United States Nuclear Regulatory Commission

Protecting People and the Environment

Safety Evaluation Report

Related to the Subsequent License Renewal of Oconee Nuclear Station, Units 1, 2, and 3

Docket Nos. 50-269, 50-270, and 50-287

Duke Energy Carolinas, LLC

Issued: December 2022

Office of Nuclear Reactor Regulation

ABSTRACT

This safety evaluation (SE) documents the technical review by the U.S. Nuclear Regulatory Commission (NRC) staff of the Oconee Nuclear Station (ONS), Units 1, 2, and 3 subsequent license renewal application (SLRA).

ONS is located 30 miles west of Greenville, South Carolina (SC) in Seneca, SC. The NRC issued the initial operating licenses on February 6, 1973, for Unit 1, October 6, 1973, for Unit 2, and July 19, 1974, for Unit 3. The NRC issued the first renewed operating licenses for these units on May 23, 2000. Each unit includes a three-coolant loop, pressurized light water reactor nuclear steam supply system with a license thermal power of 2,568 megawatts thermal.

Duke Energy Carolinas, LLC (Duke Energy or the applicant), by letter dated June 7, 2021 (Agencywide Documents Access and Management System (ADAMS) Package Accession No. ML21158A193), as supplemented, submitted an application for subsequent license renewal for ONS. Duke Energy requested renewal for a period of 20 years beyond the current expiration at midnight on February 6, 2033, for Unit 1 (Renewed Facility Operating License No. DPR-38), at midnight on October 6, 2033, for Unit 2 (Renewed Facility Operating License No. DPR-47), and at midnight on July 19, 2034, for Unit 3 (Renewed Facility Operating License No. DPR-55).

This SE documents the NRC staff's technical review of information submitted by Duke Energy through September 2, 2022. On the basis of the review of the SLRA, the NRC staff determined that Duke Energy has met the requirements of Title 10 of the *Code of Federal Regulations* Section 54.29(a).

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ACRONYM LIST

(10 CFR)	Title 10 of the Code of Federal Regulations
A/LAI	Applicant/Licensee Action Item
ACI	American Concrete Institute
ACRS	Advisory Committee on Reactor Safeguards
ACSR	aluminum-conductor steel-reinforced
ADAMS	Agencywide Documents Access and Management System
AEA	Atomic Energy Act of 1954, as amended
AERM	aging effect requiring management
AMP	aging management program
AMPs	aging management programs
AMR	aging management review
AMRs	aging management reviews
ANSI	American National Standards Institute
AR	action report
ART	adjusted reference temperature
ASME	American Society of Mechanical Engineers
ASR	alkali-silica reaction
ASTM	American Society for Testing and Materials
ATWS	anticipated transients without scram
AWWA	American Water Works Association
B&PV	Boiler and Pressure Vessel (ASME code)
B&W	Babcock and Wilcox
B&WOG	Babcock & Wilcox Owners Group
BF	baffle-to-former (bolts)
BMI	Bottom-mounted instrumentation
BSW	biological shield wall
BTP	branch technical position
BWOG	Babcock and Wilcox Owners Group
BWR	boiling-water reactor
CASS	cast austenitic stainless steel
CB	core barrel
CB-F	core barrel to former (bolts)
CCW	condenser circulating water
CE	Combustion Engineering
CFR	Code of Federal Regulations
CHAR	cable characterization
CID-VS/distortion	changes in dimension due to void swelling or distortion
CLB	current licensing basis
CMAA	Crane Manufactures Association of America
CO2	carbon dioxide
CRC	Chemical Rubber Company
CRDM	control rod drive mechanism

CRGT	control rod guide tube
CSS	core support shield
Cu wt%	weight percent copper
CUF	cumulative usage factor
CUF_{en}	environmental cumulative usage factor
CUFs	cumulative usage factors
$CUFs_{en}$	environmental cumulative usage factors
DBD	design basis document
DBE	design basis event
DOE	U.S. Department of Energy
DORT	discrete ordinate transport
dpa	displacements per atom
EAF	environmentally-assisted fatigue
ECCS	emergency core cooling system
ECT	eddy current testing
EFPY	effective full power years
EMAs	equivalent margins analyses
EMDA	Expanded Materials Degradation Assessment
ENDF/B-VI)	Evaluated Nuclear Data File/Brookhaven, Version VI
EPRI	Electric Power Research Institute
EQ	environmental qualification
ESF	engineered safety features
ESV	essential siphon vacuum
EWST	elevated water storage tank
FAC	flow-accelerated corrosion
FD	flow distributor
FE	further evaluation
FEA	finite element analysis
F_{en}	environmental fatigue correction factor
FERC	Federal Energy Regulatory Commission
FIV	flow induced vibration
FPP	fire protection program
FRP	fiber reinforced polymer
FSAR	final safety analysis report
FSWO	full structural weld overlay
FSWOs	full structural welds overlay
GALL	Generic Aging Lessons Learned
GALL-SLR	Generic Aging Lessons Learned for Subsequent License Renewal
GDC	General Design Criterion
GEIS	General Environmental Impact Statement
GL	generic letter
gpm	gallons per minute
HAZ	heat affected zone
HDPE	high-density polyethylene
HELB	high energy line break

HPI	high pressure injection
HTH	high thermal heat
HV	high voltage
I&C	instrumentation and control
I&E	inspection and evaluation
IAEA	International Atomic Energy Agency
IASCC	irradiation-assisted stress corrosion cracking
IGSCC	intergranular stress corrosion cracking
ILRT	integrated leak rate test
INPO	Institute of Nuclear Power Operations
IPA	integrated plant assessment
ISG	interim staff guidance
ISI	in service inspection
ISP	integrated surveillance program
ISR/IC	irradiation-enhanced stress relaxation or creep
KIc	Plane-strain fracture toughness, ksi in. ½
ksi	kilopound per square inch
kv	kilovolt
LBB	leak-before-break
LCB	lower core barrel
LFET	low-frequency electromagnetic testing
LFW	lower flange weld
LNB	lower nozzle belt
LOCA	loss-of-coolant accident
LOFT-IE	loss of fracture toughness due to neutron/irradiation embrittlement
LOFT-TE	loss of fracture toughness due to thermal aging embrittlement
LOM-wear	loss of material due to wear
LOP-ISR/IC	loss of preload due to irradiation-enhanced stress relaxation or creep
LR	license renewal
LRA	license renewal application
LSS	lower support structure
LST	lowest service temperature
LTOP	low temperature overpressure protection
LTS	lower thermal shield
LWR	light-water reactor
MC	metallic containment
MCNP	Monte Carlo N-Particle
MeV	mega-electron volt
MIC	microbially induced corrosion
MIRVP	Master Integrated Reactor Vessel Program
MoS_2	molybdenum disulfide
MPa	megapascal
MRP	Materials Reliability Program
MRV	minimum required value
MUR	measurement uncertainty recapture

mV	millivolts
MWt	megawatts thermal
n/cm2	neutrons per square centimeter
NACE	National Association of Corrosion Engineers
NAM	no additional measures
NDE	nondestructive examination
NDT, ΔRT_{NDT}	nil ductility temperature
NEA	Nuclear Energy Agency
NEI	Nuclear Energy Institute
NEPA	National Environmental Policy Act
NFPA	National Fire Protection Association
Ni	nickel
Ni wt%	weight percent nickel
NPP	nuclear power plant
NPS	nominal pipe size
NRC	U.S. Nuclear Regulatory Commission
NRR	Office of Nuclear Reactor Regulation
NSPC	nuclear safety performance criteria
NSSS	nuclear steam supply system
OBE	operating basis earthquake
OCCW	Open-Cycle Cooling Water (system or program)
OD	outer diameter
OE	operating experience
OECD/NEA	Organization for Economic Co-operation and Development
ONF	outlet nozzle forging
ONS	Oconee Nuclear Station
OTI	one-time inspection
OTSG	once-through steam generator
PCMG	Power Chemistry Material Guide
PORV	power operated relief valve
PSW	primary shield wall
PSWS	protected service water system
P-T	pressure-temperature
PTS	pressurized thermal shock
PVC	polyvinyl chloride
PWR	pressurized-water reactor
PWROG	Pressurized Water Reactor Owners Group
QA	quality assurance
RAI	request for additional information
RAIs	requests for additional information
RCI	request for confirmation of information
RCP	reactor coolant pump
RCS	reactor coolant system
RCSC	Research Council for Structural Connections
RCW	recirculating cooling water

RG	Regulatory Guide (NRC RG)
RHR	residual heat removal
RIS	Regulatory Issue Summary
RPV	reactor pressure vessel
RT	reference temperature
RTDs	Resistance temperature detectors
RT_{NDT}	nil-ductility transition reference temperature
$RT_{NDT(U)}$	reference temperature for nil-ductility transition
RT_{PTS}	reference temperature for pressurized thermal shock
RVCH	reactor vessel closure head
RVI	reactor vessel internal
S_A	stress range
SBO	station blackout
SC	structures and components
SC	South Carolina
SCC	stress corrosion cracking
SCs	structures and components
SE	Safety Evaluation
SEE-IN	Significant Event Evaluation and Information Network (part of INPO)
SEIS	supplemental environmental impact statement
SFP	spent fuel pool
SG	steam generator
SLR	subsequent license renewal
SLRA	subsequent license renewal application
S_m	stress intensity
SRM	Commission's staff requirements memorandum
SRP	Standard Review Plan
SRP-SLR	Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants
SS	stainless steel
SSCs	systems, structures, and components
SSSA	steel support skirt assembly
SSW	secondary shield wall
SVAM	SOLIDWORKS - VICTORA, ADVANTG, MCNP
SVAM/DORT	SOLIDWORKS - VICTORA, ADVANTG, MCNP [Monte Carlo N-Particle] / discrete ordinates transport
TLAAs	Time-Limited Aging Analyses
TMI	Three Mile Island
TS	technical specifications
UCB	upper core barrel
UFSAR	Updated Final Safety Analysis Report
UGW	upper girth weld
USAEC	United States Atomic Energy Commission
USAS	USA Standard
USE	upper-shelf energy

UT	ultrasonic test
UTS	upper thermal shield
VS	void swelling
VV	vent valve
WC	chilled water system
Wt. %	Weight percent
δ-ferrite	delta ferrite
ΔNDTT	shift in nil ductility temperature

SECTION 1 INTRODUCTION AND GENERAL DISCUSSION

1.1 Introduction

This safety evaluation (SE) documents the U.S. Nuclear Regulatory Commission (NRC) staff's safety review of the subsequent license renewal application (SLRA) for Oconee Nuclear Station (ONS), Units 1, 2, and 3, as filed by Duke Energy Carolinas, LLC (Duke Energy or the applicant), Duke Energy's application seeks to renew ONS Renewed Facility Operating License Nos. DPR-38, DPR-47, and DPR-55 for an additional 20 years beyond the current expiration dates of February 6, 2033, for Unit 1, October 6, 2033, for Unit 2, and July 19, 2034, for Unit 3. Duke Energy submitted their application by letters dated June 7, 2021 (Agencywide Documents Access and Management System (ADAMS) Package Accession No. ML21158A193), as supplemented by letters dated October 22, 2021 (ADAMS Accession No. ML21295A035), October 28, 2021 (ADAMS Accession No. ML21302A208), November 11, 2021 (ADAMS Accession No. ML21315A012), December 2, 2021 (ADAMS Accession No. ML21336A001), December 15, 2021 (ADAMS Accession No. ML21349A005), December 17, 2021 (ADAMS Accession No. ML21351A000), January 7, 2022 (ADAMS Accession No. ML22010A129), January 21, 2022 (ADAMS Accession No. ML22021A000), February 14, 2022 (ADAMS Accession No. ML22045A021), February 21, 2022 (ADAMS Accession No. ML22052A002), March 22, 2022 (ADAMS Accession No. ML22081A027), March 31, 2022 (ADAMS Accession No. ML22090A046), April 20, 2022 (ADAMS Accession No. ML22110A207), and April 22, 2022 (ADAMS Accession No. ML22112A016), May 11, 2022 (ADAMS Accession No. ML22131A023), May 20, 2022 (ADAMS Accession No. ML22140A016), May 27, 2022 (ADAMS Accession No. ML22147A001), June 7, 2022 (ADAMS Accession No. ML22158A028), June 8, 2022 (ADAMS Accession No. ML22159A151), July 8, 2022 (ADAMS Accession No. ML22189A008), July 25, 2022 (ADAMS Accession No. ML22206A005), and September 2, 2022 (ADAMS Accession No. ML22245A008).

The NRC staff performed a safety review of Duke Energy's application in accordance with Title 10 of the *Code of Federal Regulations* (10 CFR) Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants." The NRC project managers for the SLRA review are Ms. Angela Wu, who can be contacted by email at Angela.Wu@nrc.gov, and Mr. Mark Yoo, who can be contacted by email at Mark.Yoo@nrc.gov.

ONS is located 30 miles west of Greenville, South Carolina (SC) in Seneca, SC. Each unit includes a three-coolant-loop, pressurized light water reactor nuclear steam supply system with a license thermal power of 2,568 megawatts thermal (MWt). The NRC issued the initial operating licenses on February 6, 1973, for Unit 1, October 6, 1973, for Unit 2, and July 19, 1974, for Unit 3. The NRC issued renewed operating licenses for these units on May 23, 2000. The ONS updated final safety analysis report (UFSAR) describes the plant and the site (ADAMS Accession No. ML20189A066).

The NRC license renewal process consists of two concurrent reviews: (1) a safety review and (2) an environmental review. NRC regulations in 10 CFR Part 54 and 10 CFR Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions," set forth requirements for the safety review and the environmental review, respectively. The safety review for the ONS subsequent license renewal (SLR) is based on Duke Energy's SLRA, the NRC staff's audits, responses to the staff's requests for additional information (RAIs), and response to the staff's Requests for Confirmation of Information (RCIs). Duke Energy supplemented its application and provided clarifications through its responses to the staff's questions in RAIs, RCIs, audits, meetings, and docketed correspondence. The staff reviewed and considered information submitted through September 2, 2022.

The public may view the SLRA, as well as materials related to the subsequent license renewal review, on the NRC website at https://www.nrc.gov/oconee-subsequent.

This SE summarizes the results of the NRC staff's safety review of the SLRA and describes the technical details that the staff considered in evaluating the safety aspects of the units' proposed operation for an additional 20 years beyond the term of the current renewed operating licenses. The staff reviewed the SLRA in accordance with NRC regulations and the guidance in NUREG-2192, Revision 0, "Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants" (SRP-SLR), issued July 2017 (ADAMS Accession No. ML17188A158).

SE Sections 2 through 4 address the NRC staff's evaluation of SLR issues considered during its review of the application. SE Section 5 discusses the role of the Advisory Committee on Reactor Safeguards (ACRS). The conclusions of this SE are in Section 6.

SE Appendix A, "License Renewal Commitments," contains a table showing Duke Energy's commitments for subsequent renewal of the operating licenses. SE Appendix B, "Chronology," contains a chronology of the principal correspondence between the NRC staff and the applicant, as well as other relevant correspondence, regarding the SLRA review. SE Appendix C, "Principal Contributors," contains a list of principal contributors to the SE, and Appendix D, "References," contains a bibliography of the references that support the staff's review.

1.2 License Renewal Background

Under the Atomic Energy Act of 1954, as amended (AEA), and NRC regulations, the NRC issues initial operating licenses for commercial power reactors for 40 years. This 40-year license term was selected based on economic and antitrust considerations rather than on technical limitations; however, some individual plant and equipment designs may have been engineered for an expected 40-year service life. NRC regulations permit license renewals that extend the initial 40-year license for up to 20 additional years per renewal. The NRC issues renewed licenses only after it determines that a nuclear facility can operate safely to the end of the period of extended operation. There are no limitations in the AEA or NRC regulations limiting the number of times that a license may be renewed.

As described in 10 CFR Part 54, the focus of the NRC staff's license renewal safety review is to verify that the applicant has identified aging effects that could impair the ability of structures and components within the scope of license renewal to perform their intended functions, and to demonstrate that these effects will be adequately managed during a period of extended operation. The regulations of 10 CFR Part 54 establish the regulatory requirements for both initial license renewal and SLR.

1.2.1 Preparations for Subsequent License Renewal

The NRC and the U.S. Department of Energy (DOE) held two international conferences, in 2008 and 2011, on reactor operations beyond 60 years to identify the most significant issues that would need to be addressed for SLR. In 2011, the NRC also began collecting information to support the development of guidance documents for operation during the subsequent period of extended operation and to support a revision of 10 CFR Part 54, if needed.

During 2011 through 2013, the NRC performed three Aging Management Program (AMP) effectiveness audits at plants that were already in the period of extended operation. The purpose of these information collection audits was to provide an understanding of how AMPs have been implemented at plants during the period of extended operation and the degradation that has been identified by the AMPs. A summary of the NRC staff's observations from the first two AMP effectiveness audits can be found in the May 2013 report, "Summary of Aging Management Program Effectiveness Audits to Inform Subsequent License Renewal: R.E. Ginna Nuclear Power Plant and Nine Mile Point Nuclear Station, Unit 1" (ADAMS Accession No. ML13122A007). The summary of the staff's observations from the third audit can be found in the August 5, 2014, report, "H.B. Robinson Steam Electric Plant, Unit 2, Aging Management Program Effectiveness Audit" (ADAMS Accession No. ML14017A289). In addition, on June 15, 2016, the staff issued the technical letter report, "Review of Aging Management Programs: Compendium of Insight from License Renewal Applications and from AMP Effectiveness Audits Conducted to Inform Subsequent License Renewal Guidance Documents" (ADAMS Accession No. ML16167A076), which provides observations from reviewing license renewal applications and the AMP effectiveness audits, as contextualized in NRC memorandum to file from Steven D. Bloom, dated September 27, 2016 (ADAMS Accession No. ML16194A124).

On May 9, 2012 (ADAMS Accession No. ML12159A174), and subsequently on November 1, 13, and 14, 2012, the NRC staff met with interested stakeholders to hear and learn the stakeholders' concerns and recommendations for extending operation from 60 to 80 years. The staff's resolution of these public comments is available in an NRC staff memorandum from William F. Burton, Sr., to Steven D. Bloom, dated September 12, 2016 (ADAMS Accession No. ML16194A222).

In May 2012, the NRC and the DOE also cosponsored the Third International Conference on Nuclear Power Plant Life Management for Long-Term Operations, organized by the International Atomic Energy Agency (IAEA). In February 2013 and February 2015, the Nuclear Energy Institute (NEI) held forums on long-term operations and SLR. These conferences focused on the technical issues that would need to be addressed to provide assurance for safe operation beyond 60 years.

The NRC staff reviewed domestic operating experience as reported in licensee event reports and NRC generic communications related to failures and degradation of passive components. Similarly, the NRC staff reviewed the following international operating experience databases: (i) the International Reporting System, jointly operated by the IAEA and the Nuclear Energy Agency (NEA), (ii) IAEA "International Generic Ageing Lessons Learned Programme," (iii) the Organisation for Economic Co-operation and Development (OECD)/NEA "Component Operational Experience, Degradation, and Ageing Programme" database, and (iv) the OECD/NEA "Cable Ageing Data and Knowledge" database.

By letter dated August 6, 2014 (ADAMS Accession No. ML14253A104), NEI documented the industry's views and recommendations for updating NUREG-1801, Revision 2, "Generic Aging Lessons Learned (GALL) Report" (ADAMS Accession No. ML103490041), and NUREG-1800, Revision 2, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants" (ADAMS Accession No. ML103490036), to support SLR.

The NRC, in cooperation with the DOE, completed the Expanded Materials Degradation Assessment (EMDA) in October 2014 (ADAMS Accession Nos. ML14279A321, ML14279A331, ML14279A349, ML14279A430, and ML14279A461). The EMDA used an expert elicitation process to identify materials and components that could be susceptible to significant degradation during operation beyond 60 years. The EMDA covers the reactor vessel, primary system piping, reactor vessel internals, concrete, and electrical cables and qualification. The NRC staff used the results of the EMDA to identify gaps in the current technical knowledge or issues that are not being addressed by planned industry or DOE research, and to identify AMPs that will require modification for SLR.

Based on the information gathered from these conferences and forums, and other sources from 2008 through 2014, the most significant technical issues identified as challenging operation beyond 60 years are:

i. reactor pressure vessel embrittlement;

ii. irradiation-assisted stress corrosion cracking (IASCC) of reactor internals;

iii. concrete structures and containment degradation;

iv. and electrical cable environmental qualification (EQ), condition monitoring, and assessment.

Between 2014 and 2016, over 90 expert panels from the Office of Nuclear Reactor Regulation and Office of Research reviewed and dispositioned the comments and recommendations and published drafts of NUREG-2191, Revision 0, “Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report,” and NUREG-2192, “Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants” (SRP-SLR). The final guidance documents were published in July 2017 (ADAMS Accession Nos. ML17187A031 and ML17187A204) to provide sufficient guidance to support the review of an SLR application.

Concurrent with the development of the technical guidance for SLR, the NRC staff considered whether changes were needed in the regulatory framework and the license renewal rule for SLR. The NRC staff proposed a revision to the 10 CFR Part 54 rule in SECY-14-0016, “Ongoing Staff Activities to Assess Regulatory Considerations for Power Reactor Subsequent License Renewal” (ADAMS Accession No. ML14050A306). In the Commission’s staff requirements memorandum (SRM) on SECY-14-0016 (ADAMS Accession No. ML14241A578), the Commission did not approve rulemaking but instead directed the staff to continue to update the license renewal guidance, as needed, to provide additional clarity on implementation of the license renewal regulatory framework for SLR. The SRM also directed the staff to keep the Commission informed of the progress in resolving the following technical issues related to SLR:

(i) reactor pressure vessel neutron embrittlement at high fluence,

(ii) IASCC of reactor internals and primary system components,

(iii) concrete and containment degradation, and

(iv) electrical cable qualification and condition assessment.

In addition, the SRM directed the staff to keep the Commission informed regarding the staff’s readiness for accepting an application and any further need for regulatory process changes, rulemaking, or research.

Consistent with Commission direction, the NRC staff drafted updated guidance documents for SLR that addressed the four major technical issues in the Commission's SRM and, in 2017, briefed the Commission on the status of research and the development of SLR guidance, including new or revised AMPs. The final GALL-SLR Report and SRP-SLR guidance documents include new AMPs for neutron fluence and high-voltage insulators; new further evaluations for development of new plant-specific programs, as needed, to manage the effects of irradiation on concrete and steel structural components; and revised programmatic criteria for boiling-water reactor and pressurized-water reactor vessel internals programs to consider higher fluences during the SLR period. The SLR guidance documents provide a sound basis for development of applicant programs to manage the effects of aging associated with the relevant technical issues and for the NRC staff's review of applicant programs and activities proposed to manage aging during the SLR period. If new aging issues are identified through plant operating experience, industry research activities, or NRC confirmatory research, the NRC staff will revise the guidance documents to address the new information as appropriate.

1.2.2 Safety Review

License renewal requirements for power reactors (applicable to both initial and subsequent license renewal) are based on two key principles:

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

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

In implementing these two principles, 10 CFR 54.4, "Scope," paragraph (a) defines the scope of license renewal as including the following SSCs:

> (1) Safety-related systems, structures, and components 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 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 which could result in potential offsite exposures comparable to those referred to in § 50.34(a)(1), § 50.67(b)(2), or § 100.11 of [10 CFR Chapter I], as applicable.
>
> (2) All non-safety related systems, structures, and components whose failure could prevent satisfactory accomplishment of any of the functions identified in paragraphs (a)(1)(i), (ii), or (iii) of [§ 54.4].
>
> (3) 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 fire protection (10 CFR 50.48), environmental qualification [EQ] (10 CFR 50.49), pressurized thermal shock [PTS] (10 CFR

50.61), anticipated transients without scram [ATWS] (10 CFR 50.62), and station blackout [SBO] (10 CFR 50.63).

As required by 10 CFR 54.21(a), a license renewal application must review all SSCs within the scope of 10 CFR Part 54 to identify structures and components (SCs) subject to an aging management review (AMR). SCs subject to an AMR are those that perform an intended function without moving parts or without a change in configuration or properties and are not subject to replacement based on a qualified life or specified time period. In accordance with 10 CFR 54.21(a)(3), a license renewal applicant must demonstrate that the effects of aging will be adequately managed so that the intended function(s) of those SCs will be maintained consistent with the current licensing basis (CLB) for the period of extended operation.

In contrast, active equipment is adequately monitored and maintained by existing programs and is not subject to an AMR. In other words, detrimental aging effects that may affect active equipment can be readily identified and corrected through existing surveillance, performance monitoring, and maintenance programs. Surveillance and maintenance programs for active equipment, as well as other maintenance aspects of plant design and licensing basis, are required under 10 CFR Part 50, “Domestic Licensing of Production and Utilization Facilities,” regulations throughout the period of extended operation.

As required by 10 CFR 54.21(d), a license renewal application must include a UFSAR supplement with a summary description of the applicant’s programs and activities for managing the effects of aging and an evaluation of time-limited aging analyses (TLAAs) for the period of extended operation.

License renewal regulations also require TLAA identification and updating. Section 54.3, “Definitions,” of 10 CFR specifies the criteria that determine which licensee calculations and analyses are to be considered TLAAs for the purposes of license renewal. As required by 10 CFR 54.21(c)(1), the applicant must either demonstrate that these calculations will remain valid for the period of extended operation, that they have been projected to the end of the period of extended operation, or that the effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

In the ONS SLRA, Duke Energy stated that it used the process defined in the GALL-SLR Report, which summarizes NRC staff-approved AMPs for many SCs subject to an AMR. If an applicant commits to implementing these staff-approved AMPs, the time, effort, and resources for SLRA review can be greatly reduced, improving the efficiency and effectiveness of the SLR review process. The GALL-SLR Report summarizes the aging management evaluations, programs, and activities credited for managing aging for most of the SCs used throughout the nuclear power plant industry. The report is also a quick reference for both applicant and staff reviewers on AMPs and activities that can manage aging adequately during the subsequent period of extended operation.

1.2.3 Environmental Review

Part 51 of 10 CFR contains the NRC’s regulations implementing the requirements of the National Environmental Policy Act of 1969, as amended (NEPA). The NRC staff’s environmental review is ongoing. The staff will publish its environmental review findings separately from this report.

1.3 Principal Review Matters

Part 54 of 10 CFR describes the requirements for renewal of operating licenses for nuclear power plants. The NRC staff's technical review of the ONS SLRA was performed in accordance with NRC guidance and 10 CFR Part 54 requirements. Section 54.29, "Standards for issuance of a renewed license," of 10 CFR sets forth the license renewal standards. This SE describes the results of the staff's safety review in accordance with 10 CFR Part 54 requirements.

As required by 10 CFR 54.19(a), a license renewal applicant must submit general information as specified in 10 CFR 50.33(a) through (e), (h), and (i), which Duke Energy provided in SLRA Section 1. The NRC staff reviewed SLRA Section 1 and finds that Duke Energy has submitted the required information.

Section 54.19(b) requires that the SLRA include "conforming changes to the standard indemnity agreement, 10 CFR 140.92, Appendix B, to account for the expiration term of the proposed renewed license." On this issue, Duke Energy stated in SLRA Section 1.1.11:

> 10 CFR 54.19(b) requires that "each application must include conforming changes to the standard indemnity agreement, 10 CFR 140.92, Appendix B, to account for the expiration term of the proposed renewed license." The current indemnity agreement (No. B-44) for ONS states, in Article VII, that the agreement "shall terminate at the time of expiration of that license specified in Item 3 of the Attachment." Item 3 of the Attachment to the indemnity agreement, as updated in Amendment 16, lists license number DPR-38 (for ONS Unit 1), DPR-47 (for ONS Unit 2) and DPR-55 (for ONS Unit 3). Duke Energy has reviewed the original Indemnity Agreement and the Amendments. Neither Article VII nor Item 3 of the Attachment specifies an expiration date for license numbers DPR-38, DPR-47 and DPR-55. Therefore, no changes to the Indemnity Agreement are deemed necessary as part of this application. Should the license numbers be changed by NRC upon issuance of the subsequent renewed licenses, Duke Energy requests that the NRC amend the Indemnity Agreement to include conforming changes to Item 3 of the Attachment and other affected sections of the Agreement.

The NRC staff intends to maintain the original license numbers upon issuance of the subsequent renewed licenses, if approved. Therefore, the staff finds that conforming changes to the indemnity agreement need not be made and that the 10 CFR 54.19(b) requirements are met.

Section 54.21, "Contents of application—technical information," of 10 CFR requires that the SLRA contain: (a) an integrated plant assessment; (b) a description of any CLB changes during the NRC staff's review of the SLRA; (c) an evaluation of TLAAs; and (d) a UFSAR supplement. ONS SLRA Sections 3 and 4 and Appendix B address the license renewal requirements of 10 CFR 54.21(a), (b), and (c). The staff finds that ONS SLRA Appendix A addresses the license renewal requirements of 10 CFR 54.21(d).

Section 54.21(b) of 10 CFR requires that, each year following submittal of the SLRA and at least 3 months before the scheduled completion of the NRC staff's review, the applicant submit an SLRA amendment identifying any CLB changes that materially affect the contents of the SLRA, including the UFSAR supplement. By letter dated June 7, 2022, Duke Energy submitted an SLRA update that summarizes the CLB changes that have occurred during the staff's review of the SLRA (ADAMS Accession No. ML22158A028). The staff finds that this submission satisfies 10 CFR 54.21(b) requirements.

Section 54.22, "Contents of application—technical specifications," of 10 CFR requires that the SLRA include any changes or additions to the technical specifications (TS) that are necessary to manage aging effects during the period of extended operation. In ONS SLRA Appendix D, Duke Energy states that it had not identified any TS changes necessary for issuance of the subsequent renewed operating licenses. The NRC staff finds that this statement adequately addresses the 10 CFR 54.22 requirement.

The NRC staff evaluated the technical information required by 10 CFR 54.21 and 10 CFR 54.22 in accordance with NRC regulations and SRP-SLR guidance. SE Sections 2, 3, and 4 document the staff's evaluations of the SLRA technical information.

As required by 10 CFR 54.25, "Report of the Advisory Committee on Reactor Safeguards," the ACRS issues a report documenting its evaluation of the NRC staff's SLRA review and SE. SE Section 5 describes the role of the ACRS. SE Section 6 documents the findings required by 10 CFR 54.29.

1.4 Interim Staff Guidance

License renewal is a living program. The NRC staff, industry, and other interested stakeholders gain experience and develop lessons learned with each renewed license. The lessons learned contribute to the staff's performance goals of maintaining safety, improving effectiveness and efficiency, reducing regulatory burden, and increasing public confidence. The NRC identifies lessons learned in interim staff guidance (ISG) for the staff, industry, and other interested stakeholders to use until the NRC incorporates the information into license renewal guidance documents such as the SRP-SLR and GALL-SLR Report.

Table 1.4-1 shows the current set of license renewal ISG topics, as well as the sections in this SE that address each topic.

Table 1.4-1 Current License Renewal Interim Staff Guidance

License Renewal ISG Topic (Approved LR-ISG Number)	Title	SE Section
SLR-ISG-2021-04-ELECTRICAL (ADAMS Accession No. ML20181A395)	Updated Aging Management Criteria for Electrical Portions of Subsequent License Renewal Guidance	SE Sections 3.0.3.1.13, 3.0.3.2.26, 3.0.3.2.27
-MECHANICAL (ADAMS Accession No. ML20181A434)	Updated Aging Management Criteria for Mechanical Portions of Subsequent License Renewal Guidance	SE Sections 3.0.3.1.1, 3.0.3.1.4, 3.0.3.1.17, 3.0.3.2.7, 3.0.3.2.10, 3.0.3.2.17
SLR-ISG-2021-03-STRUCTURES (ADAMS Accession No. ML20181A381)	Updated Aging Management Criteria for Structures Portions of Subsequent License Renewal Guidance	SE Section 3.0.3.2.24
SLR-ISG-2021-01-PWRVI (ADAMS Accession No. ML20217L203)	Updated Aging Management Criteria for Reactor Vessel Internal Components for Pressurized-Water Reactors	SE Section 3.0.3.2.3

1.5 Summary of Open Items

An item is considered open if, in the NRC staff's judgment, the staff has not determined that the item meets all applicable regulatory requirements at the time of the issuance of this SE. After reviewing the ONS SLRA, including additional information Duke Energy submitted through September 2, 2022, the staff identified no open items.

1.6 Summary of Confirmatory Items

An item is considered confirmatory if, in the NRC staff's judgment, the staff and the applicant have reached an acceptable resolution that meets all applicable regulatory requirements but, at the time of the issuance of this SE, the staff had not received the necessary documentation to confirm the resolution. After reviewing the ONS SLRA, including additional information Duke Energy submitted through September 2, 2022, the staff finds that no confirmatory items exist requiring a formal response from Duke Energy.

1.7 Summary of Proposed License Conditions

After reviewing the ONS SLRA, including additional information and clarifications Duke Energy submitted through September 2, 2022, the NRC staff identified two proposed license conditions.

The first license condition requires Duke Energy, following the NRC staff's issuance of the subsequent renewed license, to include the UFSAR supplement (containing a summary of programs and activities for managing the effects of aging and an evaluation of TLAAs for the subsequent period of extended operation (as required by 10 CFR 54.21(d)) in its next periodic UFSAR update, as required by 10 CFR 50.71(e)). The regulation, 10 CFR 50.71(e), requires nuclear power plant licensees to periodically update their plant's final safety analysis report "to assure that the information included in the report contains the latest information developed." Duke Energy may make changes to the programs and activities described in the UFSAR update and supplement provided that Duke Energy evaluates such changes under the criteria set forth in 10 CFR 50.59, "Changes, tests and experiments," and otherwise complies with the requirements in that regulation.

The second license condition requires Duke Energy to complete future activities described in the UFSAR supplement before the beginning of the subsequent period of extended operation. Duke Energy must complete these activities no later than 6 months before the beginning of the subsequent period of extended operation and must notify the NRC in writing when it has completed those activities.

SECTION 2 STRUCTURES AND COMPONENTS SUBJECT TO AGING MANAGEMENT REVIEW

2.1 Scoping and Screening Methodology

2.1.1 Introduction

Title 10 of the *Code of Federal Regulations* (10 CFR) 54.21, "Contents of application – technical information," requires, in part, that an SLRA contain an integrated plant assessment (IPA) of the SSCs within the scope of SLR, as delineated in 10 CFR 54.4, "Scope." The IPA must identify and list those SCs included in the SSCs within the scope of SLR, which are subject to an aging management review (AMR). Section 54.21 of 10 CFR further requires that an SLRA describe and justify the methods used to identify the SSCs within the scope of SLR and the SCs therein subject to an AMR.

2.1.2 Summary of Technical Information in the Application

SLRA Section 2.0, "Scoping and Screening Methodology for Identifying Structures and Components Subject to Aging Management Review and Implementation Results," provides the technical information that 10 CFR 54.21 requires. SLRA Section 2.0 states, in part, that the applicant considered the following in developing the scoping and screening methodology described in SLRA Section 2.0:

- 10 CFR Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants" (the Rule)
- Nuclear Energy Institute (NEI) 17-01, "Industry Guideline for Implementing the Requirements of 10 CFR Part 54 for Subsequent License Renewal" (NEI 17-01) (ADAMS Accession No. ML17339A599), endorsed by NRC Regulatory Guide (RG) 1.188, Revision 2, "Standard Format and Content for Applications to Renew Nuclear Power Plant Operating Licenses," dated April 2020 (ADAMS Accession No. ML20017A265)

SLRA Section 2.1, "Scoping and Screening Methodology," describes the methodology the applicant used for the ONS, Units 1, 2, and 3, to identify the SSCs within the scope of subsequent license renewal (scoping) and the SCs therein subject to an AMR (screening).

2.1.3 Scoping and Screening Program Review

The NRC staff evaluated the applicant's scoping and screening methodology in accordance with the guidance in NUREG-2192, "Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants" (SRP-SLR), Section 2.1, "Scoping and Screening Methodology." The following regulations provide the basis for the acceptance criteria that the staff uses to assess the adequacy of the applicant's SLRA scoping and screening methodology:

- 10 CFR 54.4(a), as it relates to the identification of SSCs within the scope of the Rule
- 10 CFR 54.4(b), as it relates to the identification of the intended functions of SSCs within the scope of the Rule
- 10 CFR 54.21(a), as it relates to the methods used by the applicant to identify SCs subject to an AMR

The staff reviewed the information in SLRA Section 2.1 to confirm that the applicant described a process—the methodology—for identifying SSCs that are within the scope of SLR in accordance with the requirements of 10 CFR 54.4(a) and SCs that are subject to an AMR in accordance with the requirements of 10 CFR 54.21(a).

2.1.3.1 Documentation Sources Used for Scoping and Screening

2.1.3.1.1 Summary of Technical Information in the Application

SLRA Section 2.1.2, "Information Sources Used for Scoping and Screening," discusses the following information sources for the subsequent license renewal scoping and screening process:

- UFSAR
- flow diagrams
- design basis document (DBD)
- equipment database
- maintenance rule database
- EQ documentation
- National Fire Protection Association (NFPA) 805 Fire Protection Program
- other information sources, including:
  - application for initial renewed operating licenses for ONS Units 1, 2, and 3 (initial license renewal application [LRA])
  - NUREG-1723, "Safety Evaluation Report Related to the License Renewal of ONS, Units 1, 2, and 3"
  - NRC SEs, including NRC staff review of ONS licensing submittals; some of these documents may contain licensee commitments
  - licensing correspondence, including relief requests, licensee event reports, and responses to NRC communications such as NRC bulletins, generic letters, or enforcement actions; some of these documents may contain licensee commitments
  - ONS technical specifications and bases
  - ONS selected licensee commitments
  - engineering drawings, specifications, and calculations
  - ONS walkdown reports documenting the configuration and material properties of plant SSCs

2.1.3.1.2 Staff Evaluation

Section 54.3, "Definitions," of 10 CFR defines CLB as the set of NRC requirements applicable to a specific plant and a licensee's written commitments for ensuring compliance with and operation within applicable NRC requirements and the plant-specific design basis (including all modifications and additions to such commitments over the life of the license) that are docketed and in effect. The CLB includes the NRC regulations contained in 10 CFR Parts 2, 19, 20, 21, 26, 30, 40, 50, 51, 52, 54, 55, 70, 72, 73, and 100 and appendices thereto; orders; license conditions; exemptions; and technical specifications. It also includes the plant-specific design basis information defined in 10 CFR 50.2, "Definitions," as documented in the most recent UFSAR as required by 10 CFR 50.71, "Maintenance of records, making of reports," and the licensee's commitments remaining in effect that were made in docketed licensing correspondence, such as licensee responses to NRC bulletins, generic letters, and enforcement actions, as well as licensee commitments documented in NRC safety evaluations or licensee event reports.

The NRC staff considered the scope and depth of the applicant's CLB review to verify the methodology is sufficiently comprehensive to identify SSCs within the scope of SLR and SCs subject to an AMR. The staff determined that the documentation sources provided sufficient information to ensure that the applicant identified SSCs to be included within the scope of SLR consistent with the plant's CLB.

2.1.3.1.3 Conclusion

Based on its review of the SLRA, the NRC staff finds that the applicant's consideration of document sources, including CLB information, is consistent with the Rule, the SRP-SLR, and NEI 17-01 guidance and is, therefore, acceptable.

2.1.4 Plant Systems, Structures, and Components Scoping Methodology

SLRA Section 2.1.4, "Scoping Methodology," states, in part, the following:

> The scoping process is the systematic process used to identify the ONS SSCs within the scope of the LR rule. For mechanical systems and structures the scoping process was initially performed at the system and structure level, in accordance with the scoping criteria identified in 10 CFR 54.4(a). System and structure level intended functions were identified from a review of the CLB and DBDs. In-scope boundaries were established and documented in the scoping evaluations, based on the identified intended functions. The in-scope boundaries form the basis for identification of the in-scope components, which is the first step in the screening process.

2.1.4.1 Application of Scoping Criteria in 10 CFR 54.4(a)(1)

2.1.4.1.1 Summary of Technical Information in the Application

The applicant addressed the methods used to identify SSCs that are included within the scope of SLR, in accordance with the requirements of 10 CFR 54.4(a)(1) in SLRA Section 2.1.3.2, "10 CFR 54.4(a)(1) Scoping Criterion," which states, in part:

> Systems and structures are included within the scope of SLR in accordance with the 10 CFR 54.4(a)(1) scoping criterion. A technical basis document was prepared to ensure complete and consistent application of this scoping criterion. As noted in NEI 17-01 and consistent with NUREG-2192, an applicant's CLB definition of safety related may not match the 10 CFR 54.4(a)(1) definition. This is the case for ONS. Oconee was designed prior to the issuance of 10 CFR Part 50 Appendix A, *"General Design Criteria for Nuclear Power Plants"*, Appendix B, *"Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants,"* and the NRC's Standard Review Plan (NUREG-0800). In the absence of regulations and standards, ONS and other early commercial nuclear power plants developed their own definitions of "safety related" using a code-based approach based on correspondence from the USAEC [United States Atomic Energy Commission] and available mechanical, civil, and electrical codes. For this reason, rather than simply sorting the plant systems and structures based on safety classification, all functions required for mitigating the consequences of design basis

> events [DBEs] and the systems and components relied upon to complete those functions were identified.

SLRA Section 2.1.4.1, "Safety Related – 10 CFR 54.4(a)(1)," further stated:

> Using the complete list of mechanical systems and structures, functions that are required during and following DBEs as described in the plant's CLB were identified. For mechanical systems, the DBDs [design basis documents] identify the system level event mitigation functions and the unique events for which the event mitigation function is required. Additional sources, primarily the UFSAR and Maintenance Rule database, were utilized in this functional review. Structures that house systems that meet the (a)(1) scoping criteria also meet the (a)(1) scoping criteria, as the structure provides a support function.
>
> The ONS methodology for scoping identifies the SSCs relied upon to remain functional during and following DBEs and therefore meets the 10 CFR 54.4(a)(1) criterion. Scoping of mechanical systems and structures is performed at a system or structure level. Electrical and I&C [instrumentation and control] systems that meet the 10 CFR 54.4(a)(1) scoping criteria (and likewise for the (a)(2) and (a)(3) criteria) are not identified since the approach is to perform electrical scoping at the component level. The scoping approach is consistent with guidance contained in NEI 17-01 and NUREG-2192. The ONS methodology for scoping under the 10 CFR 54.4(a)(1) criterion meets the requirements of 10 CFR Part 54.

2.1.4.1.2 Staff Evaluation

In accordance with 10 CFR 54.4(a)(1), the applicant must consider all safety related SSCs relied on to remain functional during and following a DBE (as defined in 10 CFR 50.49(b)(1)) to ensure the following functions: (1) the integrity of the reactor coolant pressure boundary, (2) the capability to shut down the reactor and maintain it in a safe-shutdown condition, or (3) the capability to prevent or mitigate the consequences of accidents that could result in potential offsite exposures comparable to those referred to in 10 CFR 50.34(a)(1), 10 CFR 50.67(b)(2), or 10 CFR 100.11, as applicable.

Regarding the identification of DBEs, SRP-SLR Section 2.1.3, "Review Procedures," states, in part:

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

As indicated in SLRA Section 2.1.3.2, the applicant stated that the ONS CLB definition of "safety related," as described in 10 Part 54.4(a)(1), did not encompass the totality of SSCs necessary to respond to the DBEs as defined in 10 CFR 50.49(b)(1). The staff determined that the applicant performed an additional review to identify all SSCs that would have an intended function in response to the DBEs as defined in 10 CFR 50.49(b)(1) and included them within the scope of SLR. In addition, the staff determined that the applicant performed a review to identify those SSCs that were not identified as safety related but would meet the criteria of 10 CFR Part 54.4(a)(1) for being included within the scope of SLR.

The staff reviewed the applicant's basis documents that describe design basis conditions in the CLB and address DBEs as defined in 10 CFR 50.49(b)(1). The UFSAR and basis documents discuss events, such as internal and external flooding, tornados, and missiles. The staff determined that the applicant's evaluation of DBEs is consistent with the SRP-SLR. The staff reviewed SLRA Section 2.1.4.1, the applicant's evaluation of the Rule, and CLB definitions pertaining to 10 CFR 54.4(a)(1) and finds that the applicant's CLB definition of "safety related" is different than the definition of "safety--related" specified in the Rule. The staff finds that the applicant had taken appropriate action to identify SSCs, beyond those identified as safety-related in accordance the applicant's CLB definition, to ensure that all SSCs meeting the 10 CFR 54.4(a)(1) criteria were included within the scope of SLR.

2.1.4.1.3 Conclusion

Based on its review of the SLRA and the UFSAR, the staff finds that the applicant's methodology for identifying safety related SSCs relied upon to remain functional during and following DBEs and for including those SSCs within the scope of SLR is in accordance with the requirements of 10 CFR 54.4(a)(1) and is therefore acceptable.

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

2.1.4.2.1 Summary of Technical Information in the Application

The applicant addressed the methods used to identify SSCs included within the scope of SLR in accordance with the requirements of 10 CFR 54.4(a)(2) in SLRA Section 2.1.4.2, "Non-Safety Related Affecting Safety Related – 10 CFR 54.4(a)(2)," and its subsections. In addition, SLRA Section 2.0 states that the applicant's methodology is consistent with the guidance contained in NEI 17-01. NEI 17-01 (which also refers to NEI 95-10, Revision 6, endorsed by the NRC in RG 1.188) discusses the implementation of the 10 CFR 54.4(a)(2) scoping criteria to include non-safety related SSCs whose failure may have the potential to prevent satisfactory accomplishment of safety functions.

Non-safety Related SSCs Supporting Safety Functions

SLRA Section 2.1.4.2, the portion titled "Non-safety related SSCs that perform or provide support for 10 CFR 54.4(a)(1) functions," includes a discussion of non-safety related SSCs that are required to function in order to support the ability of safety related SSCs that are required to perform the safety related intended function and states, in part, the following:

> The ONS UFSAR, CLB and DBDs were reviewed to identify non-safety related mechanical systems required to support satisfactory accomplishment of a safety related function. Non-safety related mechanical systems, or non-safety related portions of safety related systems credited in CLB documents to support a safety related function have been included within the scope of SLR for 10 CFR 54.4(a)(2).

Non-safety Related SSCs Attached to Safety Related SSCs

SLRA Section 2.1.4.2, the portion titled "Non-safety related SSCs that are connected to and provide structural support for safety related SSCs," states, in part:

> The guidance of NEI 95-10, Appendix F (as referenced in NEI 17-01) was used to identify the end points of non-safety related piping components that are directly attached to, and provide support for safety related piping components. The attached non-safety related piping components must be included within scope up to and including the first seismic or equivalent anchor. NEI 95-10, Appendix F lists the following configurations that correspond to this requirement:

- A seismic anchor is defined as a device or structure that ensures that forces and moments are restrained in three orthogonal directions.
- An equivalent anchor may be defined in the CLB and can be credited for the 10 CFR 54.4(a)(2) evaluation.
- An equivalent anchor may also consist of a large piece of plant equipment (e.g., a heat exchanger) or a series of supports that have been evaluated as a part of a plant-specific piping design analysis to ensure that forces and moments are restrained in three orthogonal directions.
- In cases where an equivalent anchor is not clearly described within the existing CLB information or original design basis, a combination of restraints or supports such that the non-safety related piping and associated structures and components attached to the safety related piping is included in scope up to an endpoint that encompasses at least two supports in each of three orthogonal directions.

