not within the scope of license renewal for the purpose of TLAAs in accordance with the definition of TLAA in 10 CFR 54.3(a)(3),

In Section 4.4 of each LRA, the applicant states that the EQ equipment is identified in the Equipment Qualification Master List (EQML). This list also establishes the "equipment end-of-life date" and references the applicable qualification documentation review (QDR). The QDR contains pertinent information on qualified life and applicable environmental parameters.

Between the two applications, the applicant identified 68 component groups from the EQML that have a qualified life based on the current operating term or longer and that need to be considered under 10 CFR 54.21(c)(1).

The applicant also identifies the following corporate technical standards that are used in the implementation of its EQ Program:

- personnel responsibilities
- program methodology
- eq program maintenance
- environmental zone descriptions
- environmental qualification master list
- qualification document reviews

In addition, the applicant states that its EQ Program covers procurement, design changes, upgrades and repairs, plant operating changes, basis calculations, temperature, radiation, ventilation, industry operating experience, and document control.

The applicant states that the environmental qualification calculations (for the 50 component groups that meet the definition of a TLAA) are the technical rationale for determining the current licensing basis as it applies to the current operating term. The applicant also states that the environmental qualification calculations will be used to determine the qualification of the EQ components for the period of extended operation. When aging analysis cannot demonstrate a qualified life into the period of extended operation through reevaluation, the component and/or part will be replaced before it exceeds its qualified life in accordance with the EQ Program.

The applicant describes its process for reevaluating the qualified life of EQ equipment using the environmental service conditions that are applicable to the equipment. The environmental service conditions are divided into normal and accident service conditions. Section 50.49 of 10 CFR requires that all significant aging effects from normal service conditions be considered. This would include the expected thermal aging effects from normal temperature exposure, any radiation effects during normal plant operation, and mechanical cycle aging as applicable. Section 50.49 of 10 CFR also requires evaluation of the effects of any harsh environments the equipment could be exposed to under accident conditions.

The description provided by the applicant of its reevaluation of normal service conditions is as follows:

- <u>Thermal-Aging Considerations</u> - The specific analyses for thermal aging were reviewed by the applicant to confirm that the existing calculations would remain valid or could be projected to encompass the extended period of operation. Under a plant modification some components were installed which will not experience 60 years of thermal aging by the end of the period of extended operation.
- <u>Radiation Considerations</u> - The total integrated dose (TID), or bounding dose, for the 60-year period, was determined by adding the accident dose to the newly determined 60-year normal dose for the device. The normal dose for the extended period of operation (60 years) was obtained by multiplying the current 40-year normal operating dose by 1.5 (i.e., 60 years/40 years =1.5). The TID was compared to the qualification level to provide reasonable assurance that the required TID would be met or enveloped.

  If the TID calculated by this method is higher than the qualification value, the component group or part will be assessed prior to the end-of-life date.

- Mechanical-Cycle Considerations - The applicant made an assumption that the normal cycles for the period of extended operation would be 1.5 times (i.e., 60 years/40 years = 1.5) the established cycles for the 40-year period. If the number of cycles by this method is higher than the qualification value, the component group or part will be assessed by the applicant prior to its end-of-life date as per the EQ Program requirements.

In summary, under the EQ Program, the Qualification Documentation Review (QDR) or the reevaluation of the qualified life of EQ equipment will be used to demonstrate that the effects of aging on the intended functions will be adequately managed for the period of extended operation on the basis of the qualification levels of each aging category (i.e., thermal, radiation, and mechanical cycles). When aging analysis cannot justify a qualified life into the period of extended operation, then the refurbished component and/or part will be replaced prior to exceeding its qualified life in accordance with the EQ Program.

4.4.2 Staff Evaluation

In accordance with 10 CFR 54.29, the staff has reviewed the NAS and SPS LRAs, Section 4.4, “Environmental Qualification of Electric Equipment,” and Appendix B, Section B3.1, “Environmental Qualification Program,” to determine whether the applicant had demonstrated compliance with the requirement set forth in 10 CFR 54.21(c)(i) for EQ components. The staff also reviewed the following EQ guidance documents (as applicable): RG1.97, “Instrumentation for Light-Water-Cooled Nuclear Power Plants To Assess Plant and Environs Conditions During and Following an Accident,” Rev. 3, Information and Enforcement Bulletin (IEB) 79-01B, “Environmental Qualification of Class 1E Equipment,” NUREG-0588 (Category II), “Interim Staff Position on Environmental Qualification of Safety-related Electrical Equipment,” and the NRC guidance for addressing GSI-168 for license renewal as contained in a letter to NEI dated June 2, 1998.

In each LRA, Section 4.4, the applicant states that the EQ equipment is identified in the Equipment Qualification Master List (EQML), which also contains the end-of-life date for each component. Between the two applications, the applicant identified 68 component groups from the EQML that have a qualified life based on the current operating term or longer and that need to be considered under 10 CFR 54.21(c)(1). Equipments with a qualified life of less than the current operating term were not within the scope of this analysis. A list of EQ equipment, such as the EQML, is required under 10 CFR 50.49(d), along with the related information described by the applicant in Section 4.4 of each LRA. This list has been verified by the staff during inspection activities to establish compliance with 10 CFR 50.49 and, therefore, is accepted for the purpose of this review. The applicant’s determination to include all EQ equipment whose qualified life is based on the current operating term or longer (and to exclude equipment with a shorter qualified life) is consistent with 10 CFR 54.21(c)(1) and the definition of a TLAA as defined under 10 CFR 54.3. The staff reviewed the list of components and the requirements cited above, and did not identify any omission in the scope of EQ equipment selected by the applicant in accordance with 10 CFR 54.21(c)(1).

The applicant chooses to demonstrate that the effects of aging on the intended functions of EQ components will be adequately managed for the period of extended operation consistent with 10 CFR 54.21(c)(1), Option iii, and credits its EQ Program, as described in each LRA, Appendix B, Section B3.1, as a means of fulfilling this requirement. Option iii is allowed under

10 CFR 54.21(c)(1) and is therefore acceptable to the staff. The staff's review and evaluation of the overall aging management program elements of the EQ Program is provided in Section 3.3.3.1 of this SER. The rest of this SER section documents the staff's review and evaluation of the applicant's reevaluation methodology of the qualified life for EQ components that are in the scope of this TLAA, the predominant approach expected to be used by the applicant.

In a letter to the NRC dated November 30, 2001, the applicant described its reevaluation approach. The applicant states that conservatism may exist in aging evaluation parameters (such as the assumed ambient temperature of the component or an unrealistically low activation energy) or in the operating parameters of a component (e.g., deenergized versus energized). The reevaluation of an aging analysis to extend the qualified life of a component normally reduces the excess conservatism incorporated in the prior evaluation or demonstrates that the existing qualification parameters envelop the requirements for the period of extended operation. As part of the applicant's EQ Program, reevaluation of an aging analysis to extend the qualified life of a component is performed in accordance with 10 CFR 50.49(e). While a life-limiting component condition may be due to thermal, radiation, and/or mechanical: cycle aging; the vast majority of life-limiting conditions for EQ components are based, at least in part, on thermal conditions.

In addition, the applicant states that the reevaluation of an aging analysis is documented in accordance with its Quality Assurance Program, which requires verification of assumptions and conclusions. Important attributes of a reanalysis include analytical methods, data collection and reduction methods, underlying assumptions, acceptance criteria, and corrective actions (if acceptance criteria are not met). These attributes are discussed in the following paragraphs.

<u>Analytical Methods</u> The applicant states that its reevaluation of aging analysis for the purpose of license renewal uses the same analytical models used in determining its CLB under 10 CFR 50.49. The Arrhenius methodology is the thermal model accepted by the staff for performing its current thermal aging analyses. The analytical method used by the applicant for radiation aging analysis demonstrates qualification for the total integrated dose; that is, the normal radiation dose for the projected installed life plus the accident radiation dose. The staff accepted this approach for the current operating term of 40 years. For license renewal the applicant stated that it would be establishing the 60-year normal radiation dose by multiplying the 40-year dose by 1.5 (60 years/40 years = 1.5). The 60-year normal radiation dose will be added to the accident radiation dose to obtain the total integrated dose for each applicable component. A similar approach will be used for cyclical aging. The staff determined that the applicant's approach for thermal, radiation, and cyclical aging to be consistent with the NAS and SPS CLB, and can be effective in determining the added aging for the period of extended operation

<u>Data Collection and Reduction Methods</u> - The applicant states that reduction of excess conservatism in component service conditions (e.g., temperature, radiation, cycles) that was used in its prior aging analyses is the primary method that will be used for re-evaluating the qualified life for the period of extended operation, and will be implemented based on its EQ Program procedures. Temperature used in an aging evaluation should be conservative, and based on plant design and actual plant temperature data. Plant temperature data may be used in an aging evaluation:

- to determine the temperature service condition and directly apply the plant temperature data in an aging evaluation or

- to demonstrate conservatism when using the plant design temperature for an evaluation

Changes to material activation energy values as part of a reevaluation are to be justified on a component/materials-specific basis. Similar methods of reducing excess conservatism in the component service conditions used in prior aging evaluations can be used for radiation and cyclical aging.