In addition, SLRA Section 2.1.4.2 states, in part:

> An alternative to specifically identifying a seismic anchor or equivalent anchor is to include enough of the non-safety related piping run to ensure that these anchors are included and thereby ensure the piping and anchor intended functions are maintained. The following methods provide assurance that the included piping encompasses the non-safety related piping included in the design basis seismic analysis and is consistent with the CLB:

- A base-mounted component (e.g., pump, heat exchanger, tank, etc.) that is a rugged component and is designed not to impose loads on connecting piping. The SLR scope should include the base-mounted component as it has a support function for the safety related piping.
- A flexible connection is considered a pipe stress analysis model end point where the flexible connection decouples the piping systems (i.e., does not support loads or transfer loads across it to connecting piping).
- A free end of non-safety related piping.
- For non-safety related piping runs that are connected at both ends to safety related piping include the entire run of non-safety related piping.
- A point where the buried piping exits the ground. The buried portion of the piping should be included in the scope of SLR.

- A smaller branch line where the moment of inertia ratio of the larger piping to the smaller piping is equal to or greater than the acceptable ratio defined by the CLB (for ONS, section modulus ratio greater than 10 is used), because significantly smaller piping does not impose loads on larger piping and does not support larger piping.

Non-safety Related SSCs with the Potential for Spatial Interactions with Safety Related SSCs

SLRA Section 2.1.4.2, the portion titled "Non-safety related SSCs that have the potential for spatial interactions with safety related SSCs" discusses the evaluation of non-safety related SSCs that could potentially impact safety related SSCs through spatial interaction (i.e., impact, spray, or leakage).

SLRA Section 2.1.4.2 states, in part:

> Non-safety related systems that are not connected to safety related piping or components, or are outside the structural support boundary for the attached safety related piping system, and have a spatial relationship such that their failure could adversely impact the performance of a safety related SSC intended function, must be included within the scope of SLR in accordance with 10 CFR 54.4(a)(2) requirements.

In addition, SLRA Section 2.1.4.2 states, in part:

> Oconee [ONS] applied a combination of the preventive and mitigative option for 10 CFR 54.4(a)(2) scoping. The preventive option as implemented at Oconee is based upon a "spaces" approach for determining potential for spatial interactions with safety related SSCs. The boundaries for the "spaces" are entire structures, or in limited cases a room within a structure that acts as physical barriers and separates safety related targets from non-safety related hazards. Mitigative features (e.g., pipe whip restraints, jet impingement shields, spray and drip shields, seismic supports, flood barriers, and physical barriers) were included for 10 CFR 54.4(a)(2) scoping and are addressed as structural components. Mitigative features in the scope of SLR included those credited in the plant's CLB for protecting essential equipment or physical barriers relied upon to exclude non-safety related components from 10 CFR 54.4(a)(2) scoping under the preventive option.

2.1.4.2.2 Staff Evaluation

The staff reviewed SLRA Section 2.1.4.2, in which the applicant described the scoping methodology for non-safety related SSCs in accordance with 10 CFR 54.4(a)(2). During the review, the staff followed the guidance contained in SRP-SLR Section 2.1.3.1.2, "Non-safety related," which states that the applicant should not consider hypothetical failures but rather should base its evaluation on the plant's CLB, engineering judgment and analyses, and relevant operating experience.

<u>Non-safety related SSCs Required to Perform a Function Supporting a Safety related Function</u>

The staff reviewed SLRA Section 2.1.4.2, which describes the method used to identify non-safety related SSCs required to perform a function that safety related SSCs rely on in order to perform their safety functions to be included within the scope of SLR in accordance with 10 CFR 54.4(a)(2). The staff confirmed that the applicant reviewed the UFSAR, the equipment database, and other CLB documents to identify non-safety related SSCs that perform a function that safety related SSCs rely on, and whose failure could prevent the performance of a safety function. The staff determined that the applicant had identified the non-safety related SSCs that perform a function that safety related SSCs rely on and whose failure could prevent the performance of a safety function, and included those SSCs within the scope of SLR in accordance with 10 CFR 54.4(a)(2).

The staff determined that the applicant's methodology for identifying non-safety related SSCs that perform or support a safety function for inclusion within the scope of SLR is in accordance with the guidance of the SRP-SLR and the requirements of 10 CFR 54.4(a)(2).

Non-safety related SSCs Directly Connected to Safety related SSCs

The staff reviewed SLRA Section 2.1.4.2, which describes the method used to identify non-safety related SSCs directly connected to safety related SSCs to be included within the scope of SLR in accordance with 10 CFR 54.4(a)(2).

The staff determined that the applicant had used a combination of the following to identify the bounding portion of non-safety related piping systems to include within the scope of SLR: seismic anchors, equivalent anchors as defined in the CLB, equivalent anchors as defined in NEI 17-01 (which refers to NEI 95-10), and the bounding conditions identified in NEI 17-01 (which refers to NEI 95-10).

The staff determined that the applicant's methodology for identifying and including non-safety related SSCs directly connected to safety related SSCs within the scope of SLR is in accordance with the guidance of the SRP-SLR and the requirements of 10 CFR 54.4(a)(2).

Non-safety related SSCs with the Potential for Spatial Interaction with Safety related SSCs.

The staff reviewed SLRA Section 2.1.4.2, which describes the methods used to identify non-safety related SSCs with the potential for spatial interaction with safety related SSCs to be included within the scope of SLR in accordance with 10 CFR 54.4(a)(2).

The staff determined that the applicant had used a spaces approach and evaluated spaces to identify the portions of non-safety related systems with the potential for spatial interaction with safety related SSCs. The approach focused on the interaction between non-safety related and safety related SSCs located in the same space, which was described in the SLRA as a structure or a portion of a structure that contains active or passive safety related SSCs. The staff determined that the applicant had included the non-safety related SSCs located within the same space as safety related SSCs within the scope of SLR in accordance with 10 CFR 54.4(a)(2). In addition, the staff determined that the applicant had identified SCs that mitigated the effects of the potential failures of non-safety related SSCs on safety related SSCs and included those non-safety related SSCs within the scope of SLR in accordance with 10 CFR 54.4(a)(2).

The staff determined that the applicant's methodology for identifying and including non-safety related SSCs with the potential for spatial interaction with safety related SSCs within the scope of SLR is in accordance with the guidance of the SRP-SLR and the requirements of 10 CFR 54.4(a)(2).

2.1.4.2.3 Conclusion

Based on its review of the SLRA, the staff finds that the applicant's methodology for identifying, evaluating, and including non-safety related SSCs whose failure could prevent satisfactory accomplishment of the intended functions of safety related SSCs within the scope of SLR is in accordance with the requirements of 10 CFR 54.4(a)(2) and is, therefore, acceptable.

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

2.1.4.3.1 Summary of Technical Information in the Application

SLRA Section 2.1.4.3, "Regulated Events – 10 CFR 54.4(a)(3)," which describes the methods used to identify SSCs included within the scope of SLR in accordance with the requirements of 10 CFR 54.4(a)(3), states, in part:

> In accordance with 10 CFR 50.4(a)(3), the SSCs within the scope of [subsequent license renewal] include: 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 fire protection (10 CFR 50.48), environmental qualification (10 CFR 50.49), pressurized thermal shock (10 CFR 50.61), anticipated transients without scram (10 CFR 50.61), and station blackout (10 CFR 50.63).

SLRA Section 2.1.4.3 further states:

> For each of the five regulations, a technical basis document was prepared to provide input into the scoping process. Each of the regulated event technical basis documents (described in Section 2.1.3 [of the SLRA]) identifies the systems and structures that are relied upon to demonstrate compliance with the applicable regulation. The technical basis documents also identify the source documentation used to determine the scope of components within the system that are credited in demonstrating compliance with each of the applicable regulated events. Guidance provided by the technical basis documents was incorporated into the system and structure scoping evaluations to determine the SSCs credited for each of the regulated events. SSCs credited in the regulated events have been classified as satisfying criteria of 10 CFR 54.4(a)(3) and have been included within the scope of SLR.

2.1.4.3.2 Staff Evaluation

The staff reviewed SLRA Section 2.1.4.3, which describes the method used to identify and to include within the scope of SLR those SSCs relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48, "Fire protection"); EQ (10 CFR 50.49, "Environmental qualification of electric equipment important to safety for nuclear power plants"); PTS (10 CFR 50.61, "Fracture toughness requirements for protection against pressurized thermal shock events"); ATWS (10 CFR 50.62, "Requirements for reduction of risk from anticipated transients without scram (ATWS) events for light-water-cooled nuclear power plants"); and SBO (10 CFR 50.63, "Loss of all alternating current power").

The staff determined that the applicant's scoping process had considered information sources used for scoping and screening to verify that the appropriate SSCs were included within the scope of SLR and evaluated CLB information to identify SSCs that perform functions addressed in 10 CFR 54.4(a)(3) and included those SSCs within the scope of SLR. Based on its review of information contained in the SLRA and the CLB documents reviewed, the staff determined that the applicant's methodology is sufficient for identifying and including SSCs credited in performing functions within the scope of SLR in accordance with the requirements of 10 CFR 54.4(a)(3).

2.1.4.3.3 Conclusion

Based on its review of the SLRA, the staff finds that the applicant's methodology for identifying and including SSCs that are relied on to remain functional during regulated events is consistent with the requirements of 10 CFR 54.4(a)(3) and is, therefore, acceptable.

2.1.4.4 Scoping of Systems and Structures

2.1.4.4.1 Summary of Technical Information in the Application

SLRA Section 2.0 states, in part:

> The scoping and screening methodology is implemented in accordance with NEI 17-01, "Industry Guideline for Implementing the Requirements of 10 CFR Part 54 for Subsequent License Renewal."

SLRA Section 2.1.1, "Introduction," states, in part, for mechanical SSCs:

> For mechanical systems and structures, the initial step in the scoping process was to define the entire plant in terms of systems and structures. Each of the identified mechanical systems and structures were then evaluated against the scoping criteria in 10 CFR 54.4(a)(1), (a)(2), and (a)(3), to determine if the mechanical system or structure is relied upon to remain functional during and following a DBE, if the mechanical system or structure failure could prevent the satisfactory accomplishment of a function described in 10 CFR 54.4(a)(1)(i), (ii), or (iii) or if the mechanical system or structure is relied on in safety analysis or plant evaluation to perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48), environmental qualification (EQ) (10 CFR 50.49), pressurized thermal shock (PTS) (10 CFR 50.61), anticipated transients without scram (ATWS) (10 CFR 50.62), or station blackout (SBO) (10 CFR 50.63). The intended function(s) that are the bases for including mechanical systems and structures within the scope of SLR were also identified.

SLRA Section 2.1.1, "Introduction," states, in part, for structural SSCs:

> Structures were included within the scope of SLR if any portion of a structure met the scoping criteria in 10 CFR 54.4(a)(1), (a)(2), or (a)(3). Structures were then further evaluated to determine the structural components that are required to perform or support the identified structures intended function(s). The portions of each structure within the scope of SLR that are required to perform or support the identified structures intended function(s) were identified and are described in Section 2.4 [of the SLRA].

SLRA Section 2.1.1, "Introduction," states, in part, for electrical SSCs:

> Electrical scoping was not performed at the system level but rather at the component level using a bounding or spaces approach. As discussed in the Statement of Consideration to the License Renewal Rule (60FR22462), the term "systems, structures, and components" is used in 10 CFR 54.4 to allow an applicant to scope at a system or structure level or at a component level. Whether dividing the electrical portions of the

> plant by systems or other means, the objective is to ensure that no electrical components that perform an intended function are excluded from the review. This approach initially includes all electrical components within scope and selectively scopes out electrical components that do not perform an intended function that meets 10 CFR 54.4. Furthermore, for efficiency of review, 10 CFR 54.4(a) is applied to electrical components only after they have been screened under 10 CFR 54.21(a)(1).

2.1.4.4.2 Staff Evaluation

The staff reviewed SLRA Sections 2.0 and 2.1.1 and the associated subsections and determined that the applicant had described a methodology for identifying SSCs within the scope of SLR to verify that it meets the requirements of 10 CFR 54.4(a). SLRA Section 2.1.1 states that for mechanical and structural SSCs, the applicant defined the plant in terms of systems and structures and an evaluation was completed for all systems and structures on site to ensure that the entire plant was assessed. The staff determined that for electrical SSCs, the applicant had initially included all electrical components within the scope of SLR (bounding the requirements of 10 CFR 54.4(a)(1), 10 CFR 54.4(a)(2), and 10 CFR 54.4 (a)(3)), performing the scoping at a component level.

The staff determined that the applicant had identified the SSCs within the scope of SLR and documented the results of the scoping process in SLRA Section 2.3, “Scoping and Screening Results: Mechanical Systems”; SLRA Section 2.4, “Scoping and Screening Results: Containment, Structures, and Component Supports”; and SLRA Section 2.5, “Scoping and Screening Results: Electrical.” SLRA Sections 2.3 through 2.5 include a description of the system or structure, a list of functions the system or structure performed, identification of intended functions, the 10 CFR 54.4(a) scoping criteria the system or structure met, scoping boundaries, system intended functions, UFSAR references, and component types subject to an AMR. The staff determined that the applicant’s process is consistent with the description provided in SLRA Sections 2.0 and 2.1 through 2.5 and the guidance in SRP-SLR Section 2.1.

2.1.4.4.3 Conclusion

Based on its review of the SLRA, the NRC staff finds that the applicant’s scoping methodology is consistent with the guidance contained in the SRP-SLR and identified those SSCs (1) that are safety related, (2) non-safety related whose failure could affect safety related intended functions, and (3) that are necessary to demonstrate compliance with the NRC’s regulations for fire protection, EQ, PTS, ATWS, and SBO. The staff finds that the applicant’s methodology is consistent with the requirements of 10 CFR 54.4(a) and is, therefore, acceptable.

2.1.5 Screening Methodology

2.1.5.1 Summary of Technical Information in the Application

SLRA Section 2.1.5.1, “Identifications of Structures and Components Subject to Aging Management Review,” states in part:

> SSCs that were determined to be within the scope of SLR were then screened to determine which structures and components are subject to an AMR.

SLRA Section 2.1.5.1 further states, in part:

> Structures and components that perform an intended function without moving parts or without a change in configuration or properties are defined as passive for SLR. Passive structures and components that are not subject to replacement based on a qualified life or specified time period are defined as long-lived for SLR. Screening is the process used to identify the passive, long-lived structures, and components within the scope of SLR. These structures and components are subject to AMR.

SLRA Section 2.1.5.1 further states, in part, for mechanical SSCs:

> The mechanical system screening process began with the results from the scoping process. For in-scope mechanical systems, the written descriptions and marked up system flow diagrams identify the in-scope system boundary of passive components for SLR. The marked-up system flow diagrams are the SLR boundary drawings. These system boundary drawings were reviewed to identify the passive, long-lived components, and the identified components were evaluated in the IPA technical basis documents.

SLRA Section 2.1.5.1 further states, in part, for structural SSCs:

> Structures and structural components typically perform their functions without moving parts and without a change in configuration or properties. When a structure or structural component was determined to be within the scope of SLR by the scoping process described in Section 2.1.4 [of the SLRA], the structure screening methodology classified the component as active or passive. Active components do not require aging management. This is consistent with guidance found in NUREG-2192 Table 2.1-6, as referenced by NEI 17-01. During the structure screening process, the intended function(s) of passive structural components were documented. In the structure screening process, an evaluation was made to determine whether in-scope structural components were subject to replacement based on a qualified life or specified time period. If an in-scope structural component was determined to be subject to replacement based on a qualified life or specified time period, the component was identified as short-lived and was excluded from an AMR.

SLRA Section 2.1.5.1 further states, in part, for electrical SSCs:

> Screening of electrical and I&C components used a bounding approach as described in NEI 17-01. Electrical and I&C components were assigned to commodity groups based on the listing in NUREG-2192, Table 2.1-6. Commodities subject to an AMR were identified by applying 10 CFR 54.21(a)(1) to identify those commodities that perform their function without moving parts or a change in configuration (passive components). This method provides the most efficient means for determining the electrical commodities subject to an AMR since many electrical and I&C components are active. Passive commodity groups were reviewed, and any that did not perform an intended function were determined to not require an AMR. The remaining passive commodity groups were screened consistent with 10 CFR 54.21(a)(1)(ii) to exclude those commodities that are subject to replacement based on a qualified life or specific time period from the requirements of an AMR.

2.1.5.2 Staff Evaluation

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

The NRC staff reviewed SLRA Section 2.1.5.1, which describes the methodology the applicant used to identify the mechanical, structural, and electrical SCs within the scope of SLR that are subject to an AMR. The applicant implemented a process for determining which SCs are subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1). SLRA Section 2.1.5.1 describes the screening process, during which the applicant’s staff evaluated the component types and commodity groups included within the scope of SLR, to determine which ones are passive and long-lived and therefore subject to an AMR.

<u>Mechanical Systems and Structural</u>

The NRC staff reviewed the applicant’s methodology used for mechanical and structural component screening as described in SLRA Section 2.1.5.1, “Identifications of Structures and Components Subject to Aging Management Review.” The staff determined that the applicant used the screening process described in these documents, along with the information contained in NEI 17-01 and the SRP-SLR, to identify the mechanical and structural SCs subject to an AMR. The staff determined that the applicant identified the SCs that meet the passive criteria in accordance with the guidance contained in NEI 17-01, and among those SCs, those that are not subject to replacement based on a qualified life or specified time period (long-lived). The applicant determined that the remaining passive, long-lived components are subject to an AMR.

<u>Electrical Commodities</u>

The NRC staff reviewed the applicant’s methodology used for electrical component screening as described in SLRA Section 2.1.5.1 for electrical commodities. The staff confirmed that the applicant used the screening process described in the SLRA along with the information contained in NEI 17-01 and the SRP-SLR to identify the electrical SCs subject to an AMR. The staff determined that the applicant’s screening process initially included all electrical components within the scope of SLR (bounding the requirements of 10 CFR 54.4(a)(1), 10 CFR 54.4(a)(2) and 10 CFR 54.4 (a)(3)) and then subsequently identified electrical commodity groups that meet the passive criteria in accordance with NEI 17-01, and among those passive SCs, those SCs that are not subject to replacement based on a qualified life or specified time period (long-lived). The applicant determined that the remaining passive, long-lived components are subject to an AMR.

2.1.5.3 Conclusion

Based on its review of the SLRA, the NRC staff finds that the applicant’s screening methodology is consistent with the guidance contained in the SRP-SLR and identified the passive, long-lived components within the scope of SLR that are subject to an AMR. The staff concludes that the applicant's methodology is consistent with the requirements of 10 CFR 54.21(a)(1) and is therefore, acceptable.

2.1.6 Summary of Evaluation Findings

Based on its review of the SLRA, the NRC staff finds that the applicant's description and justification of its methodology for identifying SSCs within the scope of SLR and SCs subject to an AMR as described are consistent with the requirements of 10 CFR 54.4 and 10 CFR 54.21(a)(1) and are, therefore, acceptable.

2.2 Plant Level Scoping Results

2.2.1 Introduction

In SLRA Section 2.1, the applicant described its methodology for identifying SSCs within the scope of SLR and subject to an AMR. In SLRA Section 2.2, "Plant Level Scoping Results," the applicant applied the scoping methodology to determine which systems and structures must be included within the scope of SLR.

The NRC staff reviewed the plant level scoping results to determine whether the applicant properly identified the following in accordance with the requirements of 10 CFR 54.4(a):

a) Safety related SSCs, which are those relied on to remain functional during and following DBEs (as defined in 10 CFR 50.49(b)(1)).
b) All non-safety related SSCs whose failure could prevent satisfactory accomplishment of any of the functions identified in 10 CFR 54.4(a)(1)(i), (ii), or (iii).
c) All SSCs relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48), EQ (10 CFR 50.49), PTS (10 CFR 50.61), ATWS (10 CFR 50.62), and SBO (10 CFR 50.63).

2.2.2 Summary of Technical Information in the Application

SLRA Section 2.2 states:

> [SLRA] Table 2.2-1 and Table 2.2-2 lists the ONS mechanical systems and structures that were evaluated to determine if they were within the scope of SLR, using the methodology described in Section 2.1. A reference to the section of the application that contains the scoping and screening results is provided for each in-scope mechanical system and structure.
>
> As discussed in [SLRA] Section 2.1.4, plant level scoping results for electrical and I&C systems are not presented since scoping is performed at a component level. All plant electrical and I&C components are included in the review unless they are specifically scoped out per 10 CFR 54.4 or screened out per 10 CFR 54.21(a)(1).

2.2.3 Staff Evaluation

SE Section 2.1 contains the NRC staff's review and evaluation of the applicant's scoping and screening methodology. The staff's review focused on the implementation results shown in

SLRA Table 2.2-1, “Plant Level Scoping Results for Mechanical Systems,” and Table 2.2-2, “Plant Level Scoping Results for Structures,” and the electrical systems information contained in SLRA Section 2.1.4, SLRA Section 2.2, and SLRA Section 2.5.2, “Application of 10 CFR 54.4(a) Scoping Criteria to Electrical Components.”

The staff determined that the applicant had properly identified the systems and structures within the scope of SLR, in accordance with 10 CFR 54.4. The staff reviewed selected systems and structures that had not been identified as within the scope of SLR to verify whether these systems and structures have any intended functions requiring their inclusion within the scope of SLR. The staff conducted its review of the scoping implementation in accordance with SRP-SLR Section 2.2, “Plant Level Scoping Results.”

The staff sampled the contents of the UFSAR based on the systems and structures listed in SLRA Tables 2.2-1 and 2.2-2 and the information contained in SLRA Sections 2.1.4, 2.2, and 2.5.2. The staff sought to determine whether any systems or structures may have intended functions within the scope of SLR (as defined by 10 CFR 54.4) that had been omitted from the scope of SLR. The staff identified no such omissions.

2.2.4 Conclusion

Based on its review of the SLRA, the NRC staff finds that the SLRA adequately identifies the systems and structures within the scope of SLR in accordance with 10 CFR 54.4 and is, therefore, acceptable.

2.3 Scoping and Screening Results: Mechanical Systems

This section documents the staff’s review of the applicant’s scoping and screening results for mechanical systems SCs for the following systems:

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

In accordance with the requirements of 10 CFR 54.21(a)(1), the applicant must list the passive, long-lived SCs that are within the scope of subsequent license renewal and that are subject to an AMR. To verify that the applicant properly implemented its methodology, the NRC staff focused its review on the implementation results. This focus allowed the staff to verify that the applicant identified the mechanical system SCs that met the scoping criteria and that were subject to an AMR, thus confirming that there were no omissions.

The NRC staff’s evaluation of mechanical systems was performed using the evaluation methodology described in SRP-SLR Section 2.3, “Scoping and Screening Results: Mechanical Systems,” and considered the system function(s) described in the UFSAR. The objective was to determine whether the applicant, in accordance with 10 CFR 54.4, identified components and supporting structures for mechanical systems that meet the license renewal scoping criteria. Similarly, the staff evaluated the applicant’s screening results to verify that all passive, long-lived components are subject to an AMR, as required by 10 CFR 54.21(a)(1).

In its scoping evaluation, the NRC staff reviewed the SLRA, applicable sections of the UFSAR, subsequent license renewal boundary drawings, and other licensing-basis documents, as appropriate, for each mechanical system within the scope of SLR. The staff also reviewed relevant licensing-basis documents for each mechanical system to confirm that the SLRA specified all intended functions defined by 10 CFR 54.4(a). The review then focused on identifying any components with intended functions defined by 10 CFR 54.4(a) that the applicant may have erroneously omitted from the scoping results.

After reviewing the scoping results, the NRC staff evaluated the applicant's screening results. For those SCs with intended functions included under 10 CFR 54.4(a), the staff confirmed that the applicant properly screened out only (1) SCs that have functions performed with moving parts or that have a change in configuration or properties, or (2) SCs that are subject to replacement after a qualified life or specified time period, as described in 10 CFR 54.21(a)(1). The staff confirmed that the applicant included SCs that do not meet either of these criteria in the AMR, as required by 10 CFR 54.21(a)(1). The staff issued RAIs as needed to resolve any omissions or discrepancies, as discussed below.

2.3.1 Summary of Technical Information in the Application

SLRA Section 2.3.1, "Reactor Vessel, Reactor Internals, and Reactor Coolant System"; Section 2.3.2, "Engineered Safety Features"; Section 2.3.3, "Auxiliary Systems"; and Section 2.3.4, "Steam and Power Conversion System" identify the mechanical systems SCs subject to an AMR for license renewal. The applicant described the supporting SCs in the following SLRA sections:

- SLRA Section 2.3.1.1, "Reactor Vessel"
- SLRA Section 2.3.1.2, "Reactor Vessel Internals"
- SLRA Section 2.3.1.3, "Reactor Coolant System"
- SLRA Section 2.3.1.4, "Steam Generators"
- SLRA Section 2.3.2.1, "Reactor Building Spray System"
- SLRA Section 2.3.2.2, "Core Flood System"
- SLRA Section 2.3.2.3, "High-Pressure Injection System"
- SLRA Section 2.3.2.4, "Low-Pressure Injection System"
- SLRA Section 2.3.3.1, "Air Gas Related Systems"
- SLRA Section 2.3.3.2, "Ancillary Related Systems"
- SLRA Section 2.3.3.3, "Closed Cycle Water Related Systems"
- SLRA Section 2.3.3.4, "Fire Protection Related Systems"
- SLRA Section 2.3.3.5, "Heating Ventilation and Air Conditioning Related Systems"
- SLRA Section 2.3.3.6, "Lube Oil Related Systems"
- SLRA Section 2.3.3.7, "Miscellaneous Related Systems"
- SLRA Section 2.3.3.8, "Miscellaneous Oil Related Systems"
- SLRA Section 2.3.3.9, "Raw Water Related Systems"
- SLRA Section 2.3.3.10, "Standby Shutdown Facility Diesel Generator Related Systems"
- SLRA Section 2.3.3.11, "Waste Disposal Related Systems"
- SLRA Section 2.3.4.1, "Condensate System"
- SLRA Section 2.3.4.2, "Feedwater System"
- SLRA Section 2.3.4.3, "Heater Drain System"
- SLRA Section 2.3.4.4, "High-Pressure Turbine Exhaust System"
- SLRA Section 2.3.4.5, "Heater Vent System"
- SLRA Section 2.3.4.6, "Low-Pressure Turbine Extraction System"
- SLRA Section 2.3.4.7, "Auxiliary Steam System"

- SLRA Section 2.3.4.8, “Main Steam System”
- SLRA Section 2.3.4.9, “Turbine and Auxiliaries System”
- SLRA Section 2.3.4.10, “Plant Heating System”
- SLRA Section 2.3.4.11, “Steam Drain System”
- SLRA Section 2.3.4.12, “Steam Seal System”

2.3.2 Staff Evaluation

The NRC staff evaluated the system functions described in the SLRA and UFSAR to verify that the applicant has included within the scope of SLR all components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant identified as within the scope of SLR to verify that the applicant has included all passive and long-lived components subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

Using the evaluation methodology described in SLRA Section 2.1 and the guidance in NUREG-2192, Section 2.3, “Scoping and Screening Results: Mechanical Systems,” the staff reviewed the ONS SLRA, SLRA boundary drawings, UFSAR, and additional documents, as detailed below:

SLRA Section 2.3, “Scoping and Screening Results: Mechanical Systems”				
SLRA Section	**SLRA Section Title**	**Documents Reviewed by Staff:**		
		SLRA Tables	**USFAR**	**SLRA Drawings**
SLRA Section 2.3.1, “Reactor Vessel, Reactor Internals, and Reactor Coolant System”				
2.3.1.1	Reactor Vessel	Table 2.3.1-1, Reactor Vessel Table 3.1.2-1, Reactor Vessel, Reactor Internals and Reactor Coolant System - Reactor Vessel - Aging Management Evaluation	Section 5.3 Figures 5-1, 5-2, 5-14, 5-15, and 5-16, and Table 5-11	OSLRD-100A-1.1 OSLRD-100A-2.1 OSLRD-100A-3.1
2.3.1.2	Reactor Vessel Internals	Table 2.3.1-2, Reactor Vessel Internals Table 3.1.2-2, Reactor Vessel, Reactor Internals and Reactor Coolant System - Reactor Vessel Internals - Aging Management Evaluation	Section 4.5.1.3 Figures 4-26, 4-27, and 4-28	OSLRD-100A-1.1 OSLRD-100A-2.1 OSLRD-100A-3.1

SLRA Section 2.3, "Scoping and Screening Results: Mechanical Systems"				
2.3.1.3	Reactor Coolant System See below the table for additional review, in "Additional Discussion."	Table 2.3.1-3, Reactor Coolant System Table 3.1.2-3, Reactor Vessel, Reactor Internals and Reactor Coolant System - Reactor Coolant System - Aging Management Evaluation	Section 5.1 Figures 5-1, 5-2, 5-3, 5-4, 5-5, 5-6, 5-7, 5-8, and Tables 5-20, 5-21, and 5-22	OSLRD-100A-1.1, OSLRD-100A-1.2, OSLRD-100A-1.3, OSLRD-100A-1.4, OSLRD-100A-1.5, OSLRD-100A-2.1, OSLRD-100A-2.2, OSLRD-100A-2.3, OSLRD-100A-2.4, OSLRD-100A-2.5, OSLRD-100A-3.1, OSLRD-100A-3.2, OSLRD-100A-3.3, OSLRD-100A-3.4, OSLRD-100A-3.5
2.3.1.4	Steam Generators	Table 2.3.1-4, Steam Generators Table 3.1.2-4, Reactor Vessel, Reactor Internals and Reactor Coolant System - Steam Generators - Aging Management Evaluation	Section 5.4.2, Figure 5-25, and Table 5-20	OSLRD-100A-1.1, OSLRD-100A-2.1, OSLRD-100A-3.1
SLRA Section 2.3.2, "Engineered Safety Features"				
2.3.2.1	Reactor Building Spray System	Table 2.3.2-1, Reactor Building Spray System Table 3.2.2-1, Engineering Safety Features - Reactor Building Spray System - Aging Management Evaluation	Sections 1.2.2.4, 6.1.1, 6.2.1.1.2, and Figure 6-2	OSLRD-103A-1.1, OSLRD-103A-2.1, OSLRD-103A-3.1, OSLRD-102A-1.1, OSLRD-102A-2.1, OSLRD-102A-3.1
2.3.2.2	Core Flood System	Table 2.3.2-2, Core Flood System Table 3.2.2-2, Engineering Safety Features - Core Flood System - Aging Management Evaluation	Sections 1.2.2.4, 3.6.1.2.1, 5.4.7.3, 6.3.2.2.3, 6.3.3.2, Table 6-10, and Figure 6-1	OSLRD-102A-1.3, OSLRD-102A-2.3, OSLRD-102A-3.3, OSLRD-110A-1.1, OSLRD-110A-2.1, OSLRD-110A-3.1, OSLRD-127B-1.2, OSLRD-127B-2.2, OSLRD-127B-3.2

SLRA Section 2.3, "Scoping and Screening Results: Mechanical Systems"				
2.3.2.3	High-Pressure Injection System See below the table for additional review, in "Additional Discussion."	Table 2.3.2-3, High-Pressure Injection System Table 3.2.2-3, Engineering Safety Features - High-Pressure Injection System - Aging Management Evaluation	Sections 1.2.2.4, 3.2.2.1, 5.4.7.2, 6.1.1, 6.3.2.2.1, 6.3.3.1, Table 6-8, and Figure 6-1	OSLRD-101A-1.1, OSLRD-101A-1.2, OSLRD-101A-1.3, OSLRD-101A-1.4, OSLRD-101A-1.5, OSLRD-101A-2.1, OSLRD-101A-2.2, OSLRD-101A-2.3, OSLRD-101A-2.4, OSLRD-101A-2.5, OSLRD-101A-3.1, OSLRD-101A-3.2, OSLRD-101A-3.3, OSLRD-101A-3.4, OSLRD-101A-3.5, OSLRD-109A-1.1, OSLRD-109A-3.1, OSLRD-100A-1.3, OSLRD-100A-2.3, OSLRD-100A-3.3, OSLRD-110A-1.1, OSLRD-110A-2.1, OSLRD-110A-3.1, OSLRD-124B-1.1, OSLRD-124B-2.1, OSLRD-124B-3.1, OSLRD-125A-1.4, OSLRD-125A-2.3, OSLRD-125A-3.4, OSLRD-127B-2.2, OSLRD-127B-3.2, OSLRD-144A-1.2, OSLRD-144A-2.2, OSLRD-144A-3.2

SLRA Section 2.3, "Scoping and Screening Results: Mechanical Systems"				
2.3.2.4	Low Pressure Injection System	Table 2.3.2-4, Low Pressure Injection System Table 3.2.2-4, Engineering Safety Features - Low Pressure Injection System - Aging Management Evaluation	Sections 1.2.2.4, 3.2.2.1, 3.6.1.2.1, 5.4.7.1, 6.1.1, 6.3.1, 6.3.2.2.2, 6.3.2.5, 6.3.3.2, Table 6-9, and Figure 6-1	OSLRD-102A-1.1, OSLRD-102A-1.2, OSLRD-102A-1.3, OSLRD-102A-2.1, OSLRD-102A-2.2, OSLRD-102A-2.3, OSLRD-102A-3.1, OSLRD-102A-3.2, OSLRD-102A-3.3, OSLRD-101A-1.3, OSLRD-101A-2.3, OSLRD-101A-3.3, OSLRD-102A-1.3, OSLRD-102A-2.3, OSLRD-102A-3.3, OSLRD-104A-1.2, OSLRD-104A-3.2, OSLRD-106A-1.2, OSLRD-106A-2.2, OSLRD-106A-3.2, OSLRD-107D-1.2, OSLRD-107D-2.2, OSLRD-107D-3.2, OSLRD-110A-1.1, OSLRD-110A-1.4, OSLRD-110A-2.1, OSLRD-110A-2.4, OSLRD-110A-3.1, OSLRD-110A-3.4, OSLRD-124B-1.1, OSLRD-124B-2.1, OSLRD-124B-3.1
SLRA Section 2.3.3, "Auxiliary Systems"				
SLRA Section 2.3.3.1, "Air Gas Related Systems"				
2.3.3.1.1	Auxiliary Instrument Air System	Table 2.3.3.1-1, Auxiliary Instrument Air System	Section 9.5.2.2, "Instrument and Breathing Air Systems"	SLRA Boundary Drawings
2.3.3.1.2	Breathing Air System	Table 2.3.3.1-2, Breathing Air System	Section 9.5.2, "Instrument and Breathing Air Systems"	SLRA Boundary Drawings
2.3.3.1.3	Hydrogen System	Table 2.3.3.1-3, Hydrogen System	None	SLRA Boundary Drawings
2.3.3.1.4	Instrument Air System	Table 2.3.3.1-4, Instrument Air System	Section 9.5.2, "Instrument and Breathing Air Systems" Figure 6-9, Reactor Building Isolation Valve Arrangements	SLRA Boundary Drawings
2.3.3.1.5	Keowee Air Breaker System	Table 2.3.3.1-5, Keowee Air Breaker System	Section 8.3.1.1.1	SLRA Boundary Drawings
2.3.3.1.6	Keowee Depressing Air System	Table 2.3.3.1-6, Keowee Depressing Air System	None	SLRA Boundary Drawings
2.3.3.1.7	Keowee Governor Air System	Table 2.3.3.1-7, Keowee Governor Air System	None	SLRA Boundary Drawings
2.3.3.1.8	Keowee Station Air System	Table 2.3.3.1-8, Keowee Station Air System	None	SLRA Boundary Drawings

SLRA Section 2.3, "Scoping and Screening Results: Mechanical Systems"				
2.3.3.1.9	Nitrogen Purge and Blanket System	Table 2.3.3.1-9, Nitrogen Purge and Blanket System	Section 6.3.2.2.3 Section 7.4.3.1.2	SLRA Boundary Drawings
2.3.3.1.10	Service Air System	Table 2.3.3.1-10, Service Air System	Section 10.4.7.2.7	SLRA Boundary Drawings
2.3.3.1.11	Standby Shutdown Facility Fire Protection System See below the table for additional review, in "Additional Discussion."	Section 2.3.3.1.11, "Standby Shutdown Facility Fire Protection System" Table 2.3.3.1-11, Standby Shutdown Facility Fire Protection System Table 3.3.2-11, Auxiliary Systems - Standby Shutdown Facility Fire Protection System - Aging Management Evaluation	Section 9.5.1, "Fire Protection"	SLRA Boundary Drawings

SLRA Section 2.3, "Scoping and Screening Results: Mechanical Systems"				
SLRA Section 2.3.3.2, "Ancillary Related Systems"				
2.3.3.2.1	Chemical Addition System	Table 2.3.3.2-1, Chemical Addition System	Sections 5.1.1.4.6, 5.1.1.4.7, 5.4.7.5, 9.3.1, and 10.4.8.2 Figures 9-15 and 9-16 Table 9-5	SLRA Boundary Drawings
2.3.3.2.2	Coolant Storage System	Table 2.3.3.2-2, Coolant Storage System	Sections 6.3.2.3.5 and 9.3.4 Figure 9-20 Table 9-10	SLRA Boundary Drawings
2.3.3.2.3	Coolant Treatment System	Table 2.3.3.2-3, Coolant Treatment System	Section 9.3.5 and 11.2.2.1 Figure 9-21	SLRA Boundary Drawings
2.3.3.2.4	Demineralized Water System	Table 2.3.3.2-4, Demineralized Water System Table 3.3.2-15, Auxiliary Systems - Demineralized Water System	None	SLRA Boundary Drawings
2.3.3.2.5	Essential Siphon Vacuum System	Table 2.3.3.2-5, Essential Syphon Vacuum System Table 3.3.2-16, Essential Syphon Vacuum System	Section 7.5.2.59, "Essential Siphon Vacuum (ESV) Tank Pressure (Vacuum)" Section 7.5.2.60, "ESV Tank Water Level" Section 7.5.2.61, "Siphon Seal Water flow to Essential Siphon Pumps" Section 9.2.2.1, "Design Basis" Section 9.2.2.2.5, "Essential Siphon Vacuum and Siphon Seal Water Systems" Figure 9-42, Essential Siphon Vacuum System	SLRA Boundary Drawings
2.3.3.2.6	Spent Fuel Cooling System	Table 2.3.3.2-6, Spent Fuel Cooling System Table 3.3.2-17, Spent Fuel Cooling System	Section 9.1.3, "Spent Fuel Cooling System" Section 9.1.3.3.1, "Normal Operation" Figure 9-5, Spent Fuel Cooling System	SLRA Boundary Drawings

SLRA Section 2.3, "Scoping and Screening Results: Mechanical Systems"				
SLRA Section 2.3.3.3, "Closed Cycle Water Related Systems"				
2.3.3.3.1	Alternate Chilled Water System	Table 2.3.3.3-1, Alternate Chilled Water System Table 3.3.2-18, Alternate Chilled Water System	Section 9.2.5, "Control Room Ventilation Chilled Water System (WC)" Section 9.2.5.3, "Alternate Chilled Water System" Section 9.4.1, "Control Room Ventilation"	SLRA Boundary Drawings
2.3.3.3.2	Component Cooling Water System	Table 2.3.3.3-4, Component Cooling Water System Table 3.3.2-19, Component Cooling Water System	Section 9.2.1.1, "Design Basis" Figure 9-8, Component Cooling Water System	SLRA Boundary Drawings
2.3.3.3.3	Chilled Water (Non-Vital Loads) System	Table 2.3.3.3-3, Chilled water (Non-Vital Loads) System Table 3.3.2-20, Chilled Water (Non-Vital Loads) System	Section 9.2.5, "Control Room Ventilation Chilled Water System" Section 9.4.2, "Spent Fuel Area Ventilation System"	SLRA Boundary Drawings
2.3.3.3.4	Recirculating Cooling Water System	Table 2.3.3.3-4, Recirculation Cooling Water System Table 3.3.2-21, Recirculation Cooling Water System	Section 9.2.2.2.4, "Recirculating Cooling Water System (RCW)" Figure 9-13, Recirculating Cooling Water System	SLRA Boundary Drawings
2.3.3.3.5	Sample Cooling Water System	Table 2.3.3.3-5, Sample Cooling Water System Table 3.3.2-22, Sample Cooling Water System	None	SLRA Boundary Drawings
2.3.3.3.6	Chilled Water (Vital Loads) System	Table 3.3.3-6, Chill Water (Vital Loads) System Table 3.3.2-23, Chilled Water (Vital Loads) System	Section 9.2.5, "Control Room Ventilation Chilled Water System" Section 9.4.1, "Control Room Ventilation" Figure 9-24, Control Room Area Ventilation and Air Conditioning System	SLRA Boundary Drawings

SLRA Section 2.3, "Scoping and Screening Results: Mechanical Systems"				
SLRA Section 2.3.3.4, "Fire Protection Related Systems" See below the table for additional review, in "Additional Discussion."				
2.3.3.4.1	High-Pressure Service Water System	Table 2.3.3.4-1, High-Pressure Service Water System Table 3.3.2-24, High-Pressure Service Water System	Section 9.2.2.1, Design Basis Section 9.2.2.2, System Description and Evaluation Section 9.7.3.4.2, PSW Building Fire Protection and Detection System Section 10.4.7.2.2 Figure 9-10, High-Pressure Service Water System	SLRA Boundary Drawings
2.3.3.4.2	Keowee Service Water System	Table 2.3.3.4-2, Keowee Service Water System Table 3.3.2-25, Keowee Service Water System	None	SLRA Boundary Drawings
2.3.3.4.3	Keowee Fire Detection/Protection System	Table 2.3.3.4-3, Keowee Fire Detection/Protection System Table 3.3.2-26, Auxiliary Systems – Keowee Fire Detection/Protection System – Aging Management Evaluation	Section 9.5.1, "Fire Protection"	SLRA Boundary Drawings
SLRA Section 2.3.3.5, "Heating Ventilation and Air Conditioning Related Systems"				
2.3.3.5.1	Reactor Building Cooling and Ventilation Systems	Table 2.3.3.5-1, Reactor Building Cooling and Ventilation System Table 3.3.2-27, Reactor Building Cooling and Ventilation System	Section 6.2.2, Containment Heat Removal Systems Section 9.4.6, Reactor Building Cooling System Figure 6-3, Reactor Building Cooling Schematic	SLRA Boundary Drawings
2.3.3.5.2	Reactor Building Purge System	Table 2.3.3.5-2, Reactor Building Purge System Table 3.3.2-28, Reactor Building Purge System	Section 6.2.3, Containment Isolation System Section 9.4.5, Reactor Building Purge System Figure 6-4, Reactor Building Purge and Penetration Ventilation System	SLRA Boundary Drawings
2.3.3.5.3	Ventilation Systems	Table 2.3.3.5-3, Ventilation System Subject to AMR Table 3.3.2-29, Ventilation System	Section 6.4, Habitability Systems Section 6.5, Fission Product Removal and Control Systems Section 9.4.1, Control Room Ventilation	SLRA Boundary Drawings

SLRA Section 2.3, "Scoping and Screening Results: Mechanical Systems"				
			Section 9.4.2, Spent Fuel Pool Area Ventilation Section 9.4.3, Auxiliary Building Ventilation System Section 9.4.4, Turbine Building Ventilation System Section 9.4.8, Ventilation Systems in Station Battery Rooms Section 9.6.3.6.4, Heating Ventilation and Air Conditioning Section 9.7.3.4.3, PSW Building Fire Protection and Detection System Figure 6-4, Reactor Building Purge and Penetration Ventilation System Figure 9-24, Control Room Area Ventilation and Air Conditioning System Figure 9-25, Spent Fuel Pool Ventilation System Units 1 and 2 Figure 9-26, Spent Fuel Pool Ventilation System Unit 3 Figure 9-27, Auxiliary Building Ventilation Units 1 and 2 Figure 9-28, Auxiliary Building Ventilation Unit 3	
SLRA Section 2.3.3.6, "Lube Oil Related Systems"				
2.3.3.6.1	Lube Oil System	Table 2.3.3.6-1, "Lube Oil System Subject to Aging Management Review" Table 3.3.2-30, "Auxiliary Systems – Lube Oil System – Aging Management Evaluation"	Section 7.8.2, "Systems Design" Section 10.4.7, "Emergency Feedwater System"	OSLRD-135B-1.1 OSLRD-135B-1.2 OSLRD-135B-1.3 OSLRD-135B-1.5 OSLRD-135B-2.1 OSLRD-135B-2.2 OSLRD-135B-2.3 OSLRD-135B-2.4 OSLRD-135B-3.1 OSLRD-135B-3.2 OSLRD-135B-3.3 OSLRD-135B-3.4

SLRA Section 2.3, "Scoping and Screening Results: Mechanical Systems"				
2.3.3.6.2	Keowee Turbine Guide Bearing Oil System	Table 2.3.3.6-2, "Keowee Turbine Guide Bearing Oil System Subject to Aging Management Review" Table 3.3.2-31, "Auxiliary Systems – Turbine Guide Bearing Oil System – Aging Management Evaluation"	None	KSLRD-101A-1.1 KSLRD-101A-2.1
2.3.3.6.3	Keowee Lube Oil System	Table 2.3.3.6-3, "Keowee Lube Oil System Subject to Aging Management" Table 3.3.2-32, "Auxiliary Systems – Keowee Lube Oil System – Aging Management Evaluation"	None	KSLRD-106A-3.0
SLRA Section 2.3.3.7, "Miscellaneous Related Systems"				
2.3.3.7.1	Filtered Water System	Table 2.3.3.7-1, "Filtered Water System Subject to Aging Management Review" Table 3.3.2-33, "Auxiliary Systems – Filter Water System – Aging Management Evaluation"	None	OSLRD-126A-1.2
2.3.3.7.2	Keowee Main Turbine System	Table 2.3.3.7-2, "Keowee Main Turbine System Subject to Aging Management Review" Table 3.3.2-34, "Auxiliary Systems – Keowee Main Turbine System – Aging Management Evaluation"	Section 8.3.1.1.1, "Keowee Hydro Station"	KSLRD-100A-1.1 KSLRD-100A-2.1 KSLRD-105A-1.1 KSLRD-105A-2.1 KSLRD-111A-1.1
2.3.3.7.3	Leak Rate Test System	Table 2.3.3.7-3, "Leak Rate Test System Subject to Aging Management" Table 3.3.2-35, "Auxiliary Systems – Leak Rate Test System – Aging Management Evaluation"	Section 3.1.54, "Criterion 54 – Containment Leakage Rate Testing (Category A)" Section 3.8.1.7.4, "Leakage Monitoring" Section 6.2.4, "Containment Leakage Testing"	OSLRD-137E-1.1
2.3.3.7.4	Plant Drinking Water System	Table 2.3.3.7-4, "Plant Drinking Water System Subject to Aging Management Review" Table 3.3.2-36, "Auxiliary Systems – Plant Drinking Water System – Aging Management Evaluation"	Section 3.4.1.1.1, "Current Flood Protection Measures for the Turbine and Auxiliary Buildings"	OSLRD-126B-1.1 OSLRD-126C-1.2 OSLRD-126C-1.3 OSLRD-126C-1.4 OSLRD-126C-1.5 OSLRD-126C-1.6 OSLRD-126C-1.7
2.3.3.7.5	Radiation Monitoring System	Table 2.3.3.7-5, "Radiation Monitoring	Section 7.5.2, "Description"	OSLRD-116F-1.1 OSLRD-116F-3.1

SLRA Section 2.3, "Scoping and Screening Results: Mechanical Systems"				
		System Subject to Aging Management Review" Table 3.3.2-37, "Auxiliary Systems – Radiation Monitoring System – Aging Management Evaluation"	Section 11.5, "Process and Effluent Radiological Monitoring and Sampling Systems" Section 12.3.3, "Area Radiation Monitoring System" Section 12.4.5.2, "Inplant Radiation Monitoring" Table 11-7, "Process Radiation Monitors" Table 12-3, "Area Radiation Monitors"	OSLRD-121C-1.4 OSLRD-121C-2.3 OSLRD-121C-3.3 OSLRD-124B-1.5 OSLRD-124B-3.5 OSLRD-144A-1.1
2.3.3.7.6	Stator Coolant System	Table 2.3.3.7-6, "Stator Coolant System Subject to Aging Management" Table 3.3.2-38, "Auxiliary Systems – Stator Coolant System – Aging Management Evaluation"	None	OSLRD-121A-1.11 OSLRD-121A-2.11 OSLRD-121A-3.11
2.3.3.7.7	Station Sewage Disposal System	Table 2.3.3.7-7, "Station Sewage Disposal System Subject to Aging Management Review" Table 3.3.2-39, "Auxiliary Systems – Station Sewage Disposal System – Aging Management Evaluation"	None	OSLRD-126B-1.1 OSLRD-126D-1.1
2.3.3.7.8	Keowee Turbine Sump Pump System	Table 2.3.3.7-8, "Keowee Turbine Sump Pump System Subject to Aging Management Review" Table 3.3.2-40, "Auxiliary Systems – Keowee Turbine Sump Pump System – Aging Management Evaluation"	None	KSLRD-102A-1.1 KSLRD-102A-2.1
2.3.3.7.9	Vacuum System	Table 2.3.3.7-9, "Vacuum System Subject to Aging Management" Table 3.3.2-41, "Auxiliary Systems – Vacuum System – Aging Management Evaluation"	Sections 9.2.2.1, "Design Bases" Sections 10.4.2, "Main Condenser Evacuation System" Figure 10-5, "Vacuum System"	OSLRD-121C-1.1 OSLRD-121C-1.2 OSLRD-121C-1.3 OSLRD-121C-1.4 OSLRD-121C-2.1 OSLRD-121C-2.2 OSLRD-121C-2.3 OSLRD-121C-3.1 OSLRD-121C-3.2 OSLRD-121C-3.3

SLRA Section 2.3, "Scoping and Screening Results: Mechanical Systems"				
SLRA Section 2.3.3.8, "Miscellaneous Oil Related Systems"				
2.3.3.8.1	Electro-Hydraulic Control System	Table 2.3.3.8-1, "Electro-Hydraulic Control System"	Section 10.2.1 Section 10.4.6.5.1	SLRA Boundary Drawings
2.3.3.8.2	Fuel Oil System	Table 2.3.3.8-2, "Fuel Oil System"	None	SLRA Boundary Drawings
2.3.3.8.3	Keowee Generator High-Pressure Oil System	Table 2.3.3.8-3, "Keowee Generator High-Pressure Oil System"	None	SLRA Boundary Drawings
2.3.3.8.4	Keowee Governor Oil System	Table 2.3.3.8-4, "Keowee Governor Oil System"	Section 3.1.1.1	SLRA Boundary Drawings
2.3.3.8.5	Refueling System	Table 2.3.3.8-5, "Refueling System"	Section 9.1.4.1.1 Section 9.1.4.1.4	SLRA Boundary Drawings
2.3.3.8.6	Hydrogen Seal Oil System	Table 2.3.3.8-6, "Hydrogen Seal Oil System"	None	SLRA Boundary Drawings
SLRA Section 2.3.3.9, "Raw Water Related Systems"				
2.3.3.9.1	Condenser Circulating Water System	Table 2.3.3.9-1, "Condenser Circulating Water System"	Section 9.2.2 Section 9.6.3.3	SLRA Boundary Drawings
2.3.3.9.2	Low Pressure Service Water System	Table 2.3.3.9-2, "Low Pressure Service Water System"	Section 9.2.2.2.3	SLRA Boundary Drawings
2.3.3.9.3	Protected Service Water System	Table 2.3.3.9-3, "Protected Service Water System"	Section 9.7	SLRA Boundary Drawings
2.3.3.9.4	Siphon Seal Water System	Table 2.3.3.9-4, "Siphon Seal Water System"	Section 9.2.2.2.5	SLRA Boundary Drawings
2.3.3.9.5	Keowee Turbine Generator Cooling Water	Table 2.3.3.9-5, "Keowee Turbine Generator Cooling Water System"	None	SLRA Boundary Drawings
SLRA Section 2.3.3.10, "Standby Shutdown Facility Diesel Generator Related Systems"				
2.3.3.10.1	Standby Shutdown Facility Air Intake and Exhaust System	Table 2.3.3.10-1, "Standby Shutdown Facility Air Intake and Exhaust System"	Figure 9-30	SLRA Boundary Drawings
2.3.3.10.2	Standby Shutdown Facility Diesel Engine System	None	Section 9.6.3.4.2 Figure 9-30	SLRA Boundary Drawings
2.3.3.10.3	Standby Shutdown Facility Diesel Jacket Water Cooling System	Table 2.3.3.10-3, "Standby Shutdown Facility Diesel Jacket Water Cooling System"	Section 9.6.3.4.2 Figure 9-37	SLRA Boundary Drawings
2.3.3.10.4	Standby Shutdown Facility Diesel Lube Oil System	Table 2.3.3.10-4, "Standby Shutdown Facility Diesel Lube Oil System"	Section 9.6.3.4.2	SLRA Boundary Drawings
2.3.3.10.5	Standby Shutdown Facility Fuel Oil System	Table 2.3.3.10-5, "Standby Shutdown Facility Fuel Oil System"	Section 9.6.3.4.2 Figure 9-30	SLRA Boundary Drawings
2.3.3.10.6	Standby Shutdown Facility Governor System	None	None	SLRA Boundary Drawings

SLRA Section 2.3, "Scoping and Screening Results: Mechanical Systems"				
2.3.3.10.7	Standby Shutdown Facility Starting Air System	Table 2.3.3.10-7, "Standby Shutdown Facility Starting Air System"	Section 9.3.6.4.2 Figure 9-38	SLRA Boundary Drawings
SLRA Section 2.3.3.11, "Waste Disposal Related Systems"				
2.3.3.11.1	Gaseous Waste Disposal System	Table 2.3.3.11-1, "Gaseous Waste Management Systems"	Section 1.2.2.9, "Radioactive Waste Control" Section 11.3, "Gaseous Waste Management Systems" Figure 11-3	SLRA Boundary Drawings
2.3.3.11.2	Liquid Waste Disposal System	Table 2.3.3.11-2, "Gaseous Waste Management Systems"	Section 1.2.2.9, "Radioactive Waste Control" Section 11.2, "Liquid Waste Management Systems" Figure 11-2	SLRA Boundary Drawings
SLRA Section 2.3.4.1, "Condensate System"				
2.3.4.1	Condensate System	Table 2.3.4-1, "Condensate System"	Section 10.4.6, "Condensate and Main Feedwater Systems" Figure 10.6 Table 10-1	SLRA Boundary Drawings
SLRA Section 2.3.4.2, "Feedwater System"				
2.3.4.2	Feedwater System	Table 2.3.4-2, "Feedwater System Condensate System"	Section 10.4.1, "Main Condenser" Section 10.4.6, "Condensate and Main Feedwater Systems" Section 10.4.7, "Emergency Feedwater System" Figures 10-7 and 10-8	SLRA Boundary Drawings
SLRA Section 2.3.4.3, "Heater Drain System"				
2.3.4.3	Heater Drain System	Table 2.3.4-3,"Heater Drain System"	Section 10.4.1, "Main Condenser"	SLRA Boundary Drawings
SLRA Section 2.3.4.4, "High Pressure Turbine Exhaust System"				
2.3.4.4	High-Pressure Turbine Exhaust System	Table 2.3.4-4, "High-Pressure Turbine Exhaust System"	Section 10.2, "Turbine-Generator"	SLRA Boundary Drawings
SLRA Section 2.3.4.5, "Heater Vent System"				
2.3.4.5	Heater Vent System	Table 2.3.4-5, "Heater Vent System"	Section 10.4.1, "Main Condenser"	SLRA Boundary Drawings

SLRA Section 2.3, "Scoping and Screening Results: Mechanical Systems"				
SLRA Section 2.3.4.6, "Low Pressure Turbine Extraction System"				
2.3.4.6	Low Pressure Turbine Extraction System	Table 2.3.4-6,"Low Pressure Turbine Extraction System"	Section 10.2 "Turbine-Generator" Figure 10-2	SLRA Boundary Drawings
SLRA Section 2.3.4.7, "Auxiliary Steam System"				
2.3.4.7	Auxiliary Steam System	Table 2.3.4-7, Auxiliary Steam System – Components Subject to AMR	Section 10.3 "Main Steam System" Figure 10-1	SLRA Boundary Drawings
SLRA Section 2.3.4.8, "Main Steam System"				
2.3.4.8	Main Steam System	Table 2.3.4-8, "Main Steam System"	Section 10.3 "Main Steam System" Figure 10-1	SLRA Boundary Drawings
SLRA Section 2.3.4.9, "Turbine and Auxiliaries System"				
2.3.4.9	Turbine and Auxiliaries System	Table 2.3.4-9, "Turbine and Auxiliaries System"	Section 10.2 "Turbine-Generator" Figures 10-2 and 10-3	SLRA Boundary Drawings
SLRA Section 2.3.4.10, "Plant Heating System"				
2.3.4.10	Plant Heating System	Table 2.3.4-10, "Plant Heating System"	None	SLRA Boundary Drawings
SLRA Section 2.3.4.11, "Steam Drain System"				
2.3.4.11	Steam Drain System	Table 2.3.4-11, "Main Condenser System"	Section 10.4.1 "Main Condenser"	SLRA Boundary Drawings
SLRA Section 2.3.4.12, "Steam Seal System"				
2.3.4.12	Steam Seal System	Table 2.3.4-12, "Steam Seal System"	Section 10.1 "Summary Description" Figures 10-2 and 10-3	SLRA Boundary Drawings listed in SLRA

Additional Discussion:

SLRA Section 2.3.1.3, "Reactor Coolant System"

For SLRA Section 2.3.1.3, Reactor Coolant System: SLRA Table 2.3.1-3 - Reactor Coolant System – Pressurizer, the staff determined the need for additional information to complete the review of the applicant's scoping and screening results, which resulted in the issuance of RAIs 2.3.1.3-1 and 2.3.1.3-2. The applicant's responses, dated February 14, 2022, is documented in ADAMS Accession No. ML22045A021. In RAI 2.3.1.3-1, the staff requested an explanation on whether thermal cycling should be included as an intended function for the following components: Pressurizer; Surge Line Nozzle, Pressurizer; Surge Line Nozzle Safe End, Pressurizer; Surge Line Nozzle Safe End Weld. In response, the applicant described that thermal cycling should not be included as an intended function because NUREG-2191, "Generic Aging Lessons Learned for Subsequent License Renewal Report," includes thermal cycling as an Aging Effect/Mechanism. The staff determined that the applicant's response is acceptable because the applicant confirmed that thermal cycling does not meet the definition of an intended function, as defined in NUREG-2192, "Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants." NUREG-2192, Table 2.1-5 lists the following typical passive component-intended functions: Absorb Neutrons, Electrical Continuity, Filter, Heat Transfer, Insulate (electrical), Insulate (thermal), Leakage Boundary (spatial), Pressure

Boundary, Spray, Structural Integrity (attached), Structural Support, and Throttle. In RAI 2.3.1.3-2, the staff requested the applicant to explain if the pressurizer spray head is excluded from the scope of license renewal and provide justification by specifically addressing the related concerns presented in Table 2.3-1 of the Standard Review Plan (NUREG-2192). In response, the applicant stated that the pressurizer spray head is included with the scope of SLR. Since the applicant stated that the pressurizer spray head is included in the scope of SLR, the staff found the response acceptable, and the applicant did not need to provide justification for exclusion.

SLRA Section 2.3.2.3, "High Pressure Injection System"

For SLRA Section 2.3.2.3, "High Pressure Injection System," the applicant omitted the letdown cooler tubes from the scope of subsequent license renewal. In Supplement 1 (ADAMS Accession No. ML21302A208), the applicant modified Section 2.3.2.3 to add the letdown heat exchangers to the scope of SLR. The applicant further stated that the letdown cooler heat exchanger assembly is replaced on a specified frequency and are not subject to aging management review in accordance with 10 CFR 54.21(a)(1)(ii). The applicant removed the aging management review line items related to the head and the shell of the letdown coolers from SLRA Tables 2.3.2-3 and 3.2.2-3. The staff finds the applicant's modification to the SLRA acceptable because the letdown cooler heat exchanger assembly will undergo periodic replacement and, therefore, meets the requirements of 10 CFR 54.21(a)(1).

SLRA Section 2.3.3.1.11, "Standby Shutdown Facility Fire Protection System"

SLRA Section 2.3.3.1.11, "Standby Shutdown Facility Fire Protection System," describes the fire protection systems and components subject to an AMR and lists the SLR boundary drawings that show the fire protection system boundaries. SLRA Table 2.3.3.1-11, "Standby Shutdown Facility Fire Protection System," provides a list of the fire protection component types subject to an AMR and their intended functions. SLRA Table 3.3.2-11, "Auxiliary Systems - Standby Shutdown Facility Fire Protection System - Aging Management Evaluation," provides the results of the applicant's AMR for fire protection systems and components.

The standby shutdown facility contains two fire protection systems, a water system, and a low-pressure carbon dioxide (CO_2) system. The standby shutdown facility diesel generator room is equipped with a low-pressure CO_2 system actuated by thermal detectors to automatically flood the standby shutdown facility diesel area. Portable CO_2 fire extinguishers are also provided. Detection devices are located throughout the standby shutdown facility and annunciate with a single alarm to the Main Control Room.

To support its review of this SLRA section, the staff reviewed NUREG-1723, "Safety Evaluation Report Related to the License Renewal of Oconee Nuclear Station, Units 1, 2, and 3," March 2000, the initial LRA, SLRA boundary drawings, the Updated Safety Analysis Report (UFSAR) Section 9.5.1, "Fire Protection," the Oconee Nuclear Station Fire Protection Scoping Documents, and the NRC's SE by the Office of Nuclear Reactor Regulation (NRR), "Transition to a Risk-Informed, Performance based Fire Protection Program in Accordance with 10 CFR 50.48(c)," December 29, 2010.

The ONS, Units 1, 2, and 3 FPP is based on the compliance with Title 10 of the *Code of Federal Regulations* (10 CFR) 50.48(a) and 10 CFR 50.48(c), "National Fire Protection Association Standard (NFPA) 805," and the Oconee Nuclear Station fire protection license conditions. On December 29, 2010, the NRC issued a license amendment for the Oconee Nuclear Station to incorporate the NFPA 805, "Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants," 2001 Edition, fire protection licensing basis in accordance with the 10 CFR 50.48(c). The amendment authorized the transition of the licensee's FPP to a risk-informed, performance-based program based on the 2001 Edition of NFPA 805. The NFPA 805 standard describes how to use performance-based and risk-informed methods, such as fire probabilistic risk assessment and fire modeling, to demonstrate compliance with nuclear safety performance criteria (NSPC) (similar to compliance with post-fire safe-shutdown requirements in 10 CFR 50.48(b) and Appendix R, "Fire Protection Program for Nuclear Power Facilities Operating Prior to January 1, 1979" to 10 CFR Part 50) and to assure that structures, systems, and components (safety related and important to safety) are protected from fire.

During its review, the NRC staff evaluated the fire protection components described in the SLRA, UFSAR, and SLR boundary drawings to verify that the applicant included within the scope of SLR all components with intended functions as described in 10 CFR 54.4(a). The NRC staff then reviewed those components that the applicant identified as within the scope of SLR to verify that it included all passive or long-lived components subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

The NRC staff confirmed that the standby shutdown facility fire protection system and associated components are included in SLRA Table 2.3.3.1-11 with AMR results in SLRA Table 3.3.2-11. The staff confirmed that these components were highlighted in the SLR boundary drawings. The NRC staff did not identify any scoping omissions in the SLRA boundary drawings, the UFSAR, and the CLB document identified above, and confirmed that the fire protection systems and components were included in accordance with 10 CFR 54.4(a).

Based on the NRC staff's review of the SLRA, NUREG-1723, initial LRA, SLRA boundary drawings, UFSAR Section 9.5.1, the ONS Fire Protection Scoping Documents, and the NRC's SE by the NRR, "Transition to a Risk-Informed, Performance based Fire Protection Program in Accordance with 10 CFR 50.48(c)," December 29, 2010, the NRC staff concludes that the applicant has appropriately identified the fire protection system components within the scope of SLR, as required by 10 CFR 54.4(a). The NRC staff also concludes that the applicant has adequately identified the system components subject to an AMR, in accordance with the requirements in 10 CFR 54.21(a)(1).

SLRA Section 2.3.3.4, "Fire Protection Related Systems"

As described in SLRA Section 2.3.3.4, the ONS fire protection-related systems consist of: (1) high-pressure service water system, (2) Keowee service water system, and (3) Keowee fire detection and protection system. The high-pressure service water system is used primarily for fire protection throughout the ONS. The high-pressure service water system consists of two motor-driven large capacity pumps, one motor-driven jockey pump, and the elevated 100,000-gallon water storage tank. The motor-driven jockey pump normally operates to keep pressure on the fire headers. The high-pressure service water system supplies water at sufficient pressure and flow rate to sprinkler systems, standpipe systems, hose stations, fire hydrants, and deluge systems throughout the station and surrounding areas. The high-pressure service water system also supplies reactor coolant pump seals and cooling water to various loads.

As stated in the SLRA, the Keowee service water system provides cooling water from Lake Keowee to various Keowee plant components. The Keowee fire detection and protection system includes fire detection components that monitor for smoke and/or fire. Fire protection components consist of fire extinguishers, hydrants, hose racks, and a fire pump. Fire water is delivered to the Keowee fire detection and protection system by the Keowee intake line. The system also includes passive fire protection features including fire doors and fire penetration seals.

To support its review of this SLRA section, the staff reviewed NUREG-1723, the initial LRA, SLRA boundary drawings, UFSAR Section 9.5.1, “Fire Protection,” the ONS Fire Protection Scoping Documents, and the NRC’s SE by the NRR, “Transition to a Risk-Informed, Performance based Fire Protection Program in Accordance with 10 CFR 50.48(c),” December 29, 2010.

The ONS FPP is based on compliance with 10 CFR 50.48(a) and 10 CFR 50.48(c) and the ONS fire protection license conditions. On December 29, 2010, the NRC issued a license amendment for the ONS to incorporate the NFPA 805 2001 Edition, fire protection licensing basis in accordance with the 10 CFR 50.48(c). The amendment authorized the transition of the licensee’s FPP to a risk-informed, performance-based program based on the 2001 Edition of NFPA 805. The NFPA 805 standard describes how to use performance-based and risk-informed methods such as fire probabilistic risk assessment, and fire modeling to demonstrate compliance with NSPC (similar to compliance with post-fire safe-shutdown requirements in 10 CFR 50.48(b) and Appendix R) and to assure that structures, systems, and components (safety related and important to safety) are protected from fire.

During its review, the NRC staff evaluated the fire protection components described in the SLRA, UFSAR, and SLR boundary drawings to verify that the applicant included within the scope of SLR all components with intended functions as described in 10 CFR 54.4(a). The staff then reviewed those components that the applicant identified as within the scope of SLR to verify that it included all passive or long-lived components subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

In Supplement 1 dated October 28, 2021(ADAMS Accession No. ML21302A208), the applicant updated the high-pressure service water boundary drawing and removed the CT-5 transformer’s sprinkler system. Further, the applicant stated that the component type “piping” includes standpipe risers and fire hose connections. Fire hose stations and hose racks are included in Tables 2.4.8-1 and 3.5.2-22 (component support) and SLRA Section 2.5.2, which states that the fire hose stations in the Radwaste Building are addressed in SLRA Section 2.4.7.7, and that section refers to structural support steel elements.

The applicant also stated that nozzles are included under the component type “sprinkler heads” in SLRA Table 2.3.3.4-1 with AMR results in SLRA Table 3.3.2-24. The applicant indicated that there is no structural steel fireproofing associated with the fire barrier and no seismic support for standpipes system piping at ONS.

Based on the staff’s review of the SLRA, NUREG-1723, initial LRA, SLRA boundary drawings, UFSAR Section 9.5.1, the ONS Fire Protection Scoping Documents, and the NRC’s SE by the NRR, “Transition to a Risk-Informed, Performance based Fire Protection Program in Accordance with 10 CFR 50.48(c),” December 29, 2010, the staff concludes that the applicant has appropriately identified the fire protection system components within the scope of SLR, as required by 10 CFR 54.4(a). The staff also concludes that the applicant has adequately identified the system components subject to an AMR, in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.3 Conclusion

Based on a review of the SLRA, UFSAR, and LR drawings, the staff concludes that the applicant identified the mechanical SCs within the scope of SLR as required by 10 CFR 54.4. The staff also concludes that the applicant identified the system components subject to an AMR, in accordance with the requirements in 10 CFR 54.21(a)(1).

2.4 Scoping and Screening Results: Structures

This section documents the staff's review of the applicant's scoping and screening results for SCs. In accordance with the requirements of 10 CFR 54.21(a)(1), the applicant must list passive, long-lived SCs that are within the scope of SLR and that are subject to an AMR. To verify that the applicant properly implemented its methodology, the staff's review focused on the implementation results. This focus allowed the staff to confirm that there were no omissions of SCs that meet the scoping criteria and that are subject to an AMR.

The staff's evaluation of the information in the SLRA was the same for all SCs. The objective was to determine whether the applicant has identified, in accordance with 10 CFR 54.4, SCs that meet the SLR scoping criteria. Similarly, the staff evaluated the applicant's screening results to verify that all passive, long-lived SCs were subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

In its scoping evaluation, the staff reviewed the applicable SLRA sections, focusing on components that have not been identified as within the scope of SLR. The staff reviewed relevant licensing-basis documents, including the UFSAR, for each structure to determine whether the applicant had omitted from the scope of SLR components with intended functions delineated as required by 10 CFR 54.4(a). The staff also reviewed the licensing-basis documents to determine whether the SLRA specified all intended functions delineated as required by 10 CFR 54.4(a).

After reviewing the scoping results, the staff evaluated the applicant's screening results. For those SCs with intended functions included as required by 10 CFR 54.4(a), the staff confirmed that the applicant properly screened out only: (1) SCs that have functions performed with moving parts or that have a change in configuration or properties, or (2) SCs that are subject to replacement after a qualified life or specified time period, as described in 10 CFR 54.21(a)(1). The staff confirmed that the applicant included SCs that do not meet either of these criteria in the AMR, as required by 10 CFR 54.21(a)(1).

2.4.1 Summary of Technical Information in the Application

SLRA Sections 2.4.1 through 2.4.8, as listed below, describe the structures and structural components subject to an AMR and boundaries of the structure.

- SLRA Section 2.4.1, "Auxiliary Building"
- SLRA Section 2.4.2, "Reactor Building"
- SLRA Section 2.4.3, "Turbine Building"
- SLRA Section 2.4.4, "Keowee Hydro Station"
- SLRA Section 2.4.5, "Electrical Related Structures"
- SLRA Section 2.4.6, "Earthen Embankments"
- SLRA Section 2.4.7, "Yard Structures"
- SLRA Section 2.4.8, "Bulk Commodities"

2.4.2 Staff Evaluation

The staff evaluated the system functions described in the SLRA, including the supplement dated December 15, 2021 (ADAMS Accession No. ML21349A005), and the UFSAR to verify that the applicant has included within the scope of license renewal all components with intended functions delineated pursuant to 10 CFR 54.4(a). The staff then reviewed those components that the applicant identified as within the scope of license renewal to verify that the applicant has included all passive and long-lived components subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

Using the evaluation methodology described in SLRA Section 2.1 and the guidance in NUREG-2192, Section 2.4, "Scoping and Screening Results: Structures," the staff reviewed:

- SLRA Sections 2.4.1 through 2.4.8 and Tables 2.4.1-1 through 2.4.8-2
- UFSAR
- SLRA supplement 3 dated December 15, 2021

In an SLRA supplement, dated December 15, 2021 (ADAMS Accession No. ML21349A005), the applicant removed Cork seismic gap filler material as a fire barrier from SLRA Sections 2.4.8.2 and 3.5.2.1.23 and Tables 2.4.8-2 and 3.5.2-23. The staff concludes that the applicant has adequately identified in it supplement that the Cork as a fire barrier material is not subject to an AMR, in accordance with the requirements in 10 CFR 54.21(a)(1).

The staff reviewed NUREG-1723 and the ONS initial LRA and found that the fire barriers listed in the above tables were also listed in the ONS initial LRA.

2.4.3 Conclusion

Based on the staff's review of the SLRA, NUREG-1723, initial LRA, SLRA boundary drawings, UFSAR Section 9.5.1, the ONS Fire Protection Scoping Documents, and the NRC's SE by the NRR, "Transition to a Risk-Informed, Performance based Fire Protection Program in Accordance with 10 CFR 50.48(c)," December 29, 2010, the staff concludes that the applicant has appropriately identified the fire protection system components within the scope of SLR, as required by 10 CFR 54.4(a). The staff also concludes that the applicant has adequately identified the system components subject to an AMR, in accordance with the requirements in 10 CFR 54.21(a)(1).

2.5 Scoping and Screening Results: Electrical and Instrumentation and Control Systems

This section documents the NRC staff's review of the applicant's scoping and screening results for electrical and I&C systems as described in SLRA Section 2.5, "Scoping and Screening Results: Electrical and Instrumentation and Controls," and its subsections. Specifically, this section discusses electrical and I&C component commodity groups as described in SLRA Section 2.5.1, "Electrical and Instrumental and Control Component Commodity Groups."

In accordance with the requirements of 10 CFR 54.21(a)(1), the applicant must list passive, long-lived SCs that are within the scope of SLR and that are subject to an AMR. To verify that the applicant properly implemented its methodology, the NRC staff's review focused on the implementation results. This focus allowed the staff to confirm that there were no omissions of electrical and I&C components that meet the scoping criteria and that are subject to an AMR.

The NRC staff's evaluation of the information in the SLRA was the same for all electrical and I&C components. The objective was to determine whether the applicant identified, in accordance with 10 CFR 54.4, components that meet the subsequent license renewal scoping criteria. Similarly, the staff evaluated the applicant's screening results to verify that all passive, long-lived SCs are subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

In its scoping evaluation, the NRC staff reviewed the applicable SLRA sections, focusing on components that have not been identified as within the scope of subsequent license renewal. The staff reviewed relevant licensing-basis documents, including the UFSAR, for each component to determine whether the applicant omitted from the scope of subsequent license renewal components with intended functions delineated under 10 CFR 54.4(a). The staff also reviewed the licensing-basis documents to determine whether the SLRA specified all intended functions delineated under 10 CFR 54.4(a).

After reviewing the scoping results, the NRC staff evaluated the applicant's screening results. For those SCs with intended functions included under 10 CFR 54.4(a), the staff verified that the applicant properly screened out only (1) SCs that have functions performed with moving parts or that have a change in configuration or properties or (2) SCs that are subject to replacement after a qualified life or specified time period, as described in 10 CFR 54.21(a)(1). The staff confirmed that the applicant included SCs that do not meet either of these criteria in the AMR, as required by 10 CFR 54.21(a)(1).

2.5.1 Summary of Technical Information in the Application

SLRA Section 2.5.1 describes the electrical and I&C system components (commodity groups) subject to an AMR, and the boundaries of the structure. SLRA Table 2.5.1-1 lists the electrical and instrumental component types subject to an AMR and their intended functions. SLRA Table 3.6.2-1 provides the results of the applicant's AMR for electrical and instrumental and controls commodities.

2.5.2 Staff Evaluation

The staff's review of the SLRA, as supplemented by letters dated November 11, 2021 (ADAMS Accession No. ML21315A012) and December 15, 2021 (ADAMS Accession No. ML21349A005), for this section relates to scoping and screening of electrical and I&C system components subject to an AMR in accordance with 10 CFR 54.4 and 10 CFR 54.21.

Using the evaluation methodology described in SLRA Sections 2.1 (electrical portion), 2.2 (electrical portion), and 2.5, and the guidance in NUREG2192, Section 2.5, "Scoping and Screening Results: Electrical and Instrumentation and Controls Systems," the staff reviewed:

- SLRA, SLRA Supplements 2 and 3
- SBO Coping and Recovery Paths Figure 2.1.3-1
- UFSAR
- NUREG-2192, Standard Review Plans for Review of the SLRA for NPPs
- NEI 17-01, "Industry Guideline for Implementing the Requirements of 10 CFR Part 54 for Subsequent License Renewal"
- Licensee Event Reports related to electrical equipment failures

The staff evaluated the system functions described in the SLRA and UFSAR to verify that the applicant has included within the scope of LR all components with intended functions delineated as required by 10 CFR 54.4(a). The staff then reviewed those components that the applicant identified as within the scope of LR to verify that the applicant has included all passive and long-lived components subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff notes that 10 CFR 54.4(a) requires a list of plant SSCs within the scope of the license renewal, and 10 CFR 54.4(b) states, in part, that the intended functions of these SSCs must be shown to fulfill 10 CFR 54.21. In accordance with the requirements of 10 CFR 54.21(a)(1), the applicant must identify and list passive, long-lived SSCs within the scope of the SLR and subject to an AMR. NUREG-2192, "Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants (SRP-SLR)," Section 2.1, "Scoping and Screening Methodology" and NEI 17-01, "Industry Guideline for Implementing the Requirements of 10 CFR Part 54 for Subsequent License Renewal," provide guidance on the scoping and screening for LR.

The staff used the SRP-SLR and NEI 17-01 guidance to evaluate the methodology used by the applicant in performing the scoping and screening for the structures and components within the scope of the SLR. The staff reviewed the scoping methodology and results pertaining to the electrical and I&C system components using the scoping methodology described in SRP-SLR, Section 2.5, "Scoping and Screening Results: Electrical," and NEI 17-01. The staff finds that the scoping methodology described in the SLRA was consistent with the SRP-SLR and NEI 17-01 guidance.

The scoping criteria in 10 CFR 54.4(a)(3) require, in part, an applicant to consider "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 (SBO) (10 CFR 50.63)."

The staff evaluated the system functions described in the SLRA and UFSAR to verify that the applicant had included within the scope of the SLR all components with intended functions delineated as required by 10 CFR 54.4(a). The applicant, in SLRA Section 1.4.2, provided an overview of the Keowee Hydroelectric Station, the onsite power source for the three ONS units. This section describes the electrical paths that are required for safe shutdown of the three ONS units. SLRA Section 1.4.3 describes the standby shutdown facility designed to provide an alternate means to achieve and maintain hot shutdown conditions following a fire, sabotage, turbine building flood, SBO, and tornado events. These systems coupled with support systems required to assure operability of the power systems are within the scope of AMR. In Section 2.1 (Scoping and Screening Methodology), the applicant explained that electrical and I&C components that are part of in-scope electrical and I&C systems and in-scope mechanical systems are included within the scope of the SLR. Specifically, the applicant stated "Electrical scoping was not performed at the system level but rather at the component level using a bounding or spaces approach. As discussed in the Statement of Consideration to the License Renewal Rule (60FR22462), the term 'systems, structures, and components' is used in 10 CFR 54.4 to allow an applicant to scope at a system or structure level or at a component level. Whether dividing the electrical portions of the plant by systems or other means, the objective is to ensure that no electrical components that perform an intended function are excluded from the review." This approach is conservative as all functions required for mitigating the consequences of DBEs and the systems and components relied upon to complete those functions can be identified. In addition, the applicant noted in Section 2.1.3.4, "Other Scoping

Pursuant to 10 CFR 54.4(a)(3)," that 10 CFR 54.4(a)(3) requires that plant SSCs within the scope of SLR include all systems and structures relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the regulations for fire protection (10 CFR 50.48), EQ (10 CFR 50.49), PTS (10 CFR 50.61), ATWS (10 CFR 50.62), and SBO (10 CFR 50.63). The methodology for identifying functions required to demonstrate compliance with fire protection, EQ, ATWS, SBO, and PTS regulations for ONS is provided in Section 2.1.4.3." An overview of the boundaries for electric equipment for SBO is shown in Figure 2.1.3-1 and the SLRA Section 2.1.3.4 summarizes the SBO coping and recovery paths. In supplement 3, dated December 15, 2021, the applicant revised Figure 2.1.3-1 to include all the major components or commodities associated with coping and restoration of offsite power following an SBO event, as discussed in SLRA Section 2.1.3.4.

The applicant performed an initial plant-level scoping of the plant's systems and structures in accordance with the scoping criteria identified in 10 CFR 54.4(a) using the scoping methodology described in the SLRA, Section 2.1.4, "Scoping methodology." The applicant included in the scope of SLR:

(1) safety-related electrical and I&C systems described in the ONS Units 1, 2 and 3 UFSARs in accordance with 10 CFR 54.4(a)(1),

(2) non-safety-related electrical and I&C systems whose failure could prevent the accomplishment of safety functions in accordance with 10 CFR 54.4(a)(2), and

(3) electrical and I&C systems credited in the regulated events identified in 10 CFR 54.4(a)(3).

The applicant considered all plant conditions applicable for the ONS Units for SLR scoping. The results of the applicant's plant-level scoping for electrical and I&C systems are provided in the SLRA Section 2.2.

The staff reviewed the major components that the applicant identified as within the scope of SLR. Since the applicant has evaluated power systems at the component level for all systems identified in the application, the staff concludes that the applicant has included all passive and long-lived components subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

The evaluation related to 10 CFR 54.4(a)(2) requirements is summarized in SLRA Section 2.1.4.2. The applicant provided a summary of the methodology for identifying non-safety related systems and structures with a potential for physical (connected to and spatial) interaction with a safety-related system or component performing functions identified in 10 CFR 54.4(a)(1). Specifically, the applicant used the following criteria to identify the non-safety related SSCs that perform or provide support to equipment required for 10 CFR 54.4(a)(1) functions:

(1) Non-safety related SSCs that are connected to and provide structural support for safety related SSCs

(2) Non-safety related SSCs that have the potential for spatial interactions with safety related SSCs

The SSCs that met the above criteria are considered within the scope of SLR as required by 10 CFR 54.4(a)(2). The staff found the methodology acceptable for evaluating non-safety related systems and components required for supporting safety-related functions.

The applicant applied the guidance provided in NUREG-2192, Table 2.1-6, “Typical Structures, Components, and Commodity Groups, and 10 CFR 54.21(a)(1)(i) Determinations for Integrated Plant Assessment” to identify commodity groups that perform their intended functions without moving parts or without a change in configuration or properties, and to remove the component commodity groups that are subject to replacement based on a qualified life or specified time period. The commodities subject to an AMR were screened consistent with 10 CFR 54.21(a)(1). The passive commodity groups were screened consistent with 10 CFR 54.21(a)(1)(ii) to exclude those commodities that are subject to replacement based on a qualified life or specific time period from the requirements of AMR. The final results of applying screening criteria per 10 CFR 54.21(a)(1)(i) and 10 CFR 54.21(a)(1)(ii) and component types subject to an AMR are listed in the SLRA Table 2.5.1-1, “Electrical and Instrumentation and Controls Commodities.” The applicant included cable bus systems, metal enclosed busses, fuse holders and metallic clamps that are not included in the EQ program as part of the AMR scope.

The results of the methodology used to 1) identify non-safety SSCs that can interface with safety related SSCs and 2) screening criterion used to identify electrical commodities and components that are subject to AMR are provided in Section 2.5, “Scoping and Screening Results: Electrical and Instrumentation and Controls.” The applicant identified the following list of passive electrical component and commodity groups that meet the screening criteria of 10 CFR 54.21(a)(1)(i):

- Alarm Units
- Analyzers
- Annunciators
- Batteries
- Cable Tie Wraps
- Conductors and Connections (including splices and terminal blocks)
  - Cable Connections (metallic parts)
  - Connector Contacts for Electrical Connections Exposed to Borated Water Leakage
  - Insulation for Electrical Cables and Connections
  - Electrical and I&C Containment Penetrations (including pigtails)
  - Fuses
  - Fuse Holders (not part of active equipment)
  - Metal Enclosed Bus (metal enclosed bus, isolated-, segregated, and nonsegregated phase)
  - Switchyard Bus and Connections
  - Transmission Conductors and Connections
  - Uninsulated Ground Conductors
- Chargers
- Circuit Breakers
- Communication Equipment
- Computers
- Converters
- Electric Heaters
- Electrical Controls and Panel Internal Component Assemblies
- Elements, RTDs, Sensors, Thermocouples, Transducers
- Generators, Motors
- Heat Tracing

- High-Voltage Insulators
- Indicators
- Inverters
- Isolators
- Light Bulbs
- Loop Controllers
- Meters
- Power Supplies
- Radiation Monitors
- Recorders
- Regulators
- Relays
- Signal Conditioners
- Solenoid Operators
- Solid State Devices
- Surge Arresters
- Switches
- Switchgear, Load Centers, Motor Control Centers, Distribution Panels
- Transformers
- Transmitters

The applicant determined that the following electrical component commodity groups perform their functions without moving parts or without a change in configuration or properties and therefore meet the screening criteria of 10 CFR 54.21(a)(1)(i):

- Cable Connections (Metallic Parts)
- Connector contacts for electrical connections exposed to borated water leakage
- Insulation for Electrical Cables and Connections
- Electrical and I&C Containment Penetrations (including pigtails)
- Fuse Holders (not part of active equipment)
- Metal Enclosed Bus (isolated, segregated, and non-segregated phase)
- Switchyard Bus and Connections
- Transmission Conductors and Connections
- Uninsulated Ground Conductors
- High-Voltage Insulators
- Cable Tie Wraps

The applicant eliminated cable tie wraps from the electrical commodities with intended functions. Cable tie wraps are used in cable installations as cable ties. Cable tie wraps hold groups of cables together for restraint and ease of maintenance. Cable tie wraps are used to bundle wires and cables together to keep them running neatly and orderly. There are no CLB requirements that cable tie wraps remain functional during and following DBEs. The seismic qualification of cable trays does not credit the use of cable tie wraps. Cable tie wraps are not credited in the design basis in terms of any 10 CFR 54.4 intended function. Therefore, cable tie wraps are not within the scope of SLR and are not subject to AMR. Based on its review of this information, the staff finds that the exclusion of cable tie wraps from the electrical commodities subject to an AMR is acceptable.

The applicant eliminated uninsulated ground conductors from the electrical commodities with intended functions. The uninsulated ground conductor component group is comprised of grounding cable and associated connectors. Ground conductors are provided for equipment and personnel protection. They do not perform an intended function for LR. Therefore, uninsulated ground conductors are not within the scope of SLR and are not subject to an AMR. Based on its review of this information, the staff finds that the exclusion of uninsulated ground conductors from the electric commodities subject to an AMR is acceptable.

The applicant noted that electrical and I&C components and commodities included in the EQ Program (10 CFR 50.49) are excluded because they have defined qualified lives and are replaced prior to the expiration of their qualified lives. Therefore, no electrical and I&C components and commodities within the EQ Program are subject to an AMR in accordance with the screening criterion of 10 CFR 54.21(a)(1)(ii). The applicant described the screening analysis for in-scope containment electrical and I&C penetrations which are managed by either the EQ program or meet the criterion of 10 CFR 54.21(a)(1)(ii) and are subject to an AMR. The pressure boundary and structural support intended functions of electrical penetrations are included in the staff's evaluation of containment in SLRA Sections 2.4.2 and 2.5.1, SE Section 3.0.3.2.18 (IWE ASME Aging Management Program [AMP] B2.1.28).

In view of the unique design of the offsite and onsite power systems at Oconee Nuclear Station, the equipment associated with 230kV yellow bus (safety bus) performs functions similar to the safety bus in a conventional NPP design and the scope of equipment to be considered for the SLRA extends beyond the first breaker in the switchyard. From an AMR-related scoping perspective, all the major components associated with the 230kV bus that are either relied upon to remain functional during and following design-basis events or whose failure could prevent satisfactory accomplishment of any of the required safety functions are considered within the requirements of 10 CFR 54.21(a)(1). In addition, the UFSAR and TSs include the 100 kV systems powered by gas turbines at the Lee Station as an alternate offsite power source. In SLRA Sections 2.5.1.4, 2.5.1.5, and 2.5.1.6 and supplement 3, the applicant has provided an overview of major components in the 230 kV switchyard and 100 kV switching-station that supply power from the electric transmission system to plant buses for safe shutdown and recovery of offsite power following an SBO event. All the equipment, including control and instrumentation systems associated with these circuits, is in-scope of an AMR.

After reviewing the type of components and commodities considered for an AMR, the staff finds that the electrical components identified by the applicant as being subject to an AMR were consistent with the SRP-SLR. Based on the overview of major components and systems identified in the SLRA, the staff finds that the applicant has considered the electrical and I&C components subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1) because the listed electrical and I&C components meet the criteria in 10 CFR 54.21(a)(1)(i) and 10 CFR 54.21(a)(1)(ii). In addition, the staff finds that the inclusion of the electrical and I&C systems, electrical and I&C components in mechanical systems, and electrical equipment that supports the requirements of 10 CFR 50.63 within the scope of the SLR satisfies the requirements in 10 CFR 54.4(a). Therefore, the staff finds the ONS scoping and screening for electrical systems to be acceptable.

2.5.3 Conclusion

Based on the staff's evaluation in SE Section 2.5.2 and on a review of the SLRA, UFSAR, and LR drawings, the staff concludes that the applicant identified the electrical and I&C components within the scope of LR as required by 10 CFR 54.4(a). The staff also concludes that the applicant identified the components subject to an AMR in compliance with the requirements in 10 CFR 54.21(a)(1).

2.6 Conclusion for Scoping and Screening

The staff reviewed the information in SLRA Chapter 2.0. The staff determined that the applicant’s scoping and screening methodology is consistent with the requirements of 10 CFR 54.4 and 10 CFR 54.21(a)(1).

Based on its review, the staff finds that the applicant has adequately identified those SSCs within the scope of license renewal, as required by 10 CFR 54.4(a), and SCs subject to an AMR, as required by 10 CFR 54.21(a)(1).

SECTION 3 AGING MANAGEMENT REVIEW RESULTS

This section of the SE contains the staff's evaluation of Duke Energy Carolinas, LLC (Duke Energy or the applicant) AMRs and AMPs for ONS Units 1, 2, and 3 (Oconee or applicant) by letters dated June 7, 2021 (ADAMS Package Accession No. ML21158A193), and supplemented by letters dated October 22, 2021 (ADAMS Accession No. ML21295A035), October 28, 2021 (ADAMS Accession No. ML21302A208), November 11, 2021 (ADAMS Accession No. ML21315A012), December 2, 2021 (ADAMS Accession No. ML21336A001), December 15, 2021 (ADAMS Accession No. ML21349A005), December 17, 2021 (ADAMS Accession No. ML21351A000), January 7, 2022 (ADAMS Accession No. ML22010A129), January 21, 2022 (ADAMS Accession No. ML22021A000), February 14, 2022 (ADAMS Accession No. ML22045A021, February 21, 2022 (ADAMS Accession No. ML22052A002), March 22, 2022 (ADAMS Accession No. ML22081A027), March 31, 2022 (ADAMS Accession No. ML22090A046), April 20, 2022 (ADAMS Accession No. ML22110A207), April 22, 2022 (ADAMS Accession No. ML22112A016), May 11, 2022 (ADAMS Accession No. ML22131A023), May 20, 2022 (ADAMS Accession No. ML22140A016), May 27, 2022 (ADAMS Accession No. ML22147A001), June 7, 2022 (ADAMS Accession No. ML22158A028), June 8, 2022 (ADAMS Accession No. ML22159A151), July 8, 2022 (ADAMS Accession No. ML22189A010 [non-proprietary]), July 25, 2022 (ADAMS Accession No. ML22206A005), and September 2, 2022 (ADAMS Accession No. ML22245A010 [non-proprietary]).

The applicant describes these AMRs and AMPs in its SLRA for ONS. SLRA Section 3 provides the results of the applicant's AMRs for those systems and components (SCs) identified in SLRA Section 2 as within the scope of license renewal and subject to an AMR. SLRA Appendix B lists the 48 AMPs that the applicant will rely on to manage or monitor the aging of passive, long-lived SCs.

The staff evaluated the applicant's AMRs for in-scope components subject to an AMR, as grouped in the following six SC groups:

(3) Reactor Vessel, Reactor Internals, and Reactor Coolant System (SE Section 3.1)
(4) Engineered Safety Features (SE Section 3.2)
(5) Auxiliary Systems (SE Section 3.3)
(6) Steam and Power Conversion Systems (SE Section 3.4)
(7) Containments, Structures, and Component Supports (SE Section 3.5)
(8) Electrical and Instrumentation and Controls (SE Section 3.6)

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

In preparing its SLRA, the applicant credited NUREG-2191, Revision 0, "Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report," dated July 2017 (ADAMS Accession Nos. ML17187A031 and ML17187A204), for programs and AMR items as modified by:

- SLR-ISG-2021-04-ELECTRICAL (ADAMS Accession No. ML20181A395)
- SLR-ISG-2021-02-MECHANICAL (ADAMS Accession No. ML20181A434)
- SLR-ISG-2021-03-STRUCTURES (ADAMS Accession No. ML20181A381)
- SLR-ISG-2021-01-PWRVI (ADAMS Accession No. ML20217L203).

Per 10 CFR 54.29(a)(1), a renewed license may be issued if the staff finds that actions have been identified and have been or will be taken with respect to managing the effects of aging, during the period of extended operation, on the functionality of SCs that require review under 10 CFR 54.21(a)(1). The GALL-SLR Report provides summaries of generic AMPs that the staff has determined would be adequate to manage the effects of aging on related SCs subject to an AMR.

3.0.1 Format of the SLRA

The applicant submitted an application based on the guidance in NUREG-2192, Revision 0, “Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants,” dated July 2017 (ADAMS Accession No. ML17188A158) (SRP-SLR), and the guidance provided by NEI 17-01, “Industry Guideline for Implementing the Requirements of 10 CFR Part 54 for Subsequent License Renewal,” dated March 2017 (ADAMS Accession No. ML17339A599), which the staff endorsed as acceptable for use in performing AMRs and drafting SLRAs (ADAMS Accession No. ML18029A368).

The organization of SLRA Section 3 follows the recommendations in NEI 17-01 and parallels the section structure of SRP-SLR Chapter 3. SLRA Section 3 presents the results of the applicant’s AMRs in the following two table types:

(1) Table 1s: Table 3.x.1, where “3” indicates the SLRA Section number, “x” indicates the subsection number from the GALL-SLR Report, and “1” indicates that this is the first table type in SLRA Section 3.

(2) Table 2s: Table 3.x.2-y, where “3” indicates the SLRA Section number, “x” indicates the subsection number from the GALL-SLR Report, “2” indicates that this is the second table type in SLRA Section 3, and “y” indicates the table number for a specific system.

In the Table 1s, the applicant summarized the alignment between the ONS AMR results and the GALL-SLR Report AMR items. The applicant included a “discussion” column to document each of the AMR summary items in the Table 1s. The notation highlights if the item is consistent with the GALL-SLR Report, consistent with the GALL-SLR Report but uses a different AMP to manage aging effects, or is not applicable at ONS. Each Table 1 item summarizes how Table 2 items with similar materials, environments, and aging mechanisms compare to the GALL-SLR Report and how they will be managed for aging.

In the Table 2s, the applicant provided the detailed results of the AMR for those SCs identified in SLRA Section 2 as being subject to an AMR. Table 2 includes a column linking each AMR item to the associated Table 1 summary item.

3.0.2 Staff’s Review Process

The staff conducted the following three types of evaluations of the applicant’s AMR items and the AMPs listed in SLRA Appendix A and Appendix B that are credited for managing the effects of aging:

(1) For items that the applicant stated are consistent with the GALL-SLR Report, the staff conducted either an audit or a technical review to determine consistency. Because the GALL-SLR Report AMP and AMR analyses are one acceptable method for managing the effects of aging, the staff did not reevaluate those AMPs and AMRs that they determined to be consistent with the GALL-SLR Report.