The staff reviewed the applicant's data collection approach and found it to be conservative and bounding. The applicant used a good cross-section of plant environments over a 60-year period allowing for a cross-section of ambient conditions. The elimination of excessive conservatism is consistent with 10 CFR 50.49 and industry practices. In addition, the reduction method described by the applicant is also consistent with industry practices and, therefore, is acceptable to the staff. The staff also agrees changes to material activation energy values need to be determined on a component/material-specific basis.

Underlying Assumptions - The applicant states that EQ component aging evaluations contain sufficient conservatism to account for most environmental changes occurring due to plant modifications and events. When unexpected adverse conditions are identified during operational or maintenance activities that affect the normal operating environment of a qualified component, the affected EQ component is evaluated and appropriate corrective actions are taken, which may include changes to the qualification bases and conclusions. These events, and the applicant's evaluation and corrective actions, are typically reviewed by the staff and, therefore, are acceptable for the purpose of license renewal.

Acceptance Criteria and Corrective Action - The applicant states that under its EQ Program, the reevaluation of an aging analysis could extend the qualification of a component. If the qualified life of a component cannot be extended by reevaluation, the component must be refurbished, replaced, or requalified by testing before exceeding the period for which the current qualification remains valid. Reevaluations must be performed in a timely manner; that is, the reevaluation must be completed with sufficient time available to refurbish, replace, or requalify the component prior to exceeding its qualified life if the reevaluation is unsuccessful.

4.4.3 Conclusion

On the basis of the review described above, the staff has determined that there is reasonable assurance that the applicant has adequately identified the TLAA for the EQ components as defined in 10 CFR 54.3. On the same basis and on the basis of the staff's review of the EQ Program, as documented in Section 3.3.3.1 of this SER the staff finds that the applicant has demonstrated, with reasonable assurance, that the effects of aging on the intended functions of these components will be adequately managed for the period of extended operation.

4.5 Containment tendon Loss of Prestress

Not applicable to North Anna or Surry plants. The NAS 1/2 and SPS 1/2 containments utilize a reinforced concrete design without the use of prestressed tendons. Therefore, loss of prestress is not applicable for the containments.

4.6 Containment Liner Plate

The applicant described its evaluation of the containment liner plate, metal containment, and penetration fatigue analyses in Section 4.6 of each LRA. The staff reviewed this section of each LRA to determine whether the applicant had evaluated the TLAAs in accordance with 10 CFR 54.21(c).

4.6.1 Summary of Technical Information in the Application

The applicant indicated that fatigue of the liner plate was evaluated in accordance with paragraph N-415 of Section III of the ASME Code, 1968 edition. The fatigue design of the containment liner plate for both stations was based on the following load conditions:

- 1,000 cycles of operating-pressure variations
- 4,000 cycles of operating-temperature variations
- 20 design basis earthquake cycles

Although the applicant indicated that the number of anticipated thermal and pressure variations expected during the 40-year design life of the plant is much less than the number assumed in the design, the applicant multiplied the existing design cycles by a factor of 1.5 to evaluate the containment liner plate for the period of extended operation. The applicant further indicated that the evaluation included the effects of containment Type A pressure tests. The applicant indicated that the revised containment liner fatigue analysis is projected to remain valid for the period of extended operation, in accordance with 54.21(c)(1)(ii).

The applicant indicated that there are no TLAAs for containment penetrations. The applicant further indicated that the penetrations were designed for a one-time load due to collapse of the connecting piping. The applicant also indicated that each unit has a concrete containment with a metal liner and, therefore, metal containment fatigue analysis is not applicable to NAS or SPS.

4.6.2 Staff Evaluation

The design of the SPS liner plate and penetrations is described in Section 15.5.1.8 of the SPS UFSAR. The UFSAR indicates that the SPS containment liner is designed for 1,000 cycles of operating-pressure variations, 4,000 cycles of operating-temperature variations, and 20 design basis earthquakes, all simultaneously applied. The design of the NAS linear plate and penetrations is described in Section 3.8.2 of the NAS UFSAR. Table 3.8-7 indicates that the NAS containment liner is designed to 100 cycles of operating-pressure variations, 400 cycles of operating-temperature variations, and 20 design basis earthquake cycles. The applicant indicated that the number of temperature and pressure variations at NAS is expected to be less than these values for 40 years of plant operation. However, the staff notes that the NAS LRA states that the liner plate is designed for 1,000 cycles of operating-pressure variations, 4,000 cycles of temperature variation, and 20 design basis earthquakes, all simultaneously applied. In open item 4.6-1, the staff requested that the applicant resolve the discrepancy in the NAS design. The applicant's July 25, 2002, response to open item 4.6-1 indicated that the same number of cycles was used for the design of the NAS and SPS liner plates as stated in the LRA. The applicant explained that cycles listed in Table 3.8-7 of the NAS UFSAR were anticipated cycles and not design cycles. The applicant indicated that a revision of NAS

UFSAR Table 3.8-7 would be implemented to clarify the number of cycles used in the design of the liner plate. The applicant's clarification resolves the open item 4.6-1.

The applicant has evaluated both the NAS and SPS containment liner plates using a conservative estimate of the number of expected pressure and temperature cycles for the period of extended operation. This estimate includes 1500 cycles of operating-pressure variations, 6000 cycles of operating-temperature variations, and 30 design basis earthquake cycles. On the basis of its previous license renewal reviews, the staff agrees that the applicant has performed a conservative evaluation of the number of design cycles for the period of extended operation. The staff found the applicant's TLAA for the containment liner plate acceptable in accordance with the requirements of 10 CFR 54.21(c)(1).

4.6.3 FSAR Supplement

The applicant's FSAR supplement, provided in Section A3.4 of each LRA, did not indicate that a fatigue evaluation assuming 1.5 times the number of design cycles was used to demonstrate that the fatigue evaluation of the liner plate remained valid for the period of extended operation. In open item 4.6-2, the staff requested that the applicant revise the FSAR supplement to describe the TLAA evaluation of the containment liner plate, including the number of design cycles used for the evaluation of each facility. The applicant provided a discussion of the TLAA performed for the containment liner plate, including the number of cycles used for the evaluation of each facility, in Section 18.3.4 of the revised UFSAR supplements for NAS and SPS. The applicant's revised UFSAR supplements resolves open item 4.6-2.

On the basis of its review of the Section 18.3.4 of the revised UFSAR supplements for NAS and SPS, the staff concludes that the UFSAR supplements contain a summary description of the evaluation of time-limited aging analysis as required by 10 CFR 54.21(d).

4.6.4 Conclusions

The staff concludes the applicant's evaluation of the containment liner plate satisfies the requirements of 10 CFR 54.21(c)(1).

4.7 Other Time-limited Aging Analyses

The applicant described its evaluation of the Crane Load Cycle, RCP Flywheel, Leak-before-Break, Spent Fuel Pool Liner, Pipe Subsurface Indications, and RCP Code Case N-481 in Section 4.7 of each LRA. The staff reviewed this section of each LRA to determine whether the applicant had evaluated the TLAAs in accordance with 10 CFR 54.21(c).

4.7.1 Crane Load Cyclic Limit

The applicant described its evaluation of crane cyclic load limits in Section 4.7.1. The staff reviewed this section of each LRA to determine whether the applicant had evaluated the TLAAs in accordance with the requirements of 10 CFR 54.21(c)(1).

4.7.1.1 Summary of Technical Information in the Application

The applicant indicated that the following cranes are included in the scope of license renewal:

- containment polar cranes
- containment annulus monorails
- fuel handling bridge crane
- spent fuel crane
- auxiliary building monorails
- containment jib cranes for SPS

The applicant indicates that NUREG-0612 requires that the design of heavy load-handling systems meet the intent of Crane Manufacturers Association of America, Inc. (CMAA) Specification #70. The applicant identified the crane load cycle provided in CMAA-70 as a TLAA. The applicant indicated that the number of operating crane loads is not expected to exceed the number of design cycles and, therefore, the crane design will remain valid for the period of extended operation, in accordance with the requirements of 10 CFR 54.21(c)(1)(i).