(2) For items that the applicant stated were consistent with the GALL-SLR Report with exceptions, enhancements, or both, the staff conducted either an audit or a technical review of each item to determine consistency. In addition, the staff conducted either an audit or a technical review of the applicant's technical justifications for the exceptions or the adequacy of the enhancements. The GALL-SLR Report AMP should be described and justified. Therefore, the staff considers exceptions as portions of the GALL-SLR Report AMP that the applicant does not intend to implement.

(3) For all other items, such as plant-specific AMPs and AMR items that do not correspond to items in the GALL-SLR Report, the staff conducted a technical review to determine if the findings in 10 CFR 54.29(a)(1) were met.

A regulatory audit was conducted from July 26, 2021, to October 8, 2021, as part of the SLRA review in accordance with the audit plan dated July 23, 2021 (ADAMS Accession No. ML21196A076), and as detailed in the audit report dated February 14, 2022 (ADAMS Accession No. ML22045A053).

These audits and technical reviews were conducted to determine if the staff can make the findings of 10 CFR 54.29(a)(1) such that there is reasonable assurance that activities authorized by the subsequent renewed license will continue to be conducted in accordance with the CLB; that is, if actions have been taken or will be taken with respect to managing the effects of aging, during the period of extended operation, on the functionality of SCs that require review under 10 CFR 54.21(a)(1).

3.0.2.1 Review of AMPs

For those AMPs that the applicant asserted are consistent with the GALL-SLR Report AMPs, the staff conducted either an audit or a technical review to confirm this assertion. For each AMP that has one or more deviations, the staff evaluated each deviation to determine whether it was acceptable and whether the AMP, as modified, could adequately manage the aging effect(s) for which it was credited. For AMPs that are not addressed in the GALL-SLR Report, the staff performed a full review to determine their adequacy. The staff evaluated the AMPs against the following 10 program elements defined in Table A.11 of the SRPSLR:

(1) "scope of program": should include the specific SCs subject to an AMR for SLR.

(2) "preventive actions": should prevent or mitigate aging degradation.

(3) "parameters monitored or inspected": should be linked to the degradation of the particular SC's intended function(s).

(4) "detection of aging effects": should occur before there is a loss of SC intended function(s). This includes aspects such as method or technique (e.g., visual, volumetric, surface inspection), frequency, sample size, data collection, and timing of new or onetime inspections to ensure timely detection of aging effects.

(5) "monitoring and trending": should provide predictability of the extent of degradation, as well as timely corrective or mitigative actions.

(6) "acceptance criteria": These criteria, against which the need for corrective actions will be evaluated, should ensure that the SC intended function(s) are maintained under all CLB design conditions during the subsequent period of extended operation.

(7) "corrective actions": These actions, including root cause determination and prevention of recurrence, should be timely.

(8) "confirmation process": should ensure that corrective actions have been completed and are effective.

(9) "administrative controls": should provide for a formal review and approval.

(10) "operating experience" (OE): Adding the OE applicable to the AMP, including past corrective actions resulting in program enhancements or additional programs, should provide objective evidence to support the conclusion that the effects of aging will be adequately managed so that the SC intended function(s) will be maintained during the subsequent period of extended operation. OE with existing programs should be discussed.

In addition, the ongoing review of both plant-specific and industry OE, including relevant research and development, ensures that the AMP will be effective in managing the aging effects for which it is credited. When it is determined through the evaluation of OE that the effects of aging may not be adequately managed, either the AMP will be enhanced, or new AMPs will be developed, as appropriate.

Details of the staff's audit evaluation of program elements 1 through 6 and 10 are documented in the regulatory audit report and summarized in SE Section 3.0.3.

The staff reviewed the applicant's QA Program and documented its evaluations in SE Section 3.0.4. The staff's evaluation of the QA Program included an assessment of the "corrective actions," "confirmation process," and "administrative controls" program elements (program elements 7, 8, and 9).

The staff reviewed the information regarding the "OE" program element and documented its evaluation in SE Sections 3.0.3 and 3.0.5.

3.0.2.2 Review of AMR Results

Each SLRA Table 2 contains information concerning whether the AMRs the applicant identified align with the GALL-SLR Report AMRs. For a given AMR in a Table 2, the staff reviewed the intended function, material, environment, aging effect requiring management (AERM), and AMP combination for a particular system component type. Items in column seven, "NUREG-2191 Item," of each SLRA Table 2 correlate to an AMR combination as identified in the GALL-SLR Report. The staff also conducted a technical review of combinations not consistent with the GALL-SLR Report. Column eight, "Table 1 Item," refers to a number indicating the correlating row in Table 1.

For component groups evaluated in the GALL-SLR Report for which the applicant claimed consistency and for which it does not recommend further evaluation, the staff on the basis of its review, determined if the plant-specific components of these GALL-SLR Report component groups were bounded by the GALL-SLR Report evaluation.

The applicant noted for each AMR item how the information in the tables aligns with the information in the GALL-SLR Report. The staff audited those AMRs with notes A through E indicating how the AMR is consistent with the GALL-SLR Report.

Note A indicates that the AMR item is consistent with the GALL-SLR Report for component, material, environment, and aging effects. In addition, the AMP is consistent with the GALL-SLR Report AMP. The staff audited these items to verify consistency with the GALL-SLR Report and to confirm the validity of the AMR for the site-specific conditions. The staff also determined whether the applicant's AMP is consistent with the GALL-SLR Report AMP.

Note B indicates that the AMR item is consistent with the GALL-SLR Report for component, material, environment, and aging effects. However, the AMP takes one or more exceptions to the GALL-SLR Report AMP. The staff audited these items to verify consistency with the GALL-SLR Report and to confirm the validity of the AMR for the site-specific conditions. The staff also confirmed that the identified exceptions to the GALL-SLR Report AMPs have been reviewed and accepted.

Note C indicates that the component for the AMR item is different from that in the GALL-SLR Report, but that the item is otherwise consistent with the GALL-SLR Report for material, environment, and aging effects. In addition, the AMP is consistent with the GALL-SLR Report AMP. This note indicates that the applicant was unable to find an AMR item associated with the component in the GALL-SLR Report but identified in the GALL-SLR Report a different component with the same material, environment, aging effects, and AMP as the component under review. The staff audited these items to verify consistency with the GALL-SLR Report and to confirm the validity of the AMR for the site-specific conditions. The staff also determined whether the AMR item of the different component is applicable to the component under review and whether the AMR is valid for the site-specific conditions. Finally, the staff determined whether the applicant's AMP is consistent with the GALL-SLR Report AMP.

Note D indicates that the component for the AMR item is different from that in the GALL-SLR Report but that the item is otherwise consistent with the GALL-SLR Report for material, environment, and aging effects. In addition, the AMP takes one or more exceptions to the GALL-SLR Report AMP. Like Note C, this note indicates that the applicant was unable to find an AMR item associated with the component in the GALL-SLR Report but identified in the GALL-SLR Report a different component with the same material, environment, aging effects, and AMP as the component under review. However, Note D is used to indicate that the applicant has taken exceptions to the GALL-SLR Report AMP. The staff audited these items to verify consistency with the GALL-SLR Report and to confirm the validity of the AMR for the site-specific conditions. The staff also determined whether the AMR item of the different component is applicable to the component under review and whether the AMR is valid for the site-specific conditions. Finally, the staff confirmed that the identified exceptions to the GALL-SLR Report AMPs have been reviewed and accepted.

Note E indicates that the AMR item is consistent with the GALL-SLR Report for material, environment, and aging effects, but a different AMP is credited or the GALL-SLR Report identifies a plant-specific AMP. The staff audited these items to verify consistency with the GALL-SLR Report and to confirm the validity of the AMR for the site-specific conditions. The staff also determined whether the credited AMP would adequately manage the aging effects.

3.0.2.3 Updated Final Safety Analysis Report Supplement

10 CFR 54.21(d) requires that each application contains a UFSAR supplement. Per 10 CFR 54.21(d), the UFSAR supplement for the facility must contain a summary description of the programs and activities for managing the effects of aging and the evaluation of time-limited aging analyses (TLAAs) for the period of extended operation determined by the integrated plant

assessment and the evaluation of TLAAs. Consistent with the SRP-SLR, the staff reviewed the UFSAR supplement.

3.0.2.4 Documentation and Documents Reviewed

In performing its review, the staff used the SLRA, SLRA supplements, SRP-SLR, GALL-SLR Report, and the applicant's responses to RAIs.

During the regulatory audit, the staff examined the applicant's justifications, as documented in the audit summary report, to verify that the applicant's activities and programs were adequate to manage the effects of aging on SCs. The staff also conducted detailed discussions and interviews with the applicant's license renewal project personnel and others with technical expertise relevant to aging management.

3.0.3 Aging Management Programs

SE Table 3.0-1 below presents the AMPs credited by the applicant and described in SLRA Appendix B, "Aging Management Programs." The table also indicates (a) whether the AMP is an existing or new program, (b) the staff's final disposition of the AMP, (c) the GALL-SLR Report program to which the applicant's AMPs were compared, and (d) the SE section that documents the staff's evaluation of the program. The SE sections are based on the applicant's initial comparison to the GALL-SLR Report, NUREG-2191.

Table 3.0-1 Oconee Aging Management Programs

ONS Aging Management Program	SLRA Section(s)	New or Existing Aging Management Program	SLRA Comparison to the NUREG-2191 GALL-SLR Report	NUREG-2191 GALL Report AMPs	SE Section (Ordered Based On SLRA Disposition)
ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	A2.1 B2.1.1	Existing	Consistent with enhancements	XI.M1 ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	3.0.3.2.1
Water Chemistry	A2.2 B2.1.2	Existing	Consistent	XI.M2 Water Chemistry	3.0.3.1.1
Reactor Head Closure Stud Bolting	A2.3 B2.1.3	Existing	Consistent with exceptions and enhancements	XI.M3 Reactor Head Closure Stud Bolting	3.0.3.2.2
Boric Acid Corrosion	A2.4 B2.1.4	Existing	Consistent	XI.M10 Boric Acid Corrosion	3.0.3.1.2
Cracking of Nickel-Alloy Components and Loss of Material Due to Boric Acid-Induced Corrosion in Reactor Coolant Pressure Boundary Components	A2.5 B2.1.5	Existing	Consistent	XI.M11B Cracking of Nickel-Alloy Components and Loss of Material due to Boric Acid- Induced Corrosion in Reactor Coolant Pressure Boundary Components	3.0.3.1.3
Thermal Aging Embrittlement of Cast Austenitic Stainless Steel	A2.6 B2.1.6	New	Consistent	XI.M12 Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)	3.0.3.1.4

ONS Aging Management Program	SLRA Section(s)	New or Existing Aging Management Program	SLRA Comparison to the NUREG-2191 GALL-SLR Report	NUREG-2191 GALL Report AMPs	SE Section (Ordered Based On SLRA Disposition)
PWR Vessel Internals	A2.7 B2.1.7	Existing	Consistent with enhancements	XI.M16A PWR Vessel Internals	3.0.3.2.3
Flow-Accelerated Corrosion	A2.8 B2.1.8	Existing	Consistent with enhancements	XI.M17 Flow-Accelerated Corrosion (FAC)	3.0.3.2.4
Bolting Integrity	A2.9 B2.1.9	Existing	Consistent with enhancements	XI.M18 Bolting Integrity	3.0.3.2.5
Steam Generators	A2.10 B2.1.10	Existing	Consistent	XI.M19 Steam Generators	3.0.3.1.5
Open-Cycle Cooling Water System	A2.11 B2.1.11	Existing	Consistent with enhancements	XI.M20 Open-Cycle Cooling Water System	3.0.3.2.6
Closed Treated Water Systems	A2.12 B2.1.12	Existing	Consistent with enhancements	XI.M21A Closed Treated Water Systems	3.0.3.2.7
Inspection of Overhead Heavy Load Handling Systems	A2.13 B2.1.13	Existing	Consistent with enhancements	XI.M23 Inspection of Overhead Heavy Load and Light Load Handling Related to Refueling) Handling Systems	3.0.3.2.8
Compressed Air Monitoring	A2.14 B2.1.14	Existing	Consistent with enhancements	XI.M24 Compressed Air Monitoring	3.0.3.2.9
Fire Protection	A2.15 B2.1.15	Existing	Consistent with enhancements	XI.M26 Fire Protection	3.0.3.2.10
Fire Water System	A2.16 B2.1.16	Existing	Consistent with exceptions and enhancements	XI.M27 Fire Water System	3.0.3.2.11
Outdoor and Large Atmospheric Metallic Storage Tanks	A2.17 B2.1.17	New	Consistent	XI.M29 Outdoor and Large Atmospheric Metallic Storage Tanks	3.0.3.1.6
Fuel Oil Chemistry	A2.18 B2.1.18	Existing	Consistent with enhancements	XI.M30 Fuel Oil Chemistry	3.0.3.2.12
Reactor Vessel Material Surveillance	A2.19 B2.1.19	Existing	Consistent with exceptions	XI.M31 Reactor Vessel Material Surveillance	3.0.3.2.13
One-Time Inspection	A2.20 B2.1.20	New	Consistent	XI.M32 One-Time Inspection	3.0.3.1.7
Selective Leaching	A2.21 B2.1.21	New	Consistent with exception	XI.M33 Selective Leaching	3.0.3.2.14
ASME Code Class 1 Small-Bore Piping	A2.22 B2.1.22	New	Consistent	XI.M35 ASME Code Class 1 Small-Bore Piping	3.0.3.1.8
External Surfaces Monitoring of Mechanical Components	A2.23 B2.1.23	New	Consistent	XI.M36 External Surfaces Monitoring of Mechanical Components	3.0.3.1.9

ONS Aging Management Program	SLRA Section(s)	New or Existing Aging Management Program	SLRA Comparison to the NUREG-2191 GALL-SLR Report	NUREG-2191 GALL Report AMPs	SE Section (Ordered Based On SLRA Disposition)
Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	A2.24 B2.1.24	New	Consistent	XI.M38 Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	3.0.3.1.10
Lubricating Oil Analysis	A2.25 B2.1.25	Existing	Consistent with Enhancements	XI.M39 Lubricating Oil Analysis	3.0.3.2.15
Buried and Underground Piping and Tanks	A2.26 B2.1.26	Existing	Consistent with exceptions and enhancements	XI.M41 Buried and Underground Piping and Tanks	3.0.3.2.16
Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks	A2.27 B2.1.27	New	Consistent with exceptions	XI.M42 Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks	3.0.3.2.17
ASME XI, Subsection IWE	A2.28 B2.1.28	Existing	Consistent with enhancements	XI.S1 ASME Section XI, Subsection IWE	3.0.3.2.18
ASME XI, Subsection IWL	A2.29 B2.1.29	Existing	Consistent with exception and enhancements	XI.S2 ASME Section XI, Subsection IWL	3.0.3.2.19
ASME XI, Subsection IWF	A2.30 B2.1.30	Existing	Consistent with enhancements	XI.S3 ASME Section XI, Subsection IWF	3.0.3.2.20
10 CFR Part 50, Appendix J	A2.31 B2.1.31	Existing	Consistent	XI.S4 10 CFR Part 50, Appendix J	3.0.3.1.11
Masonry Walls	A2.32 B2.1.32	Existing	Consistent with enhancements	XI.S5 Masonry Walls	3.0.3.2.21
Structures Monitoring	A2.33 B2.1.33	Existing	Consistent with exception and enhancements	XI.S6 Structures Monitoring	3.0.3.2.22
Inspection of Water-Control Structures Associated with Nuclear Power Plants	A2.34 B2.1.34	Existing	Consistent with enhancements	XI.S7 Inspection of Water-Control Structures Associated with Nuclear Power Plants	3.0.3.2.23
Protective Coating Monitoring and Maintenance	A2.35 B2.1.35	Existing	Consistent with enhancements	XI.S8 Protective Coating Monitoring and Maintenance	3.0.3.2.24
Electrical Insulation for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	A2.36 B2.1.36	Existing	Consistent with enhancements	XI.E1 Electrical Insulation for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	3.0.3.2.25

ONS Aging Management Program	SLRA Section(s)	New or Existing Aging Management Program	SLRA Comparison to the NUREG-2191 GALL-SLR Report	NUREG-2191 GALL Report AMPs	SE Section (Ordered Based On SLRA Disposition)
Electrical Insulation for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements used in Instrumentation Circuits	A2.37 B2.1.37	New	Consistent	XI.E2 Electrical Insulation for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits	3.0.3.1.12
Electrical Insulation for Inaccessible Medium-Voltage Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	A2.38 B2.1.38	Existing	Consistent with enhancements	XI.E3A Electrical Insulation for Inaccessible Medium-Voltage Power Cables Not Subject To 10 CFR 50.49 Environmental Qualification Requirements	3.0.3.2.26
Electrical Insulation for Inaccessible Instrument and Control Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	A2.39 B2.1.39	New	Consistent	XI.E3B Electrical Insulation for Inaccessible Instrument and Control Cables Not Subject To 10 CFR 50.49 Environmental Qualification Requirements	3.0.3.1.13
Electrical Insulation for Inaccessible Low-Voltage Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	A2.40 B2.1.40	New	Consistent with exceptions	XI.E3C Electrical Insulation for Inaccessible Low-Voltage Power Cables Not Subject To 10 CFR 50.49 Environmental Qualification Requirements	3.0.3.2.27
Metal Enclosed Bus	A2.41 B2.1.41	New	Consistent	XI.E4 Metal Enclosed Bus	3.0.3.1.14
Fuse Holders	A2.42 B2.1.42	New	Consistent	XI.E5 Fuse Holders	3.0.3.1.15
Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	A2.43 B2.1.43	New	Consistent	XI.E6 Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	3.0.3.1.16
Fatigue Monitoring	A3.1 B3.1	Existing	Consistent with enhancements	X.M1 Fatigue Monitoring	3.0.3.2.28
Neutron Fluence Monitoring	A3.2 B3.2	Existing	Consistent	X.M2 Neutron Fluence Monitoring	3.0.3.1.17

ONS Aging Management Program	SLRA Section(s)	New or Existing Aging Management Program	SLRA Comparison to the NUREG-2191 GALL-SLR Report	NUREG-2191 GALL Report AMPs	SE Section (Ordered Based On SLRA Disposition)
Environmental Qualification of Electric Equipment	A3.3 B3.3	Existing	Consistent with enhancements	X.E1 Environmental Qualification (EQ) of Electric Equipment	3.0.3.2.29
Concrete Containment Unbonded Tendon Prestress	A3.4 B3.4	Existing	Consistent with exceptions	X.S1 Concrete Containment Tendon Prestress	3.0.3.2.30
Secondary Shield Wall Tendon Surveillance	A5.1 B4.1	Existing	Not Consistent with or Not Addressed in the GALL-SLR Report	None. Oconee Plant-Specific Program	3.0.3.3.1

3.0.3.1 AMPs Consistent with the GALL-SLR Report

In SLRA Appendix B, the applicant identified the following AMPs as consistent with the GALL-SLR Report:

- Water Chemistry
- Boric Acid Corrosion
- Cracking of Nickel-Alloy Components and Loss of Material Due to Boric Acid-Induced Corrosion in Reactor Coolant Pressure Boundary Components
- Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)
- Steam Generators
- Outdoor and Large Atmospheric Metallic Storage Tanks
- One-Time Inspection
- ASME Code Class 1 Small-Bore Piping
- External Surfaces Monitoring of Mechanical Components
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components
- 10 CFR Part 50, Appendix J
- Electrical Insulation for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification (EQ) Requirements Used in Instrumentation Circuits
- Electrical Insulation for Inaccessible Instrument and Control Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements
- Metal Enclosed Bus
- Fuse Holders
- Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements
- Neutron Fluence Monitoring

In the following sections, the staff discusses the results of the evaluation for all of these AMPs, listing any amendments to the programs during the review, a summary of the staff's determination of consistency, any requests for information and applicant responses, OE, and a review of the applicant's UFSAR supplement summary of the program.

3.0.3.1.1 Water Chemistry

SLRA Section B2.1.2 describes the existing Water Chemistry program as consistent with GALL-SLR Report AMP XI.M2, "Water Chemistry," as modified by SLR-ISG-2021-02-MECHANICAL, "Updated Aging Management Criteria for Mechanical Portions of Subsequent License Renewal Guidance." The applicant amended this SLRA section by Supplement 1 dated October 28, 2021 (ADAMS Accession No. ML21302A208).

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL-SLR Report. The staff compared the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements of the SLRA of the applicant's program to the corresponding program elements of GALL-SLR Report AMP XI.M2, as modified by SLR-ISG-2021-02-MECHANICAL.

Based on its audit and review of the SLRA, the staff finds that the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements are consistent with the corresponding program elements of GALL-SLR Report AMP XI.M2.

OE. SLRA Section B2.1.2 summarizes OE related to the Water Chemistry program. The staff reviewed OE information in the application and during the audit. As discussed in the audit report, the staff reviewed the plant OE information the applicant provided for this program to (a) identify examples of age-related degradation, and (b) provide a basis for the staff's conclusions on the ability of the applicant's proposed AMPs to manage the effects of aging in the subsequent period of extended operation. The staff did not identify any OE indicating that the applicant should modify its proposed program. Based on its audit and review of the application, the staff finds that the conditions and OE at the plant are bounded by those for which the Water Chemistry program was evaluated.

UFSAR Supplement. SLRA Section A2.2 provides the UFSAR supplement for the Water Chemistry program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in GALL-SLR Report Table XI-01. The staff also noted that the applicant committed to ongoing implementation of the Water Chemistry program for managing the effects of aging for applicable components during the subsequent period of extended operation. The staff finds that the information in the final safety analysis report (FSAR) supplement is an adequate summary description of the program.

Conclusion. Based on its review of the applicant's Water Chemistry program, the staff concludes that those program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.2 Boric Acid Corrosion

SLRA Section B2.1.4 states that the Boric Acid Corrosion program is an existing condition monitoring program that is consistent with the program elements in the GALL-SLR Report AMP XI.M10, "Boric Acid Corrosion."

Staff Evaluation. The staff conducted an audit to verify the applicant's claim of the Boric Acid Corrosion program's consistency with the GALL-SLR Report. The staff compared the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements described in the associated AMP evaluation report to the corresponding program elements of GALL-SLR Report AMP XI.M10.

Based on its audit and review of the SLRA, the staff finds that the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements are consistent with the corresponding program elements of GALL-SLR Report AMP XI.M10.

OE. SLRA Section B2.1.4 summarizes OE related to the Boric Acid Corrosion program. The staff reviewed OE information in the application and during the audit. As discussed in the audit report, the staff reviewed the plant OE information the applicant provided for this program to (a) identify examples of age-related degradation, and (b) provide a basis for the staff's conclusions on the ability of the applicant's proposed AMP to manage the effects of aging in the subsequent period of extended operation. The staff did not identify any OE indicating that the applicant should modify its proposed program.

Based on its audit and review of the application, the staff finds that the conditions and OE at the plant are bounded by those for which the Boric Acid Corrosion program was evaluated.

UFSAR Supplement. SLRA Section A2.4 provides the UFSAR supplement for the Boric Acid Corrosion program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in GALL-SLR Report Table XI-01. The staff also noted that the applicant committed to ongoing implementation of the existing Boric Acid Corrosion AMPs. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. Based on its review of the applicant's Boric Acid Corrosion program, the staff concludes that those program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.3 Cracking of Nickel-Alloy Components and Loss of Material Due to Boric Acid–Induced Corrosion in Reactor Coolant Pressure Boundary Components

SLRA Section B2.1.5 describes the existing Cracking of Nickel-Alloy Components and Loss of Material Due to Boric Acid–Induced Corrosion in Reactor Coolant Pressure Boundary Components program as consistent with GALL-SLR Report AMP XI.M11B, "Cracking of Nickel-

Alloy Components and Loss of Material Due to Boric Acid–Induced Corrosion in Reactor Coolant Pressure Boundary Components."

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL-SLR Report. The staff compared the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements of the SLRA of the applicant's program to the corresponding program elements of GALL-SLR Report AMP XI.M11B.

Based on a review of the SLRA, the staff finds that the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria" and "corrective actions" program elements are consistent with the corresponding program elements of GALL-SLR Report AMP XI.M11B. The staff finds that the AMP is adequate to manage the applicable aging effects.

OE. SLRA Section B2.1.5 summarizes OE related to the Cracking of Nickel-Alloy Components and Loss of Material Due to Boric Acid–Induced Corrosion in Reactor Coolant Pressure Boundary Components program. The staff reviewed OE information in the application and the audit. As discussed in the audit report, the staff reviewed the plant OE information the applicant provided for this program to (a) identify examples of age-related degradation, and (b) provide a basis for the staff's conclusions on the ability of the applicant's proposed AMPs to manage the effects of aging in the subsequent period of extended operation. The staff verified that the applicant has implemented the latest industry guidance in Electric Power Research Institute (EPRI) Report 3002017288, "Materials Reliability Program: Guideline for Nondestructive Examination of Reactor Vessel Upper Head Penetrations," Revision 1 (MRP-384), as required under NEI 03-08 implementation criteria. The staff also verified that the applicant has reviewed the information in RIS 2015-10, "Applicability of ASME Code Case N-770-1 as Conditioned in 10 CFR 50.55a, Codes and Standards, to Branch Connection Butt Welds," for applicability to its Alloy 600 management plan. Based on its audit and review of the application, the staff finds that the conditions and OE at the plant are bounded by those for which the Cracking of Nickel-Alloy Components and Loss of Material Due to Boric Acid–Induced Corrosion in Reactor Coolant Pressure Boundary Components program was evaluated.

UFSAR Supplement. SLRA Section A2.5 provides the UFSAR supplement for the Cracking of Nickel-Alloy Components and Loss of Material Due to Boric Acid–Induced Corrosion in Reactor Coolant Pressure Boundary Components program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in GALL-SLR Report Table XI-01. The staff also noted that the applicant committed to ongoing implementation of the existing Cracking of Nickel-Alloy Components and Loss of Material Due to Boric Acid–Induced Corrosion in Reactor Coolant Pressure Boundary Components program for managing the effects of aging for applicable components during the subsequent period of extended operation. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. Based on its review of the applicant's Cracking of Nickel-Alloy Components and Loss of Material Due to Boric Acid–Induced Corrosion in Reactor Coolant Pressure Boundary Components program, the staff concludes that those program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.4 Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)

SLRA Section B2.1.6 describes the existing Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS) program as consistent with GALL-SLR Report AMP XI.M12, “Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS).”

Staff Evaluation. During its audit, the staff reviewed the applicant’s claim of consistency with the GALL-SLR Report. The staff compared the “scope of program,” “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” “acceptance criteria,” and “corrective actions” program elements of the SLRA of the applicant’s program to the corresponding program elements of GALL-SLR Report AMP XI.M12.

Based on a review of the SLRA, the staff finds that the “scope of program,” “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” “acceptance criteria,” and “corrective actions” program elements are consistent with the corresponding program elements of GALL-SLR Report AMP XI.M12. The staff finds that the AMP is adequate to manage the applicable aging effects.

For the “detection of aging effects” program element, the staff reviewed the applicant’s screening methodology, which identified four reactor coolant pump material heats that are susceptible to thermal aging embrittlement. The staff also reviewed the applicant’s bounding flaw tolerance evaluation for these four heats of materials for the subsequent period of extended operation. The staff finds that the applicant’s plant-specific flaw tolerance evaluation is acceptable because: (a) the fracture toughness values for the thermally embrittled CASS were estimated in accordance with NRC NUREG/CR-4513, Revision 2, “Estimation of Fracture Toughness of Cast Stainless Steels during Thermal Aging in LWR Systems,” (b) it was performed in accordance with guidance provided in the GALL-SLR Report, and (c) the result of the bounding flaw tolerance evaluation successfully demonstrated that the subject materials have adequate fracture toughness to address thermal aging embrittlement for the subsequent period of extended operation. The staff further noted that the applicant has demonstrated that the thermally embrittled CASS components at Oconee Units 1, 2, and 3 have tolerance for flaws such that even if they had an undetected flaw that would grow with time, the final flaw size in the proposed 80-year plant life would be significantly less than the critical flaw size. Therefore, the flaw tolerance analysis demonstrates that the thermally embrittled CASS components would not affect the structural integrity of the piping during the subsequent period of extended operation.

OE. SLRA Section B2.1.6 summarizes OE related to the Thermal Aging Embrittlement of CASS program. The staff reviewed OE information in the application and during the audit. As discussed in the audit report, the staff reviewed the plant OE information the applicant provided for this program to (a) identify examples of age-related degradation, and (b) provide a basis for the staff’s conclusions on the ability of the applicant’s proposed AMP to manage the effects of aging during the subsequent period of extended operation. The staff did not identify any OE indicating that the applicant should modify its proposed program.

Based on its audit and review of the application, the staff finds that the conditions and OE at the plant are bounded by those for which the Thermal Aging Embrittlement of CASS program was evaluated.

UFSAR Supplement. SLRA Section 16.2.2.1 of Appendix A provides the UFSAR supplement for AMP B2.1.6, "Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)." The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in GALL-SLR Report Table XI-01. The staff noted that the applicant committed to ongoing implementation of the Thermal Aging Embrittlement of CASS program for managing the effects of aging for applicable components during the subsequent period of extended operation. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. On the basis of its review of the applicant's Thermal Aging Embrittlement of CASS program, the staff concludes that those program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.5 Steam Generators

SLRA Section B2.1.10 states that the Steam Generators program is an existing program that is consistent with the program elements in the GALL-SLR Report AMP XI.M19, "Steam Generators." The applicant amended this SLRA section by Supplement 1 dated October 28, 2021, and by letter dated February 14, 2022 (ADAMS Accession Nos. ML21302A208 and ML22045A021, respectively).

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL-SLR Report. The staff compared the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements of the SLRA to the corresponding program elements of GALL-SLR Report AMP XI.M19.

For the "scope of the program" program element, the staff needed additional information regarding sleeves, plant-specific notes, AMR items and industry standards notes, and primary manway and inspection opening covers and backing plates, and issued RAIs B2.1.10-1, B2.1.10-2, B2.1.10-3, B2.1.10-4, and B2.1.10-2a. The staff's requests and the applicant's responses are documented in ADAMS Accession Nos. ML22045A021 and ML22112A016.

In its response to RAI B2.1.10-1, the applicant revised SLRA Section B2.1.10 to remove references to "mechanical sleeves" and "sleeves." The staff finds the applicant's response acceptable because sleeving is not an NRC-approved steam generator tube repair method at Oconee.

In its response to RAI B2.1.10-2, the applicant revised SLRA Table 3.1.2-4 to correct the plant-specific notes. The staff finds the applicant's response acceptable because SLRA Table 3.1.2-4 includes three plant-specific notes that clarify that the secondary feedwater and treated water environments are considered the same for the tube support plate assembly (support rods) and other steam generator components and that the auxiliary feedwater nozzle flanges are insulated with stainless steel (SS) metal reflective insulation.

In its response to RAI B2.1.10-2a, the applicant revised Item 3.1.1-071 in SLRA Table 3.1.1 to change its designation from "Not applicable to ONS steam generators. The associated NUREG-2191 aging items are not used" to "Consistent with NUREG-2191, except that the associated NUREG-2191 item is aligned to stainless steel Babcock & Wilcox Once Through Steam Generator Tube Support Plate Assembly support rods and tube support plates." The applicant revised SLRA Table 3.1.2-4 by changing AMR Item 3.1.1-014 to AMR Item 3.4.1-014 for managing loss of material of the auxiliary feedwater nozzle inlet header, citing plant-specific Note 1 for AMR Item 3.1.1-071 for managing loss of material of the tube support plate assembly (support rods), changing the tubesheet material from SS to steel, and citing AMR item 3.1.1-002 for managing cumulative fatigue damage of the tube-to-tubesheet welds. The staff finds the applicant's response acceptable because (1) SLRA Tables 3.1.1 and 3.1.2-4 are now consistent with regard to AMR Item 3.1.1-071, (2) AMR Item 3.4.1-014 is an appropriate AMR item for managing loss of material in the steel auxiliary feedwater nozzle inlet header exposed internally to treated water, (3) plant-specific Note 1 is cited for the SS tube support plate assembly (support rods) exposed externally to treated water to clarify that the secondary feedwater and treated water environments are considered the same, (4) SLRA Table 3.1.2-4 correctly states that the tubesheet material is steel, and (5) the nickel alloy tube-to-tubesheet welds exposed internally to secondary feedwater will be managed for cumulative fatigue damage.

In its response to RAI B2.1.10-3, the applicant revised SLRA Table 3.1.2-4 to: (1) cite plant-specific Note 3 for AMR Item 3.1.1-005 for managing cumulative fatigue damage of the auxiliary feedwater nozzle inlet header, (2) cite Industry Standard Note C for AMR Item 3.1.1-083 for managing loss of material of the secondary manway and handhole opening covers, (3) cite AMR Item 3.1.1-071 (IV.D1.RP-384) and Industry Standard Note C for managing cracking of the tube support plate assembly (support rods), (4) cite AMR Item 3.1.1-071 (IV.D1.RP-226) and Industry Standard Note C for managing loss of material of the tube support plate assembly (support rods and tube support plates) and correcting the environments, and (5) cite Industry Standard Note C for AMR Item 3.1.1-072 for managing loss of material of the tubesheet. The staff finds the applicant's response acceptable because the programs cited are capable of managing the aging effects; Industry Standard Note C was used appropriately to note when a component was different but material, environment, and aging effects were consistent with the GALL-SLR; and plant-specific notes were used appropriately to clarify information in the table.

In its response to RAI B2.1.10-4, the applicant stated that the primary manway and inspection covers are steel (SA-533 Type B Class 1) and are exposed to indoor uncontrolled air, and the backing plates, or diaphragms, are nickel alloy (SB-168 UNS N06690) and are exposed to reactor coolant. The applicant also stated that the primary manway and inspection opening covers and backing plates do not contain cladding material. The staff finds the applicant's response acceptable because it clarifies the materials of the primary manway and inspection covers and the backing plates. In addition, during its review of the response to RAI B2.1.10-4, the staff noted that SLRA Table 3.1.2-4 includes AMR items for managing cracking, cumulative fatigue damage, and loss of material of the nickel-alloy backing plates exposed to reactor coolant, and AMR items for managing loss of material of the steel primary manway and inspection covers exposed to indoor uncontrolled air. No changes were made to the SLRA as a result of RAI B2.1.10-4.

Based on a review of the SLRA, amendments, and the applicant's responses to B2.1.10-1, B2.1.10-2, B2.1.10-3, B2.1.10-4, and B2.1.10-2a, the staff finds that the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent with the corresponding program elements of GALL-SLR Report AMP XI.M19.

OE. SLRA Section B2.1.10 summarizes OE related to the Steam Generators program. The staff reviewed OE information in the application and during the audit. As discussed in the audit report, the staff reviewed the plant OE information the applicant provided for this program to (a) identify examples of age-related degradation, and (b) provide a basis for the staff's conclusions on the ability of the applicant's proposed AMPs to manage the effects of aging in the subsequent period of extended operation. The staff did not identify any OE indicating that the applicant should modify its proposed program. Based on its audit and review of the application, the staff finds that the conditions and OE at the plant are bounded by those for which the Steam Generators program was evaluated.

UFSAR Supplement. SLRA Section A2.10 provides the UFSAR supplement for the Steam Generators program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in GALL-SLR Report Table XI-01. The staff also noted that the applicant committed to ongoing implementation of the existing Steam Generators program for managing the effects of aging for applicable components during the subsequent period of extended operation. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. Based on its review of the applicant's Steam Generators program, the staff concludes that those program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.6 Outdoor and Large Atmospheric Metallic Storage Tanks

SLRA Section B2.1.17 describes the new Outdoor and Large Atmospheric Metallic Storage Tanks program as consistent with GALL-SLR Report AMP XI.M29, "Outdoor and Large Atmospheric Metallic Storage Tanks." The applicant amended this SLRA section by Supplement 1 dated October 28, 2021 (ADAMS Accession No. ML21302A208).

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL-SLR Report. The staff compared the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements of the SLRA of the applicant's program to the corresponding program elements of GALL-SLR Report AMP XI.M29.

Based on a review of the SLRA and an amendment, the staff finds that the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements are consistent with the corresponding program elements of GALL-SLR Report AMP XI.M29.

OE. SLRA Section B2.1.17 summarizes OE related to the Outdoor and Large Atmospheric Metallic Storage Tanks program. The staff reviewed OE information in the application and during the audit. As discussed in the audit report, the staff reviewed the plant OE information the applicant provided for this program to (a) identify examples of age-related degradation, and (b) provide a basis for the staff's conclusions on the ability of the applicant's proposed AMP to manage the effects of aging in the subsequent period of extended operation. The staff did not identify any OE indicating that the applicant should modify its proposed program beyond that incorporated during the development of and staff review of the SLRA.

Based on its audit and review of the application, the staff finds that the conditions and OE at the plant are bounded by those for which the Outdoor and Large Atmospheric Metallic Storage Tanks program was evaluated.

UFSAR Supplement. SLRA Section A2.17 provides the UFSAR supplement for the Outdoor and Large Atmospheric Metallic Storage Tanks program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in GALL-SLR Report Table XI-01. The staff also noted in SLRA Section A6.0-1, Item 17, that the applicant committed to implement the new Outdoor and Large Atmospheric Metallic Storage Tanks program 6 months prior to the subsequent period of extended operation or no later than the last refueling outage prior to the subsequent period of extended operation for managing the effects of aging for applicable components. The staff finds that the information in the UFSAR supplement, as amended by Supplement 1 dated October 28, 2021, is an adequate summary description of the program.

Conclusion. Based on its review of the applicant's Outdoor and Large Atmospheric Metallic Storage Tanks program, the staff concludes that those program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.7 One-Time Inspection

SLRA Section B2.1.20 describes the new One-Time Inspection program as consistent with GALL-SLR Report AMP XI.M32, "One-Time Inspection." The applicant amended this SLRA section by letter dated October 22, 2021 (ADAMS Accession No. ML21295A035).

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL-SLR Report. The staff compared the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements of the SLRA of the applicant's program to the corresponding program elements of GALL-SLR Report AMP XI.M32.

Based on a review of the SLRA and amendment, the staff finds that the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria" and "corrective actions" program elements are consistent with the corresponding program elements of GALL-SLR Report AMP XI.M32

OE. SLRA Section B2.1.20 summarizes OE related to the One-Time Inspection program. The staff reviewed OE information in the application and during the audit. As discussed in the audit report, the staff reviewed the plant OE information the applicant provided for this program to (a) identify examples of age-related degradation, and (b) provide a basis for the staff's conclusions on the ability of the applicant's proposed AMPs to manage the effects of aging in the subsequent period of extended operation. The staff did not identify any OE indicating that the applicant should modify its proposed program beyond that incorporated during the development of the SLRA. Based on its audit and review of the application, the staff finds that the conditions and OE at the plant are bounded by those for which the One-Time Inspection program was evaluated.

UFSAR Supplement. SLRA Section A2.20 provides the UFSAR supplement for the One-Time Inspection program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in GALL-SLR Report Table XI-01. The staff also noted the applicant has committed to implementing the new One-Time Inspection program, and inspections begin 10 years before the subsequent period of extended operation. Inspections that are to be completed prior to the subsequent period of extended operation will be completed 6 months prior to the subsequent period of extended operation or no later than the last refueling outage prior to the subsequent period of extended operation. The staff finds that the information in the UFSAR supplement, as amended by letter dated October 22, 2021, is an adequate summary description of the program.

Conclusion. Based on its review of the applicant's One-Time Inspection program, the staff concludes that those program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.8 ASME Code Class 1 Small-Bore Piping

SLRA Section B2.1.22 describes the new ASME Code Class 1 Small-Bore Piping program as consistent with GALL-SLR Report AMP XI.M35, "ASME Code Class 1 Small-Bore Piping."

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL-SLR Report. The staff compared the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements of the SLRA of the applicant's program to the corresponding program elements of GALL-SLR Report AMP XI.M35.

Based on a review of the SLRA, the staff finds that the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements are consistent with the corresponding program elements of GALL-SLR Report AMP XI.M35. The staff finds that the AMP is adequate to manage the applicable aging effects.

OE. SLRA Section B2.1.22 summarizes OE related to the ASME Code Class 1 Small-Bore Piping program. The staff reviewed OE information in the application and during the audit. As discussed in the audit report, the staff reviewed the plant OE information the applicant provided for this program to (a) identify examples of age-related degradation, and (b) provide a basis for the staff's conclusions on the ability of the applicant's proposed AMPs to manage the effects of aging in the subsequent period of extended operation. The staff verified that age-related cracking has been identified in Class 1 small-bore piping butt welds. The staff also verified that the applicant has performed corrective actions to address and mitigate the cause of cracking and leaks through design changes, improved maintenance practices, or increased inspections and replacements. No age-related cracking has been identified in Class 1 small-bore piping socket welds. The applicant confirmed that it will perform the examinations of Class 1 small-bore piping welds in accordance with the applicable category of NUREG-2191, Table XI.M35-1 to monitor for cracking. The staff did not identify any OE indicating that the applicant should modify its proposed program. Based on its audit and review of the application, the staff finds that the conditions and OE at the plant are bounded by those for which the ASME Code Class 1 Small-Bore Piping program was evaluated.

UFSAR Supplement. SLRA Section A2.22 provides the UFSAR supplement for the ASME Code Class 1 Small-Bore Piping program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in GALL-SLR Report Table XI-01. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. Based on its review of the applicant's ASME Code Class 1 Small-Bore Piping program, the staff concludes that those program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.9 External Surfaces Monitoring of Mechanical Components

SLRA Section B2.1.23 describes the new External Surfaces Monitoring of Mechanical Components AMP as consistent with GALL-SLR Report AMP XI.M36, "External Surfaces Monitoring of Mechanical Components."

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL-SLR Report. The staff compared the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements of the applicant's SLRA to the corresponding program elements of GALL-SLR Report AMP XI.M36.

Based on a review of the SLRA, the staff finds that the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements are consistent with the corresponding program elements of GALL-SLR Report AMP XI.M36.

OE. SLRA Section B2.1.23 summarizes operating experience related to the External Surfaces Monitoring of Mechanical Components program. The staff reviewed operating experience information in the application and during the audit. As discussed in the Audit Report, the staff reviewed the plant OE information the applicant provided for this program to (a) identify examples of age-related degradation, and (b) provide a basis for the staff's conclusions on the ability of the applicant's proposed AMPs to manage the effects of aging in the subsequent period of extended operation. The staff did not identify any operating experience indicating that the applicant should modify its proposed program.

UFSAR Supplement. SLRA Section A2.23 provides the UFSAR supplement for the External Surfaces Monitoring of Mechanical Components AMP. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in GALL-SLR Report Table XI-01. In Table A6.0-1, “Subsequent License Renewal Commitments,” the staff noted that the applicant committed to implement the listed program 6 months prior the subsequent period of extended period of operation. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. Based on its review of the applicant’s External Surfaces Monitoring of Mechanical Components AMP, the staff concludes that those program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.10 Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components

SLRA Section B2.1.24 states that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program is a new program that will be consistent with the program elements in the GALL-SLR Report AMP XI.M38, “Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components.” The applicant amended this SLRA section by letter dated October 22, 2021 (ADAMS Accession No. ML21295A035), and Supplement 4 dated June 7, 2022 (ADAMS Accession No. ML22158A028).

Staff Evaluation. During its audit, the staff reviewed the applicant’s claim of consistency with the GALL-SLR Report. The staff compared the “scope of program,” “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” “acceptance criteria,” and “corrective actions” program elements of the SLRA to the corresponding program elements of GALL-SLR Report AMP XI.M38.

Based on a review of the SLRA (as amended), the staff finds that the “scope of program,” “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” “acceptance criteria,” and “corrective actions” program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent with the corresponding program elements of GALL-SLR Report AMP XI.M38.

OE. SLRA Section B2.1.24 summarizes OE related to the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program. The staff reviewed OE information in the application and during the audit. As discussed in the Audit Report, the staff reviewed the plant OE information the applicant provided for this program to (a) identify examples of age-related degradation, and (b) provide a basis for the staff’s conclusions on the ability of the applicant’s proposed AMPs to manage the effects of aging in the subsequent period of extended operation.

The staff did not identify any OE indicating that the applicant should modify its proposed program. Based on its audit and review of the application, the staff finds that the conditions and OE at the plant are bounded by those for which the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program was evaluated.

UFSAR Supplement. As amended by Supplement 4 dated June 7, 2022, SLRA Section A2.24 provides the UFSAR supplement for the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in GALL-SLR Report Table XI-01. The staff also noted that the applicant committed to implement the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program 6 months prior to the subsequent period of extended operation for managing the effects of aging for applicable components. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. Based on its review of the applicant's Internal Surfaces in Miscellaneous Piping and Ducting Components program, the staff concludes that those program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.11 10 CFR Part 50, Appendix J

SLRA Section B2.1.31 describes the existing 10 CFR Part 50, Appendix J program as consistent with GALL-SLR Report AMP XI.S4, "10 CFR Part 50, Appendix J."

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL-SLR Report. The staff compared the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements of the SLRA of the applicant's program to the corresponding program elements of GALL-SLR Report AMP XI.S4.

Based on a review of the SLRA, the staff finds that the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements are consistent with the corresponding program elements of GALL-SLR Report AMP XI.S4.

OE. SLRA Section B2.1.31 summarizes OE related to the 10 CFR Part 50, Appendix J program. The staff reviewed OE information in the application and during the audit. As discussed in the audit report, the staff reviewed the plant OE information the applicant provided for this program to (a) identify examples of age-related degradation, and (b) provide a basis for the staff's conclusions on the ability of the applicant's proposed AMPs to manage the effects of aging in the subsequent period of extended operation.

The staff did not identify any OE indicating that the applicant should modify its proposed program. Based on its audit and review of the application, the staff finds that the conditions and OE at the plant are bounded by those for which the 10 CFR Part 50, Appendix J program was evaluated.

UFSAR Supplement. SLRA Section A2.31 provides the UFSAR supplement for the 10 CFR Part 50, Appendix J program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in GALL-SLR Report Table XI-01. The staff also noted that the applicant committed to ongoing implementation of the existing 10 CFR Part 50, Appendix J program for managing the effects of aging for applicable components during the subsequent period of extended operation. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. Based on its review of the applicant's 10 CFR Part 50, Appendix J program, the staff concludes that those program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.12 Electrical Insulation for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits

SLRA Section B2.1.37 states that the Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualifications [EQ] Requirements Used in Instrumentation Circuits program is a new program and will be consistent with NUREG-2191, GALL-SLR Report, AMP XI.E2, "Electrical Insulation for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits." The performance monitoring program will manage the effects of reduced insulation resistance of non-EQ cable and connection insulation used in instrumentation circuits with sensitive, high-voltage, low-level current signals that are subjected to adverse localized environments caused by temperature, radiation, or moisture. The applicant stated that the program will evaluate electrical insulation material for cables and connections subjected to an adverse localized environment at least once every 10 years, and the AMP will include the in-scope non-EQ portions of circuits in the area radiation monitoring system and the neutron flux monitoring nuclear instrumentation system.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL-SLR Report. The staff compared the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements of the SLRA to the corresponding program elements of GALL-SLR Report AMP XI.E2.

Based on a review of the SLRA, the staff finds that the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent with the corresponding program elements of GALL-SLR Report AMP XI.E2.

OE. SLRA Section B2.1.37 summarizes OE related to identification of problems with instrumentation system components. The applicant has provided an example of an action request that was initiated in the corrective action program related to an issue with nuclear instrumentation associated with channel measurements. As part of the troubleshooting exercise, the applicant performed circuit testing and identified and located an open connection between the power supply triaxial cable and the detector connector. Subsequent testing confirmed a poor solder contact on the center conductor in the detector end of the power supply triaxial field cable in the reactor building. The applicant cited a specific type of circuit testing (CHAR) that was used to identify and locate the open connection. The staff reviewed OE information in the application and during the audit. As discussed in the audit report, the staff reviewed the plant OE information the applicant provided for this program to (a) identify examples of age-related degradation, and (b) provide a basis for the staff's conclusions on the ability of the applicant's proposed AMPs to manage the effects of aging in the subsequent period of extended operation. The staff did not identify any OE indicating that the applicant should modify its proposed program. Based on its audit and review of the application, the staff finds that the conditions and OE at the plant are bounded by those for which the Electrical Insulation for Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits program was evaluated.

UFSAR Supplement. SLRA Section A2.37 provides the UFSAR supplement for the Electrical Insulation for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in GALL-SLR Report Table XI-01. The staff also noted that ONS committed to implement the program 6 months prior to the subsequent period of extended operation for managing the effects of aging for applicable components during the subsequent period of extended operation. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. Based on the review of the applicant's Electrical Insulation for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits program, the staff concludes that those program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.13 Electrical Insulation for Inaccessible Instrument and Control Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements

SLRA Section B2.1.39 describes the new Electrical Insulation for Inaccessible Instrument and Control Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program as consistent with GALL-SLR Report AMP XI.E3B, "Electrical Insulation for Inaccessible Instrument and Control Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements," as modified by SLR-ISG-2021-04-ELECTRICAL, "Updated Aging Management Criteria for Electrical Portions of Subsequent License Renewal Guidance."

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL-SLR Report. The staff compared the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements of the SLRA to the corresponding program elements of GALL-SLR Report AMP XI.E3B.

Based on a review of the SLRA, the staff finds that the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent with the corresponding program elements of GALL-SLR Report AMP XI.E3B.

OE. SLRA Section B2.1.39 summarizes OE related to the Electrical Insulation for Inaccessible Instrument and Control Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program. The staff reviewed OE information in the application and during the audit. As discussed in the audit report, the staff reviewed the plant OE information the applicant provided for this program to (a) identify examples of age-related degradation and (b) provide a basis for the staff's conclusions on the ability of the applicant's proposed AMPs to manage the effects of aging in the subsequent period of extended operation. The staff did not identify any OE indicating that the applicant should modify its proposed program. Based on its audit and review of the application, the staff finds that the conditions and OE at the plant are bounded by those for which the Electrical Insulation for Inaccessible Instrument and Control Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program was evaluated.

UFSAR Supplement. SLRA Section A2.39 provides the UFSAR supplement for the Electrical Insulation for Inaccessible Instrument and Control Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in GALL-SLR Report Table XI-01. The staff also noted that the applicant committed to implement the program 6 months prior to the subsequent period of extended operation or no later than the last refueling outage prior to the subsequent period of extended operation for managing the effects of aging for applicable components during the subsequent period of extended operation. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. Based on its review of the applicant's Electrical Insulation for Inaccessible Instrument and Control Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program, the staff concludes that those program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.14 Metal-Enclosed Bus

SLRA Section B2.1.41 describes the new Metal-Enclosed Bus program as consistent with GALL-SLR Report AMP XI.E4, "Metal Enclosed Bus."

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL-SLR Report. The staff compared the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements of the SLRA to the corresponding program elements of GALL-SLR Report AMP XI.E4.

Based on a review of the SLRA, the staff finds that the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent with the corresponding program elements of GALL-SLR Report AMP XI.E4.

OE. SLRA Section B2.1.41 summarizes OE related to the Metal-Enclosed Bus program. The staff reviewed OE information in the application and during the audit. As discussed in the audit report, the staff reviewed the plant OE information the applicant provided for this program to (a) identify examples of age-related degradation, and (b) provide a basis for the staff's conclusions on the ability of the applicant's proposed AMPs to manage the effects of aging in the subsequent period of extended operation. The staff did not identify any OE indicating that the applicant should modify its proposed program. Based on its audit and review of the application, the staff finds that the conditions and OE at the plant are bounded by those for which the Metal-Enclosed Bus program was evaluated.

UFSAR Supplement. SLRA Section A2.41 provides the UFSAR supplement for the Metal-Enclosed Bus program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in GALL-SLR Report Table XI-01. The staff also noted that the applicant committed to implement the program 6 months prior to the subsequent period of extended operation or no later than the last refueling outage prior to the subsequent period of extended operation for managing the effects of aging for applicable components during the subsequent period of extended operation. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. Based on its review of the applicant's Metal-Enclosed Bus program, the staff concludes that those program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.15 Fuse Holders

SLRA Section B2.1.42 describes the new Fuse Holders program as consistent with GALL-SLR Report AMP XI.E5, "Fuse Holders."

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL-SLR Report. The staff compared the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements of the SLRA of the applicant's program to the corresponding program elements of GALL-SLR Report AMP XI.E5.

Based on a review of the SLRA, the staff finds that the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements are consistent with the corresponding program elements of GALL-SLR Report AMP XI.E5.

OE. SLRA Section B2.1.42 summarizes OE related to the Fuse Holders program. The staff reviewed OE information in the application and during the audit. As discussed in the audit report, the staff reviewed the plant OE information the applicant provided for this program to

(a) identify examples of age-related degradation, and (b) provide a basis for the staff's conclusions on the ability of the applicant's proposed AMPs to manage the effects of aging in the subsequent period of extended operation. The staff did not identify any OE indicating that the applicant should modify its proposed program. Based on its audit and review of the application, the staff finds that the conditions and OE at the plant are bounded by those for which the Fuse Holders program was evaluated.

UFSAR Supplement. SLRA Section A2.42 provides the UFSAR supplement for the Fuse Holders program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in GALL-SLR Report Table XI-01. The staff also noted that the applicant committed to implement the new Fuse Holders Program 6 month prior to the subsequent period of extended operation or no later than the last refueling outage prior to the subsequent period of extended operation for managing the effects of aging for applicable components during the subsequent period of extended operation. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. Based on its review of the applicant's Fuse Holders program, the staff concludes that those program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.16 Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements

SLRA Section B2.1.43 describes the new Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program as consistent with GALL-SLR Report AMP XI.E6, "Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements."

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL-SLR Report. The staff compared the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements of the SLRA of the applicant's program to the corresponding program elements of GALL-SLR Report AMP XI.E6.

Based on a review of the SLRA, the staff finds that the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements are consistent with the corresponding program elements of GALL-SLR Report AMP XI.E6.

OE. SLRA Section B2.1.43 summarizes OE related to the Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program. The staff reviewed OE information in the application and during the audit. As discussed in the audit report, the staff reviewed the plant OE information the applicant provided for this program to (a) identify examples of age-related degradation, and (b) provide a basis for the staff's conclusions on the ability of the applicant's proposed AMPs to manage the effects of aging in the subsequent period of extended operation. The staff did not identify any OE indicating that the applicant should modify its proposed program. Based on its audit and review of the application, the staff finds that the conditions and OE at the plant are bounded by those for which the Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program was evaluated.

UFSAR Supplement. SLRA Section A2.43 provides the UFSAR supplement for the Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in GALL-SLR Report Table XI-01. The staff also noted that the applicant committed to implement the new Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program 6 months prior to the subsequent period of extended operation or no later than the last refueling outage prior to the subsequent period of extended operation for managing the effects of aging for applicable components during the subsequent period of extended operation. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. Based on its review of the applicant’s Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program, the staff concludes that those program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.17 Neutron Fluence Monitoring

SLRA Section B3.2 describes the existing Neutron Fluence Monitoring AMP as consistent with GALL-SLR Report AMP X.M2, “Neutron Fluence Monitoring Program,” as modified by SLR-ISG-2021-02-MECHANICAL, “Updated Aging Management Criteria for Mechanical Portions of the Subsequent License Renewal Guidance.”

Staff Evaluation. The staff compared the “scope of program,” “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” “acceptance criteria,” and “corrective actions” program elements of the applicant’s Neutron Fluence Monitoring program to the corresponding program elements of GALL-SLR Report AMP X.M2, as modified by SLR-ISG-2021-02-MECHANICAL.

During its review of SLRA Section B3.2, the staff identified a difference in the “scope of program,” “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” and “monitoring and trending” program elements. In this difference, the staff noted that the applicant will not monitor for changes in the neutron fluence values of the reactor vessel internal (RVI) components during the subsequent period of extended operation.

The staff noted that the applicant evaluated the RVI components for their susceptibility to neutron radiation damage mechanisms (including irradiation embrittlement, irradiation-assisted stress corrosion cracking [IASCC], irradiation-enhanced stress relaxation or creep, and void swelling or neutron-induced component distortion). Furthermore, this evaluation explicitly considered plant-specific 80-year neutron fluence values for RVI components, which were calculated using NRC-approved methodologies, a plant-specific RVI component model, and a plant-specific core neutron source conforming to Regulatory Guide (RG) 1.190, "Calculational and Dosimetry Methods for Determining Pressure Vessel Neutron Fluence."

The staff reviewed this difference against the corresponding program elements in GALL-SLR Report AMP X.M2 and finds it acceptable because during the subsequent period of extended operation, in addition to the reactor pressure vessel (RPV), the applicant will monitor RVI components for neutron radiation damage mechanisms under the ONS PWR [Pressurized Water Reactor] Vessel Internals Program. The staff's evaluation of the PWR Vessel Internals program is documented in SE Section 3.0.3.2.3. In addition, the Reactor Vessel Material Surveillance program (SLRA Section A2.19) provides material data and dosimetry to support adequate dosimetry monitoring during the subsequent period of extended operation. The Reactor Vessel Material Surveillance program is used in conjunction with the Neutron Fluence Monitoring program (SLRA Sections A3.2 and B3.2) to monitor neutron fluence for reactor vessel components and RVI components.

Based on a review of the SLRA Section B3.2, the staff finds that the "acceptance criteria" and "corrective actions" program elements are consistent with the corresponding program elements of GALL-SLR Report AMP X.M2. The staff also finds that the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," and "monitoring and trending" program elements of SLRA Section B3.2 associated with a staff-identified difference are adequate to manage the applicable aging effects.

OE. SLRA Section B3.2 summarizes OE related to the Neutron Fluence Monitoring program. The staff reviewed OE information in the application and during the audit. As discussed in the audit report, the staff reviewed the plant OE information the applicant provided for this program to (a) identify examples of age-related degradation, and (b) provide a basis for the staff's conclusions on the ability of the applicant's proposed AMPs to manage the effects of aging in the subsequent period of extended operation. The staff did not identify any OE indicating that the applicant should modify its proposed program. Based on its audit and review of the application, the staff finds that the conditions and OE at the plant are bounded by those for which the Neutron Fluence Monitoring Program was evaluated.

UFSAR Supplement. SLRA Section A3.2 provides the UFSAR supplement for the Neutron Fluence Monitoring program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in GALL-SLR Report Table XI-01. The staff also noted that the applicant committed (Commitment No. 45) to ongoing implementation of the existing Neutron Fluence Monitoring program for managing the effects of aging for applicable components during the subsequent period of extended operation. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. Based on its review of the applicant's Neutron Fluence Monitoring program in SLRA Section B3.2, the staff concludes that those program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent. In addition, the staff reviewed the difference between the applicant's program and GALL-SLR Report X.M2 as modified by SLR-ISG-2021-02-MECHANICAL and concludes that the AMP B3.2 is adequate to manage the applicable aging effects. The staff further concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2 AMPs Consistent with the GALL-SLR Report with Exceptions, Enhancements or Both

In SLRA Appendix B, the applicant stated that the following AMPs are or will be consistent with the GALL-SLR Report, with exceptions or enhancements:

- ASME Section XI, “Inservice Inspection,” Subsections IWB, IWC, and IWD
- Reactor Head Closure Stud Bolting
- PWR Vessel Internals
- Flow-Accelerated Corrosion
- Bolting Integrity
- Open-Cycle Cooling Water System
- Closed Treated Water Systems
- Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems
- Compressed Air Monitoring
- Fire Protection
- Fire Water System
- Fuel Oil Chemistry
- Reactor Vessel Material Surveillance
- Selective Leaching
- Lubricating Oil Analysis
- Buried and Underground Piping and Tanks
- Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks
- ASME Section XI, Subsection IWE
- ASME Section XI, Subsection IWL
- ASME Section XI, Subsection IWF
- Masonry Walls
- Structures Monitoring
- Inspection of Water-Control Structures Associated with Nuclear Power Plants
- Protective Coating Monitoring and Maintenance
- Electrical Insulation for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements

- Electrical Insulation for Inaccessible Medium-Voltage Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements
- Electrical Insulation for Inaccessible Low-Voltage Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements
- Fatigue Monitoring
- Environmental Qualification of Electric Equipment
- Concrete Containment Unbonded Tendon Prestress

For AMPs that the applicant claimed are consistent with the GALL-SLR Report with exception(s) and/or enhancement(s), the staff performed an audit and review to confirm that those attributes or features of the program for which the applicant claimed consistency with the GALL-SLR Report are indeed consistent. The staff reviewed the exceptions to the GALL-SLR Report to determine whether they are acceptable and adequate. The staff also reviewed the enhancements to determine whether they will make the AMP consistent with the GALL-SLR Report AMP to which it is compared. The results of the staff's audits and reviews are documented in the following sections.

3.0.3.2.1 ASME Section XI, "Inservice Inspection," Subsections IWB, IWC, and IWD

SLRA Section B2.1.1 states that the ASME Section XI, "Inservice Inspection," Subsections IWB, IWC, and IWD program is an existing program with enhancements that will be consistent with GALL-SLR Report AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD." The applicant amended this SLRA section by letters dated January 7, 2022, and February 14, 2022 (ADAMS Accession Nos. ML22010A129 and ML22045A021).

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL-SLR Report. The staff compared the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements of the SLRA to the corresponding program elements of GALL-SLR Report AMP XI.M1.

The staff also reviewed the portions of the "detection of aging effects" associated with enhancements to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of these enhancements follows.

SLRA Section B2.1.1 includes the following enhancements to the "detection of aging effects" program element that are to be implemented prior the subsequent period of extended operation:

Enhancement 1. Procedures will be revised to require inspections on components associated with sentinel locations assessed in accordance with ASME Code, Section XI, Non-Mandatory Appendix L for:

- Reactor coolant system pressurizer surge line piping (hot-leg elbow)
- High-pressure injection piping, stop valve-to-check valve (usage bounds high-pressure injection nozzle)

Enhancement 2. SLRA Section B2.1.1 was amended to include an additional enhancement related to the revision of program documents to:

- Specify volumetric inspection for each inspection interval for those full structural weld overlay (FSWO) components qualified to 1/6 of the 60-year design cycles for Units 2 and 3 hot-leg surge nozzles and Units 1, 2, and 3 pressurizer surge nozzles.
- Specify volumetric inspections at a frequency that ensures that the qualified life is not exceeded between inspections for those FSWO components qualified to less than 60 years of operation for Units 1, 2, and 3 hot-leg decay heat FSWOs and Unit 3 cold-leg letdown FSWO.

The staff reviewed the enhancements against the corresponding program element in the GALL-SLR Report AMP XI.M1 and finds them acceptable because the periodic volumetric inspections are capable of identifying age-related degradation during the subsequent period of extended operation. Additionally, the adequacy of the frequency of these inspections was determined by flaw tolerance evaluations in accordance with the requirements of ASME Code, Section XI, Non-Mandatory Appendix L.

Based on a review of the SLRA (as amended), the staff finds that the “scope of program,” “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” “acceptance criteria,” and “corrective actions” program elements are consistent with the corresponding program elements of GALL-SLR Report AMP XI.M11B. In addition, the staff reviewed the enhancements associated with the “detection of aging effects” program element and finds that, when implemented, they will make the AMP adequate to manage the applicable aging effects. The staff finds that the AMP is adequate to manage the applicable aging effects.

OE. SLRA Section B2.1.1 summarizes OE related to the ASME Section XI, “Inservice Inspection,” Subsections IWB, IWC, and IWD program. The staff reviewed OE information in the application and during the audit. As discussed in the audit report, the staff reviewed the plant OE information the applicant provided for this program to (a) identify examples of age-related degradation, and (b) provide a basis for the staff’s conclusions on the ability of the applicant’s proposed AMP to manage the effects of aging in the subsequent period of extended operation.

During its review, the staff identified OE for which it determined the need for additional information, which resulted in the issuance of RAI 3.3.2.2.2-1. The RAI and applicant’s response are documented in ADAMS Accession Nos. ML22012A039 and ML22045A021, respectively. In its response, the applicant stated that the letdown coolers are passive components that perform a license renewal intended function but do not require AMRs because they are replaced at a specific time. The applicant further stated that the replacement time period (i.e., 14 years) for the coolers was established based on plant and industry OE as well as metallurgical testing. Additionally, operational indicators are in place to assure continual oversight of the performance of the letdown coolers prior to their scheduled replacement. Specifically, these operational indicators consist of continuous radiation monitoring of the component cooling water system and monthly sampling of component cooling water. The applicant also stated that past leaks have not resulted in sudden and large leaks. Additionally, past leaks were small leaks that grew very slowly over time, and radiation monitoring was proven to be effective at monitoring the small leaks prior to the leak rates being detectable.

The staff finds the applicant’s response acceptable because during its evaluation of the applicant’s OE and response to RAI 3.3.2.2.2-1, the staff reviewed the OE related to the letdown coolers and confirmed that the applicant’s radiation monitoring was able to detect very small leaks. The staff was also able to confirm that the letdown cooler leaks were small and did not grow significantly over time. Additionally, staff also reviewed the results from the metallurgical examinations performed on a leaking letdown cooler from Oconee Unit 3. These examinations provided valuable insight into the root cause and the failure mechanism responsible for the leakage and the tube failures. Specifically, it was noted that localized boiling caused the failure, which caused a concentration of highly caustic deposits. As a result of the localized boiling, the subject tube became susceptible to caustic SCC. Caustic SCC can be mitigated by maintaining a minor addition of borate and by lowering contaminants in the component cooling water. The applicant's corrective action program included maintenance of a minimum concentration of borate in the component cooling water and a lower control limit for contaminants. The metallurgical examinations also confirmed that the leakage was small and limited to a single tube. Based on its review, the staff finds that the applicant's periodic replacement provides reasonable assurance that these coolers will be replaced prior to tube failure. Additionally, if there is a failure, the resultant leakage will be relatively small and quickly detected so that the coolers will maintain their structural integrity. Therefore, the staff's issues raised in RAI 3.3.2.2.2-1 are resolved.

Based on its audit and review of the application, and review of the applicant's response to RAI 3.3.2.2.2-1, the staff finds that the conditions and OE at the plant are bounded by those for which the ASME Section XI, "Inservice Inspection," Subsections IWB, IWC, and IWD program was evaluated.

UFSAR Supplement. As amended by letter dated January 7, 2022, SLRA Section A2.1 provides the UFSAR supplement for the ASME Section XI, "Inservice Inspection," Subsections IWB, IWC, and IWD program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in GALL-SLR Report Table XI-01. The staff also noted that the applicant committed to implement the enhancements associated with the applicant's ASME Section XI, "Inservice Inspection," Subsections IWB, IWC, and IWD program 6 months prior to the subsequent period of extended operation. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. Based on its review of applicant's ASME Section XI, "Inservice Inspection," Subsections IWB, IWC, and IWD program, the staff concludes that those program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent. The staff also reviewed the enhancements and finds that with the enhancements when implemented, the AMP will be adequate to manage the applicable aging effects. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.2 Reactor Head Closure Stud Bolting

The SLRA states that AMP B2.1.3, "Reactor Head Closure Stud Bolting," is an existing program with enhancements that will be consistent with the program elements in the GALL-SLR Report AMP XI.M3, "Reactor Head Closure Stud Bolting," except for the exceptions identified in the SLRA.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL-SLR Report. The staff compared the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements of the SLRA to the corresponding program elements of GALL-SLR Report AMP XI.M3.

The staff also reviewed the portions of the "preventive actions" and "corrective actions" program elements associated with the exceptions and enhancements to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of the two exceptions and two enhancements (one enhancement applied to two program elements) is as follows.

Exceptions. SLRA Section B2.1.3 includes exceptions to the "preventive actions" and "corrective actions" program elements related to limits on yield strength of replacement bolts and ultimate tensile strength of existing bolts. GALL-SLR Report AMP XI.M3 places limits on the yield and ultimate tensile strength values of the reactor head closure studs as a preventive measure to reduce the potential for SCC or intergranular stress corrosion cracking (IGSCC) in the studs. This measure reduces susceptibility of the studs to SCC or IGSCC because susceptibility of the studs to SCC or IGSCC increases as material strength increases. The applicant stated in SLRA Section B2.1.3 that the installed and spare reactor head closure studs at ONS were not procured under specifications that limited the measured maximum yield and ultimate tensile strengths, which may present a concern for SCC. The applicant is therefore taking exceptions to the recommendation in the GALL-SLR Report AMP XI.M3 that specifies upper limit values on the measured yield strength of newly installed (i.e., spare or replacement) bolts and the ultimate tensile strength of existing bolts.

The staff reviewed the exceptions against the corresponding program elements in GALL-SLR Report AMP XI.M3 and finds them acceptable for the following reasons: (1) there were no relevant indications or issues identified during the last volumetric examinations performed, as required by the ASME Code, Section XI, Table IWB-2500-1, for the 60 reactor closure head studs (Examination Category B-G-1, Item No. B6.20) of each unit, which the applicant confirmed in its response to Request for Confirmation of Information (RCI) B2.1.3-A (ADAMS Accession No. ML21336A001); (2) the Reactor Head Closure Stud Bolting AMP will continue to perform volumetric examinations of the 60 reactor head closure studs of each unit under Table IWB-2500-1, Examination Category B-G-1, Item B6.20 as part of the program, which is an effective examination for detecting degradation due to SCC or IGSCC; (3) the installed and spare reactor head closure studs of Units 1 and 2 that potentially exceeded the recommended yield and ultimate tensile strength limits have maximum hardness values that are less than the threshold value below which SCC does not present a concern (provided in SLRA Section B2.1.3 as a Rockwell C hardness value for the Unit 1 studs and in the response to RCI B2.1.3-B [ADAMS Accession No. ML21336A001] as a Brinell hardness value for the Unit 2 studs); (4) all other preventive measures listed in the GALL-SLR Report AMP XI.M3 that reduce the potential for cracking are met; and (5) implementation of the enhancements (described next) will ensure that the replacement bolts will have the yield and ultimate tensile strength necessary to be consistent with the recommendations in GALL-SLR Report AMP XI.M3.

Enhancements. SLRA Section B2.1.3 includes enhancements to the "preventive actions" and "corrective actions" program elements. The enhancement, which is applicable to both elements, is to revise procurement requirements within the Reactor Head Closure Stud Bolting AMP to incorporate guidance from RG 1.65, "Materials and Inspections for Reactor Vessel Closure Studs," Revision 1, and the GALL-SLR Report AMP XI.M3 to ensure that newly procured bolting material does not exceed the limit for maximum measured yield strength of 150 kilopounds per square inch (ksi) and measured ultimate tensile strength of 170 ksi. The staff reviewed the enhancements against the corresponding program elements in GALL-SLR Report AMP XI.M3 and finds them acceptable because when they are implemented, they will be consistent with the GALL-SLR Report AMP XI.M3 guidance.

Based on a review of the SLRA, the staff finds that the “scope of program,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” and “acceptance criteria” program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent with the corresponding program elements of GALL-SLR Report AMP XI.M3. The staff also reviewed the exceptions associated with the “preventive actions” and “corrective actions” program elements and their justifications, and finds that the AMP, with the exceptions, is adequate to manage the applicable aging effects. In addition, the staff reviewed the enhancements associated with the “preventive actions” and “corrective actions” program elements and finds that, when implemented, they will make the AMP adequate to manage the applicable aging effects.

OE. SLRA Section B2.1.3 summarizes OE related to the Reactor Head Closure Stud Bolting AMP. The staff reviewed OE information in the application and during the audit. As discussed in the audit report, the applicant made a presentation on the process it used to identify and evaluate pertinent OE. The applicant’s search of the plant OE was conducted to identify examples of age-related degradation, as documented in the applicant’s corrective action program database. As discussed in the Audit Report, the staff reviewed the plant OE information the applicant provided for this program to: (a) identify examples of age-related degradation, and (b) provide a basis for the staff’s conclusions on the ability of the applicant’s proposed AMPs to manage the effects of aging in the subsequent period of extended operation. The staff did not identify any OE indicating that the applicant should modify its proposed program.

Based on its audit and review of the application, the staff finds that the conditions and OE at the plant are bounded by those for which the Reactor Head Closure Stud Bolting AMP was evaluated.

UFSAR Supplement. SLRA Section A2.3 provides the UFSAR supplement for the Reactor Head Closure Stud Bolting AMP. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in GALL-SLR Report Table XI-01. The staff also noted that the applicant committed to ongoing implementation of the existing Reactor Head Closure Stud Bolting AMP with enhancement (Commitment No. 3 in SLRA Table A6.0-1) for managing the effects of aging for applicable components during the subsequent period of extended operation. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. Based on its review of the applicant’s Reactor Head Closure Stud Bolting AMP, the staff concludes that those program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent. The staff also reviewed the exceptions and enhancements, and finds that, with the exceptions and the implemented enhancements, the AMP will be adequate to manage the applicable aging effects. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.3 PWR Vessel Internals

SLRA Section B2.1.7 states that the PWR Vessel Internals Program is an existing AMP with new enhancements to bring the program in line with the program elements in the GALL-SLR AMP XI.M16A, "PWR Vessel Internals," as updated in Interim Staff Guidance No. SLR-ISG-2021-01-PWRVI (ADAMS Accession No. ML20217L203). The applicant amended SLRA Section B2.1.7 inclusive of changes to the AMP made in the applicant's correspondence letters of February 14, 2022 (ADAMS Accession No. ML22045A021 [non-proprietary]), July 8, 2022 (ADAMS Accession No. ML22189A010 [non-proprietary]), and September 2, 2022 (ADAMS Accession No. ML22245A010 [non-proprietary]). The applicant's PWR Vessel Internals Program includes the results of the applicant's RVI gap analysis that was performed for the RVI component types in the ONS reactor designs.

Staff Evaluation. The staff performed its review in accordance with the following NRC guidance: (1) the staff's AMR "acceptance criteria" and "review procedures" guidance for implementing PWR vessel internals programs (i.e., PWR RVI AMPs) in SRP-SLR Sections 3.1.2.2.9 and 3.1.3.2.9, and (2) the staff's programmatic guidance for implementing PWR vessel internals AMPs in GALL-SLR AMP XI.M16A.

As defined in GALL-SLR AMP XI.M16A, the applicant's PWR Vessel Internals Program is a risk-informed, sampling-based AMP for the RVI components that is based on the current staff-approved guidelines in EPRI Report No. 300217168 (MRP-227, Revision 1-A) (ADAMS Accession No. ML12017A193), as supplemented by other industry guidelines that may be applicable to the RVI component types. However, since the RVI component-specific assessments in MRP-227, Revision 1-A, are based on an assessment of aging over a cumulative 60-year plant licensing period, the staff's guidelines in SRP-SLR Section 3.1.2.2.9 and GALL-SLR AMP XI.M16A (as updated in the referenced interim staff guidance [ISG]) state that an SLR applicant owning a PWR facility should perform a gap analysis of its PWR RVI components to identify those AMP programmatic changes that may need to be made to the guidelines in MRP-227, Revision 1-A, if the assessment of aging was based on a cumulative 80-year plant licensing period. Alternatively, the guidelines in SRP-SLR Section 3.1.2.2.9 and GALL-SLR AMP XI.M16A allow for implementation of the PWR Vessel Internals Program that is based on a staff-approved version of MRP-227 covering a cumulative 80-year plant licensing period without any need for performance of an RVI gap analysis.

Consistent with the guidance in GALL-SLR AMP XI.M16A, the staff confirmed that the applicant's PWR Vessel Internal Program uses the risk-informed "MRP-227" sample selection methodology to rank and place each of the Babcock & Wilcox (B&W)-designed RVI components at ONS into one of the following three risk-informed inspection categories included within the scope of the AMP:

- Primary category: applies to specific RVI components that are inspected because they are considered to be lead indicators of aging based on the MRP-227-based, risk-informed program
- Expansion category: applies to additional RVI components that are either inspected or subject to supplemental evaluations (for operability or functionality) should the degree of aging in a linked Primary category component be greater than expected, as defined for the

component in the MRP-227 version applied for the program or the gap analysis of the program

- No Additional Measures (NAM) category: RVI components that do not require any aging management activities during the subsequent period of extended operation.

During its audit of the AMP (ADAMS Accession No. ML22045A053), the staff reviewed the applicant's claim of consistency with the GALL-SLR Report. The staff compared the "scope of program," "preventive actions," "parameters monitored or inspected," "monitoring and trending," and "corrective actions" program elements of the SLRA to the corresponding program elements of GALL-SLR AMP XI.16A. The staff found these program elements of the AMP to be acceptable because the staff confirmed that the program elements are consistent with corresponding program elements defined in GALL-SLR AMP XI.M16A (as updated in the referenced ISG).

The staff also reviewed the portions of the "detection of aging effects" and "acceptance criteria" program elements associated with enhancements to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of these two enhancements are as follows.

<u>Enhancement 1</u>. The PWR Vessel Internals Program (as amended by letter dated September 2, 2022) includes an enhancement (Enhancement 1) to the "detection of aging effects" and "acceptance criteria" program elements; it states that the PWR Vessel Internals Program will be updated as necessary to provide guidance for implementing the changes to the Primary and Expansion category component items in MRP-227, Revision 1-A, Tables 4-1 and 4-4, and to the "acceptance criteria" defined for these components in Table 5-1 of MRP-227, Revision 1-A, as modified by the results of RVI gap analysis that was performed for components and included in the PWR Vessel Internals Program.

The scope of the staff's audit of SLRA AMP B2.1.7 included a review of the programmatic enhancements and gap analysis results of the AMP (including the supplemental review of changes to the gap analysis results made in the letter dated September 2, 2022) and of all relevant generic or plant-specific operating experience that is applicable to the AMP. The staff confirmed that the applicant performed and applied an 80-year-based gap analysis assessment of the ONS RVI components to account for any changes that would need to be made to the inspection and evaluation (I&E) bases of the ONS RVI components from those defined for components in MRP-227, Revision 1-A. The staff also confirmed that the applicant applied the criteria in EPRI Proprietary Report No. MRP-189, Revision 3 (ADAMS Accession No. ML20091K284; ADAMS Accession No. ML20091K282 for the redacted, publicly available version of the report), as the background methodology for performing the gap analysis.

The staff noted that Enhancement 1 is consistent with the staff's guidance in GALL-SLR AMP XI.M16A that establishes the risk-informed objective for performing a gap analysis of the RVI components. Thus, based on this review, the staff finds the Enhancement 1 to be acceptable because (1) the enhancement conforms to the staff's criteria in SRP-SLR Section 3.1.2.2.9 and GALL-SLR Section XI.M16A for basing the program on MRP-227, Revision 1-A as supplemented by the results of a gap analysis, and (2) when the enhancement is implemented, the "detection of aging effects" and "acceptance criteria" of the PWR Vessel Internals Program will be consistent with staff's aging management criteria in SRP-SLR Section 3.1.2.2.9 and GALL-SLR AMP XI.M16A.

Enhancement 2. The PWR Vessel Internals Program (as amended by letter dated September 2, 2022) includes a commodity-group-based enhancement (Enhancement 2) to the "detection of aging effects" and "acceptance criteria" program elements in which the applicant identified the updated set of component-specific gap analysis results for the AMP as a set of component-specific enhancements for the program and included these component-specific gap analysis enhancements in SLRA Appendix A, Section A2.7, and in Part 2 of Commitment No. 7 in SLRA UFSAR Supplement Appendix A, Table A6.0-1.

For the component-specific gap analysis results that were updated in the letter of September 2, 2022 and treated as component-specific gap analysis enhancements for Enhancement 2, the staff considers the gap analysis results to be relevant OE for the AMP. Therefore, the staff's evaluations of the component-specific gap analysis enhancements of Enhancement 2 are provided in the Operating Experience and AMP Gap Analysis Results subsection that follows.

Operating Experience and AMP Gap Analysis Results. The staff's audit report input for the PWR Vessel Internals Program summarizes those component-specific gap analysis results that (1) the staff confirmed to be acceptable for aging management objectives and closed as part of its audit activities for the AMP (i.e., without the need for assessing those technical matters in the SE), and (2) remain as unedited component-specific gap analysis enhancements in the letter dated September 2, 2022. The staff's audit report also summarizes the staff's review of those RVI gap analyses or operating experience for the AMP that would need to be further assessed, described, and evaluated in this section of the SE. The staff confirmed that, in the applicant's letter dated September 2, 2022, and response to RAI B2.1.7-4a, the applicant provided its updated set of RVI gap analysis results for the ONS RVI components and treated the component-specific gap analysis results as component-specific enhancements for AMP Enhancement 2. With the exception of those component-specific gap analysis enhancements that warranted further staff evaluations in the SE subsections that follow, the staff determined that the component-specific gap analysis enhancements specified in SLRA Section A2.7 (and in Part 2 of Commitment No. 7 in SLRA Appendix A, Table A6.0-1) were acceptable for implementation because the staff confirmed that the enhancements would make the procedural controls for managing the components consistent with I&E bases for managing the component types in MRP-227, Revision 1-A, or else with I&E bases defined in accordance supplemental methodologies that the staff found to be acceptable implementation, as described in the audit report for SLRA AMP B2.1.7.

The following subsections address the staff's evaluations of the applicant's component-specific gap analysis results, which included the changes made by letter dated September 2, 2022, and OE topics that either were identified in the staff's audit or RVI topics that warranted staff evaluation or technical clarifications in this SE section; this includes the staff's evaluation of those component-specific gap analysis results and enhancements that apply to inspection categories and inspection bases of the core barrel (CB) assembly welds in ONS Units 1, 2, and 3, as revised by letter dated September 2, 2022.

Component-specific gap analysis enhancement – ONS vent valve (VV) bodies. As summarized in SLRA AMP B2.1.7 (as amended by letter dated September 2, 2022), the applicant identified that the VV bodies will no longer be linked Expansion category components for the Primary component inspections that will be performed on the Primary category control rod guide tube spacer castings during the subsequent period of extended operation. The applicant stated that, for the current 60-year version of the AMP, the VV bodies only screen in for the aging effect/mechanism combination of loss of fracture toughness due to thermal aging embrittlement

(LOFT-TE). The applicant also stated that a review of VV body-specific design documentation for the 80-year aging management objective indicated that the delta-ferrite (δ-ferrite) contents of the CASS alloys used to fabricate the VV bodies were below the EPRI MRP's proprietary weight percent (Wt.-%) δ-ferrite alloying content threshold cited in MRP-189, Revision 3 for inducing LOFT-TE in the CASS materials.

The staff confirmed that, per Item B2.1 of Table 4-4 in the MRP-227, Revision 1-A report, the CASS VV bodies in B&W-designed PWRs only screen in for the aging effect and mechanism combination of LOFT-TE. During the staff's audit of ONS-specific documentation associated with the PWR Vessel Internals Program, the staff verified that the design report and fabrication records for ONS VV bodies provided sufficient evidence that the δ-ferrite contents for the VV bodies were well below the proprietary δ-ferrite alloying content threshold in EPRI Report MRP-189, Revision 3, that is used to screen CASS B&W-design RVI components in for LOFT-TE. The staff also verified that Framatome Proprietary Report No. ANP-3899P, Revision 0, supports a conclusion that the projected neutron fluence of the VV bodies at 72 effective full power years (72 EPFY) will be lower than the EPRI MRP's fluence threshold for screening of loss of fracture toughness due to irradiation embrittlement (LOFT-IE) as an applicable aging effect and mechanism combination and that LOFT-IE does not need to be identified as an aging effect and mechanism combination for the VV bodies during the subsequent period of extended operation.

The staff also noted that the applicant's technical basis for placing the VV bodies in the NAM category of the PWR Vessel Internals Program is analogous to the staff's basis for addressing LOFT-TE and LOFT-IE in B&W-designed CASS internals and closing Applicant/Licensee Action Item (A/LAI) #7 for B&W-design CASS internals, as evaluated and resolved in Section 3.6.7 of the staff's April 25, 2019, SE (ADAMS Accession No. ML19081A001) for MRP-227, Revision 1-A. The staff noted that the applicant identified that the VV top and bottom retaining rings made from 15-5 precipitation hardened SS (i.e., another material type that may be potentially susceptible to LOFT-TE) are the lead VV assembly components for LOFT-TE and has designated the VV retaining rings as the lead Primary VV assembly components for LOFT-TE; the staff noted that this is consistent with the staff's conclusion for B&W-design LOFT-TE susceptible components in Section 3.6.7 of the staff's April 25, 2019, SE. Thus, based on this review, the staff finds that the applicant has provided an acceptable gap analysis basis for placing the VV bodies into the NAM category of the program because (1) based on the applicant's AMP program basis document, fabrication records, and neutron fluence projections for the VV bodies (as provided and reviewed by the staff during the staff's audit), the applicant has provided sufficient evidence that that VV bodies will not be susceptible to any AERMs (including LOFT-TE and LOFT-IE) during the subsequent period of extended operation; (2) the applicant's AERM basis provides sufficient support that the VV bodies can be placed in the NAM category for the version of the PWR Vessel Internals Program that will be implemented during the subsequent period of extended operation; and (3) the applicant will perform inspections of those Primary category VV assembly component types that are anticipated as being the lead indicators of LOFT-TE (i.e., the VV top and bottom retaining rings) during the subsequent period of extended operation.

Component-specific gap analysis enhancement and relevant OE–upper core barrel (UCB) bolts, lower core barrel (LCB) bolts, and flow distributor (FD) bolts, upper thermal shield (UTS) bolts, and lower thermal shield (LTS) bolts. In the initial version of SLRA AMP B2.1.7, the applicant identified that expansion of the volumetric ultrasonic test (UT) inspections to the LTS and UTS bolts would only be implemented if (1) the number of bolts with detected crack-like indications for assessed UCB, LCB, or FD bolting types exceeds the 10% population threshold for bolts with crack-like indications (i.e., as defined in Items B7, B8, and B12 in Table 5-1 of MRP-227, Revision 1-A); and (2) if evidence of cracking detected in the UCB, LCB, or FD bolts was confirmed to have initiated by an SCC mechanism. During its review of the proposed change to the expansion-link criteria for the Expansion category UTS bolts and LTS bolts, the staff identified a difference in the "detection of aging effects," "monitoring and trending," and "acceptance criteria" program elements of the AMP, as applied to these bolting types. Specifically, the staff observed that, in Table 5-1 of MRP-227, Revision 1-A, the EPRI MRP only predicates the need for bolt sample-expansion on the detection of cracking in a specified Primary category RVI bolting type; the staff observed that the methodology in MRP-227, Revision 1-A does not base the programmatic need for Primary-to-Expansion category bolt sample-expansion on performance of supplemental root cause activities that would, in turn, be used to confirm that the initiating cause or mechanism of cracking in a specified Primary bolting component type was the same as the one for cracking mechanisms that screened in for the linked Expansion category bolt type. Thus, the staff noted that this type of change to the expansion-link basis for the UTS and LTS bolts might be considered as an actual change to the MRP-227, Revision 1-A methodology that the staff had yet to review or approve.

The staff also noted that the UT inspection methods that will be applied to the linked Primary category UCB, LCB, and FD bolts (or potentially to the Expansion category LTS or UTS bolts if expansion inspections were triggered) are incapable of generating any UT sensor signal results that can distinguish crack-like indications caused by SCC from crack-like conditions caused by a metal fatigue or cyclical loading mechanism. Thus, for the "detection of aging effects," "monitoring and trending," and "acceptance criteria" program elements, the staff determined the need for additional information, which resulted in the issuance of an RAI. RAI B2.1.7-1 and the applicant's response are documented in ADAMS Accession No. ML22045A021 (non-proprietary).

In its response, the applicant confirmed that the Primary UT inspections performed on the UCB, LCB, and FD bolts cannot distinguish between crack-like indications initiated by fatigue or cyclic loading conditions from those that would initiate by an SCC mechanism. As a result of this response, the applicant amended the RVI gap analysis portion in SLRA AMP B2.1.7 to remove the gap analysis change to the expansion-link acceptance criterion for the Expansion category UTS and LTS bolting types. Based on this programmatic change, the staff noted that the adjusted gap analysis enhancement for the specified bolting types (as amended by the letter dated September 2, 2022) will call for the applicant to schedule and perform UT inspections of the Expansion category UTS and LTS bolts if relevant crack-like indications are confirmed to occur in greater than 10% of the UCB, LCB, or FD bolt populations, regardless of the mechanism that was confirmed as the root cause of the detected crack-like conditions. The staff also noted that this amended gap analysis basis is consistent with the current expansion-link criteria for UTS and LTS bolts in Items B7, B8, and B12 of MRP-227, Revision 1-A, Table 5-1, for the referenced Primary UCB, LCB, and FD bolting types. Thus, the staff finds the expansion-link criterion of UTS and LTS bolts to be acceptable because expansion-link criteria between the Primary category UCB, LCB, or FD bolting types and the Expansion category UTS and LTS bolting types will remain the same as those defined for the components in Items B7, B8, and B12 of Table 5-1 in MRP-227, Revision 1-A. The technical topic and request in RAI B2.1.7-1 are resolved.

The staff also noted that in 1981, the applicant reported past incidents of cracking in the original A-286 SS-grade LTS bolts of ONS Unit 1, where the cause of cracking was predominantly confirmed to have initiated by an SCC mechanism. The staff observed that one of the corrective actions resulting from the applicant's evaluation of this OE event was the applicant's decision to replace the original LTS bolts with LTS bolts fabricated from an X-750 nickel-based alloy material. The staff determined that the applicant would need to provide further clarifications related to the basis for maintaining the LTS bolts as designated Expansion category components when assessed in light of this ONS Unit 1 OE event and the specified change in the LTS bolting material. Thus, for the "detection of aging effects," "monitoring and trending," and "acceptance criteria" program elements, the staff determined the need for additional information, which resulted in the issuance of an RAI B2.1.7-2.

In its response (ADAMS Accession No. ML22045A021, non-proprietary), the applicant indicated that the replacement X-750 LTS bolts were made from high thermal heat (HTH)-treated X-750 nickel-based alloy materials; the applicant also provided a summary of some extremely detailed experimental test results that support a conclusion that HTH-treated X-750 materials are not nearly as susceptible to SCC-type mechanisms as the A-286 SS materials that were used in the original LTS bolting design and were the subject of the 1981 cracking event. Based on the details provided in the response to RAI B2.1.7-2, the staff finds that the RAI response supports a finding that the LTS bolts may remain as designated Expansion category components for the Primary UCB, LCB, and FD bolt types because the staff has confirmed that (1) the Alloy X-750 materials used in the fabrication of the replacement LTS bolts are less susceptible to SCC than the

A-286 SS materials that were used in the original LTS bolt designs and in the current UCB, LCB, and FD bolt designs; (2) based on the A-286 materials used in the current UCB, LCB, FD bolt designs, the UCB, LCB, and FD are still expected to be the lead indicators of SCC-induced cracking in these bolting types and thus can remain as the lead Primary components for cracking; and (3) based on their X-750 material of fabrication, the LTS bolts can remain as one of the two applicable Expansion category component types for the Primary category UCB, LCB, and FD bolts in the units. The technical topic and request in RAI B2.1.7-2 are resolved.

Component-specific gap analysis enhancement – high-strength bolt-locking devices.

In SLRA AMP B2.1.7 (inclusive of changes made to the AMP in the September 2, 2022 letter), the applicant states that it removed visual VT-3 inspection needs for ONS RVI bolt-locking devices associated with RVI bolting component types made from high-strength materials. The staff noted that this specific gap analysis adjustment would amend the inspection category of the referenced bolt-locking device types from either being designated Primary or Expansion category bolt-locking devices to bolt-locking devices that are placed into the NAM category of the program. However, the staff observed the SLRA did not identify which types of the RVI bolt-locking devices in the ONS units were being associated with the referenced high-strength bolting terminology. Also, as discussed in the "operating experience" program element in SLRA Section B2.1.7, the staff noted that the applicant reported the occurrence of some missing or partially missing RVI bolt-locking device welds. Thus, for the "detection of aging effects," "monitoring and trending," "acceptance criteria," and "operating experience" program elements, the staff determined the need for additional information, which resulted in the issuance of RAI B2.1.7-3.

In its response (ADAMS Accession No. ML22045A021, non-proprietary), the applicant identified that the applicable bolt-locking devices (including locking weld types) being placed in the NAM category of the AMP are the locking devices associated with the Primary category UCB, LCB, and FD bolts and the Expansion category UTS and LTS bolts. The applicant also identified that the specified missing locking weld was detected in one of the Unit 1 LTS bolts. However, the applicant also clarified that the degradation in the LTS bolt-locking device was not initiated by an age-related aging mechanism; the applicant supported this basis with specific proprietary information that was included in the response to RAI B2.1.7-3.

The staff noted that, per the existing I&E criteria in Tables 4-1 and 5-1 of MRP-227, Revision 1-A, it is the Primary UCB, LCB, FD bolt-locking devices that will be subject to the augmented VT-3 visual inspection bases of MRP-227, Revision 1-A, with the need for expanding the VT-3 inspections to the Expansion category UTS and LTS bolt-locking devices, if relevant, and unacceptable indications of cracking are found in more than 10 percent of the population of the Primary UCB, LCB, or FD bolt-locking device types. However, the staff also noted that, although the UCB, LCB, FD, UTS, and LTS bolt-locking devices are not credited with a 10 CFR 54.4(b) safe shutdown–related or accident mitigation–related intended function for the RVI assemblies containing the specified bolting types, the applicant still included these components within the scope of the PWR Vessel Internals program. The reference of intended function in this paragraph of this SE is used in terms of performing a risk-informed, component-specific inspection categorization basis determination for the program and not in terms of component-specific scoping under 10 CFR 54.4. Thus, the staff observed that the lack of an "intended function" basis serves as a sufficient basis for eliminating VT-3 visual inspection needs of the referenced UCB, LCB, FD, UTS, and LTS bolt-locking devices and for placing these bolt-locking device types into the NAM category of the PWR Vessel Internals Program (i.e., for the 80-year version of the AMP that will be implemented during the subsequent period of extended operation). Thus, the staff finds the applicant's basis to be acceptable because the referenced bolt-locking devices do not serve an intended function objective to warrant continued VT-3 visual inspections of the UCB, LCB, FD, UTS, and LTS bolt-locking devices for the version of the PWR Vessel Internals Program that will be implemented during the subsequent period of extended operation. The technical topic and request in RAI B2.1.7-3 are resolved.

Component-specific gap analysis enhancements – EPRI MRP inspection category and I&E basis changes for CB assembly weld components. In SLRA AMP B2.1.7, the applicant states that the gap analysis results in (1) elevating the ONS Unit 2 CB cylinder top flange circumferential weld and ONS Unit 2 CB cylinder center circumferential weld from designated Expansion category components to Primary category components of the AMP, and (2) a downgrade of the CB cylinder top flange circumferential welds and CB cylinder center circumferential welds in Units 1 and 3 and the CB cylinder vertical welds and CB cylinder bottom flange circumferential welds in Units 1, 2, and 3 into the NAM category of the AMP. For those ONS unit-specific CB cylinder weld components being placed into the NAM category, the staff observed that the applicant was relying on some specified component-specific proprietary fabrication practices and fatigue screening results as its basis for concluding that the specified CB assembly welds could be placed in the NAM category of the program (i.e., this does not apply to the specified Unit 2 CB cylinder circumferential seam weld types being elevated to Primary category status).