4.7.1.2 Staff Evaluation

The applicant indicated that, based on CMAA-70, the most limiting number of loading cycles is 100,000. The applicant further indicated that the most frequently used cranes are the spent fuel cranes. The applicant estimated that the spent fuel cranes will make no more than 50,000 lifts in a 60-year period and, therefore, the number of operating load cycles will not exceed the number of cycles assumed in the design. The staff found the applicant’s evaluation acceptable in accordance with the requirements of 10 CFR 54.21(c)(1).

4.7.1.3 FSAR Supplement

The applicant described its evaluation of crane cyclic load limits in Section A3.5.1 of each LRA. The applicant indicates that the number of crane operating load cycles will not exceed the number of cycles assumed in the design and, therefore, the analyses of the NAS and SPS crane design remain valid for the period of extended operation. The staff concludes the applicant’s FSAR supplement summary description of the crane evaluation is adequate.

4.7.1.4 Conclusions

The staff concludes the applicant's evaluation satisfies the requirements of 10 CFR 54.21(c)(1).

4.7.2 Reactor Coolant Pump Flywheel

The applicant evaluates the TLAA relating to the reactor coolant pump flywheel in Section 4.7.2 of the LRA.

4.7.2.1 Summary of Technical Information in the Application

During normal operation, the reactor coolant pump flywheel possesses sufficient kinetic energy to potentially produce high-energy missiles in the unlikely event of failure. Conditions that may result in overspeed of the reactor coolant pump increase both the potential for failure and the increased kinetic energy. The aging effect of concern is fatigue crack initiation in the flywheel bore keyway. An evaluation of a failure over the period of extended operation was performed by the applicant. The evaluation demonstrated that the flywheel design has a high structural reliability with a very high flaw tolerance and negligible flaw crack growth over a 60-year service life.

4.7.2.2 Staff Evaluation

On July 1, 1999, the NRC staff approved the application of WCAP-14535A, "Topical Report on Reactor Coolant Pump Flywheel Inspection Elimination," to the Surry reactor coolant pump (RCP) flywheels and a revision of the Surry technical specifications (TSs) to adopt a 10-year inspection interval for the flywheels. A similar application for the North Anna Units was approved on April 22, 1998. During the staff review, the applicant informed the staff that the 10-year inspection intervals for reactor coolant pump flywheels were currently in the applicant's augmented inspection program and would be carried forward to the extended period of operation. Since the analysis of WCAP-14535A is for 60 years of operation and an appropriate inspection plan is in place, the staff determined that the applicant has demonstrated the structural integrity of the RCP flywheels for the period of extended operation.

4.7.2.3 Conclusions

The staff concludes that the applicant has provided an acceptable TLAA regarding the RCP flywheel and meets 10 CFR 54.21 (c)(1)(ii).

4.7.3 Leak-Before-Break

The applicant's leak-before-break (LBB) analysis is provided in Section 4.7.3 of the LRA.

4.7.3.1 Summary of Technical Information in the Application

Westinghouse tested and analyzed crack growth with the goal of eliminating reactor coolant system primary loop pipe breaks from plant design bases. The objective of the investigation was to determine whether a postulated crack causing a leak, will grow to become unstable and lead to a full circumferential break when subjected to the worst possible combinations of plant loading.

The evaluation showed that double-ended breaks of reactor coolant pipes are not credible, and as a result, large LOCA loads on primary system components will not occur. The applicant stated that the overall conclusion of the evaluation was, that, with the worst combination of plant loading, including the effects of safe-shutdown-earthquake, the crack will not propagate around the circumference and cause a guillotine break. The plant has leakage detection systems that can identify a crack with margin, and provide adequate warning before the crack can grow.

4.7.3.2 Staff Evaluation

The applicant confirmed that the lines that had been approved by the staff for the WCAP-14535A leak-before-break (LBB) application were the primary-loop piping for both NAS 1/2 and SPS 1/2, and the bypass line for the NAS 1/2. Since the material for the North Anna bypass line is forged stainless steel, which is not subjected to thermal aging, it is not a TLAA. The previously approved Surry and North Anna LBB applications for the primary loop considered design transients and cycles for 40 years of operation. However, only the approved North Anna application considered the thermal aging effect for the cast austenitic stainless steel pipe components. To address the LBB in the context of the TLAA, the applicant performed revised LBB analyses for a 60-year plant life for the Surry and North Anna units considering the thermal aging effect for cast austenitic stainless steel pipe components, and concluded that the revised LBB analyses are valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii). The staff agrees with the applicant's conclusion for the Surry units because an appropriate analysis has been performed with acceptable results and the Surry primary-loop piping does not have welds fabricated from Alloy 82/182 weld material.

Due to the Summer main coolant loop weld cracking event involving Alloy 82/182 weld material, the staff now considers the effect of primary water stress corrosion cracking (PWSCC) on Alloy 82/182 piping welds in all LBB evaluations. For the North Anna units, only the steam generator primary-nozzles-to-safe-end welds in the primary-loop piping contain Alloy 82/182 weld material. In its response to the staff's RAI, the licensee proposed to include the following statement in Section A3.5.3 of the UFSAR Supplement: "The steam generator primary-nozzles-to-safe-end welds in the primary loop piping that have been analyzed for LBB are the only components fabricated with Alloy 82/182-weld material for NAPS 1 and 2. Dominion will continue to participate in the ongoing NRC/industry program on Alloy 82/182-weld material and will implement the findings/resolution from this effort, as appropriate." Because of this commitment and the information submitted in the draft MRP Report, "PWR Materials Reliability Program Interim Alloy 600 Safety Assessment for U.S. PWR Plants", Part 1, the staff accepts the revised LBB application for the North Anna primary-loop piping. However, the staff is continuing to review the generic implications of PWSCC on existing LBB approvals. The staff may consider the need for additional licensee action/analysis, as appropriate, to ensure that the underlying basis for the approval of LBB for the North Anna and Surry piping systems remains valid. If the staff concludes that such additional licensee action/analysis is required, this issue will constitute a generic issue, not an issue specific to the North Anna and Surry LRAs.

A detailed discussion of how the applicant is addressing the event at the V.C. Summer plant with respect to its inservice inspection program is provided in Section 3.3.1.11, "ISI Program - Component and Component Support Inspections," of this SER.

4.7.3.3 Conclusions

The staff concludes that the applicant has provided an acceptable TLAA regarding LBB and meets 10 CFR 54.21(c)(i)(ii).

4.7.4 Spent Fuel Pool Liner

4.7.4.1 Summary of Technical Information in the Application

In Section 4.7.4 of the LRA, the applicant describes the time-limited fatigue analysis related to the spent fuel pool liners for the two plants as follows:

> The spent fuel pool liner located in the Fuel Building is needed to prevent a leak to the environment. A design calculation has been identified which documents that the spent fuel pool design meets the general industry criteria. The calculation includes a fatigue analysis to add a further degree of confidence.
>
> The normal thermal cycles occur at each refueling, resulting in 80 cycles for both units in 60 years. Total number of thermal cycles is expected to be 90, which includes normal, upset, emergency, and faulted conditions.

For NAS and SPS, the calculations show that the allowable thermal cycles for spent fuel pool liner for the most severe thermal condition, which includes a loss of cooling, is 100 and 95, respectively.

Based on the above, the applicant concludes that the existing calculations remain valid for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(i).

4.7.4.2 Staff Evaluation

The bulk temperature of the water in the spent fuel pool would vary depending upon the number and the age of the fuel assemblies stored in the spent fuel pool. In order to understand clearly the time-limited thermal fatigue analysis, the staff requested additional information related to the temperature ranges and number of cycles assumed in the analyses.

By letter dated January 16, 2002, the applicant responded to the staff's RAIs. The applicant provided a table describing various design conditions, expected number of cycles, and associated temperature ranges as follows:

CONDITIONS	DESCRIPTION	DESIGN CYCLES	TEMPERATURE RANGE
Condition 1 (Normal)	1/3 Core Initial Load	1	70°F - 121°F
Condition 2 (Normal)	1/3 Core Refuel with 10 years fuel in the pool	80	70°F - 135°F
Condition 3 Upset	1 core offload - 45 days after refueling abnormal condition	8	70°F - 170°F

CONDITIONS	DESCRIPTION	DESIGN CYCLES	TEMPERATURE RANGE
Condition 4 Faulted	Faulted condition	1	70°F - 212°F

The staff notes that in condition 3, the maximum temperature of the spent fuel pool concrete is likely to go above the acceptable limit of 150° F. However, considering that this is an abnormal condition, and that the spent fuel pool concrete can withstand such temperature without significantly affecting the concrete properties, the expected eight cycles in the lifetime of the plant is acceptable.