Based on its review, the staff did not consider the NAM category to be a conservative inspection category for those CB assembly welds that were proposed for placement in the NAM category of the program because the CB assemblies (and the welds in the assemblies) serve a critical 10 CFR 54.4(b) safety-related intended function of diverting and controlling injected emergency reactor coolant flow through the reactor core during a postulated loss of coolant accident event. Thus, in relation to the "detection of aging effects," "monitoring and trending," and "acceptance criteria" program elements of the AMP, the staff observed that it would need additional information or justifications from the applicant on the I&E bases for managing aging in the CB assemblies and the specified CB assembly weld components, including but not limited to the following matters that warranted further clarifications from the applicant: (1) the intended safety function of the CB assembly (including welds in the assembly); (2) the basis for using a specified proprietary weld design fabrication practice as a basis for establishing the appropriate EPRI MRP inspection category basis for the weld types; (3) screening results for the assessed SCC, IASCC, fatigue, and IE aging mechanisms in the welds; and (4) CB weld accessibility considerations for weld access by applicable non-destructive examination equipment.

Thus, for the “detection of aging effects,” “monitoring and trending,” and “acceptance criteria” program elements, the staff determined the need for additional information, which resulted in the issuance of three RAIs. RAIs B2.1.7-4, B2.1.7-4a, and B2.1.7-4b and the applicant’s proprietary responses to the RAIs are documented in ADAMS Accession Nos. ML22045A021 (non-proprietary), ML22189A009 (non-proprietary), and ML22245A009 (non-proprietary), respectively.

The staff noted that the net effect of the responses to RAIs B2.1.7-4, B2.1.7-4a, and B2.1.7-4b accomplished the following I&E objectives for managing cracking in the designated CB assembly welds (including cracks in the welds that may be indicative of IE occurring in the welds):

- <u>Designation of CB Assembly Weld Inspection Categories</u>. The staff notes that, in the collective responses to RAI B2.1.7-4 and B2.1.7-4a, the applicant established and maintained the SLRA’s gap analysis position that the ONS Unit 2 CB cylinder top flange circumferential weld (Item B16 weld) and CB cylinder center circumferential weld (Item B17 weld) are the designated Primary category welds for the CB assembly and that these welds replace the core baffle plates as the original Primary category components for CB assembly welds. The staff notes that the response to RAI B2.1.7-4a also established that the remaining CB welds in ONS Units 1, 2, and 3 serve as Expansion category welds for the referenced Unit 2 Primary category CB Item B16 or B17 welds such that no CB assembly weld type in Unit 1, 2, or 3 would remain classified as an NAM category weld component under the gap analysis basis for the program. The staff found that this amended set of gap analysis enhancements for the CB welds basis resolved the staff’s initial concern (in RAI B2.1.7-4) with the SLRA’s initial basis for placing some Unit 1, 2, or 3 CB weld types in the NAM category of the AMP because amended gap analysis basis in the RAI B2.1.7-4a response firmly establishes that all CB assembly welds will be placed (at a minimum) in either the Expansion category of the program or else, for the case of the Unit 2 CB Items B16 and B17 circumferential welds, as designated Primary category CB welds for the program.
- <u>Designation of CB Assembly Weld Inspection Methods or Alternative Aging Management Bases</u>. The applicant’s program (as amended by letter dated September 2, 2022) allows for 10 CFR 54.21(a)(3) aging management of the CB assembly Primary and Expansion category weld components through implementation of either designated inspection methods (i.e., use of condition monitoring bases) or alternatively by component-specific analysis for the component type that will be performed and submitted for staff approval. The staff noted that, if aging management of the designated Primary category welds (i.e., the Unit 2 CB assembly top flange and center circumferential welds [Unit 2 Primary CB Assembly Item B16 and B17 welds]) or designated Expansion category welds (when triggered) will be done by performance of condition monitoring activities, the program calls for performance of either an EVT-1 visual inspection or eddy current testing (ECT) or UT of the specified component weld(s). The staff finds these inspection methods to be acceptable because the staff confirmed that the specified inspection methods are

consistent with those defined and approved for PWR RVI weld types in Chapter 5 of MRP-227, Revision 1-A.

The staff noted that the applicant's program allows for the specified CB weld types to be managed for aging under 10 CFR 54.21(a)(3) through implementation of an alternative component-specific analysis. If this evaluation method is chosen, the applicant would submit it on the docket for NRC staff review and approval. The staff observed that this type of aging management option was approved for B&W-design CB assembly welds in Item B10.1 of Table 4.4 in MRP-227, Revision 1-A or in Section A.2.4 of Westinghouse Non-Proprietary Report WCAP-17096-NP-A, Revision 2 (ADAMS Accession No. ML16279A320), which was approved in the staff's May 3, 2016, SE for the report. Thus, the staff finds the basis for dispositioning the CB weld types either by condition monitoring (i.e., by inspection) or alternatively by component-specific analysis to be acceptable because the selected basis is consistent with those allowed for B&W-design CB assembly welds in either MRP-227, Revision 1-A report or the WCAP-17096-NP-A, Revision 2 report.

- <u>Designation of CB Assembly Component-Specific Sample-Expansion Criteria</u>. The staff observed that, in the response to RAI B2.1.7-4a, the applicant amended SLRA AMP B2.1.7 to define and establish a set and series of cascading main and secondary sample-expansion criteria for the designated Primary and Expansion category CB assembly weld components. These main and secondary sample-expansion component-specific relationships are discussed in the numbered subsections that follow.

  1) <u>Primary Component-to-Main Expansion Component Sample-Expansion Criteria</u>. For inspections of the Primary CB cylinder top flange circumferential weld in Unit 2 (i.e., the Primary category weld designated as the Unit 2 Item B16 weld), detection of relevant conditions in the weld will require sample-expansion to corresponding CB cylinder top flange circumferential welds in Units 1 and 3 (i.e., the Expansion category welds designated as the Unit 1 Item B16.1 weld and the Unit 3 Item B16.2 weld) and to the CB cylinder bottom flange circumferential weld in Unit 2 (i.e., the Expansion category weld designated as the Unit 2 Item B16.3 weld).

     Similarly, for the inspections of the Primary CB cylinder center circumferential weld in Unit 2 (i.e., the Primary category weld designated as the Unit 2 Item B17 weld), detection of relevant conditions in the weld will require sample-expansion to corresponding CB cylinder center circumferential welds in Units 1 and 3 (i.e., the main Expansion category welds designated as the Unit 1 Item B17.1 weld and the Unit 3 Item B17.2 weld) and to the CB cylinder axial seam welds in Unit 2 (i.e., the main Expansion category welds designated as the Unit 2 Item B17.3 welds).

  2) <u>Main Expansion Component-to-Secondary Expansion Component Sample-Expansion Criteria</u>. For the potential sample-expansion inspections that may be triggered and performed on the main Expansion category Unit 1 CB cylinder top flange circumferential weld (i.e., main Expansion category weld designated as the Unit 1 Item B16.1 weld), detection of relevant conditions in the weld will require sample-expansion to the corresponding CB cylinder bottom flange circumferential weld in Unit 1 (i.e., the secondary Expansion category weld designated as the Unit 1 Item B16.4 weld). For potential sample-expansion inspections welds that may be triggered and performed on the main Expansion category Unit 3 CB cylinder top flange circumferential weld (i.e., main Expansion category weld designated as the Unit 3 Item B16.2 weld), detection of relevant conditions in the weld will require sample-expansion to the corresponding CB cylinder bottom flange circumferential weld in Unit

3 (i.e., secondary Expansion category weld designated as the Unit 3 Item B16.5 weld).

For the potential expansion category inspections that may be triggered and performed on the main Expansion category Unit 1 CB cylinder center circumferential weld (i.e., main Expansion category weld designated as the Unit 1 Item B17.1 weld), detection of relevant conditions in the weld will require sample-expansion to corresponding CB cylinder vertical seam welds in Unit 1 (i.e., the secondary Expansion category welds designated as the Unit 1 Item B17.4 welds). For potential expansion category inspections that may be triggered and performed on the main Expansion category Unit 3 CB cylinder center circumferential weld (i.e., main Expansion category weld designated as the Unit 3 Item B17.2 weld), detection of relevant conditions in the weld will require sample-expansion to corresponding CB cylinder vertical seam welds in Unit 3 (i.e., secondary Expansion category welds designated as the Unit 3 Item B17.5 welds).

In relation to these sample-expansion criteria, the staff has previously approved, in MRP-227, Revision 1-A, cascading main and secondary sample-expansion criteria for specified weld or base-metal component types in the CB assemblies or lower support structure (LSS) assemblies of Westinghouse-designed PWRs, where (1) the upper girth weld (UGW) and lower flange weld (LFW) in the CB assembly and the lower support forging or casting in the LSS are designated as the main Expansion category components for the Primary category CB assembly upper flange weld, and (2) the CB upper axial welds are designated as secondary Expansion category components for potential sample-expansion inspections that may be performed on the main Expansion category UGW and LFW (i.e., when triggered per the guidance in Item W3 in Tables 4-1 and 5-1 of MRP-227, Revision 1-A). Therefore, the staff found the main and secondary sample-expansion criteria defined by the applicant for the ONS CB assembly weld types to be acceptable because (1) the staff has set precedent and approved cascading sample-expansion criteria for designated CB and LSS assembly component types in Westinghouse-designed PWRs, and (2) from a risk perspective, the applicant's set of cascading sample-expansion criteria for the ONS CB assembly weld types are sufficiently conservative and consistent with those established and approved by the staff for corresponding CB assembly weld types in Westinghouse-designed PWRs.

- <u>Designation of CB Assembly Weld Relevant Conditions</u>. The staff observed that in the response to RAI B2.1.7-4a, the applicant amended SLRA AMP B2.1.7 to define the relevant conditions for EVT-1, ECT, or UT inspections that will be applied to the Primary category CB weld types or may be applied (when triggered) to CB assembly Expansion category weld types (i.e., for the age management option that calls for the welds to be age-managed using one of the specified condition monitoring inspection methods). For inspections of CB welds performed using an EVT-1 visual inspection method, the applicant identified that the relevant condition is a detectable crack-like surface indication; for inspections performed using ECT or UT inspection methods, the applicant stated that the relevant condition is to be established as part of the site-specific examination technical justification for the inspection method. The staff found the applicant's relevant condition criteria to be acceptable for implementation because they are consistent with the EPRI MRP's bases for defining the relevant conditions that may be detected by EVT-1, ECT, and UT inspection methods in MRP-227, Revision 1-A or with the relevant conditions defined and established by the Pressurized Water Reactor Owners Group (PWROG) for these inspection methods in the latest staff-approved version of PWROG Report WCAP-

17096 that is applied for the design basis (currently WCAP-17096-NP-A, Revision 2; ADAMS Accession No. ML16279A320).

- Designation of CB Assembly Weld Inspection Coverage and Completion Time Criteria. The staff observed that, in the response to RAI B2.1.7-4a, the applicant amended SLRA AMP B2.1.7 to define the following inspection coverage criteria for inspections that will be applied to the designated CB assembly Primary category welds or potentially to the designated CB assembly main Expansion category welds or secondary Expansion category welds (if triggered by the applicable sample-expansion criteria). Specifically, the applicant identified that the program will implement either an EVT-1 visual inspection, ECT, or UT of "essentially 100%" (as defined in ASME Section XI, Paragraph IWA-2200(c)) of the outer diameter (OD) surfaces of the weld and of ¾ of an inch of the adjacent base metal in the designated Unit 2 Primary Item B16 and B17 welds prior to entering into the subsequent period of extended operation, with subsequent inspections of the designated Unit 2 Item B16 and B17 welds to be performed during each subsequent 10-year ISI interval.

  Similarly, the applicant identified that it will implement identical weld inspection coverage criteria for sample-expansion inspections that may be triggered off the designated main or secondary Expansion category CB assembly weld types, with the inspection of the designated main Expansion category weld types to be performed within two refueling outages of any inspection that reveals relevant conditions (as discussed in the next bullet subsection) in the linked Primary category CB weld type and inspections of the designated secondary Expansion category weld type within two refueling outages of any inspection that reveals relevant conditions (as discussed in the next bullet subsection) in the linked Primary category CB weld type. The applicant stated that, if adverse conditions or non-conforming conditions are detected in the examined weld, or if inspection coverage of the weld is less than "essentially 100%" of the OD weld surface and ¾-inch adjacent base metal, the applicant will take appropriate corrective actions under its 10 CFR Part 50, Appendix B Quality Assurance Program (SLRA AMP B1.3) to ensure the intended function of the impacted CB assembly is met during the subsequent period of extended operation.

  The staff noted that the applicant is defining its weld coverage criterion based on the definition for "essentially 100%" coverage in ASME Section XI, Paragraph IWA-2200(c), which basically defines "essentially 100%" weld coverage as being achieved if the inspection of the weld component achieves weld coverage in excess of 90%. The staff also noted that the applicant is setting the "essentially 100%" weld coverage as a minimum acceptance criteria above which the applicant could take inspection credit and would not need to take additional corrective action. The staff noted that the applicant will take appropriate corrective actions under SRLA AMP B1.3 (the 10 CFR Part 50, Appendix B Quality Assurance Program) if the applicant does not achieve the required "essentially 100%" coverage criterion specified for inspection credit or if adverse relevant conditions (as defined, discussed, and evaluated in the previous bulleted subsection) are detected in the weld being examined. The staff finds the "essentially 100%" coverage criterion for taking inspection credit of the welds to be acceptable because (1) it is based on the current conservative and staff-approved weld coverage criterion established in ASME Code Section XI Paragraph IWA-2200(c), and (2) the applicant will take appropriate corrective action under the "corrective actions" program element of the PWR Vessel Internals Program (and the applicant's 10 CFR Part 50, Appendix B Quality Assurance Program [SLRA AMP B1.3]) if this weld coverage criterion is not met.

Alternatively, if the applicant opts out of inspecting the Unit 2 Primary category Item B16 and B17 welds and instead decides to disposition the Unit 1, 2, and 3 CB assemblies (and the welds contained in the assemblies) using the alternative component-specific analysis option, the applicant indicated that the component-specific analysis will be submitted to the NRC for staff approval four years before entering into the subsequent period of extended operation. The staff noted that the staff has previously accepted options for using component-specific analysis as an aging management basis for B&W-design CB assemblies through its bases for managing aging of B&W-design CB assemblies in its April 25, 2019, and May 3, 2016, SE approvals of the MRP-227, Revision 1-A and WCAP-17096-NP-A, Revision 2 reports. The staff noted that its May 3, 2016, SE for WCAP-17096-NP-A, Revision 2, it established a minimum one-year submittal timing for submitting component-specific analyses that would be used to disposition B&W-design CB assemblies and their welds for aging management objectives. Based on a comparison to the criteria set in the staff's May 3, 2016, SE, the staff finds the applicant's alternative for dispositioning the CB assemblies (under 10 CFR 54.21(a)(3)) using a component-specific analysis to be acceptable because the staff has approved this type of aging management option in its referenced May 3, 2016, SE and because the minimum 4-year submittal time is more conservative than the minimum one-year time frame allowed for such submittals in the referenced May 3, 2016, SE. For such analyses (i.e., if the component-specific analysis option is selected as the aging management basis) and consistent with the criteria established in Section 7.5 of MRP-227, Revision 1-A, the applicant may use the acceptance criteria and data analysis criteria for the B&W-design CB assemblies and welds specified in the latest staff-approved version of WCAP-17096 (currently WCAP-17096-NP-A, Revision 2) for development of the applicable component-specific analysis for the CB assemblies.

- Resolution of RAI B2.1.7-4b. In its response to RAI B2.1.7-4b, the applicant provided its updated risk-informed screening bases for assessed SCC, IASCC, fatigue, and IE aging mechanisms in the specified CB assembly weld types (i.e., conclusions that the applicable mechanism either screens in or out for the applicable weld type when assessed for a cumulative 80-year service life). The staff noted that the amended EPRI MRP inspection categories, Primary category-to-Expansion category inter-relationships, and component-specific acceptance criteria and accessibility relationships for the specified CB weld types (i.e., as submitted by the applicant in its response to RAI B2.1.7-4a and as discussed and accepted by the staff in the bullets above) are now based primarily on the specified intended safety function of the CB assemblies. Therefore, the staff finds the updated age-related screening bases for the specified CB weld mechanisms to be acceptable because they support the applicant's basis for designating the reference Unit 2 CB Item B16 and B17 welds as the lead Primary CB assembly weld for the program and the remaining Unit 1, 2, and 3 welds as either main Expansion category or secondary Expansion CB welds for the program.
- Staff's Conclusion of the Basis for Managing Cracking and Irradiation Embrittlement in the ONS CB Assembly Welds. Based on the assessments provided in the bullets above, the staff finds the amended inspection categorizations and I&E bases for the specified CB assembly weld types in AMP B2.1.7 (as amended in the applicant's responses to RAI Nos. B2.1.7-4, B2.1.7-4a, and B2.1.7-4b) to be acceptable for implementation during the subsequent period of extended operation and for aging management under the requirements of 10 CFR 54.21(a)(3) because:
  1) The applicant has elevated the CB cylinder top flange circumferential weld and CB cylinder center circumferential weld in Unit 2 (i.e., the referenced Unit 2 CB assembly

Item B16 and B17 circumferential welds) to be designated as the applicable Primary category CB assembly components for the version of the PWR Vessel Internals Program that will be implemented during the subsequent period of extended operation.

2) The applicant has amended the AMP to designate all other CB assembly weld types in Units 1, 2, and 3 as Expansion category components for the version of the PWR Vessel Internals Program that will be implemented during the subsequent period of extended operation.
3) For the aging management option of managing the designated ONS Primary category and Expansion category CB weld components through inspection activities, the applicant has defined a conservative set of cascading expansion-link criteria that are analogous to those developed and approved for Westinghouse-design CB assembly welds in MRP-227, Revision 1-A and has appropriately addressed the accessibility considerations of the CB assembly welds in a manner that establishes a conservative inspection coverage criterion (i.e., “essentially 100%” coverage) that must be achieved for taking inspection credit of the welds during the subsequent period of extended operation.
4) For the programmatic option of aging management by inspection, the applicant will take appropriate corrective actions in accordance with the applicant’s 10 CFR Part 50, Appendix B program (SLRA AMP B1.3) if the applicant does not achieve the minimum “essentially 100%” weld coverage criterion established for inspection of the designated Primary category Items B16 and B17 or if relevant conditions are detected in the welds that require sample-expansion to the Expansion category CB welds in the program.
5) For the alternative aging management option of managing the CB assemblies and designated ONS Primary category and Expansion category CB welds through performance of a component-specific analysis, the applicant’s basis for performing the analysis and submitting the analysis to the staff are at least as stringent and conservative for performing a component-specific CB assembly analysis in Section A.2.4 of the latest staff-approved version of WCAP-17096 (currently WCAP-17096-NP-A, Revision 2), and the applicant is no longer designating any type of CB assembly weld component in ONS Unit 1, 2, or 3 for inclusion or placement in the NAM category of the version of the PWR Vessel Internals Program that will be implemented during the subsequent period of extended operation.

The technical topics and requests in RAIs B2.1.7-4, B2.1.7-4a, and B2.1.7-4b are resolved.

Gap analysis change – change in expansion-link relationship between Primary baffle-to-former (BF) bolts and Expansion category core barrel-to-former (CB-F) bolts. As summarized in SLRA AMP B2.1.7, the applicant stated that a new aging mechanism was added to the CB assembly BF bolts and that the new aging mechanism is void swelling (VS). The applicant also stated that an expansion-link note was added for the CB assembly BF bolts (refer to Item B9 in Table 4-1 of MRP-227, Revision 1-A); the note states that the linked Expansion category CB-F bolts “are Category A for void swelling (VS) so expansion does not apply.”

During its review of the proposed expansion-link criterion for the CB-F bolts, the staff identified a difference in the “monitoring and trending” and “acceptance criteria” program elements of the AMP, as applied to the MRP-based inspection and evaluation criteria for the CB-F bolts. Specifically, the staff observed that, in MRP-227, Revision 1-A, the CB-F bolts screen in as Expansion category components for aging mechanisms of IASCC, wear, fatigue, IE, and irradiation-enhanced stress relaxation or creep (ISR/IC). Thus, the staff could not initially determine whether the change in the expansion-link basis for the CB-F bolts was eliminating the CB-F bolts as a specified Expansion category bolt component type for all assessed aging mechanisms or only eliminating VS as a considered aging mechanism for the CB-F bolts, where the CB-F bolts would remain as designated Expansion category components for the aging mechanisms of IASCC, wear, fatigue, IE, and ISR/IC. However, during the staff's audit of the PWR Vessel Internals Program (ADAMS Accession No. ML22045A053), the staff verified that the CB-F bolts will remain as designated Expansion category components for the UT inspections that will be performed on the linked Primary category BF bolts during the subsequent period of extended operation.

The staff also confirmed that, even if VS could still be postulated as a screened in mechanism for the CB-F bolts, the Primary category BF bolts would continue to be the lead indicators of aging for the CB-F bolts. The staff noted that, under this type of Primary-to-Expansion category link basis, the Primary category UT inspections being applied to the BF bolts would be performed to monitor for evidence of cracking occurring in the BF bolts, including any cracking that might be induced by stresses imparted from potential swelling of the bolts. Thus, the staff finds the expansion-link basis change for the CB-F bolts to be acceptable because the UT inspections being scheduled and applied to the linked Primary category BF bolts will account for the potential need to schedule and perform sample-expansion UT inspections of the CB-F bolts for evidence of cracking; this includes monitoring for cracking that could be induced in the CB-F bolts as a result of potential VS occurring in the bolting.

<u>General AMP Technical Assessment Determination</u>. Based on the staff review of the AMP program elements above (including Enhancement 2 of the "detection of aging effects" and "acceptance criteria" program elements of the AMP), the applicant's steps to resolve applicable RVI operating experience, and the results of the RVI gap analysis (as amended by letter dated September 2, 2022 [including those for CB weld inspection or alternative component-specific CB assembly analysis]), the staff finds the PWR Vessel Internals Program, as subject to the stated enhancements, to be acceptable because when the program is implemented during the subsequent period of extended operation, it will be consistent with program element criteria of GALL-SLR AMP XI.M16A, "PWR Vessel Internals."

UFSAR Supplement. SLRA Section A2.7 (as amended by letter dated September 2, 2022) provides the UFSAR supplement for the PWR Vessel Internals Program. The staff reviewed this FSAR supplement description of the program against the recommended description for this type of program as described in GALL-SLR Report Table XI-01.

The staff noted that the SLRA Appendix A, Table A6.01, as amended by letter dated September 2, 2022, includes the applicant's current enhancement for the program, as associated with SLRA Commitment No. 7, Part 1, which states:

"The PWR Vessel Internals AMP is an existing program that will be enhanced as follows:

> The PWR Vessel Internals AMP will be updated as necessary to provide guidance for implementing the changes to primary and expansion items in MRP-227, Rev 1-A, Tables 4-1, 4-4 (and Table 5-1 for Element 6 only), as modified by the ONS gap analysis reported in Appendix B2.1.7. (Elements 4 and 6)."

The staff noted that, in the applicant's letter dated September 2, 2022, the applicant amended UFSAR Supplement Section A2.7 and SLRA Appendix A Table A6.0-1 to include the updated list of component-specific gap analysis enhancements that were incorporated and included as Enhancement No. 2 of the program. The staff has reviewed the component-specific gap analysis enhancements of the AMP in the Operating Experience and Gap Analysis Results section of this SE evaluation and has found them to be acceptable for implementation because when the component-specific enhancements are implemented, the program will be consistent with the guidance in GALL-SLR AMP XI.M16A. The staff also noted that UFSAR supplement summary description for the PWR Vessel Internals Program is consistent with the staff's UFSAR supplement summary description for these types of AMPs in Table X-01 of the GALL-SLR report. Thus, the staff determined that SLRA Section A.2.7 provides an adequate UFSAR supplement summary description of the PWR Vessel Internals Program because (1) the UFSAR supplement summary description sufficiently describes how the program will be implemented during the subsequent period of extended operation in conformance with the guidelines in MRP-227, Revision 1-A, as modified by the results of the RVI gap analysis, (2) the applicant has included the component-specific gap analysis enhancements in UFSAR Section A2.7 and in Commitment No. 7 of UFSAR Supplement Table A6.0-1, and (3) the staff has found the component-specific gap analysis enhancements (as amended by letter dated September 2, 2022) to be acceptable for implementation during the subsequent period of extended operation.

The staff also noted that applicant indicated the programmatic enhancements of the AMP will be put into effect at least six months prior to the subsequent period of extended operation. The staff evaluated these programmatic enhancements earlier in this evaluation and found them to be acceptable for implementation because, when the enhancements are implemented, the PWR Vessel Internals Program will be consistent with the criteria in GALL-SLR AMP XI.M16A and MRP-227, Revision 1-A, as supplemented by the results of the applicant's RVI gap analysis.

Based on this review, the staff finds that UFSAR Supplement Section A2.7 provides an acceptable UFSAR supplement summary description of the PWR Vessel Internals Program, as required by 10 CFR 54.21(d). Additionally, the staff finds that the UFSAR supplement summary description for the PWR Vessel Internals Program is consistent with the corresponding program description in GALL-SLR Report Table XI-01.

Conclusion.

Based on its review of the applicant's PWR Vessel Internals Program, the staff concludes that those program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent. The staff also reviewed the enhancements of the AMP and finds that, when the enhancements are implemented, the AMP will be adequate to manage the applicable aging effects. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.4 Flow-Accelerated Corrosion

SLRA Section B2.1.8 states that the Flow-Accelerated Corrosion program is an existing program with an enhancement that will be consistent with the program elements in the GALL-SLR Report AMP XI.M17, "Flow-Accelerated Corrosion." The applicant amended this SLRA section by Supplement 1 dated October 28, 2021; by Supplement 2 dated November 11, 2021; and by letters dated February 14, 2022, and April 22, 2022

(ADAMS Accession Nos. ML21302A208, ML21315A012, ML22045A021, and ML22112A016, respectively).

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL-SLR Report. The staff compared the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements of the SLRA to the corresponding program elements of GALL-SLR Report AMP XI.M17.

For the "scope of program" and "detection of aging effects" program elements, the staff needed additional information regarding erosion-susceptible materials, Oconee's erosion susceptibility analyses, wall thinning due to erosion of main condenser tubes, and validation and verification and error notification for FAC software. Therefore, the staff issued RAI B2.1.8-1, RAI B2.1.8-2, RAI B2.1.8-2a, and RCI 2.1.8-A. The staff's requests and the applicant's responses are documented in ADAMS Accession Nos. ML22045A021, ML22112A016, and ML21336A001.

In its response to B2.1.8-1, the applicant stated that wall thinning due to erosion is an applicable aging effect only for steel piping and piping components exposed to raw water in the condenser circulating water and low-pressure service water systems, based on plant OE. The staff finds the applicant's response acceptable because SLRA Tables 3.3.2-48 and 3.3.2-49 now include AMR items for managing wall thinning due to erosion of steel piping and piping components exposed to raw water by the Open-Cycle Cooling Water System program, and plant OE has not shown instances of wall thinning due to erosion of components constructed of materials other than steel in these systems.

In its response to request 1 of B2.1.8-2, the applicant stated that erosion in non-FAC-susceptible systems is not managed by the Flow-Accelerated Corrosion program and is instead entered into the corrective action program. When wall thinning due to erosion is managed by ongoing monitoring, the recurring inspections are documented in preventive maintenance work orders and implemented in accordance with work management processes. Specifically, the Open-Cycle Cooling Water System program manages wall thinning due to erosion in the condenser circulating water system, low-pressure service water system, and recirculating cooling water system. The ASME Section XI, "Inservice Inspection," Subsections IWB, IWC, and IWD program will manage wall thinning due to erosion in the high-pressure injection system. The applicant revised the SLRA to cite these programs for managing wall thinning due to erosion in these systems. For additional information regarding these programs managing wall thinning due to erosion, see Sections 3.2.2.1.2, 3.3.2.1.4, and 3.4.2.1.2, "Loss of Material Due to Erosion," of this SE.

In its response to request 2 of B2.1.8-2, the applicant stated that a safety factor of 2 is used for erosion evaluations in FAC-susceptible systems due to the nonlinear nature of erosion mechanism degradation. For the non-FAC-susceptible systems, a safety factor of 2 is used when the corrosion rate is based on a single inspection, and a safety factor of 1.5 is used if the corrosion rate is based on multiple inspections. In addition, the recirculating cooling water system heat exchanger tubes rely on a pre-established tube-plugging criteria consistent with industry guidance. In addition, the acceptance criteria of 87.5 percent of nominal wall thickness is used for the high-pressure injection system managed by the ASME Section XI, "Inservice Inspection," Subsections IWB, IWC, and IWD program.

In its response to request 3 of B2.1.8-2, the applicant revised the enhancement to the FAC program to clarify that the reassessment of piping systems that have been excluded from the scope of the FAC program because they are infrequently used applies to both wall thinning due to FAC and erosion mechanisms.

In its response to request 4 of B2.1.8-2, the applicant stated that, through evaluation or plant-specific OE, locations in FAC-susceptible systems determined to be susceptible to erosion are managed by the Flow-Accelerated Corrosion program. The applicant stated that there are no material type exclusion criteria, including chromium content, for these evaluations. While procedures allow for components with a chromium content greater than 0.10 percent to be excluded from further inspections when significant wear is not identified, it does not apply to components susceptible to erosion mechanisms. In addition, components may only be excluded from further inspections if it is confirmed that no wall thinning due to erosion is occurring.

The staff finds the applicant’s response acceptable because (1) wall thinning due to erosion in FAC-susceptible systems is managed by the Flow-Accelerated Corrosion program, and wall thinning due to erosion in non-FAC-susceptible systems is entered into the corrective action program; (2) inspections of locations in non-FAC-susceptible systems that are susceptible to wall thinning due to erosion are implemented in accordance with work management processes; (3) the SLRA identifies AMPs capable of managing wall thinning due to erosion in non-FAC-susceptible systems; (4) conservative safety factors, heat exchanger tube plugging criteria, and minimal wall thickness acceptance criteria are used for erosion evaluations in both FAC- and non-FAC-susceptible systems; (5) the applicant will reassess piping systems that have been excluded from the scope of the Flow-Accelerated Corrosion program because they are infrequently used for both FAC and erosion mechanisms; and (6) excluding components based on chromium content does not apply to erosion mechanisms.

In its response to B2.1.8-2a, the applicant revised the SLRA to cite the Open-Cycle Cooling Water System program for managing wall thinning due to erosion of main condenser tubes, deleted treated borated water as an environment that components in-scope of the FAC program are exposed to, and updated the Open-Cycle Cooling Water program description to include discussion of managing wall thinning due to erosion of the main condenser tubes and relevant main condenser tube plant-specific OE (moved from SLRA Section B21.8). In addition, SLRA Table 3.4.2-1 was updated to correct the plant-specific note numbering. The staff finds the applicant’s response acceptable because SLRA Tables 3.4.1 and 3.4.2-1 and SLRA Sections B2.1.8 and B2.1.11 reflect that the Open-Cycle Cooling Water program manages wall thinning due to erosion of the main condenser tube by periodic ECT. In addition, the plant-specific note numbering in SLRA Table 3.4.2-1 has been corrected.

The applicant confirmed the following in its response to RCI 2.1.8-A: validation and verification and error notification for FAC software will continue to be performed during the subsequent period of extended operation as part of the Software Quality Assurance process, including error notification from software supplier and industry support organizations. The staff finds the applicant’s response acceptable because validation and verification and error notification for FAC software will be performed during the subsequent period of extended operation.

The staff also reviewed the portions of the “detection of aging effects” program element associated with the enhancement to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff’s evaluation of the enhancement is as follows.

Enhancement. As amended by letter dated February 14, 2022 (ADAMS Accession No. ML22045A021), SLRA Section B2.1.8 includes an enhancement to the "detection of aging effects" program element that relates to reassessing piping systems that have been excluded from the scope of the FAC program because they are infrequently used to ensure adequate bases exist to exclude the piping systems for the subsequent period of extended operation. The reassessment applies to wall thinning due to both FAC and erosion mechanisms. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.M17 and finds it acceptable because when it is implemented, the applicant will have confirmed that there is sufficient technical basis to continue excluding low-usage systems from the Flow-Accelerated Corrosion program, which is consistent with the recommendations in GALL-SLR Report AMP XI.M17.

Based on a review of the SLRA, amendments, and the applicant's responses to RAI B2.1.8-1, RAI B2.1.8-2, RAI B2.1.8-2a, and RCI 2.1.8-A, the staff finds that the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent with the corresponding program elements of GALL-SLR Report AMP XI.M17. In addition, the staff reviewed the enhancement associated with the "detection of aging effects" program element and finds that, when implemented, it will make the AMP adequate to manage the applicable aging effects.

OE. SLRA Section B2.1.8 summarizes OE related to the Flow-Accelerated Corrosion program. The staff reviewed OE information in the application and during the audit. As discussed in the Audit Report, the staff reviewed the plant OE information the applicant provided for this program to (a) identify examples of age-related degradation, as documented in the applicant's corrective action program database, and (b) provide a basis for the staff's conclusions on the ability of the applicant's proposed AMPs to manage the effects of aging in the subsequent period of extended operation.

During the audit, questions posed by the staff regarding erosion-related OE resulted in the addition of a Flow-Accelerated Corrosion program–related AMR item to several auxiliary system tables (e.g., condenser circulating water system, low-pressure service water, recirculating cooling water) in SLRA Supplement 1 and Supplement 2 (ADAMS Accession Nos. ML21302A208 and ML21315A012). The staff notes that this resulted in a change to the AMR item from "not applicable" to being consistent with the GALL-SLR Report. Other than these changes, the staff did not identify any OE indicating that the applicant should modify its proposed program. Based on its audit and reviews of the application and supplements, the staff finds that the conditions and OE at the plant are bounded by those for which the Flow-Accelerated Corrosion program was evaluated.

UFSAR Supplement. SLRA Section A2.8, as amended by Supplement 1 dated October 28, 2021, and by letter dated February 14, 2022 (ADAMS Accession No. ML21302A208 and ML22045A021), provides the UFSAR supplement for the Flow-Accelerated Corrosion program. The staff reviewed this UFSAR supplement description of the program, as amended, and noted that it is consistent with the recommended description in GALL-SLR Report Table XI-01. The staff also noted in SLRA Table A6.0-1 that the applicant committed to enhance the Flow-Accelerated Corrosion program by implementing the enhancement discussed above 6 months prior to the subsequent period of extended operation. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. Based on its review of the applicant's Flow-Accelerated Corrosion program, the staff concludes that those program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent. The staff also reviewed the enhancement and concluded that its implementation prior to the subsequent period of extended operation will make the AMP adequate to manage the applicable aging effects. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.5 Bolting Integrity

SLRA Section B2.1.9 states that the Bolting Integrity program is an existing program with enhancements that will be consistent with the program elements in the GALL-SLR Report AMP XI.M18, "Bolting Integrity." The applicant amended this SLRA section by Supplement 1 dated October 28, 2021 (ADAMS Accession No. ML21302A208); and by letters dated February 14, 2022 (ADAMS Accession No. ML22045A021); March 31, 2022 (ADAMS Accession No. ML22090A046); and June 8, 2022 (ADAMS Accession No. ML22159A151).

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL-SLR Report. The staff compared the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements of the SLRA to the corresponding program elements of GALL-SLR Report AMP XI.M18.

For the "preventive actions" program element, the staff determined the need for additional information, which resulted in the issuance of an RAI. RAI B2.1.9-1 and the applicant's response are documented in ADAMS Accession No. ML22045A021.

In its response, the applicant stated that guidance exists within current procedures to ensure that products containing molybdenum disulfide (MoS_2) are restricted from use as bolting thread lubricant and as specified in the Power Chemistry Material Guide (PCMG) Program for ONS. The applicant also stated that although individual maintenance procedures may not directly reference the PCMG, the work planning process requires work planners to ensure that all chemicals meet the requirements of the PCMG. However, to specifically document this prohibition, the applicant revised SLRA Sections B2.1.9 and A2.9 and item No. 9 in SLRA Table A6.0-1 to include an enhancement that will revise the fleet work planning procedure to specifically prohibit the use of products containing MoS_2 as bolting thread lubricants.

During its evaluation of the applicant's response to RAI B2.1.9-1, the staff noted that the PCMG program specifically restricts the use of products containing MoS_2 as bolting thread lubricants. The staff also noted that the new enhancement will ensure that existing guidance and processes are in place to further prohibit the use of products containing MoS_2 as bolting thread lubricants. The staff finds the applicant's response and changes to SLRA Sections B2 1.9 and A2.9 and Table A6.0-1 acceptable because they will make the preventive actions program elements consistent with the GALL-SLR Report recommendation to ensure that bolting integrity is maintained by preventing the use of products containing MoS_2 as a lubricant.

For the "detection of aging effects," and "acceptance criteria" program elements, the staff determined the need for additional information, which resulted in the issuance of RAIs.

RAIs B2.1.9-2 and B2.1.9-2a and the applicant's responses are documented in ADAMS Accession Nos. ML22045A021 and ML22159A151.

In its responses, the applicant stated that, for closure bolting in systems that are not normally pressurized, a representative sample (20 percent of population or 17 bolts, whichever is less) will be visual inspected (bolt heads and threads) for aging effects (loss of material, visible cracking, and loose or missing bolting) during maintenance activities, without relying on alternative inspection methods, such that the minimum sample size is met; the applicant revised SLRA Sections B2.1.9 and A2.9 and Table A6.0-1 to add Enhancement 8 to accomplish this inspection. Further, for submerged closure bolting, the applicant stated that there are two populations of such bolting: one population of SS bolting exposed to borated water associated with the submerged spent fuel pool (SFP) transfer tube isolation valve flange (two 30-inch valves per unit), and the second population of carbon steel bolting exposed to raw water associated with the large vertical condenser circulating water (CCW) intake pump casings (four per unit). The applicant also provided appropriate alternate inspection methods and acceptance criteria for use when the minimum sample size is not met with the preferred direct visual inspection of bolt heads and threads during maintenance activities. The applicant accordingly revised Enhancement 4 in SLRA Sections B2.1.9 and A2.9 and SLRA Table A6.0-1 to specify the alternative inspection methods and acceptance criteria for submerged bolting.

During its evaluation of the applicant's responses to RAI B2.1.9-2 and RAI B2.1.9-2a, the staff noted that for the SFP transfer tube isolation valve flange closure bolting, the alternative inspections will consist of visual inspection by remote video or photographs using high-definition underwater cameras for indications of degraded, visibly loose, or missing bolts and signs of leakage, as well as comparison to previous video or photographic inspection results for changes related to loss of material, bolt loosening, or signs of leakage. The staff also noted that the cracking aging effect of the SFP valve bolting will be managed by GALL-SLR recommended One-Time Inspection and Water Chemistry AMPs, GALL-Report XI.M18 and XI.M2, respectively. The staff further noted that for the CCW intake pump casing closure bolting, the applicant's alternative inspection will consist of visual inspection by divers for evidence of loose or missing bolting and loss of material, and periodic semiannual vibration monitoring (measurements) and trending for increased vibration levels or adverse trends. The staff also noted that each of the submerged bolting joints consists of a relatively large number of bolts and would require relatively appreciable degradation to adversely impact the integrity and intended function of the joints. The staff finds the applicant's response and changes to the SLRA Sections B2.1.9 and A2.1.9 and SLRA Table A6.0-1 acceptable for the following reasons: (a) for closure bolting for systems that are not normally pressurized, the applicant will use direct visual inspection methods during maintenance activities consistent with GALL-SLR Report recommendations for three-unit sites until the minimum sample size is met and will not rely on alternative inspection methods, and (b) for submerged bolting, the applicant identified the specific populations of such bolting and described reasonable alternative inspection methods and acceptance criteria for use when the minimum sample size is not met for the preferred sample-based direct inspections during maintenance activities that are consistent or sufficiently meet the intent of the GALL-SLR Report recommendations to provide reasonable assurance that applicable aging effects will be adequately managed such that integrity and intended function of these relatively large submerged closure bolting joints will be maintained during the subsequent period of extended operation.

For the "parameters monitored or inspected" and "detection of aging effects" program elements, the staff determined the need for additional information, which resulted in the issuance of an

RAI. RAI B2.1.9-3 and the applicant's response are documented in ADAMS Accession No. ML22045A021.

In its response, the applicant stated that Enhancement 3 in SLRA Section B2.1.9 needed further clarification to properly define "high-strength bolting" as bolting with actual measured yield strength greater than or equal to 150 ksi (1,034 megapascal [MPa]). Therefore, the applicant revised SLRA Sections A2.9 and B2.1.9 and Table A6.0-1 to reflect this change. The applicant also stated that the only bolting identified as high strength based on a minimum specified yield that exceeds 120 ksi is the high-strength bolting in the main turbine stop and control valves of the main steam system and high-strength bolting in the high- and low-pressure turbine casings of the turbine and auxiliary systems. The applicant further stated that all other bolting has been evaluated as non-high strength for the SLR.

During its evaluation of the applicant's response to RAI B2.1.9-3, the staff noted that the applicant has identified all applicable high-strength bolting at ONS and updated the SLRA to clarify that applicable high-strength bolts are those with an actual measured yield strength that is greater than or equal to 150 ksi (1,034 MPa). The staff finds the applicant's response and changes to SLRA Sections A2.9 and B2.1.9 and Table A6.0-1 acceptable because they will make the "parameters monitored or inspected" and "detection of aging effects" program elements consistent with the GALL-SLR Report recommendation to ensure that closure bolting with actual yield strength greater than or equal to 150 ksi is monitored for surface and subsurface discontinuities indicative of cracking during the subsequent period of extended operation.

The staff also reviewed the portions of the "preventive actions," "parameters monitored or inspected," "detection of aging effects," and "corrective actions" program elements associated with enhancements to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of the eight enhancements are as follows.

Enhancement 1. SLRA Section B2.1.9 includes an enhancement to the "preventive actions" program element that relates to revising applicable procedures to reference EPRI Report 1015336, "Nuclear Maintenance Applications Center: Bolted Joint Fundamentals"; EPRI Report 1015337, "Nuclear Maintenance Applications Center: Assembling Gasketed, Flanged Bolted Joints"; and NUREG-1339, "Resolution of Generic Safety Issue 29: Bolting Degradation or Failure in Nuclear Power Plants," as appropriate. As stated in the SLRA, the existing program already uses recommendations and guidelines delineated by these documents for the selection of bolting material, lubricants, and sealants. Therefore, the enhancement ensures that references to these documents are properly captured within the applicable procedure. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.M18 and finds it acceptable because, when it is implemented, it will be consistent with the GALL-SLR Report recommendation to ensure preventive actions are in accordance with current industry guidelines and maintenance practices to prevent or mitigate SCC.

Enhancement 2. SLRA Section B2.1.9 includes an enhancement to the "detection of aging effects" program element that relates to ensuring that governing procedures include inspection parameters such as proper lighting, distance, and offset during direct visual inspections. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M18 and finds it acceptable because, when it is implemented, it will be consistent with the GALL-SLR Report recommendation of ensuring that site procedures include inspections parameters such as adequate lighting, distance, and offset to provide an adequate examination.

Enhancement 3. SLRA Section B2.1.9, as amended by letter dated February 14, 2022, includes an enhancement to the “parameters monitored or inspected” and “detection of aging effects” program elements that relates to ensuring that volumetric inspections are performed in accordance with the methods described in ASME Code Section XI, Table IWB-2500-1, Examination Category B-G-1, for non-ASME high-strength bolting with a diameter greater than 2 inches. In its response to RAI B2.1.9-3, the applicant revised this enhancement to further clarify that high-strength bolting are those with an actual yield strength greater than or equal to 150 ksi (1,034 MPa). The staff reviewed this enhancement, as revised by the RAI response, against the corresponding program elements in GALL-SLR Report AMP XI.M18 and finds it acceptable because, when it is implemented, it will be consistent with the GALL-SLR Report recommendation to ensure that the program includes volumetric examination for high-strength closure bolting and demonstrates that surface and subsurface discontinuities indicative of cracking due to SCC will be adequately detected and monitored during the subsequent period of extended operation.

Enhancement 4. SLRA Section B2.1.9, as amended by letters dated March 31, 2022, and June 8, 2022, includes an enhancement to the “detection of aging effects” and “acceptance criteria” program elements that relates to performing a direct visual inspection of a representative sample of closure bolting where leakage is difficult to detect and establishing different alternative inspection methods and acceptance criteria for when the minimum sample size is not met during a 10-year period. The enhancement specifies different alternative inspection methods and acceptance criteria for the two specific populations of submerged bolting at ONS and for bolting in systems containing air or gas. The staff reviewed this enhancement, as amended, against the corresponding program elements in GALL-SLR Report AMP XI.M18 and finds it acceptable because, when it is implemented, it will be consistent with the GALL-SLR Report recommendation to ensure that aging effects are being monitored and detected for a representative population of closure bolting in locations that preclude detection of joint leakage by considering opportunistic maintenance activities and by establishing different alternative inspection methods and corresponding acceptance criteria when the minimum sample size is not met.

Enhancement 5. SLRA Section B2.1.9, as amended by Supplement 1 dated October 28, 2021, includes an enhancement to the “corrective actions” program element that relates to ensuring that:

- additional inspections of a minimum of 20 percent of similar bolting or five additional inspections (whichever is less) is performed for each sample-based inspection that does not meet the acceptance criteria
- that the additional inspections of similar bolting are performed at all three units, occurring within the same interval in which the original inspection was conducted
- that changes to inspection frequency are appropriate if any inspection results indicate that loss of function will occur prior to the next scheduled inspection.

The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M18 and finds it acceptable because, when it is implemented, it will be consistent with the GALL-SLR Report recommendation to (a) ensure that proper corrective actions are in place when the acceptance criteria are not met for a sample-based inspection, (b) ensure that additional inspections are performed within the interval in which the original inspection was conducted, and (c) ensure that adjusted sampling inspection frequencies will not result in the component not meeting the acceptance criteria prior to the next scheduled inspection.

Enhancement 6. SLRA Section B2.1.9, as amended by Supplement 1 dated October 28, 2021, includes an enhancement to the "preventive actions" program element that relates to revising applicable procedures and specifications to avoid the use of bolting with measured yield strength greater than or equal to 150 ksi (1,034 MPa) in newly designed applications, when practical. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.M18 and finds it acceptable because, when it is implemented, it will be consistent with the GALL-SLR Report recommendation to ensure bolting integrity by preventing the use of high-strength bolting by using bolting material that has an actual measured yield strength less than 150 ksi (1,034 MPa).

Enhancement 7. SLRA Section B2.1.9, as amended by letter dated February 14, 2022, includes an enhancement to the "preventive actions" program element that relates to revising applicable procedures to specifically prohibit the use of products containing MoS_2 as bolting thread lubricants. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.M18 and finds it acceptable because, when it is implemented, it will be consistent with the GALL-SLR Report recommendation to ensure bolting integrity is maintained by preventing the use of products containing MoS_2 as a lubricant.

Enhancement 8. SLRA Section B2.1.9, as amended by letter dated March 31, 2022, includes an enhancement to the "detection of aging effects" program element that relates to performing visual inspections of a representative sample of 20 percent of closure bolting (bolt heads and threads) for components that are not normally pressurized or a maximum of 17 bolts for each material and environment population per unit, whichever is less, during each 10-year interval. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.M18 and finds it acceptable because, when it is implemented, it will ensure that, for systems that are not normally pressurized, a representative sample size of closure bolting in each unit will be visually inspected (bolt heads and threads), when accessible, and disassembled during maintenance activities such that sample size is met, consistent with the GALL-SLR Report recommendations for components exposed to similar environments in three-unit sites.

Based on a review of the SLRA, amendments, and the applicant responses to RAIs B2.1.9-1, B2.1.9-2, B2.1.9-2a, and B2.1.9-3, the staff finds that the "scope of program" and "monitoring and trending" program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent with the corresponding program elements of GALL-SLR Report AMP XI.M18. In addition, the staff reviewed the enhancements associated with the "preventive actions," "parameters monitored or inspected," "detection of aging effects," "acceptance criteria," and "corrective actions" program elements and finds that, when implemented, they will make the AMP adequate to manage the applicable aging effects.

OE. SLRA Section B.2.3.9 summarizes OE related to the Bolting Integrity program. The staff reviewed OE information in the application and during the audit. As discussed in the audit report, the staff reviewed the plant OE information the applicant provided for this program to (a) identify examples of age-related degradation, and (b) provide a basis for the staff's conclusions on the ability of the applicant's proposed AMPs to manage the effects of aging in the subsequent period of extended operation. The staff did not identify any OE indicating that the applicant should modify its proposed program. Based on its audit and review of the application, the staff finds that the conditions and OE at the plant are bounded by those for which the Bolting Integrity program was evaluated.

UFSAR Supplement. SLRA Section A2.9, as amended by Supplement 1 dated October 28, 2021; and by letters dated February 14, 2022; March 31, 2022; and June 8, 2022, provides the UFSAR supplement for the Bolting Integrity program. The staff reviewed this UFSAR supplement description of the program against the recommended description for this type of program as described in GALL-SLR Report Table XI-01 and noted that it is consistent with the recommended description in GALL-SLR Report Table XI-01.

The staff noted that the applicant committed (i.e., SLRA Commitment No. 9 in SLRA Table A6.0-1) to implement the program enhancements by no later than 6 months prior to the subsequent period of extended operation. The staff also noted that the applicant committed to ongoing implementation of the existing Bolting Integrity program for managing the effects of aging for applicable components during the subsequent period of extended operation. The staff finds that the information in the UFSAR supplement, as amended, is an adequate summary description of the program.

Conclusion. Based on its review of the applicant's Bolting Integrity program, as amended, the staff concludes that those program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent. The staff also reviewed the enhancements, and finds that, with the enhancements when implemented, the AMP will be adequate to manage the applicable aging effects. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement, as amended, for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.6 Open-Cycle Cooling Water System

SLRA Section B2.1.11 states that the Open-Cycle Cooling Water System program is an existing program with enhancements that will be consistent with the program elements in the GALL-SLR Report AMP XI.M20, "Open-Cycle Cooling Water System," except for the exception identified in the SLRA. The applicant amended this SLRA section by letter dated February 14, 2022 (ADAMS Accession No. ML22045A021).

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL-SLR Report. The staff compared the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," "corrective actions," and "administrative controls" program elements of the SLRA to the corresponding program elements of GALL-SLR Report AMP XI.M20.

The staff also reviewed the portions of the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements associated with an exception and enhancements to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of this one exception and seven enhancements is as follows.

Exception. SLRA Section B2.1.11 includes an exception to the "scope of program" program element related to management of recurring internal corrosion that is occurring in steel piping exposed to raw water from Lake Keowee, which includes using the OCCW system to manage recurring internal corrosion in the water-based fire suppression system. These systems are of similar design and construction, and because the materials of construction and service environments are equivalent, managing recurring internal corrosion of these systems as a single population is appropriate. Although designated as an exception by the applicant, the GALL-SLR recommends the Open-Cycle Cooling Water System AMP as one of three options for managing recurring internal corrosion of the water-based fire suppression system, since the Open-Cycle Cooling Water System AMP was designed to manage the aging effects of components in raw water systems. In addition, SRP-SLR Table 3.3-1, Item 3.3.1-127 recommends that the Open-Cycle Cooling Water System AMP be evaluated for inclusion of augmented requirements to ensure adequate management of any recurring aging effects. The staff reviewed this exception against the corresponding program element in GALL-SLR Report AMP XI.M20 and finds that it is not needed because when the enhancements listed below are implemented, the Open-Cycle Cooling Water AMP will be consistent with the recommendations in the GALL-SLR Report.

Enhancement 1. SLRA Section B2.1.11 includes an enhancement to the "parameters monitored or inspected" program element that relates to performing periodic inspections, cleaning, and ECT of the A and B chiller condensers at least once every 5 years. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.M20 and finds it acceptable because, when it is implemented, the program's procedures will be consistent with the recommendations in the GALL-SLR Report.

Enhancement 2. SLRA Section B2.1.11 includes an enhancement to the "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," and "corrective actions" program elements that relates to performing a minimum of 20 inspections for recurring internal corrosion in raw water systems every 24 months until the rate of recurring internal corrosion occurrences no longer meets the criteria for recurring internal corrosion as defined in Section 3.3.2.2.7 of NUREG-2192. The selected inspection locations will be periodically reviewed to validate their relevance and usefulness and adjusted as appropriate. Evaluation of the inspection results will include (1) trending of the measured rate of corrosion degradation, (2) verification that design minimum allowable wall thickness is maintained, and (3) determination of the re-inspection interval. The staff reviewed these enhancements against the corresponding program elements in GALL-SLR Report AMP XI.M20 and finds them acceptable because, when they are implemented, the program's procedures will be consistent with the recommendations in the GALL-SLR Report.

Enhancement 3. SLRA Section B2.1.11 includes an enhancement to the "parameters monitored or inspected" and "detection of aging effects" program elements that relates to performing periodic internal visual inspections of the visible portion of the supply and return piping to the radwaste equipment cooling system from the CCW system intake piping, in conjunction with performing intake piping internal coating inspections. These visual inspections will be performed to identify direct evidence of internal degradation and indirect evidence of through-wall leakage, including the presence of backfill material or gravel within the pipe. The staff reviewed these enhancements against the corresponding program elements in GALL-SLR Report AMP XI.M20 and finds them acceptable because, when they are implemented, the program's procedures will be consistent with the recommendations in the GALL-SLR Report.

Enhancement 4. SLRA Section B2.1.11 includes an enhancement to the "detection of aging effects" program element that relates to providing additional guidance in procedures for inspections of non-ASME Code components for items such as lighting, distance, offset, surface coverage, presence of protective coatings, and cleaning processes. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.M20 and finds it acceptable because, when it is implemented, the program’s procedures will be consistent with the recommendations in the GALL-SLR Report.

Enhancement 5. SLRA Section B2.1.11 includes an enhancement to the “monitoring and trending” program element that relates to providing additional guidance for trending of heat exchanger inspection results to evaluate the adequacy of inspection frequencies. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.M20 and finds it acceptable because, when it is implemented, the program’s procedures will be consistent with the recommendations in the GALL-SLR Report.

Enhancement 6. SLRA Section B2.1.11 includes an enhancement to the “corrective actions” program element that relates to conducting additional inspections if inspections identify wall thickness below the minimum required wall thickness and the cause of the aging effect for each applicable material and environment is not corrected by repair or replacement for all components constructed of the same material and exposed to the same environment. The number of increased inspections is determined in accordance with the corrective action program; however, at least five additional inspections will be conducted for each inspection that did not meet acceptance criteria, or 20 percent of each applicable material, environment, and aging effect combination is inspected, whichever is less. The additional inspections include inspections at all of the units with the same material, environment, and aging effect combination. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.M20 and finds it acceptable because, when it is implemented, the program’s procedures will be consistent with the recommendations in the GALL-SLR Report.

Enhancement 7. SLRA Section B2.1.11, as amended by letter dated February 14, 2022, includes an enhancement to the “Administrative Controls” program element that relates to incorporating programmatic guidance contained in engineering support documents into controlled plant procedures, subject to administrative controls in accordance with the applicant’s QA Program. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.M20 and finds it acceptable because, when it is implemented, the program’s procedures will be consistent with the recommendations in the GALL-SLR Report.

Based on a review of the SLRA, amendments, and the applicant’s response to RAI B2.1.11-1, the staff finds that the “scope of program,” “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” “acceptance criteria,” and “corrective actions” program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent with the corresponding program elements of GALL-SLR Report AMP XI.M20. The staff also reviewed the enhancement between the applicant’s program and GALL-SLR Report XI.M20 associated with the “scope of program” program element and its justification, and finds that the AMP, with the enhancement, is adequate to manage the applicable aging effects. In addition, the staff reviewed the enhancements associated with the “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” “acceptance criteria,” “corrective actions,” and “administrative controls” program elements and finds that, when implemented, they will make the AMP adequate to manage the applicable aging effects.

OE. SLRA Section B2.1.11 summarizes OE related to the Open-Cycle Cooling Water System AMP. The staff reviewed OE information in the application and during the audit. As discussed in the audit report, the staff reviewed the plant OE information the applicant provided for this program to (a) identify examples of age-related degradation, and (b) provide a basis for the staff's conclusions on the ability of the applicant's proposed AMPs to manage the effects of aging in the subsequent period of extended operation. The staff did not identify any OE indicating that the applicant should modify its proposed program. Based on its audit and review of the application, the staff finds that the conditions and OE at the plant are bounded by those for which the Open-Cycle Cooling Water System program was evaluated.

UFSAR Supplement. SLRA Section A2.11 provides the UFSAR supplement for the Open-Cycle Cooling Water System AMP. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in GALL-SLR Report Table XI-01. The staff also noted that the applicant committed to implementing program and SLR enhancements, when applicable, 6 months prior to the subsequent period of extended operation. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. Based on its review of the applicant's Open-Cycle Cooling Water System AMP, the staff concludes that those program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent. The staff also reviewed the exception and the seven enhancements and finds that, with the exception and the enhancements when implemented, the AMP will be adequate to manage the applicable aging effects. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.7 Closed Treated Water Systems

SLRA Section B2.1.12 states that the Closed Treated Water System program is an existing program with enhancements that will be consistent with the program elements in the GALL-SLR Report AMP XI.M21A, "Closed Treated Water Systems."

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL-SLR Report. The staff compared the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements of the SLRA to the corresponding program elements of GALL-SLR Report AMP XI.M21A.

The staff also reviewed the portions of the "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," and "corrective actions" program elements associated with enhancements to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of these six enhancements is as follows.

Enhancement 1. SLRA Section B2.1.12 includes an enhancement to the "parameters monitored or inspected" and "detection of aging effects" program elements that relate to performing condition monitoring using techniques (visual, surface, or volumetric) capable of detecting loss of material, cracking, and fouling (as appropriate), and performing visual inspections for loss of material and fouling whenever the system boundaries of the closed treated water systems are opened. The enhancement also includes surface or volumetric examinations when susceptible materials are inspected for cracking. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M21A and finds it acceptable because, when it is implemented, it will be consistent with the GALL-SLR Report.

Enhancement 2. SLRA Section B2.1.12 includes an enhancement to the "detection of aging effects" program element that relates to performing a sufficient number of inspections in each 10-year period during the subsequent period of extended operation to ensure that the minimum representative sample of 20 percent of the population, up to 17 inspections per unit, is met. A population is defined as components having the same material, water treatment program, and aging effect combination. The enhancement also relates to inspections being performed on those components that are more likely to be susceptible to aging based on time in service and severity of operating conditions. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.M21A and finds it acceptable because, when it is implemented, it will be consistent with the GALL-SLR Report.

Enhancement 3. SLRA Section B2.1.12 includes an enhancement to the "detection of aging effects" and "corrective action" program elements that relate to performing additional inspections when inspections do not meet acceptance criteria. At least five additional inspections are performed for every inspection not meeting acceptance criteria, or 20 percent of each applicable material, environment, and aging effect combination, whichever is less. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M21A and finds it acceptable because, when it is implemented, it will be consistent with the GALL-SLR Report.

Enhancement 4. SLRA Section B2.1.12 includes enhancements to the "detection of aging effects" program element that relates to providing additional guidance in procedures for inspections of non-ASME code components for items such as lighting, distance, offset, surface coverage, presence of protective coatings, and cleaning processes. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M21A and finds it acceptable because, when it is implemented, it will be consistent with the GALL-SLR Report.

Enhancement 5. SLRA Section B2.1.12 includes an enhancement to the "monitoring and trending" program element that relates to, where practical, projecting the rate of any degradation until the next scheduled inspection or the end of the subsequent period of extended operation (whichever is shorter), and then adjusting the sampling bases (e.g., selection, size, frequency) as necessary based on the projections. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M21A and finds it acceptable because, when it is implemented, it will be consistent with the GALL-SLR Report.

Enhancement 6. SLRA Section B2.1.12 includes an enhancement to the "corrective actions" program element that relates to using the corrective action program to determine the extent of condition and extent of cause if subsequent inspections identify aging effects, and to then determine further extent of inspections. The enhancement also includes performing additional inspections on all units with the same material, environment, and aging effect combinations and within the interval of the original inspection (e.g., refueling outage interval, 10-year inspection interval). The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M21A and finds it acceptable because, when it is implemented, it will be consistent with the GALL-SLR Report.

Based on a review of the SLRA and enhancements, the staff finds that the “scope of program,” “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” “acceptance criteria,” and “corrective actions” program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent with the corresponding program elements of GALL-SLR Report AMP XI.M21A. In addition, the staff reviewed the enhancements associated with the “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” and “corrective actions program elements and finds that, when implemented, they will make the AMP adequate to manage the applicable aging effects.

OE. SLRA Section B2.1.12 summarizes OE related to the Closed Treated Water Systems program. The staff reviewed OE information in the application and during the audit. As discussed in the audit report, the staff reviewed the plant OE information the applicant provided for this program to (a) identify examples of age-related degradation, and (b) provide a basis for the staff’s conclusions on the ability of the applicant’s proposed AMPs to manage the effects of aging in the subsequent period of extended operation. The staff did not identify any OE indicating that the applicant should modify its proposed program beyond that incorporated during the development of the SLRA.

UFSAR Supplement. SLRA Section A2.12 provides the UFSAR supplement for the Closed Treated Water System AMP. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in GALL-SLR Report Table XI-01. The staff also noted the applicant committed to implement the Closed Treated Water System program enhancements 6 months prior to the subsequent period of extended operation. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. Based on its review of the applicant’s Closed Treated Water System AMP, the staff concludes that those program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent. The staff also reviewed the enhancements and finds that, when implemented, the AMP will be adequate to manage the applicable aging effects. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.8 Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems

SLRA Section B2.1.13 states that the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems program is an existing program with enhancements that will be consistent with the program elements in the GALL-SLR Report AMP XI.23, “Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems.”

Staff Evaluation. During its audit, the staff reviewed the applicant’s claim of consistency with the GALL-SLR Report. The staff compared the “scope of program,” “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” “acceptance criteria,” and “corrective actions” program elements of the SLRA to the corresponding program elements of GALL-SLR Report AMP XI.M23.

The staff also reviewed the portions of the “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” “acceptance criteria,” and “corrective actions” program elements associated with enhancements to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff’s evaluation of these four enhancements follows.

Enhancement 1. SLRA Section B2.1.13 includes an enhancement to the “parameters monitored or inspected,” “detection of aging effects,” and “acceptance criteria” program elements that relates to providing additional procedural guidance to include visual inspections looking for deformation and cracking of bridges, structural members, and structural components. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M23 and finds it acceptable because, when it is implemented, it will be consistent with the GALL-SLR Report recommendation for performing periodic visual inspections to monitor for loss of material due to wear.

Enhancement 2. SLRA Section B2.1.13 includes an enhancement to the “parameters monitored or inspected,” “detection of aging effects,” and “acceptance criteria” program elements that relate to providing additional procedural guidance to specify that bolted connections are monitored for loss of material, cracking, loose or missing bolts or nuts, and other conditions indicative of loss of preload. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M23 and finds it acceptable because, when it is implemented, it will be consistent with the GALL-SLR Report recommendation associated with implementation of the ASME B30.2 standard or other applicable industry standards in the ASME B30 series.

Enhancement 3. SLRA Section B2.1.13 includes an enhancement to the “acceptance criteria” program element that relates to including an evaluation of findings according to ASME B30.2 or other applicable ASME B30 series in applicable procedures. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M23 and finds it acceptable because, when it is implemented, it will be consistent with the GALL-SLR Report recommendation associated with implementation of the ASME B30.2 standard or other applicable industry standards in the ASME B30 series.

Enhancement 4. SLRA Section B2.1.13 includes an enhancement to the “corrective actions” program element that relates to enhancing maintenance procedures to ensure that repairs are performed in accordance with manufacturer’s literature and ASME B30.2 or other applicable ASME B30 series. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M23 and finds it acceptable because, when it is implemented, it will be consistent with the GALL-SLR Report recommendation associated with implementation of the ASME B30.2 standard or other applicable industry standard in the ASME B30 series.

Based on a review of the SLRA, the staff finds that the “scope of program,” “preventive actions,” and “monitoring and trending” program elements are consistent with the corresponding program elements of GALL-SLR Report AMP XI.M23. In addition, the staff reviewed the enhancements associated with the “parameters monitored or inspected,” “detection of aging effects,” “acceptance criteria,” and “corrective actions” program elements and finds that, when implemented, they will make the AMP adequate to manage the applicable aging effects.

OE. SLRA Section B2.1.13 summarizes OE related to the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems program. The staff reviewed OE information in the application and during the audit. As discussed in the audit report, the staff reviewed the plant OE information the applicant provided for this program to (a) identify examples of age-related degradation, and (b) provide a basis for the staff's conclusions on the ability of the applicant's proposed AMPs to manage the effects of aging in the subsequent period of extended operation. The staff did not identify any OE indicating that the applicant should modify its proposed program. Based on its audit and review of the application, the staff finds that the conditions and OE at the plant are bounded by those for which the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems program was evaluated.

UFSAR Supplement. SLRA Appendix A, Section A2.13, provides the UFSAR supplement for the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in GALL-SLR Report Table XI-01. The staff also noted that the applicant committed to ongoing implementation of the existing Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems AMP for managing the effects of aging for applicable components during the subsequent period of extended operation. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. Based on its review of the applicant's Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems AMP, the staff concludes that those program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent. The staff also reviewed the enhancements, and finds that, with the enhancements when implemented, the AMP will be adequate to manage the applicable aging effects. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.9 Compressed Air Monitoring

SLRA Section B2.1.14 states that the Compressed Air Monitoring program is an existing program with an enhancement that will be consistent with the program elements in the GALL-SLR Report AMP XI.M24, "Compressed Air Monitoring."

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL-SLR Report. The staff compared the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements of the SLRA to the corresponding program elements of GALL-SLR Report AMP XI.M24. The staff also reviewed the portions of the "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements associated with the enhancement to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of this enhancement follows.

Enhancement. SLRA Section B2.1.14 includes an enhancement to the "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements that relates to revising the program procedure for the Compressed Air Monitoring program to include the element-by-element requirements presented in NUREG-2191

Section XI.M24. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.M24 and finds it acceptable because, when it is implemented, it will be consistent with the GALL-SLR Report recommendations.

Based on a review of the SLRA, the staff finds that the “scope of program,” “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” “acceptance criteria,” and “corrective actions” program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent with the corresponding program elements of GALL-SLR Report AMP XI.M24. In addition, the staff reviewed the enhancement associated with the “detection of aging effects,” “monitoring and trending,” “acceptance criteria,” and “corrective actions” program elements and finds that, when implemented, it will make the AMP adequate to manage the applicable aging effects.

OE. SLRA Section B2.1.14 summarizes OE related to the Compressed Air Monitoring program. The staff reviewed OE information in the application and during the audit. As discussed in the audit report, the staff reviewed the plant OE information the applicant provided for this program to (a) identify examples of age-related degradation, and (b) provide a basis for the staff’s conclusions on the ability of the applicant’s proposed AMPs to manage the effects of aging in the subsequent period of extended operation. The staff did not identify any OE indicating that the applicant should modify its proposed program. Based on its audit and review of the application, the staff finds that the conditions and OE at the plant are bounded by those for which the Compressed Air Monitoring program was evaluated.

UFSAR Supplement. SLRA Section A2.14 provides the UFSAR supplement for the Compressed Air Monitoring program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in GALL-SLR Report Table XI-01. The staff also noted that the applicant committed to ongoing implementation of the existing Compressed Air Monitoring program for managing the effects of aging for applicable components during the subsequent period of extended operation. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. Based on its review of the applicant’s Compressed Air Monitoring program, the staff concludes that those program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent. The staff also reviewed the enhancement, and finds that, with the enhancement when implemented, the AMP will be adequate to manage the applicable aging effects. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.10 Fire Protection

SLRA Section B2.1.15 states that the Fire Protection program is an existing program with an enhancement that will be consistent with the program elements in the GALL-SLR Report AMP XI.M26, “Fire Protection,” as modified by SLR-ISG-2021-02-MECHANICAL, “Updated Aging Management Criteria for Mechanical Portions of Subsequent License Renewal Guidance” (ADAMS Accession No. ML20181A434).

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL-SLR Report. The staff compared the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements of the SLRA to the corresponding program elements of GALL-SLR Report AMP XI.M26, as modified by SLR-ISG-2021-02-MECHANICAL.

For the "scope of the program" and "monitoring and trending" program elements, the staff needed additional information regarding concrete block masonry walls, "Fire Barrier – Penetration Seals" component types, and trending inspection results. The staff's requests and the applicant's responses to RAIs B2.1.15-1 and B2.1.15-2 and RCIs 2.1.15-A, B2.1.15-1-A, and B2.1.15-2-A are documented in ADAMS Accession Nos. ML21336A001, ML22045A021, and ML22081A027.

In its responses to RAI B2.1.15-1 and RCI B2.1.15-1-A, the applicant clarified that "concrete block" and "masonry wall" material types are used interchangeably for various aging management items and have multiple intended functions (i.e., structural support, shelter, protection, and fire barrier). In addition, the applicant confirmed that the Fire Protection program is credited for maintaining the fire barrier intended function and that the Masonry Walls program is credited for maintaining the other intended functions of the masonry walls. The staff finds the responses acceptable because the applicant treats concrete block and masonry walls as equivalent material types and only credits the Fire Protection program for maintaining the fire-barrier intended function of the masonry walls.

In its responses to RAI B2.1.15-2 and RCI B2.1.15-2-A, the applicant revised SLRA Section 2.4.8.2 to state that Armaflex is not credited as a fire barrier, addressed whether other programs are credited for ensuring the fire-barrier intended function of fire-barrier materials, and confirmed whether the Fire Protection program is credited for inspections of penetration seals with a flood-barrier intended function. The staff finds the applicant's responses acceptable because the applicant corrected the discrepant information in the SLRA, clarified that the Structures Monitoring program is not credited for ensuring the fire-barrier intended function of fire-barrier materials, and confirmed that the Fire Protection program is not credited for ensuring the flood-barrier intended function of penetration seals.

In its response to RCI 2.1.15-A, the applicant confirmed that the Oconee Fire Protection program trends all inspection results, whether or not they are entered in the "corrective action" program, to provide for timely detection of aging effects. The staff finds the applicant's response acceptable because inspection results will be trended, which is consistent with GALL-SLR Report AMP XI.M26.

The staff also reviewed the portions of the "parameters monitored or inspected," "detection of aging effects," and "acceptance criteria" program elements associated with the enhancement to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of the enhancement is as follows.

Enhancement. SLRA Section B2.1.15 includes an enhancement to the "parameters monitored or inspected," "detection of aging effects," and "acceptance criteria" program elements, to perform visual inspections of the external surfaces of the standby shutdown facility fire protection carbon dioxide system every 18 months to detect corrosion that may lead to loss of material. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M26 and finds it acceptable because, when it is implemented, it will require periodic visual inspection of the in-scope carbon dioxide fire suppression system, which is consistent with GALL-SLR Report AMP XI.M26.

Based on a review of the SLRA, the enhancement, and the applicant's responses to RAI B2.1.15-1, RAI B2.1.15-2, RCI 2.1.15-A, RCI B2.1.15-1-A, and RCI B2.1.15-2-A, the staff finds that the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent with the corresponding program elements of GALL-SLR Report AMP XI.M26, as modified by SLRISG202102MECHANICAL. In addition, the staff reviewed the enhancement associated with "parameters monitored or inspected," "detection of aging effects," and "acceptance criteria" program elements and finds that, when implemented, it will make the AMP adequate to manage the applicable aging effects.

OE. SLRA Section B2.1.15 summarizes OE related to the Fire Protection program. The staff reviewed OE information in the application and during the audit. As discussed in the audit report, the staff reviewed the plant OE information the applicant provided for this program to (a) identify examples of age-related degradation, and (b) provide a basis for the staff's conclusions on the ability of the applicant's proposed AMPs to manage the effects of aging in the subsequent period of extended operation. The staff did not identify any OE indicating that the applicant should modify its proposed program. Based on its audit and review of the application, the staff finds that the conditions and OE at the plant are bounded by those for which the Fire Protection Program was evaluated.

UFSAR Supplement. SLRA Section A2.15 provides the UFSAR supplement for the Fire Protection program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in GALL-SLR Report Table XI-01. The staff also noted in SLRA Table A6.0-1 that the applicant committed to enhance the Fire Protection program by implementing the enhancement discussed above 6 months prior to the subsequent period of extended operation. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. Based on its review of the applicant's Fire Protection program, the staff concludes that those program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent. The staff also reviewed the enhancement and concluded that its implementation prior to the subsequent period of extended operation will make the AMP adequate to manage the applicable aging effects. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.11 Fire Water System

SLRA Section B2.1.16 states that the Fire Water System program is an existing program with enhancements that will be consistent with the program elements in the GALL-SLR Report AMP XI.M27, "Fire Water System," except for the exceptions identified in the SLRA. The applicant amended this SLRA section by Supplement 1 dated October 28, 2021; by Supplement 2 dated November 11, 2021; by letter dated February 14, 2022; and by Supplement 4 dated

June 7, 2022 (ADAMS Accession Nos. ML21302A208, ML21315A012, ML22045A021, and ML22158A028, respectively).

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL-SLR Report. The staff compared the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements of the SLRA to the corresponding program elements of GALL-SLR Report AMP XI.M27.

For the "scope of the program," "detection of aging effects," "monitoring and trending," and "acceptance criteria" program elements, the staff had questions regarding main drain pressure test monitoring, inspection guidance, status of previous changes to SLRA Table A6.0-1 for the Fire Water System program, internal inspections of piping, and test result trending and issued RAI B2.1.16-1, RAI B2.1.16-2, RAI B2.1.16-2a, RAI B2.1.16-3, and RCI 2.1.16-A. The staff's requests and the applicant's responses are documented in ADAMS Accession Nos. ML22045A021, ML22112A016, and ML21336A001.

In its response to B2.1.16-1, the applicant stated that the results of original acceptance testing would not provide a valid baseline for the main drain testing due to system modifications since initial construction. The applicant stated that the baseline value will be established using the results of the initial main drain testing. The staff finds the applicant's response acceptable because main drain testing results will be compared with a baseline value established using the initial main drain testing results and, as a result, degradation of the fire water system supply over several years can be reasonably identified. For additional information related to the main drain testing of deluge systems, see the discussion of Enhancement 9 below.

In its response to B2.1.16-2, the applicant revised SLRA Sections A2.16 and B2.1.16 and SLRA Table A6.0-1 to clarify the additional inspection guidance for age-related degradation that will be added to the Fire Water System program inspection procedures. The staff finds the applicant's response acceptable because the SLRA has been updated to clarify that inspection procedures will be revised to include specific guidance for the identification and documentation of age-related degradation. For additional information, see the discussion of Enhancement 5 below.

In its response to B2.1.16-2a, the applicant stated that previous changes made to the Fire Water System program are still in effect and provided a consolidated SLRA Table A6.0-1 showing all previously made changes. In addition, the applicant revised SLRA Table A6.0-1 by making two editorial changes to Enhancement 9. The staff finds the applicant's response acceptable because the consolidated SLRA Table A6.0-1 includes all previous changes made to the Fire Water System program, and the two editorial changes to Enhancement 9 do not change the previous changes related to main drain testing of deluge systems.

In its response to B2.1.16-3, the applicant revised SLRA Section B2.1.16 to clarify that Exception 3 applies to sprinkler system piping within the scope of the Fire Water System program. Specifically, the applicant stated that "Exception 3 applies to all system piping that is maintained dry between the first block isolation valve and the sprinklers in the manually actuated dry sprinkler systems for the cable room, cable shaft level 3, and cable shaft level 4 & 5 rooms." The staff finds the applicant's response acceptable because the SLRA was revised to clarify the applicability of Exception 3. For additional information, see the discussion of Exception 3 below.

The applicant confirmed the following in its response to RCI 2.1.16-A: (1) the Oconee Fire Water System program trends flow test and ultrasonic test results not entered into the "corrective actions" program in addition to trending flow test and ultrasonic test results not meeting acceptance criteria that are entered into the "corrective actions" program, and (2) all unexpected results of flushes are entered into the "corrective actions" program (all flush result trending is performed under the "corrective actions" program). The staff finds the applicant's response acceptable because results of flow tests, ultrasonic tests, and flushes will be trended, which is consistent with GALL-SLR Report AMP XI.M27.

The staff also reviewed the portions of the "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements associated with the exceptions and enhancements to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of these exceptions and enhancements are as follows.

Exception 1. As amended by Supplement 2 dated November 11, 2021 (ADAMS Accession No. ML21315A012), SLRA Section B2.1.16 was updated to delete *Exception 1* to the "detection of aging effects" program element related to flow testing at hose stations other than the hose station that is hydraulically the most remote. See discussion of Enhancement 6 below regarding hose station flow testing.

Exception 2. SLRA Section B2.1.16 includes an exception to the "detection of aging effects" program element related to air discharge testing of deluge systems without compressed air connections. The staff reviewed this exception against the corresponding program element in GALL-SLR Report AMP XI.M27 and finds it acceptable because deluge systems that will not be air tested will have (1) periodic visual inspections to verify correct spray nozzle positions, consistent with Section 10.3.4.3 of National Fire Protection Association (NFPA) 25, (2) trip testing every 2 years to verify operation of the deluge valves, (3) periodic main drain testing at each deluge valve to ensure that the water supply pipe is not excessively fouled and any accumulated debris is cleared, (4) internal inspections of upstream and downstream piping attached to the deluge valve in each system every 5 years, (5) internal inspections of branch lines supplying individual spray nozzles for loss of material and flow blockage, and (6) internal inspections following removal of a spray nozzle every 5 years from one branch line in 50 percent of the deluge systems that are not flow tested for detecting plugged nozzles and degradation that may result in plugged nozzles.

Exception 3. As amended by letter dated February 14, 2022 (ADAMS Accession No. ML22045A021), SLRA Section B2.1.16 includes an exception to the "detection of aging effects" program element related to periodic internal inspections of sprinkler system piping. Specifically, periodic internal inspections will not be performed for "all system piping that is maintained dry between the first block isolation valve and the sprinklers in the manually actuated dry sprinkler systems for the cable room, cable shaft level 3, and cable shaft level 4 & 5 rooms." The applicant stated that these systems are maintained dry and are not subject to periodic wetting during testing, and plant-specific OE did not identify instances of these systems being actuated. In addition, these systems are isolated from the supply header by two locked, closed isolating valves. Downstream, at a system low point from the two locked, closed isolating valves is a tell-tale drain with a normally open drain valve. The staff reviewed this exception against the corresponding program element in GALL-SLR Report AMP XI.M27 and finds it acceptable because (1) the manually actuated dry sprinkler systems for the cable room, cable shaft level 3, and cable shaft level 4 and 5 rooms are maintained dry and are not subject to periodic wetting during testing, (2) the two locked isolating valves are verified to be locked closed, (3) the tell-tale drain valve is verified to be open, and (4) the tell-tale drain is inspected monthly for leakage.

Enhancement 1. SLRA Section B2.1.16 includes an enhancement to the “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” “acceptance criteria,” and “corrective actions” program elements related to internal visual inspections of deluge system piping. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M27 and finds it acceptable because, when it is implemented, (1) internal visual inspection of the deluge system piping not subject to flow testing every 5 years (see discussion of Exception 2 above) will be performed by removing a hydraulically remote nozzle (50 percent every 5 years, alternate systems inspected during subsequent 5-year inspection period, so that 100 percent are inspected every 10 years), and (2) follow-up volumetric wall-thickness examinations will be performed when an unexpected level of degradation is identified by the internal visual inspections and, as a result, these inspections can detect internal corrosion, foreign material, and obstructions to flow.

Enhancement 2. SLRA Section B2.1.16 includes an enhancement to the “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” “acceptance criteria,” and “corrective actions” program elements related to submitting sprinkler heads for field-service testing prior to 50 years in service. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M27 and finds it acceptable because, when it is implemented, sprinkler heads that have been in service for 50 years will be submitted for field-service testing by a recognized testing laboratory consistent with Section 5.3.1 of NFPA 25, which is consistent with GALL-SLR Report AMP XI.M27.

Enhancement 3. As amended by Supplement 2 dated November 11, 2021 (ADAMS Accession No. ML21315A012), SLRA Section B2.1.16 includes an enhancement to the “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” “acceptance criteria,” and “corrective actions” program elements related to one-time volumetric wall-thickness inspection of deluge system supply piping that is periodically subject to flow during functional testing. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M27 and finds it acceptable because, when it is implemented, a one-time volumetric inspection will be performed on a representative sample of deluge system supply piping that is periodically subject to flow during functional testing and will include criteria for selecting the inspection locations and acceptance criteria and determining the need for follow-up examinations based on results.

Enhancement 4. SLRA Section B2.1.16 includes an enhancement to the “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” “acceptance criteria,” and “corrective actions” program elements related to internal flow blockage identified during internal inspections. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M27 and finds it acceptable because, when it is implemented, (1) an obstruction investigation consistent with Section 14.3 of NFPA 25 will be performed if unacceptable internal flow blockage is identified during internal inspections, and (2) corrective actions for unacceptable internal flow blockage will include removal of the material, an extent-of-condition determination, a review for increased inspections, follow-up examinations, and a flush consistent with Annex D.5 of NFPA 25, which are consistent with the GALL-SLR Report AMP XI.M27.

Enhancement 5. As amended by letter dated February 14, 2022 (ADAMS Accession No. ML22045A021), SLRA Section B2.1.16 includes an enhancement to the “parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements related to revising procedures to provide additional inspection guidance for identification and documentation of age-related degradation and to include inspection parameters (i.e., lighting, distance, offset, protective coatings, and cleaning processes). The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M27 and finds it acceptable because, when it is implemented, procedures will include guidance specific to the identification and documentation of age-related degradation and inspection parameters for items such as lighting, distance, offset, protective coatings, and cleaning processes, which is consistent with GALL-SLR Report AMP XI.M27.

Enhancement 6. As amended by Supplement 2 dated November 11, 2021 (ADAMS Accession No. ML21315A012), SLRA Section B2.1.16 includes an enhancement to the "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements related to flow testing at hose stations. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M27 and finds it acceptable because, when it is implemented, (1) at least one hose station in each building will be flow tested every 5 years; (2) the flow testing will be performed at the hose station that is hydraulically the most remote; (3) at least two additional tests will be performed within 2 years if acceptance criteria are not met; (4) an extent-of-condition and extent-of-cause analysis will be conducted if subsequent tests do not meet acceptance criteria; and (5) additional tests will include at least one test at one of the other units with same material, environment, and aging effect combination, consistent with GALL-SLR Report AMP XI.M27.

Enhancement 7. SLRA Section B2.1.16 includes an enhancement to the "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements related to performing external visual inspections of the elevated water storage tank (EWST). The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M27 and finds it acceptable because, when it is implemented, external visual inspections of the EWST will be performed every 2 years, consistent with Section 9.2.5.5 of NFPA 25, which is consistent with GALL-SLR Report AMP XI.M27.

Enhancement 8. SLRA Section B2.1.16 includes an enhancement to the "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements related to performing flushing of mainline strainers. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M27 and finds it acceptable because, when it is implemented, mainline strainers will be flushed after system actuation, consistent with Section 10.2.7 of NFPA 25, which is consistent with GALL-SLR Report AMP XI.M27.

Enhancement 9. As amended by Supplement 2 dated November 11, 2021 (ADAMS Accession No. ML21315A012), SLRA Section B2.1.16 includes an enhancement to the "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements related to main drain testing of deluge systems. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M27 and finds it acceptable because, when it is implemented, (1) main drain testing of deluge systems will be performed, consistent with Sections 13.2.5 and A.13.2.5 of NFPA 25; (2) when there is a 10 percent reduction in full flow pressure when compared to a baseline value established using the results of the initial main drain testing results, the cause shall be identified and corrected; (3) at least two additional tests will be performed within 2 years if acceptance criteria are not met; (4) an extent-of-condition and extent-of-cause analysis will be conducted if subsequent tests do not meet acceptance criteria; and (5) additional tests will include at least one test at one of the other units with same material, environment, and aging effect combination, consistent with GALL-SLR Report AMP XI.M27.

Enhancement 10. SLRA Section B2.1.16 includes an enhancement to the "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements related to internal inspections and wall-thickness measurements of the EWST. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M27 and finds it acceptable because, when it is implemented, the acceptance criteria and corrective actions for the EWST will be in accordance with the recommendations in GALL-SLR Report AMP XI.M42 for internally coated or lined fire water tanks, and EWST wall-thickness measurements will be performed when interior pitting or general corrosion (beyond minor surface rust) is detected, consistent with GALL-SLR Report AMP XI.M27.

Enhancement 11. As amended by Supplement 1 dated October 28, 2021 (ADAMS Accession No. ML21302A208), SLRA Section B2.1.16 includes an enhancement to the "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements related to training and qualification of personnel involved with inspecting the EWST internal coatings and evaluating degraded conditions. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M27 and finds it acceptable because, when it is implemented, personnel involved with inspecting the EWST internal coatings and evaluating degraded conditions will be trained and qualified in accordance with an American Society for Testing and Materials (ASTM) international standard endorsed in RG 1.54, which is consistent with the GALL-SLR Report AMP XI.M42 recommendation to enhance the Fire Water System program to include its training and qualification recommendations for internally coated fire water storage tanks.

Based on a review of the SLRA, amendments, and the applicant's response to RAI B2.1.16-1, RAI B2.1.16-2, RAI B2.1.16-2a, RAI B2.1.16-3, and RCI 2.1.16-A, the staff finds that the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent with the corresponding program elements of GALL-SLR Report AMP XI.M27. The staff also reviewed the exceptions associated with the "detection of aging effects" program element and their justifications and finds that the AMP, with the exceptions, is adequate to manage the applicable aging effects. In addition, the staff reviewed the enhancements associated with the "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements and finds that, when implemented, they will make the AMP adequate to manage the applicable aging effects.

OE. SLRA Section B2.1.16 summarizes OE related to the Fire Water System program. The staff reviewed OE information in the application and during the audit. As discussed in the Audit Report, the staff reviewed the plant OE information the applicant provided for this program to: (a) identify examples of age-related degradation, and (b) provide a basis for the staff's conclusions on the ability of the applicant's proposed AMPs to manage the effects of aging in the subsequent period of extended operation. The staff did not identify any OE indicating that the applicant should modify its proposed program. Based on its audit and review of the application, the staff finds that the conditions and OE at the plant are bounded by those for which the Fire Water System program was evaluated.

UFSAR Supplement. SLRA Section A2.16, as amended by Supplement 1 dated October 28, 2021; by Supplement 2 dated November 11, 2021; by letter dated February 14, 2022; and by Supplement 4 dated June 7, 2022 (ADAMS Accession Nos. ML21302A208, ML21315A012, ML22045A021, and ML22158A028, respectively), provides the UFSAR supplement for the Fire Water System program. The staff reviewed this UFSAR supplement description of the program, as amended, and noted that it is consistent with the recommended description in GALL-SLR Report Table XI-01. The staff also noted in SLRA Table A6.0-1 that the applicant committed to enhance the Fire Water System program by implementing *Enhancements 1* through *11*, discussed above, 5 years prior to the subsequent period of extended operation. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. Based on its review of the applicant's Fire Water System program, the staff concludes that those program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent. The staff also reviewed the exceptions and enhancements, and finds that, with the exceptions and the enhancements when implemented prior to the subsequent period of extended operation, the AMP will be adequate to manage the applicable aging effects. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.12 Fuel Oil Chemistry

SLRA Section B2.1.18 states that the Fuel Oil Chemistry program is an existing program with enhancements that will be consistent with the program elements in the GALL-SLR Report AMP XI.M30, "Fuel Oil Chemistry." The applicant has amended this SLRA section by Supplement 4 dated June 7, 2022 (ADAMS Accession No. ML22158A028).

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL-SLR Report. The staff compared the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements of the SLRA to the corresponding program elements of GALL-SLR Report AMP XI.M30.

The staff also reviewed the portions of the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," and "acceptance criteria" program elements associated with enhancements to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of these enhancements follows.

Enhancement 1. SLRA Section B2.1.18 includes an enhancement to the "preventive actions," "parameters monitored or inspected," and "corrective actions" program elements that relates to monitoring the standby shutdown facility fuel oil day tank quarterly for the presence of water by draining oil from the bottom of the tank and removing the water, if found. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M30 and finds it acceptable because, when it is implemented, it will be consistent with the recommendations of the GALL-SLR Report.

Enhancement 2. SLRA Section B2.1.18 includes an enhancement to the "preventive actions," "parameters monitored or inspected," "detection of aging," "monitoring and trending," and "acceptance criteria" program elements that relates to monitoring the fuel oil stored in the standby shutdown facility fuel oil day tank quarterly for the presence of bacteria and fungi. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M30 and finds it acceptable because, when it is implemented, it will be consistent with the recommendations of the GALL-SLR Report.

Enhancement 3. SLRA Section B2.1.18 includes an enhancement to the "parameters monitored or inspected" and "detection of aging" program elements that relates to performing volumetric wall-thickness measurements of the standby shutdown facility fuel oil day tank if evidence of degradation is identified visually during the 10-year internal inspection. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M30, and finds it acceptable because, when it is implemented, it will be consistent with the recommendations of the GALL-SLR Report.

Based on a review of the amended SLRA, the staff finds that the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent with the corresponding program elements of GALL-SLR Report AMP XI.M30. In addition, the staff reviewed the enhancements associated with the "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements and finds that, when implemented, they will make the AMP adequate to manage the applicable aging effects.

OE. SLRA Section B2.1.18 summarizes OE related to the Fuel Oil Chemistry program. The staff reviewed OE information in the application and during the audit. As discussed in the Audit Report, the staff reviewed the plant OE information the applicant provided for this program to (a) identify examples of age-related degradation, and (b) provide a basis for the staff's conclusions on the ability of the applicant's proposed AMPs to manage the effects of aging in the subsequent period of extended operation.

The staff did not identify any OE indicating that the applicant should modify its proposed program beyond that incorporated during the development of the SLRA. Based on its audit and review of the application, the staff finds that the conditions and OE at the plant are bounded by those for which the Fuel Oil Chemistry program was evaluated.

UFSAR Supplement. SLRA Appendix A, Section A2.18 provides the UFSAR supplement for the Fuel Oil Chemistry program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in GALL-SLR Report Table XI-01. The staff also noted that the applicant committed to ongoing implementation of the existing Fuel Oil Chemistry program for managing the effects of aging for applicable components during the subsequent period of extended operation. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. Based on its review of the applicant's Fuel Oil Chemistry program, the staff concludes that those program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent. The staff also reviewed the enhancements, and finds that, with the enhancements implemented, the AMP will be adequate to manage the applicable aging effects. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.13 Reactor Vessel Material Surveillance

The SLRA states that AMP B2.1.19, “Reactor Vessel Material Surveillance,” is an existing program with three exceptions to the program elements in the GALL-SLR Report AMP XI.M31, “Reactor Vessel Material Surveillance.”

Staff Evaluation: During its audit, the staff reviewed the applicant’s claim of consistency with the GALL-SLR Report with three exceptions. The staff compared the “scope of program,” “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” “acceptance criteria,” and “corrective actions” program elements of the SLRA to the corresponding program elements of GALL-SLR Report AMP XI.M31. The staff’s evaluation of these three exceptions follows.

Exception 1. The first exception is applicable to Unit 3 only. All Oconee units include beltline welds using Linde 80 weld wire heats. While surveillance data are available for Units 1 and 2 Linde 80 weld wire heats at neutron fluence values projected to between one and two times the neutron fluence at the period of SLR (72 EFPY), the surveillance data for the Unit 3 Linde 80 weld wire heats are below this value. Specifically, the neutron fluence for the tested surveillance specimens for the Unit 3 upper shell to lower shell circumferential weld (weld wire heat 72442) was 1.95E19 n/cm^2 (E>1 MeV). This is less than the 72 EFPY projected neutron fluence of 2.10E19 n/cm^2 (E>1 MeV).

The staff noted that Oconee is a part of an NRC-approved integrated reactor vessel material surveillance program. The Babcock & Wilcox Owners Group (B&WOG) designed a reactor vessel material surveillance program, the Master Integrated Reactor Vessel Program (MIRVP). The PWROG is now the vehicle for the previous B&WOG reactor vessel working group activities. Oconee is a member of the PWROG. In the MIRVP, reactor pressure vessel (RPV) materials from PWROG (former B&WOG reactor vessel working group) member plants are irradiated at host plants to supplement plant-specific capsules.

Data for the limiting Unit 3 weld wire heat 72442 is included in this integrated surveillance program. Three capsules containing this material have been tested at neutron fluence values ranging from 6.09E18 n/cm^2 to 1.95E19 n/cm^2 (E>1MeV). The integrated surveillance program for the Linde 80 welds includes several other welds with compositions very near that of weld wire heat 72442. Data from these Linde 80 weld wire heats have resulted in predicted shifts of reference temperature, nil-ductility temperature (ΔRT_{NDT}), within the 2-sigma bounds determined following the methodology contained in RG 1.99, Revision 2, “Radiation Embrittlement of Reactor Vessel Materials.” In combination with the small differences in neutron fluence (surveillance capsule fluence of 1.95E19 n/cm^2 [E>1MeV] versus the 72 EFPY projected neutron fluence of 2.10E19 n/cm^2 [E>1MeV]), the staff finds that the reactor vessel surveillance program for Unit 3 provides reasonable assurance of adequate aging management of RPV embrittlement during the subsequent period of extended operation, and this exception is acceptable.

Exception 2. The second exception is applicable to Units 1, 2, and 3. Appendix H programs include program capsules scheduled for withdrawal and testing and, if applicable, standby capsules. The Oconee plant-specific standby capsules are not required to meet the requirements of 10 CFR Part 50, Appendix H, for the subsequent period of extended operation because surveillance capsule data with neutron fluence values between one and two times the peak RPV inner diameter surface at the end of the subsequent period of extended operation have been obtained for each unit, with the exception of Unit 3 weld wire heat 72442, which was addressed in the first exception. Reactor vessel material surveillance programs for Units 1, 2, and 3 are conducted through participation in the MIRVP, an integrated surveillance program (ISP). The staff found that the ISP criteria, as provided by Appendix H to 10 CFR, Part 50, "Reactor Vessel Material Surveillance Program Requirements," were met for the MIRVP. Approvals for the disposal of untested capsules for Units 1, 2, and 3 have previously been approved by the staff through the MIRVP. The staff noted that in BAW-1543, Revision 4, Supplement 5-A, "Supplement to the Master Integrated Reactor Vessel Surveillance Program" (ADAMS Accession No. ML052300219), the Oconee MIRVP ISP surveillance capsules that had been installed at Crystal River Unit 3 could not be removed. These capsules are disposed of through the decommissioning process for Crystal River Unit 3. The staff determined that the inability to withdraw these capsules had no impact on the ability of the Oconee surveillance capsule programs to meet the Appendix H requirements.

For each unit, reactor vessel material surveillance capsules have already been removed and tested, thus providing data at neutron fluence values between one and two times the peak RPV inner diameter surface at the end of the subsequent period of operation for each unit (with the exception of Unit 3 weld wire heat 72442, which was addressed in the first exception). In addition, the MIRVP maintains an inventory of unirradiated material and stores tested specimens. Therefore, the staff finds that the incorporation of standby capsules into the reactor vessel material surveillance programs for Oconee is not necessary in order to provide reasonable assurance of adequate aging management of RPV embrittlement during the subsequent period of extended operation, and this exception is acceptable.