The staff also requested information related to the anchorages to the concrete walls. RAI 4.7.4-3 asks, "As the stainless steel spent fuel pool liner is attached to the concrete walls and floors, the effects of thermal cycling is on the anchorages of the liner to the concrete. Provide information that would explain how the TLAA account for these effects." The applicant's January 16, 2002 letter provided the following response:

> The NAPS pool liner was designed in accordance with the design criteria provided in the ASME Boiler and Pressure Vessel Code, Section III, Division 1 - 1974 edition; Nuclear Power Plant Components, Subsection NA (with addenda up to Summer 1976). The SPS pool liner was designed in accordance with the design criteria provided in the ASME Boiler and Pressure Vessel Code, Section III, Division 1 - 1971 edition. The following procedure was used in the existing calculations to qualify the fuel pool liner.
>
> Procedure:
>
> 1. Membrane plus bending stresses caused by differential thermal expansion was calculated using linear elastic methods of analysis.
>
> 2. If one of the following two conditions were met, the liner was considered to be acceptable.
>
>   - If stresses calculated at points, which are not welds or points of stress concentrations, the calculated stresses should be less than $3S_m$
>
>   - If stresses calculated at points, which are welds or points of stress concentrations, the calculated stresses should be less than $0.75S_m$. (Note: The limit of $0.75S_m$ results in a stress concentration factor of 4.0.)
>
> 3. If the calculated stresses exceed either $3S_m$ or $0.75S_m$ as identified in 2, then the liner is evaluated on the basis of fatigue life. The liner integrity was assessed in accordance with the cyclic loading design procedure, Paragraph XIV- 1221.3, Pages 336 and 337 of Section III. Stresses to determine the fatigue life was calculated as follows
>
>   - Stress concentration factor of 1.0 was used for points, which are not welds or points of stress concentrations.

- Stress concentration factor of 4.0 was used for points, which are welds or points of stress concentrations.

4. Appropriate design stress intensity values from Section III were used.

5. The applicable design fatigue curve from Section III was used.

For the locations with welds or stress concentrations, a factor of 4 has been used. The most limiting condition is that the concrete structure is deformed to its maximum permissible limit and is at room temperature. The liner design calculations show that the allowable cycles for the liner reaching 212°F are 100 for North Anna and 95 for Surry. This number of allowable cycles exceeds the total number of expected operating cycles (90) as identified in Section 4.7.4 of the application. Furthermore, the temperature of the fuel pool is expected to be below 135°F under normal conditions. Since the operating temperature is low, effects of sustained high temperature is not a concern.

The welding at the Surry anchorages has been analyzed for fatigue usage factor using the operating cycles listed above. It was found to be 0.578, which is less than the allowable value of 1.0. No additional analysis has been performed for North Anna, since the SPS liner is the most limiting."

Based on the procedure used for evaluating the effects of thermal fatigue cycles on the liner anchorages during the extended period of operation, the staff finds the approach reasonable and acceptable.

4.7.4.3 Conclusion

Based on the additional information provided, the staff concludes that the TLAA performed by the applicant to address the effects of thermal cycling on the spent fuel pool liners at NAS and SPS provides a reasonable assurance that the spent fuel pool liners will be able to safely withstand the thermal cyclic loads that could occur during the period of extended operation. Therefore, the TLAA is acceptable pursuant to 10 CFR 54.21(c)(1)(i).

4.7.5 Piping Subsurface Indications

Flaws in ASME Class 1 components that exceed the size of allowable flaws defined in ASME Code, Section XI, IWB-3500 need not be repaired if they are analytically evaluated to the criteria in IWB-3600 of the ASME Code. The analytic evaluation requires the licensee to project the amount of flaw growth due to fatigue and stress corrosion mechanisms, or both, where applicable, during a specified evaluation period. The applicant identified the evaluation of piping subsurface indications as a TLAA. The staff reviewed this section of both LRAs to determine whether the applicant has evaluated the TLAAs in accordance with the requirements of 10 CFR 54.21(c)(1).

4.7.5.1 Summary of Technical Information in the Application

In section 4.7.5 of both LRAs, the applicant indicated that calculations were identified at both NAS and SPS that addressed piping subsurface indications detected during inspections performed in accordance with ASME Section XI. The applicant indicated that the calculations determined the number of thermal cycles required for the flaws to reach an unacceptable size. The applicant indicated that the number of thermal cycles expected for sixty years of plant operation does not exceed the number required for these flaws to reach an unacceptable size and, therefore, the analyses remain valid for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(i).

4.7.5.2 Staff Evaluation

The applicant's evaluation indicates that the number of thermal cycles required for the flaws to reach an unacceptable size exceeds the number of thermal cycles predicted for the 60-years of plant operation. Therefore, the staff concludes the analyses remain valid for the extended period of operation in accordance with 10 CFR 54.21(c)(1)(i).

4.7.5.3 FSAR Supplement

The applicant described its evaluation of subsurface indications in Section A3.5.5 of both LRAs. The applicant indicated that the number of cycles required for the flaws to reach an unacceptable size exceeds the number of cycles predicted for 60-years of plant operation. The staff concludes that the summary description of the TLAA for piping subsurface indications is adequate.

4.7.5.3 Conclusions

The staff concludes the applicant's evaluation satisfies the requirements of 10 CFR 54.21(c)(1).

4.7.6 Reactor Coolant Pump-Code Case N-481

The applicant's analysis of reactor coolant pump Code Case N-481 is given in Section 4.7.6 of the LRA.

4.7.6.1 Summary of Technical Information in the Application

Section XI of the ASME Boiler and Pressure Vessel Code require periodic volumetric inspections of the welds for the primary loop pump casings of commercial nuclear power plants. These inspections require a large amount of time and resources to complete, and result in large radiation exposure. Since the pump casings are inspected prior to being placed in service, and no significant mechanisms exist for crack initiation and propagation, it has been concluded that the inservice volumetric inspection can be replaced with an acceptable alternate inspection. In recognition of this, ASME Code Case N-481, Alternative Examination Requirements for Cast Austenitic Pump Casings, provided an alternative to the volumetric inspection requirement. The code case allows the replacement of volumetric examinations of primary loop pump casings with fracture mechanics-based integrity evaluations (Item (d) of the code case) supplemented by specific visual examinations.

The applicant stated that Westinghouse performed the primary loop piping pump casings integrity analyses to the ASME Code Case N-481 requirements. It was concluded that the primary loop pump casings are in compliance with item (d) of ASME Code Case N-481.

TLAAs related to Code Case N-481 have been identified as thermal aging of cast austenitic stainless steel (CASS) and its consequence on fatigue crack growth. Comparisons of pump casing loads with the screening loads have been made. The stability of the flaws postulated in the primary loop pump casings has been established by evaluating the necessary material properties against the saturated (fully aged) fracture toughness values. Thus, the applicant stated that Code Case N-481 is satisfied for the period of extended operation.

4.7.6.2 Staff Evaluation

Components of the RCS were designed to codes that contained explicit criteria for fatigue analysis. Consequently, the applicant identified the fatigue analyses and the flaw growth evaluations of the RCS components for compliance with the provisions of 10 CFR 54.21(c)(1).

The Code Case N-481 flaw tolerance evaluation was reviewed by the applicant to determine if the evaluation is acceptable for the period of extended operation. A separate effort was carried out to evaluate the acceptability of a Code Case N-481 flaw growth analysis for the RCS pump casings for the period of extended operation, taking into consideration the effects of thermal aging on fracture toughness. This was done by performing an integrity analyses on the primary loop piping pump casings to the ASME Code Case N-481 requirements. The primary loop pump casings were found to be in compliance with Item (d) of ASME Code Case N-481. Code Case N-481 was approved by the staff in regulatory guide 1.147, revision 5. Therefore, the staff agrees that the flaw growth evaluation for pump casings is acceptable for the period of extended operation.

4.7.6.3 Conclusions

The staff concludes that the applicant has provided an acceptable TLAA regarding the use of NRC -approved Code Case N-481 and meets 10 CFR 54.21(c)(1)(ii).

5.0 Review by the Advisory Committee on Reactor Safeguards (ACRS)

The NRC staff issued its SER with open items related to the license renewal of the North Anna power station Units 1 and 2, and Surry power station Units 1 and 2 on June 6, 2002. On July 9, 2002, the NRC staff briefed the Advisory Committee on Reactor Safeguards (ACRS) subcommittee on plant license renewal on the SER with open items. Due to the small number of open items, the ACRS subcommittee did not issue an interim letter on its review of the SER with open items. The staff finalized and issued its SER related to the license renewal of the North Anna power station Units 1 and 2, and Surry power Units 1 and 2 on November 5, 2002.

During its 498th meeting on December 5-7, 2002, the ACRS full committee completed its review of the Dominion's license renewal applications and the NRC staff's safety evaluation report. The ACRS documented its findings in a letter to the Commission dated December 18, 2002. A copy of the ACRS full committee is attached.

December 18, 2002

The Honorable Richard A. Meserve
Chairman
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

SUBJECT: REPORT ON THE SAFETY ASPECTS OF THE LICENSE RENEWAL APPLICATIONS FOR THE NORTH ANNA POWER STATION UNITS 1 AND 2 AND THE SURRY POWER STATION UNITS 1 AND 2

Dear Chairman Meserve:

During the 498th meeting of the Advisory Committee on Reactor Safeguards, December 5-7, 2002, we completed our review of the License Renewal Application for North Anna Power Station (NAS) Units 1 and 2, the Surry Power Station (SPS) Units 1 and 2, and the final Safety Evaluation Report (SER) prepared by the staff of the U. S. Nuclear Regulatory Commission (NRC). Our review included a meeting of our Plant License Renewal Subcommittee on July 9, 2002. During our review, we had the benefit of discussions with representatives of the NRC staff and Virginia Electric and Power Company (Dominion). We also had the benefit of the documents referenced.

CONCLUSIONS AND RECOMMENDATIONS

1. The Dominion application for renewal of the operating licenses for NAS Units 1 and 2 and SPS Units 1 and 2 should be approved.

2. The programs instituted to manage aging-related degradation are appropriate and provide reasonable assurance that NAS Units 1 and 2 and SPS Units 1 and 2 can be operated in accordance with their current licensing bases for the period of extended operation without undue risk to the health and safety of the public.

BACKGROUND AND DISCUSSION

This report fulfills the requirement of 10 CFR 54.25 which states that the ACRS should review and report on license renewal applications. Dominion requested renewal of the operating licenses for NAS Units 1 and 2 and SPS Units 1 and 2 for a period of 20 years beyond the current license terms, which expire on April 1, 2018 (NAS Unit 1); August 21, 2020 (NAS Unit 2); May 25, 2012 (SPS Unit 1); and January 29, 2013 (SPS Unit 2). The final SER, issued on November 5, 2002, documents the results of the staff's review of information submitted by Dominion, including commitments that were necessary to resolve the open items identified by the staff in the initial SER. This review of the application was conducted concurrently for two stations with a total of four units. Given the similarity of the units and the formatting of the application, which clearly highlighted the few differences, the concurrent review did not present any unusual difficulties.

The staff reviewed the completeness of the identification of structures, systems, and components (SSCs) subject to aging management; the integrated plant assessment process; the applicant's identification of the possible aging mechanisms associated with passive, long-lived components; and the adequacy of the aging management programs. The staff also conducted three inspections. First, a 1-week inspection was performed to assess the applicant's scoping and screening methodology. Next a 1-week inspection was conducted at each facility to assess plant material condition and aging management programs. Lastly, an inspection was performed to close open items resulting from the earlier inspections.

The staff provided the Committee with details of the scope and results of its inspections of material condition at both plants. We agree with the staff's assessment that there are no issues that would preclude renewal of the operating license for NAS Units 1 and 2 and SPS Units 1 and 2.

On the basis of our review of the final SER, we agree that all open items and confirmatory items have been appropriately closed. We also discussed several items that were raised at the Subcommittee meeting on July 9, 2002, and found that the staff and the applicant have satisfactorily addressed each item.

The processes implemented by the applicant to identify SSCs that are within the scope of license renewal were effective. As with several previous applicants, the staff engaged in considerable discussion with the applicant regarding the portion of the offsite power system to be included within the scope of license renewal. After reviewing the information provided by the applicant, we agree that appropriate portions of the offsite power system are included in scope. During our review, we questioned why certain other SSCs were not included within the scope and, in all cases, the applicant provided appropriate justification for exclusion.

The applicant has performed a comprehensive aging management review of SSCs that are within the scope of license renewal. There are 19 existing aging management programs and four new programs.

The applicant has satisfactorily responded to NRC Bulletin 2002-01, "Reactor Pressure Vessel Head Degradation and Reactor Coolant Pressure Boundary Integrity," dated March 18, 2002. Further, the applicant has committed to replace all four reactor vessel heads. The replacement of the NAS Unit 2 head is currently in progress.

The applicant used the guidance specified in Westinghouse Owners Group reports for reactor coolant system piping, pressurizer, and reactor internals. The staff reviewed and approved the use of these reports with certain stipulations. Each stipulation was sufficiently addressed in the staff's review.

We questioned the method by which reactor coolant piping is to be inspected in light of the failure of the initial volumetric inservice inspection to detect vessel nozzle cracking at V.C. Summer. Although continued improvement in the inspection methodology is warranted, the staff considers current methods adequate to detect primary water stress corrosion cracking. This is a generic issue and we remain concerned with the effectiveness of inspection techniques. Dominion has committed to employ best industry practices as they are developed.

Dominion has also committed to conduct a one-time inspection of a representative sample of buried piping. Opportunistic inspections of in-scope buried piping will be performed when the piping is uncovered during other maintenance activities. If significant degradation is identified, the results will be entered into the licensee's corrective action program and the inspection will be expanded. If no opportunity presents itself by the end of the current license period, excavations will be made to inspect the piping.

The applicant's erosion/corrosion program is of particular interest in light of the previous carbon steel piping failures at SPS. Dominion uses the CHECWORKS program to identify locations to be monitored and trend erosion/corrosion rates. The program appears to be effective in managing erosion/corrosion.

Certain medium-voltage cables exposed to moisture for long periods of time fail due to a phenomenon called "water treeing." To preclude this failure, the applicant has committed to a program that will control water in manholes and underground ducts associated with energized power cables. The Cable Monitoring Activities Program for non-environmentally qualified cable has been enhanced to ensure that if degraded cable is identified, the cable environment, including the potential for moisture shall be evaluated and appropriate corrective actions initiated through the corrective action program.

During the discussion of time-limited aging analyses, we expressed a concern that the applicant had not submitted its evaluations of the reactor vessel margins for pressurized thermal shock and upper shelf energy. The staff had accepted the applicant's position that these values were acceptable without performing an independent evaluation. Subsequently, the staff obtained this information from the applicant and the staff performed an independent evaluation. Although in some cases the margins are small, we agree with the staff's position that margin does exist. We believe that in the future such critical parameters should be reviewed by the staff. The staff agreed to require that these data be provided with future license renewal applications.

In several situations, Dominion and other applicants have committed to actions based on future technology development. In Dominion's case, two examples are (1) the method for inspecting reactor coolant piping, and (2) the method for testing of medium-voltage cables exposed to moisture. The NRC staff needs to continue to keep abreast of these developing technologies and review and approve methodologies at the appropriate time.

License renewal applications include a number of activities and commitments, for example one-time inspections, that will not be accomplished until near the end of the current license period. There is a large amount of inspection activity that needs to be conducted at that time period. The staff is aware of this future work load and is working on a plan to properly manage this significant effort.

The applicant and the staff have identified plausible aging effects associated with passive, long lived components. Adequate programs have been established to manage the effects of aging so that NAS Units 1 and 2 and SPS Units 1 and 2 can be operated in accordance with their current licensing bases for the period of extended operation without undue risk to the health and safety of the public.

Sincerely,

/RA/

George E. Apostolakis
Chairman

References:

- U.S. Nuclear Regulatory Commission, "Safety Evaluation Report Related to the License Renewal of the North Anna Power Station, Units 1 and 2, and the Surry Nuclear Station, Units 1 and 2," issued November 2002.
- Dominion Application for Renewed Operating License for North Anna Power Station, Units, 1 and 2, and Surry Power Station, Units 1 and 2, submitted May 29, 2001.

6.0 Conclusions

The NRC staff reviewed Dominion's license renewal applications for North Anna, Units 1 and 2 and Surry, Units 1 and 2, in accordance with Commission's regulations and the NRC's draft Standard Review Plan (SRP) for the Review of License Renewal Applications for Nuclear Power Plants," dated August 2000. The SRP was revised and issued as NUREG-1800 in July 2001. The standards for renewing an operating license are set forth in 10 CFR 54.29.

On the basis of its review of the applications and evaluation, the staff has determined that the requirements of 10 CFR 54.29(a) have been met.

The NRC staff notes that the requirements of Subpart A of 10 CFR Part 51 are documented in NUREG-1437, Supplements 6 and 7, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants: Regrading Surry Power Station, Units 1 and 2" and "Generic Environmental Impact Statement for License Renewal of Nuclear Plants: Regrading North Anna Power Station, Units 1 and 2," dated November 2002.

Appendix A: Chronology

This appendix contains a chronological listing of routine licensing correspondence between the U.S. Nuclear Regulatory Commission (NRC) staff and Virginia Electric and Power Company (Dominion). This appendix also contains other correspondence regarding the NRC staff's review of the North Anna power station, Units 1 and 2, (under docket Nos. 50-338, 50-339), and Surry power station, Units 1 and 2 (under docket Nos. 50-280, and 50-281.)

May 29, 2001	In a letter (signed by D. Christian) Dominion submitted its applications to renew the operating licenses of North Anna and Surry power stations. In its submittal, Dominion provided one hard copy of the applications and 37 copies of applications on CDs. (ADAMS Accession Number: ML011500496)
May 29, 2001	In a letter (signed by D. Christian) Dominion submitted five sets of boundary drawings to the NRC. (ADAMS Accession Number: ML011500498)
July 3, 2001	In a letter (signed by D. Matthews) NRC informed Dominion that the NRC had received its applications to renew the operating licenses of North Anna and Surry power stations on May 29, 2001, and that Mr. Robert Prato was appointed as the project manager for the North Anna and Surry LRAs. (ADAMS Accession Number: ML011900065)
July 18, 2001	In a letter (signed by R. Prato) NRC issued a summary for the public meeting held on June 27, 2001. In this meeting, Dominion made a presentation to the NRC staff and members of the public regarding information contained In the North Anna and Surry LRAs. (ADAMS Accession Number: ML012000293)
July 23, 2001	In a letter (signed by C. Grimes) NRC published an "acceptance for docketing and opportunity for hearing" Federal Register Notice (FRN) as to North Anna and Surry LRAs. (ADAMS Accession Number: ML
July 30, 2001	In a letter (signed by D. Matthews) NRC informed Dominion that the NRC staff determined that the information contained In the North Anna and Surry LRAs submitted in May 29, 2001, was acceptable for docketing, and sufficient for the staff to begin its review. (ADAMS Accession Number: ML012120025)
August 8, 2001	In a letter (signed by R. Prato) the summary of a telecommunication between the staff and Dominion representatives was published and documented. The telecommunication was held on July 31, 2001, to clarify

information provided by Dominion in its LRAs Sections 2.5, 3.3.1, 3.3.6, and B2.1.1. (ADAMS Accession Number: ML012260187)

August 8, 2001	In a letter (signed by R. Prato) the NRC staff requested for additional information (RAIs) regarding Sections 2.5 and B2.1.1 of North Anna and Surry LRAs. (ADAMS Accession Number: ML012260171)
October 11, 2001	In a letter (signed by R. Prato) the NRC staff requested for additional information (RAIs) regarding Sections 3.1.1, 3.1.2, 3.5.1, 3.5.2, 3.5.3, 3.5.4, 4.4, B2.2.1, B2.2.7, B2.2.9, B2.2.17, and B2.2.19 of North Anna and Surry LRAs. (ADAMS Accession Number: ML012860003)
October 11, 2001	In a letter (signed by R. Prato) the summary of five telecommunications between the staff and Dominion representatives was published and documented. These telecommunications were held on August 8, 9, 13, 27, and 28, 2001, to clarify information provided by Dominion in its North Anna and Surry LRAs, Sections 2.3.3.7, 2.3.3.16, 3.1.1.2, 3.1.2.2, 3.1.3.2, 3.1.4.2, 3.2.2, 3.3.9, 3.5, B2.1.2, B2.2.1, B2.2.4, B2.2.5, B2.2.7, B2.2.9, B2.2.17, and B2.2.19. (ADAMS Accession Number: ML012840320)
October 22, 2001	In a letter (signed by R. Prato) the NRC staff requested for additional information (RAIs) regarding Sections 2.1, B2.0, 4.1, 4.3, and 4.7.4 of North Anna and Surry LRAs. (ADAMS Accession Number: ML013040121)
October 22, 2001	In a letter (signed by R. Prato) the NRC staff requested for additional information (RAIs) regarding Sections 3.6, 4.7.3, and B2.1.3 of North Anna and Surry LRAs. (ADAMS Accession Number: ML013040164)
October 25, 2001	In a letter (signed by R. Prato) the summary of two telecommunications between the staff and Dominion representatives was published and documented. These telecommunications were held on September 25 and 26, 2001, to clarify information provided by Dominion in its North Anna and Surry LRAs, Sections 2.4.1, 2.4.2, 2.4.3, 2.4.4, 2.4.5, 2.4.6, 2.4.7, 2.4.9, 4.1, 4.3, and 4.7.4. (ADAMS Accession Number: ML012990334)
October 25, 2001	In a letter (signed by R. Prato) the summary of two telecommunications between the staff and Dominion representatives was published and documented. These telecommunications were held on October 3 and 4, 2001, to clarify information provided by Dominion in its North Anna and

Surry LRAs, Sections 2.2, 2.3.3.29, 2.3.3.31, 2.3.3.34, 3.6, 4.7.2, 4.7.3, B2.1.3, and B2.2.2. (ADAMS Accession Number: ML013020127)

November 14, 2001	In a letter (signed by R. Prato) the NRC staff requested for additional information (RAIs) regarding Sections 2.3.1 and 2.3.2 of North Anna and Surry LRAs. (ADAMS Accession Number: ML013180452)
November 14, 2001	In a letter (signed by R. Prato) the summary of three telecommunications between the staff and Dominion representatives was published and documented. These telecommunications were held on October 9, 11, and 15, 2001, to clarify information provided by Dominion in its North Anna and Surry LRAs, Sections 2.3.1, 2.3.1.3, 2.3.1.4, 2.3.1.5, 2.3.2.4, 2.3.3.1, 2.3.3.3, 2.3.3.4, 2.3.3.9, 2.3.3.30, 3.1.5.2.1, 3.1.5.2.2, 4.2.1, 4.2.2, B2.2.8, and B2.2.18. (ADAMS Accession Number: ML013190418)
November 26, 2001	In a letter (signed by R. Prato) the NRC staff requested for additional information (RAIs) regarding Sections 2.3.3.21, 2.3.3.31, 2.3.4, and 3.5 of North Anna and Surry LRAs. (ADAMS Accession Number: ML013300471)
November 30, 2001	In a letter (signed by D. Christian) Dominion submitted its response to the NRC staff's request for additional information (RAIs) dated October 11, 2001, regarding Sections 3.1.1, 3.5.1, 3.5.2, 3.5.3, 3.5.4, 3.6.2, 4.4, B2.2.1, B2.2.7, B2.2.9, B2.2.17, and B2.2.19 of North Anna and Surry LRAs. (ADAMS Accession Number: ML020030330)
December 5, 2001	In a letter (signed by R. Prato) the summary of three telecommunications between the staff and Dominion representatives was published and documented. These telecommunications were held on November 14, 19, and 21, 2001, to clarify information provided by Dominion in its North Anna and Surry LRAs, Sections 2.3.3.10, 2.3.3.11, 2.3.3.21, 2.3.3.31, 2.3.4.1, 2.3.4.2, 2.3.4.3, 2.3.4.4, 2.3.4.5, 2.3.4.6, 2.3.4.7, 2.4.8, 2.4.10, 2.4.12, 3.5.5, 3.5.6, 3.5.8, 3.5.9, 3.5.10, 3.5.11, B2.2.6, B2.2.10, B2.2.11, and B2.2.12. (ADAMS Accession Number: ML013400189)
January 4, 2002	In a letter (signed by D. Christian) Dominion submitted its response to the NRC staff's request for additional information (RAIs) dated October 22, 2001, regarding Sections 3.6, 4.7.3, and B2.1.3 of North Anna and Surry LRAs. (ADAMS Accession Number: ML020160075)

January 4, 2002	In a letter (signed by D. Christian) Dominion submitted its response to the NRC staff's request for additional information (RAIs) dated November 14, 2001, regarding Sections 2.3.1 and 2.3.2 of North Anna and Surry LRAs. (ADAMS Accession Number: ML020160066)
January 16, 2002	In a letter (signed by D. Christian) Dominion submitted its response to the NRC staff's request for additional information (RAIs) dated October 22, 2001, regarding Sections 4.1, 4.3, 4.7.4, and B2.0 of North Anna and Surry LRAs. (ADAMS Accession Number: ML020230330)
January 17, 2002	In a letter (signed by R. Prato) the NRC published a public meeting summary which was held on December 12, 2001, between the NRC, Nuclear Energy Institute (NEI), Dominion, and Duke Energy Corporation regarding license renewal emerging issues. (ADAMS Accession Number: ML020300026)
January 22, 2002	In a letter (signed by R. Prato) the NRC published a public meeting summary which was held on January 10, 2002, between the NRC and Dominion regarding the treatment of station blackout issue In the North Anna and Surry LRAs. (ADAMS Accession Number: ML020220368)
January 30, 2002	In a letter (signed by R. Prato) the summary of two telecommunications between the staff and Dominion representatives was published and documented. These telecommunications were held on January 28 and 29, 2002, to clarify information provided by Dominion in its North Anna and Surry LRAs, Sections 4.4, and B2.2.3. (ADAMS Accession Number: ML020350508)
February 1, 2002	In a letter (signed by D. Christian) Dominion submitted its response to the NRC staff's request for additional information (RAI) dated October 22, 2001, regarding Section 3.6 of North Anna and Surry LRAs. (ADAMS Accession Number: ML021970004)
February 1, 2002	In a letter (signed by D. Christian) Dominion submitted its response to the NRC staff's request for additional information (RAI) dated October 22, 2001, regarding Section 2.1 of North Anna and Surry LRAs. (ADAMS Accession Number: ML021970005)
February 5, 2002	In a letter (signed by D. Christian) Dominion submitted its response to the NRC staff's requests for additional information (RAIs) dated November 26, 2001, regarding Sections 2.3.3.21, 2.3.3.31, 2.3.4, 3.5, B2.2.6, B2.2.10, B2.2.11, and B2.2.12, of

	North Anna and Surry LRAs. (ADAMS Accession Number: ML021970007)
April 22, 2002	In an electronic mail (sent by M. Henig to O. Tabatabai) Dominion transmitted supplemental response to the staff's RAI 4.3-6. (ADAMS Accession Number: ML021410080)
April 29, 2002	In an electronic mail (sent by M. Henig to O. Tabatabai) Dominion transmitted a supplemental response to the NRC staff's request for additional information (RAI) 2.5-1, and compliance with staff's position on SBO. (ADAMS Accession Number: ML021330417)
May 22, 2002	In a letter (signed by D. Christian) Dominion submitted its formal concurrence on contents of the telecommunication summaries prepared by R. Prato on August 8, 2001, October 11, 2001, and January 30, 2002. (ADAMS Accession Number: ML021510279)
May 22, 2002	In a letter (signed by D. Christian) Dominion submitted its supplemental responses to the NRC staff's RAIs 2.1-3, 3.5-5, 3.5.8-2, 3.5.9-2, 3.5.9-4, 3.5.9-5, B2.2.7-1, B2.2.7-2, B2.2.7-3, B2.2.11-1, and B2.2.19-3 regrading the North Anna and Surry LRAs. (ADAMS Accession Number: ML021480185)
June 6, 2002	In a letter (signed by P.T. Kuo) the NRC staff issued its draft safety evaluation report with open items related to the license renewal of North Anna and Surry nuclear stations. (ADAMS Accession Number: ML021580123)
June 19, 2002	In an electronic mail (sent by M. Henig to O. Tabatabai) Dominion submitted its revised SBO and Non-EQ Cables Aging Management Activity Letter, Serial No. 02-297, to the NRC. (ADAMS Accession Number: ML021890549)
July 5, 2002	In an electronic mail (sent by T. Snow to O. Tabatabai) Dominion submitted its Technical Report LR-1921/LR-2921, Criterion 2 Evaluation, to the NRC. (ADAMS Accession Number: ML021890423)
July 16, 2002	In an electronic mail (sent by M. Henig to O. Tabatabai) Dominion transmitted its editorial comments on the draft safety evaluation report related to the license renewal applications for North Anna and Surry. (ADAMS Accession Number: ML021990430)
July 31, 2002	In an electronic mail (sent by M. Henig to O. Tabatabai) Dominion transmitted additional information on staff's RAI 2.1-3. (ADAMS Accession Number: ML022170561)

August 01, 2002	In an electronic mail (sent by M. Henig to O. Tabatabai) Dominion transmitted data on reactor vessel beltline neutron fluence, pressurized thermal shock, and Charpy upper shelf energy for North Anna and Surry reactor vessels. (ADAMS Accession Number: ML022190253)
August 20, 2002	In an electronic mail (sent by T. Snow to O. Tabatabai) Dominion provided additional information related to the dissimilar metal weld cracking event in V. C. Summer. (ADAMS Accession Number: ML022390432)
August 22, 2002	In an electronic mail (sent by M. Henig to O. Tabatabai) Dominion transmitted three topical reports; BAW-2178P, BAW-2192P, and BAW-2323. (ADAMS Accession Number: ML022390113)
August 23, 2002	In a letter (signed by L. Hartz) Dominion submitted a supplemental response to the staff's RAI 2.1-3. (ADAMS Accession Number: ML022460156)
August 23, 2002	In an electronic mail (sent by M. Henig to O. Tabatabai) Dominion transmitted additional information on evaluation of Surry 1/2 reactor vessel material surveillance data. (ADAMS Accession Number: ML022400102)
August 29, 2002	In a letter (signed by O. Tabatabai) the NRC staff published the summary of a meeting with Dominion representatives on August 08, 2002. The purpose of this meeting was to discuss comments provided by the Advisory Committee on Reactor Safeguards (ACRS) on the staff's draft safety evaluation report. (ADAMS Accession Number: ML022410357)
September 10, 2002	In a letter (signed by O. Tabatabai) the NRC staff published the summary of two telecommunications between the staff and Dominion representatives. These telecommunications were held on August 20 and 22, 2002, to clarify information provided by Dominion on reactor vessel neutron embrittlement evaluations (ADAMS Accession Number: ML022530347)
September 10, 2002	In an electronic mail (sent by M. Henig to O. Tabatabai) Dominion transmitted a revised response to the staff's RAI 4.3-6. (ADAMS Accession Number: ML022730096)
September 18, 2002	In a letter (signed by O. Tabatabai) the NRC staff informed Dominion that the third inspection of the North Anna and Surry Nuclear Stations was rescheduled for September 27, 2002. (ADAMS Accession Number: ML022620260)

September 18, 2002	In an electronic mail (sent by M. Henig to O. Tabatabai) Dominion transmitted a draft report on Surry 1/2 reactor vessel beltline neutron fluence, PTS, and USE data on reactor vessel beltline neutron fluence, pressurized thermal shock, and Charpy upper shelf energy. (ADAMS Accession Number: ML022620688)
September 26, 2002	In a letter (signed by O. Tabatabai) the NRC staff published the summary of two telecommunications between the staff and Dominion representatives. These telecommunications were held on September 4 and 19, 2002, regarding Dominion's report on reactor vessel surveillance data. (ADAMS Accession Number: ML022700123)
October 1, 2002	In a letter (signed by L. Hartz) Dominion submitted a supplemental response to the staff's Open Item 4.3-6. (ADAMS Accession Number: ML022810329)
October 15, 2002	In a letter (signed by L. Hartz) Dominion formally submitted all the information that were provided to the staff and/or discussed during telecommunications held on August 20 and 22, September 4 and 19, and October 9, 2002, regarding Surry 1 and 2, and North Anna 1 and 2 reactor vessel neutron embrittlement TLAA. (ADAMS Accession Number: ML022960411)
October 21, 2002	In a letter (signed by O. Tabatabai) the NRC published the summary of a telecommunication between the staff and Dominion representatives on October 9, 2002, to receive additional information from Dominion on reactor vessel neutron embrittlement evaluations. (ADAMS Accession Number: ML022940533)
October 21, 2002	In a letter (signed by O. Tabatabai) the NRC staff provided Dominion with the revised 22-month review schedule for the license renewal of the North Anna and Surry nuclear stations. (ADAMS Accession Number: ML022950104)

November 4, 2002	In a letter (signed by L. Hartz) Dominion committed to implement, at North Anna and Surry, the final staff guidance on the aging management of fuse holders. (ADAMS Accession Number: ML023080355)
November 5, 2002	In a letter (signed by P.T. Kuo) the NRC staff issued its Safety Evaluation Report Related to the License Renewal of the North Anna Power Station Units 1 and 2, and Surry Power Station Units 1 and 2," (ADAMS Accession Number: ML023090552)
December 2, 2002	In a letter (signed by E. Grecheck) Dominion committed to expand the scope of the Civil Engineering Structural Inspection program to consider the potential for seasonal chemistry variation in annual groundwater monitoring at North Anna and Surry. (ADAMS Accession Number: ML023400532)

Appendix B: References

This appendix contains a listing of references used in preparation of this safety evaluation report during review of NAS 1/2 and SPS 1/2 LRAs.

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ANSI B31.1, *Power Piping Code*

American Society of Mechanical Engineers (ASME)

Code Case N-577, *Risk-informed Requirements for Class 1, 2, and 3 Piping*, ASME Section XI, American Society of Mechanical Engineers, New York.

Code Case N-481, Alternate Examination Requirements for Cast Austenitic Pump Casings, ASME Section XI, American Society of Mechanical Engineers, New York.

Section XI, *Rules for Inservice Inspection of Nuclear Power Plant Components*, ASME Boiler and Vessel Pressure Code, American Society of Mechanical Engineers, July 1986.

Section III, *Rules for Construction of Nuclear Vessels*, ASME Boiler and Vessel Pressure Code, American Society of Mechanical Engineers, 1971.

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ASTM-E185, *Standard Practice for Conducting Surveillance Tests for Light-Water Cooled Nuclear Power Reactor Vessels.*

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TR-103842, *Class 1 Structures License Renewal Industry Report*; Revision 1, TR-107569, *Power Steam Generator Examination Guidelines,*

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TR-105714, *PWR Primary Water Chemistry Guidelines*,

TR-102134, *PWR Secondary Water Chemistry Guidelines*

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TR-110356, *Evaluation of Environmental Thermal Fatigue Effects on Selected Components in a Boiling Water Reactor Plant*

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Generic Letter 89-08, *Erosion/Corrosion-Induced Pipe Wall Thinning*, May 2, 1989.

Generic Letter 89-13, *Service Water System Problems Affecting Safety-Related Equipment*, July 18, 1989 (Supplement 1 dated 4/4/90).

Generic Letter 97-01, *Degradation of Control Rod Drive Mechanism Nozzle and Other Vessel Closure Head Penetrations*, Nuclear Regulatory Commission, April 1, 1997.

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IN 2000-17, *Crack in Weld Area of Reactor Coolant System Hot Leg Piping at* V. C. Summer, Information Notice, Nuclear Regulatory Commission, Washington, D.C.

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Virginia Electric and Power Company (Dominion)

Correspondence

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Letter from James P. O'Hanlon, Senior Vice President-Nuclear, to the U. S. Nuclear Regulatory Commission Document Control Desk, *Degradation of Control Rod Drive Mechanism Nozzle and Other Vessel Closure Head Penetrations*, Serial No. 97-214A, July 25, 1997.

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Letter from W. L. Stewart of Dominion to the Nuclear Regulatory Commission, Serial No. 91-328, Subject: "Revision to 10 CFR 50.61 Fracture Toughness for Protection Against Pressurized Thermal Shock Events, Surry Power Station Units 1 and 2, North Anna Power Station Units 1 and 2," December 10, 1991.

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Appendix C: Principal Contributors

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Appendix D: Commitments Listing

During the review of Dominion LRAs by the NRC staff, the applicant made commitments to provide aging management programs to manage aging effects on structures and components prior to the expiration of its current operating license terms. The following table lists these commitments along with their implementation schedule.

Item	Commitment	UFSAR Supplement Location	Implementation Schedule	Source
1	Develop and implement an inspection program for buried piping and valves.	18.1.1	One-Time between years 30-40. Additional inspections based on results.	LRA (App. A, & Table B4.0), RAI B2.1.1-1
2	Add PZR surge line to Augmented Inspection Program.	18.2.1	Prior to PEO	LRA Table B4.0, RAI 4.3-7
3	Add core barrel hold-down spring to Augmented Inspection Program.	18.2.1	Prior to PEO	LRA Table B4.0
4	Expand scope of Civil Eng Structural Inspection to cover LR requirements.	18.2.6	Prior to PEO	LRA Table B4.0
5	Revise plant documents to use inspection opportunities when inaccessible areas become accessible during work activities.	18.2.6	Prior to PEO	LRA Table B4.0
6	Incorporate NFPA-25, Section 2-3.1.1 for sprinklers.	18.2.7	Prior to year 50. If testing used, repeat every 10 years.	LRA Table B4.0
7	Develop inspection criteria for non-ASME supports and doors.	18.2.9	Prior to PEO	LRA Table B4.0

PEO: Period of Extended Operation

Item	Commitment	UFSAR Supplement Location	Implementation Schedule	Source
8	Develop procedural guidance for inspection criteria that puts focus on aging effects.	18.2.9	Prior to PEO	LRA Table B4.0
9	Develop and implement inspection program for infrequently accessed areas.	18.1.2	One-Time between years 30-40. Additional inspections based on results.	LRA (App. A, & Table B4.0), RAI 3.5-1, RAI 3.5.8-1
10	Develop and implement inspection program for tanks.	18.1.3	One-Time between years 30-40. Additional inspections based on results.	LRA (App. A, & Table B4.0)
11	Follow industry activities related to failure mechanisms for small-bore piping. Evaluate changes to inspection activities based on industry recommendations.	18.2.11	On-going activity	LRA Table B4.0, RAI 3.1.1.2-2
12	Follow industry activities related to core support lugs. Evaluate need to enhance inspection activities based on industry recommendations.	18.2.13	On-going activity	LRA Table B4.0
13	Inspect representative sections of polar crane box girders.	18.2.10	One-Time between years 30-40. Additional inspections based on results.	LRA Table B4.0
14	Follow industry activities related to RV internals issues such as void swelling, thermal and neutron embrittlement, etc. Evaluate industry recommendations. Inspect accordingly.	18.2.15	One-Time inspection between years 30-40 on most susceptible single unit (SPS or NAPS). Additional inspections based on results.	LRA Table B4.0

PEO: Period of Extended Operation

Item	Commitment	UFSAR Supplement Location	Implementation Schedule	Source
15	Implement changes into procedures to assure consistent inspection of components for aging effects during work activities.	18.2.19	Prior to PEO	LRA Table B4.0
16	Incorporate groundwater monitoring into the civil engineering structural monitoring program. Consider groundwater chemistry in engineering evaluations of deficiencies	18.2.6	Prior to PEO	RAI 3.5-2
17	Incorporate management of concrete aging into the civil structural monitoring program and the infrequently accessed area inspection programs.	18.1.3 and 18.2.6	Prior to PEO	RAI 3.5-7
18	Incorporate management of elastomers into the work control activities.	18.2.19	Prior to PEO	RAI 3.5.6-4, RAI B2.2.19-3
19	Develop and implement inspection program for Non-EQ cables.	18.1.4	One-Time between years 30-40. Additional inspections every 10 years thereafter.	RAI 3.6.2-1
20	Follow industry activities related to Alloy 82/182 weld material. Implement activities based on industry recommendations, as appropriate.	18.3.5.3	On-going activity	RAI 4.7.3-1
21	Inspectors credited in the Work Control Process will be QMR or VT qualified.	18.2.19	Prior to PEO	RAI B2.2.19-1

PEO: Period of Extended Operation

Item	Commitment	UFSAR Supplement Location	Implementation Schedule	Source
22	Perform audit of work control inspections to ensure representation by all in-scope LR systems and to determine need for supplemental inspections.	18.2.19	Prior to PEO and every 10 years thereafter. Supplemental inspections within 5 year of audit.	RAI B2.2.19-3
23	Measure the sludge buildup in the SW reservoir at NAPS.	18.2.17	One-Time between years 35 and 40	RAI 3.5.8-2
24	Provide inspection details for PZR surge line inspections to the NRC for review and approval	18.3.2.4	Prior to PEO	RAI 4.3-7, RAI 4.3-6
25	Provide inspection details for SI and charging line inspections to the NRC for review and approval.	18.3.2.4	Prior to PEO	RAI 4.3-6, SER OI 4.3-1
26	Address NRC staff final guidance regarding fuse holders when issued.	18.1.4	When issued or prior to PEO, whichever is later.	Ltr. No. 02-691
27	Develop and implement a program to control water intrusion into manholes at SPS.	18.1.4	Prior to PEO	RAI 3.6.2-1
28	Revise procedures for groundwater testing to account for possible seasonal variations.	18.2.6	Prior to PEO	Ltr. No. 02-706

PEO: Period of Extended Operation

Item	Commitment	UFSAR Supplement Location	Implementation Schedule	Source
29	Inspect similar material/environment components, both within the system and outside the system, if aging identified in a location within a system cannot be explained by environmental/operational conditions at that specific location.	18.2.19	Prior to PEO	RAI B2.2.19-3
30	Supplement the NFPA pressure and flowrate testing credited in each LRA as part of the fire protection program activity with the work control process activity in order to manage aging effects for the fire protection system piping.	18.2.7	Prior to PEO	RAI B2.2.7-2

PEO: Period of Extended Operation