Exception 3. The third exception is applicable to Units 1, 2, and 3 regarding GALL-SLR Report AMP XI.M31 Criterion 5, *Monitoring and Trending.* Surveillance capsule withdrawal schedules and the disposal of irradiation plant-specific specimens were previously reviewed and approved by the staff through the NRC-approved MIRVP ISP via the staff's approval of BAW-1543, Revision 4, Supplement 5-A. Through the MIRVP ISP, unirradiated archived Oconee RPV materials continue to be held in storage for possible future use, and previously tested Linde 80 weld specimens are stored for possible future use under the NRC-approved MIRVP ISP. Maintaining sufficient material provides for future potential surveillance program needs. The disposal of previously tested surveillance program specimens is conducted through the NRC-approved MIRVP ISP and does not impact the adequacy of the reactor vessel material surveillance programs for Oconee. The staff further notes that data at neutron fluence values between one and two times the peak RPV inner diameter surface at the end of the subsequent period of extended operation for each unit (with the exception of Unit 3 weld wire heat 72442, which was addressed in the first exception) have already been obtained for each unit. Therefore, the staff finds that reactor vessel material surveillance programs for Oconee have adequate material consistent with the MIRVP ISP to provide reasonable assurance of adequate aging management during the subsequent period of extended operation, and this exception is acceptable.

Based on its audit and review of the SLRA and its supplements, the staff finds that the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent with the corresponding program elements of GALL-SLR Report AMP XI.M31. The staff reviewed the exceptions against the corresponding program elements in GALL-SLR Report AMP XI.M31 and finds them acceptable because, when implemented, the Reactor Vessel Material Surveillance AMP described in SLRA Section B2.1.19 will provide adequate aging management for the subsequent period of extended operation.

OE. SLRA Section B2.1.19 summarizes the OE related to the Reactor Vessel Material Surveillance AMP. The staff evaluated the OE information by reviewing the SLRA and conducting an audit. As discussed in the audit report, the staff reviewed the plant OE information the applicant provided for this program to (a) identify examples of age-related degradation, and (b) provide a basis for the staff's conclusions on the ability of the applicant's proposed AMPs to manage the effects of aging in the subsequent period of extended operation. The staff determined that documents reviewed during the audit related to OE support the adequacy of the applicant's proposed AMP to manage the effects of aging in the subsequent period of extended operation. Based on its audit and review of the application, the staff finds that the conditions and OE at the plant are bounded by those for which the Reactor Vessel Material Surveillance AMP was evaluated.

UFSAR Supplement. SLRA Section A2.19 provides the UFSAR supplement for the Reactor Vessel Material Surveillance AMP. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. Based on its review of the Reactor Vessel Material Surveillance AMP, the staff concludes that those program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent. The staff reviewed three exceptions identified by the applicant and finds that with the exceptions, that the applicant has demonstrated that the effects of aging will be adequately managed through the Reactor Vessel Material Surveillance AMP for Oconee Units 1, 2, and 3 so that the intended function(s) will be maintained consistent with the CLB for the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.14 Selective Leaching

SLRA Section B2.1.21 states that the Selective Leaching program is a new program that will be consistent with the program elements in the GALL-SLR Report AMP XI.M33, "Selective Leaching," except for the exception identified in the SLRA (the exception was added by Supplement 3 dated December 15, 2021 [ADAMS Accession No. ML21349A005]). In addition, the applicant amended this SLRA section by letter dated January 7, 2022 (ADAMS Accession No. ML22010A129).

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL-SLR Report. The staff compared the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements of the SLRA to the corresponding program elements of GALL-SLR Report AMP XI.M33.

For the "scope of program," "parameters monitored or inspected," and "detection of aging effects" program elements, the staff determined the need for additional information regarding why selective leaching is not an AERM for malleable iron components (based on plant-specific OE in 2020 involving graphitic corrosion on the internal surfaces of malleable iron fittings exposed to closed-cycle cooling water). RAI B2.1.21-1 and the applicant's response are documented in ADAMS Accession Nos. ML21327A277 and ML22010A129.

In its response, the applicant stated the following (in part):

(1) "[m]echanical components constructed of malleable iron are within the scope of SLR at Oconee and are exposed to aqueous environments where selective leaching could occur."

(2) "[t]he Oconee SLRA is revised…to reflect that malleable iron mechanical components exposed to environments where selective leaching could occur will be managed for loss of material due to selective leaching."

(3) "[d]ue to the similarities between malleable iron and ductile iron microstructures, components constructed of these two materials and exposed to closed cycle cooling water will be evaluated as a single sample population in the Selective Leaching aging management program (AMP). Malleable and ductile iron will also be grouped together in sample populations for other environments where selective leaching could occur. Periodic inspections will be performed for malleable iron and ductile iron components exposed to closed cycle cooling water."

(4) "[e]ach of the nine [malleable iron] pipe fittings [exposed to closed-cycle cooling water] exhibited some degree of degradation consistent with graphitic corrosion. The locations with the greatest wall loss were under deposit pitting-type indications. Relatively minor degradation was present in eight of the nine pipe fittings with an estimated degradation rate of 0.001 inch to 0.002 inch per year. A deeper pit was present in one of the fittings indicating an accelerated degradation rate of approximately 0.0035 inch per year."

(5) "destructive examination of a gray cast iron RCW [Recirculating Cooling Water] system elbow performed in October 2020 identified evidence of superficial graphitic corrosion. The penetration depth of the de-alloyed material was less than 0.040 inch after approximately 47 years in service. Based on the measured penetration depth, a conservative linear degradation rate of 0.001 inch per year is assumed for gray cast iron components in a closed cycle cooling water environment. If this conservative corrosion rate is assumed, localized selective leaching with a penetration depth of up to 0.080 inch could occur by the end of the subsequent period of extended operation. Gray cast iron components within the scope of subsequent license renewal and exposed to a closed cycle cooling water system are limited to pump casings, heat exchanger heads, and valve bodies which are thicker walled, heavier castings. As such, selective leaching of gray cast iron component exposed to closed cycle-cooling water is not expected to impact the performance of component intended functions through the end of the subsequent period of extended operation. One-time inspections of a representative sample of these components will be performed to confirm that the assumed selective leaching rate is conservative."

In addition, the applicant revised SLRA Tables 3.3.2-1, 3.3.2-4, 3.3.2-6, 3.3.2-8, 3.3.2-10, 3.3.218, 3.3.2-20, 3.3.2-21, 3.3.2-22, 3.3.223, 3.3.2-24, 3.3.2-25, 3.3.2-26, 3.3.2-36, 3.3.2-41, 3.3.2-48, 3.3.2-49, 3.3.2-59, 3.4.2-1, 3.4.2-2, 3.4.2-3, 3.4.2-7, and 3.4.2-10 to reflect that selective leaching for malleable iron piping exposed to raw water, raw water (potable), closed-cycle cooling water, waste water, and treated water will be managed by the Selective Leaching program. Furthermore, SLRA Section B2.1.21 (and corresponding UFSAR supplement) were revised to reflect the following: (a) one-time inspections will be conducted for gray cast iron components exposed to a closed-cycle cooling water environment because plant-specific OE has not revealed evidence of significant selective leaching of gray cast iron in closed-cycle cooling water, (b) opportunistic and periodic inspections will be performed for malleable iron and ductile iron components exposed to closed-cycle cooling water, and (c) a representative sample of components will be inspected from the combined population of ductile iron and malleable iron components in each environment due to the similarities in the microstructures of these two materials.

During its evaluation of the applicant's response to RAI B2.1.211, the staff noted the following:

- During a quarterly meeting with the NEI to discuss current and SLR topics on September 10, 2015 (ADAMS Accession No. ML15253A217), the staff noted that ductile iron is less susceptible to graphitic corrosion when compared to gray cast iron.
- GALL-SLR Report AMP XI.M33 recommends (a) one-time inspections for components exposed to closed-cycle cooling water when no plant-specific OE of selective leaching exists in this environment; and (b) opportunistic and periodic inspections for components in closed cycle-cooling water where plant-specific OE includes selective leaching in this environment.

The staff finds the applicant's response and changes to the SLRA acceptable based on the following reasons:

- Although malleable iron is not specifically called out in GALL-SLR Report AMP XI.M33, cast irons (i.e., gray cast iron, ductile iron, and malleable iron) can be effectively managed for loss of material due to selective leaching using the Selective Leaching program in environments where selective leaching may occur (i.e., raw water, raw water (potable), closed-cycle cooling water, waste water, and treated water).
- Ductile iron and malleable iron consist of spherical graphite nodules and irregularly shaped graphite nodules, respectively, embedded in iron (whereas gray cast iron has a continuous network of graphite flakes surrounded by iron). Due to the similarities in microstructure, the staff finds the applicant's approach to group ductile iron and malleable iron together in sample populations to be reasonable.
- Consistent with GALL-SLR Report AMP XI.M33 recommendations, opportunistic and periodic inspections will be performed for malleable iron and ductile iron components exposed to closed-cycle cooling water due to plant-specific OE of selective leaching for this material and environment combination.
- Although gray cast iron is generally considered more susceptible to selective leaching when compared to ductile and malleable iron, the staff finds the applicant's basis for performing one-time inspections for gray cast-iron components exposed to closed-cycle cooling water to be reasonable based on the following reasons: (a) corrosion rates for gray cast-iron components exposed to closed-cycle cooling water were approximately 2 to 3 times lower when compared to malleable iron components exposed to closed-cycle cooling water, (b) gray cast-iron components within the scope of SLR have increased wall thickness (i.e., greater margin) when compared to malleable iron components within the scope of SLR, and (c) based on lower corrosion rates and increased wall thickness, the staff has reasonable assurance that loss of material due to selective leaching will not result in a loss of intended function for gray cast-iron components exposed to closed-cycle cooling water during the subsequent period of extended operation.

The staff also reviewed the portions of the "detection of aging effects" program element associated with the exception to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of this exception follows.

Exception. As amended by Supplement 3 dated December 15, 2021, SLRA Section B2.1.21 includes an exception to the "detection of aging effects" program element related to using the representative sample size for a single-unit site (i.e., 3 percent of the population or a maximum of 10 components per population) for ductile iron and gray cast-iron fire header components exposed to soil in lieu of the representative sample size for a three-unit site (i.e., 3 percent of the population or a maximum of seven components per population per unit). During its evaluation of the exception, and as the applicant confirmed through RCIs B2.1.21-A, B2.1.21-B, B2.1.21-C, B2.1.21-D, B2.1.21-E, B2.1.21-F, and B2.1.21-G by letter dated January 21, 2022 (ADAMS Accession No. ML22021A000), the staff noted the following:

- In-scope buried fire protection system piping is specified to be externally coated with a high-build epoxy primer and a high-build coal tar epoxy finish coat. (RCI B2.1.21-A)
- Between 2008 and 2012, 56 samples for soil resistivity were taken during soil corrosivity testing. All 56 samples had soil resistivity greater than 3,000 ohm-cm. (RCI B2.1.21-B)
- Between 2008 and 2009, 24 samples for pH were taken during soil corrosivity testing with a pH ranging from 5.2 to 7.8. (RCI B2.1.21-C)
- Between 2008 and 2009, 14 samples for redox potential were taken during soil corrosivity testing with all samples having a redox potential greater than positive 100 millivolts. (RCI B2.1.21-D)
- Between 2008 and 2009, 17 samples for sulfides were taken during soil corrosivity testing with 13 of the samples negative for sulfides. (RCI B2.1.21-E)
- Between 2008 and 2009, 24 samples for soil moisture were taken during soil corrosivity testing with moisture content ranging from 7.44 to 40.6 percent. (RCI B2.1.21-F)
- Between 2008 and 2009, 24 samples for chlorides were taken during soil corrosivity testing with all samples having chlorides less than 100 parts per million. (RCI B2.1.21-G)

During its evaluation of the exception and applicant's response to the RCIs, the staff noted the following: (a) GALL-SLR Report AMP XI.M41, "Buried and Underground Piping and Tanks," recommends external coatings for buried metallic piping; (b) the recommended coating types in GALL-SLR Report AMP XI.M41 include coal tar enamel and epoxy; (c) GALL-SLR Report Table XI.M41-2, "Inspection of Buried and Underground Piping and Tanks," references American Water Works Association (AWWA) C105, "Polyethylene Encasement for Ductile-Iron Pipe Systems," Table A.1, "Soil-Test Evaluation," with respect to determining soil corrosivity; (d) gray cast iron and ductile iron exhibit similar corrosion rate behavior in a soil environment (i.e., the staff considers AWWA C105, Table A.1 applicable to gray cast iron, in addition to ductile iron); (e) AWWA C105, Table A.1, uses the soil parameters of soil resistivity, pH, redox potential, sulfides, and moisture to determine the overall soil corrosivity index; (f) AWWA C105, Table A.1, indicates that soil is considered corrosive when the soil corrosivity index is 10 points or greater; and (g) in addition to the soil parameters cited above, Table 9-4, "Soil Corrosivity Index from BPWORKS," of EPRI Report 3002005294, "Soil Sampling and Testing Methods to Evaluate the Corrosivity of the Environment for Buried Piping and Tanks at Nuclear Power Plants," includes the additional soil parameter of chlorides to determine the overall soil corrosivity index, which provides more comprehensive input into determining overall soil corrosivity when compared to GALL-SLR Report AMP XI.M41 recommendations (i.e., AWWA C105, Table A.1).

The staff reviewed this exception related to using a reduced inspection sample size for ductile iron and gray cast-iron components exposed to soil and finds it acceptable for the following reasons: (a) the subject buried piping is externally coated consistent with GALL-SLR Report AMP XI.M41 recommendations, (b) the soil analyses performed between 2008 and 2012 indicated non-corrosive soil conditions per GALL-SLR Report AMP XI.M41 guidance (i.e., the soil corrosivity index was less than 10 points per AWWA C105, Table A.1), (c) the soil analyses performed between 2008 and 2009 indicate non-aggressive levels of chlorides per Table 9-4 of EPRI Report 3002005294, and (d) the staff's review of plant-specific OE that the applicant provided did not identify any instances of significant selective leaching for components exposed to a soil environment.

Based on a review of the SLRA (as amended) and the applicant's response to RAI B2.1.21-1, the staff finds that the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent with the corresponding program elements of GALL-SLR Report AMP XI.M33. The staff also reviewed the exception associated with the "detection of aging effects" program element (including the applicant's response to RCIs B2.1.21-A, B2.1.21-B, B2.1.21-C, B2.1.21-D, B2.1.21-E, B2.1.21-F, and B2.1.21-G), and its justification and finds that the AMP, with the exception, is adequate to manage the applicable aging effects.

OE. As amended by letter dated January 7, 2022, SLRA Section B2.1.21 summarizes OE related to the Selective Leaching program. The staff reviewed OE information in the application and during the audit. As discussed in the audit report, the staff reviewed the plant OE information the applicant provided for this program to (a) identify examples of age-related degradation, and (b) provide a basis for the staff's conclusions on the ability of the applicant's proposed AMPs to manage the effects of aging in the subsequent period of extended operation.

The staff identified OE for which it determined the need for additional information, which resulted in the issuance of RAI B2.1.21-1. The staff's evaluation of RAI B2.1.21-1 is documented above. Based on its audit and review of the application, and review of the applicant's response to RAI B2.1.21-1, the staff finds that the conditions and OE at the plant are bounded by those for which the Selective Leaching program was evaluated.

UFSAR Supplement. As amended by letter dated January 7, 2022, SLRA Section A2.21 provides the UFSAR supplement for the Selective Leaching program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in GALL-SLR Report Table XI-01 (excluding changes related to the addition of malleable iron as a susceptible material, which is documented in the staff's evaluation of RAI B2.1.21-1 above). The staff also noted the applicant committed to the following: (a) implement the new Selective Leaching program no later than 10 years prior to the subsequent period of extended operation for managing the effects of aging for applicable components, and (b) perform the one-time and initial periodic inspections no later than 6 months prior to the subsequent period of extended operation, or no later than the last refueling outage prior to the subsequent period of extended operation. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. Based on its review of the applicant's Selective Leaching program, the staff concludes that those program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent. The staff also reviewed the exception, and finds that with the exception implemented, the AMP will be adequate to manage the applicable aging effects. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.15 Lubricating Oil Analysis

SLRA Section B2.1.25 describes the existing Lubricating Oil Analysis program that, with enhancements, will be consistent with GALL-SLR Report AMP XI.M39, "Lubricating Oil Analysis." The applicant has amended this SLRA section by Supplement 4 dated June 7, 2022 (ADAMS Accession No. ML22158A028).

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL-SLR Report. The staff compared the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements of the SLRA of the applicant's program to the corresponding program elements of GALL-SLR Report AMP XI.M39.

The staff also reviewed the portions of the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements that are consistent with the corresponding program elements of GALL-SLR Report AMP XI.M39.

The staff also reviewed the portions of the "detection of aging effects," "acceptance criteria," and "corrective action" program elements associated with enhancements to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of these enhancements follows.

Enhancement 1. SLRA Section B2.1.25 includes an enhancement to the "detection of aging effects" program element that updates the Oconee Lubricating Oil Analysis program procedure to specify that in all cases, phase-separated water in any amount is not acceptable. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M39 and finds it acceptable because, when it is implemented, it will be consistent with the recommendations of the GALL-SLR Report.

Enhancement 2. SLRA Section B2.1.25 includes an enhancement to the "acceptance criteria" and "corrective action" program elements that updates the Oconee Lubricating Oil Analysis program procedure to specify that in all cases, phase-separated water in any amount is not acceptable. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M39 and finds it acceptable because, when it is implemented, it will be consistent with the recommendations of the GALL-SLR Report.

Based on a review of the amended SLRA, the staff finds that the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent with the corresponding program elements of GALL-SLR Report AMP XI.M39. In addition, the staff reviewed the enhancements associated with the “detection of aging effects,” “acceptance criteria,” and “corrective action” program elements and finds that, when implemented, they will make the AMP adequate to manage the applicable aging effects.

OE. SLRA Section B2.1.25 summarizes OE related to the Lubricating Oil Analysis program. The staff reviewed OE information in the application and during the audit. As discussed in the audit report, the staff reviewed the plant OE information the applicant provided for this program to (a) identify examples of age-related degradation, and (b) provide a basis for the staff’s conclusions on the ability of the applicant’s proposed AMPs to manage the effects of aging in the subsequent period of extended operation. The staff did not identify any OE indicating that the applicant should modify its proposed program. Based on its audit and review of the application, the staff finds that the conditions and OE at the plant are bounded by those for which the Lubricating Oil Analysis program was evaluated.

UFSAR Supplement. SLRA Appendix A, Section A2.25, provides the UFSAR supplement for the Lubricating Oil Analysis Program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in GALL-SLR Report Table XI.M39. The staff also noted that the applicant committed to ongoing implementation of the existing Lubricating Oil Analysis program for managing the effects of aging for applicable components during the subsequent period of extended operation. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. Based on its review of the applicant’s Lubricating Oil Analysis program, the staff concludes that those program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent. Also, the staff reviewed the enhancements and concluded that their implementation prior to the subsequent period of extended operation will make the AMP adequate to manage the applicable aging effects. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.16 Buried and Underground Piping and Tanks

SLRA Section B2.1.26 states that the Buried and Underground Piping and Tanks program is an existing program with enhancements that will be consistent with the program elements in the GALL-SLR Report AMP XI.M41, “Buried and Underground Piping and Tanks,” except for the exceptions identified in the SLRA. The applicant amended this SLRA section by Supplement 2 dated November 11, 2021 (ADAMS Accession No. ML21315A012).

Staff Evaluation. During its audit, the staff reviewed the applicant’s claim of consistency with the GALL-SLR Report. The staff compared the “scope of program,” “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” “acceptance criteria,” and “corrective actions” program elements of the SLRA to the corresponding program elements of GALL-SLR Report AMP XI.M41, “Buried and Underground Piping and Tanks.”

The staff also reviewed the portions of the "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements associated with the exceptions and enhancements to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of these three exceptions and 11 enhancements follows.

Exception 1. SLRA Section B2.1.26 includes an exception to the "preventive actions" program element related to abandoning uncoated and non-cathodically protected buried copper-alloy instrument air system piping prior to the subsequent period of extended operation. The staff reviewed this exception and noted that although not providing cathodic protection or external coatings for buried copper-alloy piping would typically be classified as an exception, the fact that the subject piping will be abandoned prior to the subsequent period of extended operation makes the staff's concerns regarding the adequacy of preventive actions for this piping no longer relevant. Based on the above, the disposition of this exception is not needed because abandoning the subject piping does not conflict with guidance provided in GALL-SLR Report AMP XI.M41.

Exception 2. As amended by Supplement 2 dated November 11, 2021, SLRA Section B2.1.26 includes an exception to the "preventive actions" program element related to using a limiting critical potential of -2,000 millivolts (mV) in lieu of the -1,200 mV value cited in GALL-SLR Report AMP XI.M41 for the test well on the north side of the standby shutdown facility diesel engine fuel oil tank. The subject exception states the following (in part):

> "[t]he cathodic protection system for the standby shutdown facility diesel engine fuel oil tank was installed in 2010 to replace the original passive sacrificial anode system. Due to the location of the tank and space limitations in the area, anodes could not be installed on the south side of the tank that is adjacent to the standby shutdown facility building wall. Also, the design depth for the anodes on the north side of the tank could not be obtained due to a shallow bedrock layer in the area. In order to achieve adequate polarization at test locations for the south side of the tank, an instant-off potential more negative than -1200 mV was required for test locations for the north side of the tank."

The staff reviewed this exception and finds it acceptable for the following reasons: (a) a limiting critical potential of -1,200 mV will be used for the south side of the subject tank and in-scope buried steel piping, consistent with GALL-SLR Report AMP XI.M41 recommendations, and (b) based on the plant-specific configuration, the south side of the standby shutdown facility diesel engine fuel oil tank would not be able to receive adequate cathodic protection (i.e., -850 mV instant-off) without implementation of the subject exception.

Exception 3. SLRA Section B2.1.26 includes an exception to the "detection of aging effects" program element related to exposing a quadrant (i.e., 9 to 12 o'clock or 12 to 3 o'clock) of 10 linear feet of buried steel CCW system piping during each inspection in lieu of GALL-SLR Report AMP XI.M41, which recommends that 10 feet of piping is exposed for each inspection (i.e., entire circumference). The subject exception states the following (in part):

- "[t]he buried steel condenser circulating water system piping consists of large diameter (96-inch to 132-inch) low pressure piping…"
- "[g]iven the size of this piping, excavation and visual inspection of 360 degrees of the circumference of the pipe is not feasible. Inspection of a quadrant of ten linear feet of the

piping…will provide a sufficient representative sample to determine the condition of the piping. To supplement the external inspection, low frequency electromagnetic testing [LFET] will be performed from the internal surface of the entire circumference of the same ten linear foot section of piping that is externally inspected. Follow-up ultrasonic wall thickness measurements will be performed of areas identified as low points during the low frequency electromagnetic testing inspection."

During its review, the staff noted that GALL-SLR Report AMP XI.M29, "Outdoor and Large Atmospheric Metallic Storage Tanks," states that internal low-frequency electromagnetic testing (LFET) inspections can effectively detect loss of material on the external surfaces of tank shells, roofs, or bottoms when follow-up ultrasonic examinations are conducted in areas below nominal wall thickness. The staff reviewed this exception and finds it acceptable based on the following reasons: (a) inspecting a quadrant of large diameter (i.e., 96-inch to 132-inch) piping would provide similar insights when compared to inspecting the entire circumference of smaller diameter (e.g., 12-inch to 24-inch) piping, and (b) performing LFET (with follow-up ultrasonic wall-thickness measurements performed on low-thickness areas) around the entire circumference will provide further insights into whether loss of material due to general, pitting, crevice, or microbiologically influenced corrosion is progressing in an adverse manner for the subject piping.

Enhancement 1. SLRA Section B2.1.26 includes an enhancement to the "preventive actions" program element that relates to installing a cathodic protection system in accordance with NACE SP0169-2007, "Control of External Corrosion on Underground or Submerged Metallic Piping Systems," for buried carbon steel piping within the scope of the program. In addition, the staff noted that SLRA Table A6.0-1, "Subsequent License Renewal Commitments," specifies that the cathodic protection system for buried steel piping will be installed no later than 5 years prior to the subsequent period of extended operation. The staff reviewed this enhancement and finds it acceptable because providing cathodic protection for buried steel piping at least 5 years prior to the subsequent period of extended operation is consistent with GALL-SLR Report AMP XI.M41 recommendations.

Enhancement 2. SLRA Section B2.1.26 includes an enhancement to the "preventive actions" and "parameters monitored or inspected" program elements that relates to completing a modification to abandon the buried copper-alloy instrument air system piping within the scope of the program prior to subsequent period of extended operation. The staff's evaluation of the applicant's approach to abandon the subject piping is documented in Exception 1 above.

Enhancement 3. SLRA Section B2.1.26 includes an enhancement to the "preventive actions" program element that relates to performing annual cathodic protection system monitoring with a maximum grace period of two months. The staff reviewed this enhancement and finds it acceptable because performing cathodic protection system monitoring on an annual basis with a 1–2 month grace period is consistent with GALL-SLR Report AMP XI.M41 recommendations.

Enhancement 4. As amended by Supplement 2 dated November 11, 2021, SLRA Section B2.1.26 includes an enhancement to the "parameters monitored or inspected," "acceptance criteria," and "corrective actions" program elements that relates to (a) using an inspection method demonstrated to be capable of detecting cracking for buried SS piping, and (b) evaluating indications of cracking in accordance with applicable codes and plant-specific design criteria. The staff reviewed this enhancement and finds it acceptable because it is consistent with GALL-SLR Report AMP XI.M41 recommendations related to managing cracking of buried SS piping.

Enhancement 5. SLRA Section B2.1.26 includes an enhancement to the "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements that relates to performing additional inspections when wall thickness extrapolated to the end of the subsequent period of extended operation does not meet minimum wall-thickness requirements. The staff reviewed this enhancement and finds it acceptable because the extent and timing of additional inspections described in the enhancement are consistent with GALL-SLR Report AMP XI.M41 recommendations.

Enhancement 6. SLRA Section B2.1.26 includes an enhancement to the "detection of aging effects" program element that relates to (a) performing inspections of buried steel CCW system piping at least once every 10 years in accordance with GALL-SLR Report Table XI.M41-2, "Inspection of Buried and Underground Piping and Tanks," and (b) how inspections of the subject piping will be performed (i.e., visual inspection of an exterior quadrant, LFET on the internal surfaces with follow-up ultrasonic wall-thickness measurements performed on low-point areas). The staff reviewed this enhancement and finds it acceptable for the following reasons: (a) performing inspections of buried steel piping in accordance with the recommended inspections in GALL-SLR Report Table XI.M41-2 is consistent with GALL-SLR Report AMP XI.M41 recommendations, and (b) the staff's evaluation of the inspection methodology for the subject piping is documented in Exception 3 above.

Enhancement 7. As amended by Supplement 2 dated November 11, 2021, SLRA Section B2.1.26 includes an enhancement to the "detection of aging effects" program element that relates to performing visual inspections of at least two 10-linear-foot sections of buried SS piping at least once every 10 years. In its Supplement 2 dated November 11, 2021, the applicant clarified that all buried SS piping within the scope of SLR is externally coated. The staff reviewed this enhancement and finds it acceptable based on the following reasons: (a) buried SS piping is externally coated, consistent with GALL-SLR Report Table XI.M41-1, "Preventive Actions for Buried and Underground Piping and Tanks," and (b) the number of inspections for buried SS is consistent with GALL-SLR Report AMP XI.M41 recommendations.

Enhancement 8. SLRA Section B2.1.26 includes an enhancement to the "detection of aging effects" program element that relates to performing visual inspections of at least four 10-linear-foot sections of underground coated steel piping at least once every 10 years. The staff reviewed this enhancement and finds it acceptable because the extent of inspections for underground steel piping is consistent with GALL-SLR Report AMP XI.M41 recommendations.

Enhancement 9. SLRA Section B2.1.26 includes an enhancement to the "detection of aging effects" program element that specifies that internal volumetric inspections of the standby shutdown facility diesel engine fuel oil tank will cover at least 25 percent of the surface area of the tank and include at least some of both the top and bottom of the tank. During its review, the staff noted (a) that the subject tank cites both an underground and soil external environment and (b) there is an increased potential for degradation at air-to-soil interface locations for partially buried tanks. Prior to the issuance of an RAI (to clarify how inspections of the subject tank will account for the increased potential for degradation at interface locations), the applicant provided a supplement (ADAMS Accession No. ML21302A208) that added a plant-specific note to SLRA Table 3.3.2-56, "Auxiliary Systems - Standby Shutdown Facility Fuel Oil System - Aging Management Evaluation." The plant-specific note stated the following:

> The Underground (External) environment was included to account for the air space in the manhole that provides access to the tank manway. There is no air-to-soil interface as would be seen with a partially buried tank. The bottom, top

and sides of the external surface of the tank are exposed to soil except for the area of the tank within the manhole.

Based on the supplemental response that clarified that the tank is not partially buried (i.e., air space is only associated with the manway), the staff's concern associated with corrosion at interface locations is resolved. The staff reviewed this enhancement and finds it acceptable because the inspection methodology and inspection coverage for the subject tank is consistent with GALL-SLR Report AMP XI.M41 recommendations.

Enhancement 10. SLRA Section B2.1.26 includes an enhancement to the "acceptance criteria" program element that relates to the qualifications of personnel performing inspections of buried coated piping and tanks. The staff reviewed this enhancement and finds it acceptable because the qualifications of personnel determining if the type and extent of coating degradation is insignificant is consistent with GALL-SLR Report AMP XI.M41 recommendations.

Enhancement 11. SLRA Section B2.1.26 includes an enhancement to the "corrective actions" program element that relates to conducting an extent-of-condition evaluation to determine the extent of degraded backfill in the vicinity of the observed damage (if significant coating damage caused by nonconforming backfill is identified during visual inspections). The staff reviewed this enhancement and finds it acceptable because it is consistent with GALL-SLR Report AMP XI.M41 recommendations.

Based on a review of the SLRA (as amended), the staff finds that the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent with the corresponding program elements of GALL-SLR Report AMP XI.M41. The staff also reviewed the exceptions associated with the "preventive actions" and "detection of aging effects" program elements and their justifications and finds that the AMP, with the exceptions, is adequate to manage the applicable aging effects. In addition, the staff reviewed the enhancements associated with the "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements and finds that, when implemented, they will make the AMP adequate to manage the applicable aging effects.

OE. SLRA Section B2.1.26 summarizes OE related to the Buried and Underground Piping and Tanks program. The staff reviewed OE information in the application and during the audit. As discussed in the audit report, the staff reviewed the plant OE information the applicant provided for this program to (a) identify examples of age-related degradation, and (b) provide a basis for the staff's conclusions on the ability of the applicant's proposed AMPs to manage the effects of aging in the subsequent period of extended operation.

The staff did not identify any OE indicating that the applicant should modify its proposed program. Based on its audit and review of the application, the staff finds that the conditions and OE at the plant are bounded by those for which the Buried and Underground Piping and Tanks program was evaluated.

UFSAR Supplement. As amended by Supplement 2 dated November 11, 2021, SLRA Section A2.26 provides the UFSAR supplement for the Buried and Underground Piping and Tanks program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in GALL-SLR Report Table XI-01.

The staff also noted that the applicant committed to ongoing implementation of the existing Buried and Underground Piping and Tanks program for managing the effects of aging for applicable components during the subsequent period of extended operation. Furthermore, the staff noted that the applicant committed to the following: (a) implement program enhancements for SLR and begin inspections 10 years before the subsequent period of extended operation, (b) complete inspections required during the 10-year interval prior to the subsequent period of extended operation no later than 6 months prior to the subsequent period of extended operation, (c) install the cathodic protection system for buried steel piping no later than 5 years prior to the subsequent period of extended operation, and (d) abandon the buried copper-alloy instrument air system piping no later than 6 months prior to the subsequent period of extended operation. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. Based on its review of the applicant's Buried and Underground Piping and Tanks program, the staff concludes that those program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent. The staff also reviewed the exceptions and enhancements and finds that with the exceptions and the enhancements implemented, the AMP will be adequate to manage the applicable aging effects. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.17 Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks

SLRA Section B2.1.27 states that the Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks program is an new program that will be consistent with the program elements in the GALL-SLR Report AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks," as modified by SLR-ISG-2021-02-MECHANICAL, "Updated Aging Management Criteria for Mechanical Portions of the Subsequent License Renewal Guidance," except for the exceptions identified in the SLRA. The applicant amended this SLRA section by letter dated January 7, 2022 (ADAMS Accession No. ML22010A129), and by Supplement 4 dated June 7, 2022 (ADAMS Accession No. ML22158A028).

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL-SLR Report. The staff compared the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements of the SLRA to the corresponding program elements of GALL-SLR Report AMP XI.M42, as modified by SLR-ISG-2021-02-MECHANICAL.

For the "scope of program" and "detection of aging effects" program elements, the staff determined the need for additional information with respect to crediting alternative AMPs (i.e., Fire Water System, Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components, and Open-Cycle Cooling Water System) to manage the effects of aging for internally coated components, which resulted in the issuance of RAIs B2.1.27-1 and B2.1.27-1a (ADAMS Accession Nos. ML21271A590 and ML21327A277, respectively). The staff's evaluation of these RAIs is documented in SE Sections 3.3.2.1.7 and 3.4.2.1.4.

The staff also reviewed the portions of the "scope of program," "detection of aging effects," and "corrective actions" program elements associated with exceptions to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of these three exceptions follows.

Exception 1. SLRA Section B2.1.27 includes an exception to the "detection of aging effects" program element related to performing opportunistic inspections, in lieu of periodic inspections, of the cement lining of the buried Keowee fire detection/protection system piping. During its review, the staff noted that GALL-SLR Report AMP XI.M42, as modified by SLR-ISG-2021-02-MECHANICAL, states that opportunistic inspections, in lieu of periodic inspections, are an acceptable alternative for buried internally lined fire water system piping provided the following criteria are met: (a) flow tests and internal piping inspections will occur at intervals specified in NFPA 25, "Standard for the Inspection, Testing, and Maintenance of Water Based Fire Protection Systems," or as modified by GALL-SLR Report Table XI.M27-1, "Fire Water System Inspection and Testing Recommendations"; (b) through-wall flaws in the piping can be detected through continuous system pressure monitoring; and (c) plant-specific OE is acceptable. With respect to criterion (b) above, the applicant stated that system pressure monitoring is not an effective means of detecting through-wall flaws in Keowee fire detection/protection system piping. In lieu of conducting system pressure monitoring, the applicant provided the following justification:

> The Keowee fire detection/protection system pressure and normal system loads are supplied by the static head between Lake Keowee level and elevation of the fire suppression equipment. A flow switch is installed upstream of the buried cement lined ductile iron piping. This flow switch provides an auto-start signal to the pump if flow greater than ten gallons per minute is detected. Start of the fire protection pump is indicated in the control room such that any significant leak of buried system piping would be immediately detected. In a typical fire protection system, header pressure is maintained by a jockey pump. A leak in excess of jockey pump capacity would result in decreased header pressure which would provide indication of a leak. A typical jockey pump in nuclear station fire protection system has a capacity on the order of 50 gallons per minute. As such, the alternate leak detection method utilized for the Keowee fire detection/protection system is more sensitive than the recommended method.

The staff reviewed this exception and finds the applicant's approach to perform opportunistic inspections of the cement lining of the buried Keowee fire detection/protection system piping acceptable based on the following reasons: (a) flow testing and internal piping inspections of the Keowee fire detection/protection system will be performed consistent with the recommendations provided in GALL-SLR Report AMP XI.M42, as modified by SLR-ISG-2021-02-MECHANICAL, (b) continuous flow-rate monitoring and a high flow-rate alarm associated with the Keowee fire detection/protection system are effective means to detect potential through-wall flaws in the piping, and (c) there have been no leaks due to age-related degradation of internal linings used in buried in-scope fire water system components.

Exception 2. SLRA Section B2.1.27 includes an exception to the "corrective actions" program element related to not repairing or replacing the emergency feedwater pump turbine lubricating oil tank internal coating if degradation is identified. The staff reviewed this exception against the corresponding program element in GALL-SLR Report AMP XI.M42 and finds it acceptable for the following reasons: (a) as documented in the exception, industry practice for maintenance of internal coatings applied to turbine oil systems does not recommend recoating areas where degraded coatings are identified, and (b) degraded coatings will be removed, providing reasonable assurance that flow blockage will not occur due to further degradation of degraded coatings.

Exception 3. As amended by letter dated January 7, 2022, SLRA Section B2.1.27 includes an exception to the "scope of program" program element related to crediting the Open-Cycle Cooling Water System program to manage the internal coatings for the main condenser outlet waterbox, outlet waterbox tubesheet, and discharge piping. The staff's evaluation of the applicant's approach to credit an alternative AMP (i.e., Open-Cycle Cooling Water System) to manage the effects of aging for internally coated components is documented in SE Sections 3.3.2.1.5 and 3.4.2.1.3.

Based on a review of the SLRA (as amended) and the applicant's responses to RAIs B2.1.27-1 and B2.1.27-1a, the staff finds that the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent with the corresponding program elements of GALL-SLR Report AMP XI.M42, as modified by SLR-ISG-2021-02-MECHANICAL. The staff also reviewed the exceptions associated with the "scope of program," "detection of aging effects," and "corrective actions" program elements and their justifications and finds that the AMP, with the exceptions, is adequate to manage the applicable aging effects.

OE. SLRA Section B2.1.27 summarizes OE related to the Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks program. The staff reviewed OE information in the application and during the audit. As discussed in the audit report, the staff reviewed the plant OE information the applicant provided for this program to (a) identify examples of age-related degradation, and (b) provide a basis for the staff's conclusions on the ability of the applicant's proposed AMPs to manage the effects of aging in the subsequent period of extended operation.

The staff did not identify any OE indicating that the applicant should modify its proposed program. Based on its audit and review of the application, the staff finds that the conditions and OE at the plant are bounded by those for which the Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks program was evaluated.

UFSAR Supplement. SLRA Section A2.27 provides the UFSAR supplement for the Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in GALL-SLR Report Table XI-01. The staff also noted the applicant committed to the following: (a) implement the new Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks program no later than 10 years prior to the subsequent period of extended operation for managing the effects of aging for applicable components; and (b) perform baseline inspections that may be required in the 10-year period prior to the subsequent period of extended operation no later than 6 months prior to the subsequent period of extended operation, or no later than the last refueling outage prior to the subsequent period of extended operation. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. Based on its review of the applicant's Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks program, the staff concludes that those program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent. The staff also reviewed the exceptions, and finds that with the exceptions implemented, the AMP will be adequate to manage the applicable aging effects. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.18 ASME Section XI, Subsection IWE

SLRA Section B2.1.28 states that the ASME Section XI, Subsection IWE program is an existing program with enhancements that will be consistent with the program elements in the GALL-SLR Report AMP XI.S1, "ASME Section XI, Subsection IWE." The applicant amended this SLRA section by Supplement 3 dated December 15, 2021.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL-SLR Report. The staff compared the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements of the SLRA to the corresponding program elements of GALL-SLR Report AMP XI.S1.

The staff also reviewed the portions of the "preventive actions," "parameters monitored or inspected," and "detection of aging effects" program elements associated with enhancements to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of these three enhancements is as follows.

Enhancement 1. SLRA Section B2.1.28, as amended by Supplement 3 dated December 15, 2021, includes an enhancement to the "preventive actions" program element that relates to maintaining structural bolting integrity.

For the "preventive actions" program element, the staff determined the need for additional information, which resulted in the issuance of an RAI. RAI B2.1.28-1 and the applicant's response are documented in ADAMS Accession No. ML22045A021.

In its response, the applicant included a reference to the bolting and coating material selection guidance from Section 2 of the Research Council for Structural Connections (RCSC) publication "Specification for Structural Joints Using High-Strength Bolts" in the enhancement to Element 2 in the ASME Section XI, Subsection IWE program.

During its evaluation of the applicant's response to RAI B2.1.28-1, the staff noted that the applicant included the bolting and coating material selection in the enhancement to Element 2 in SLRA Section A2.28, and Table A6.0-1. The staff finds the applicant's response and changes to SLRA Section A2.28, and Appendix Table A6.0-1 acceptable because, when it is implemented, it will be consistent with the GALL-SLR Report recommendation to ensure proper selection of bolting and coating materials as discussed in Section 2 of the RCSC publication.

The staff reviewed this enhancement, as amended by SLRA Supplement 3 and the RAI B2.1.28-1 response, against the corresponding program element in GALL-SLR Report AMP XI.S1 and finds it acceptable because, when it is implemented, it will be consistent with the GALL-SLR Report recommendation to ensure proper selection of bolting and coating materials, appropriate installation torque or tension to prevent or minimize loss-of-bolting preload and cracking of high-strength bolting, and preventive actions for storage, use of lubricant and sealant, and bolting and coating material selection consistent with industry standards and guidelines.

Enhancement 2. SLRA Section B2.1.28 includes an enhancement to the “parameters monitored or inspected” program element that relates to including inspection attributes for the aging mechanisms for painted or coated surfaces and non-coated surfaces. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.S1 and finds it acceptable because, when it is implemented, it will be consistent with the GALL-SLR Report recommendation to include parameters to be monitored and inspected for painted or coated surfaces and noncoated surfaces.

Enhancement 3. SLRA Section B2.1.28 includes an enhancement to the “detection of aging effects” program element that relates to specifying a one-time volumetric examination of metal liner surfaces that are inaccessible from one side if triggered by plant-specific OE. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.S1 and finds it acceptable because, when it is implemented, it will be consistent with the GALL-SLR Report recommendation to include a one-time volumetric examination of metal liner surfaces that are inaccessible from one side if triggered by plant-specific OE.

Based on a review of the SLRA, amendments, and the applicant’s response to RAI B2.1.28-1, the staff finds that the “scope of program,” “monitoring and trending,” “acceptance criteria,” and “corrective actions” program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent with the corresponding program elements of GALL-SLR Report AMP XI.S1. In addition, the staff reviewed the enhancements associated with the “preventive actions,” “parameters monitored or inspected,” and “detection of aging effects” program elements and finds that, when implemented, they will make the AMP adequate to manage the applicable aging effects.

OE. SLRA Section B2.1.28 summarizes OE related to the ASME Section XI, Subsection IWE Program. The staff reviewed OE information in the application and during the audit. As discussed in the audit report, the staff reviewed the plant OE information the applicant provided for this program to (a) identify examples of age-related degradation, and (b) provide a basis for the staff’s conclusions on the ability of the applicant’s proposed AMPs to manage the effects of aging in the subsequent period of extended operation. The staff did not identify any OE indicating that the applicant should modify its proposed program. Based on its audit and review of the application and of the applicant’s responses to RAI B2.1.28, the staff finds that the conditions and OE at the plant are bounded by those for which the ASME Section XI, Subsection IWE Program was evaluated.

UFSAR Supplement. SLRA Section A2.28, as amended by Supplement 3 dated December 15, 2021, and the applicant’s responses to RAI B2.1.28-1, provides the UFSAR supplement for the ASME Section XI, Subsection IWE Program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in GALL-SLR Report Table XI-01. The staff noted that the applicant committed to ongoing implementation of the existing ASME Section XI, Subsection IWE program for managing the effects of aging for applicable components during the subsequent period of extended operation. The staff also noted that the applicant committed to implement AMP enhancements for SLR no later than 6 months prior to the subsequent period of extended operation. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. Based on its review of the applicant's ASME Section XI, Subsection IWE Program, the staff concludes that those program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent. The staff also reviewed the enhancements and finds that, with the enhancements when implemented, the AMP will be adequate to manage the applicable aging effects. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.19 ASME Section XI, Subsection IWL

SLRA Section B2.1.29 states that the ASME Section XI, Subsection IWL Program is an existing program with enhancements that will be consistent with the program elements in the GALL-SLR Report AMP XI.S2, "ASME Section XI, Subsection IWL," except for the exception identified in the SLRA.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL-SLR Report. The staff compared the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements of the SLRA to the corresponding program elements of GALL-SLR Report AMP XI.S2.

The staff also reviewed the portions of the "parameters monitored or inspected," "monitoring and trending," and "acceptance criteria" program elements associated with exceptions and enhancements to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of the exception and the two enhancements is as follows.

Exception. SLRA Section B2.1.29 includes an exception to the "acceptance criteria" program element related to developing predicted lower limit values for tendon prestress in accordance with RG 1.35.1. The SLRA notes that losses resulting from elastic shortening were computed for each tendon group and not individually, as prescribed in RG 1.35.1. The staff reviewed Section 3.2 of RG 1.35.1 and notes that the RG states that tendon groups *may* be divided into subgroups to account for differences due to instantaneous elastic shortening. The RG further explains that whatever the procedure, the intent is to track prestressing forces as precisely as possible; however, the RG does not state that individual losses due to elastic shortening must be computed for each tendon. The staff reviewed this exception against the corresponding program element in GALL-SLR Report AMP XI.S2 and finds it acceptable because the applicant uses an acceptable method for predicting the losses for each tendon group, and the method has been previously reviewed and approved by the staff in an SE dated September 15, 1997 (ADAMS Accession No. ML16161A269), and in NUREG-1723 (ADAMS Accession No. ML003695154), which documented the staff's SE for initial license renewal.

Enhancement 1. SLRA Section B2.1.29 includes an enhancement to the "parameters monitored or inspected" program element that relates to incorporating inspection guidance into the program for increases in porosity and permeability and patterned cracking with darkened edges. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.S2 and finds it acceptable because, when it is implemented, it will update the program's guidance to align with the GALL-SLR Report AMP for visual inspections related to increases in porosity and permeability and alkali-silica reaction (ASR) degradation (i.e., patterned cracking with darkened edges).

Enhancement 2. SLRA Section B2.1.29 includes an enhancement to the "monitoring and trending" program element that relates to documenting and comparing inspection results to previous results. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.S2 and finds it acceptable because, when it is implemented, it will align the program with the GALL-SLR Report recommendation and will ensure that inspection results are reviewed over multiple inspections to identify possible trends in the degradation.

Based on a review of the SLRA, the staff finds that the "scope of program," "preventive actions," "detection of aging effects," and "corrective actions" program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent with the corresponding program elements of GALL-SLR Report AMP XI.S2. The staff also reviewed the exception associated with the "acceptance criteria" program element and its justification and finds that the AMP, with the exception, is adequate to manage the applicable aging effects. In addition, the staff reviewed the enhancements associated with the "parameters monitored or inspected" and "monitoring and trending" program elements and finds that, when implemented, they will make the AMP adequate to manage the applicable aging effects.

OE. SLRA Section B2.1.29 summarizes OE related to the ASME Section XI, Subsection IWL Program. The staff reviewed OE information in the application and during the audit. As discussed in the Audit Report, the staff reviewed the plant OE information the applicant provided for this program to: (a) identify examples of age-related degradation, and (b) provide a basis for the staff's conclusions on the ability of the applicant's proposed AMPs to manage the effects of aging in the subsequent period of extended operation. The staff identified OE related to high concrete temperatures at the main steam penetrations in the reactor building, for which it determined the need for additional information, which resulted in the issuance of RAI 3.5.2.2.1.2-1. The applicant's response is documented in ADAMS Accession No. ML22045A021.

In its response, the applicant noted that Unit 1 had identified surface concrete temperatures at the main steam penetrations as high as 227 °F, and the recommended temperature limit for local areas is 200 °F per the ASME Code. To address this elevated temperature, nondestructive testing was performed on the impacted concrete. The results of the testing demonstrated that the concrete strength was not significantly impacted by the elevated temperatures. The applicant further noted that Units 2 and 3 have the same configuration as Unit 1, that all three Units were constructed using the same concrete specifications, and that Units 2 and 3 have not shown any visual signs of concrete degradation due to increased temperatures (e.g., surface scaling or cracking). Additionally, it was noted that Unit 1 has been operating the longest; therefore, the Unit 1 concrete has received the most thermal exposure.

During its evaluation of the applicant's response to RAI 3.5.2.2.1.2-1, the staff noted that the Unit 1 concrete has been operating the longest and has likely been exposed to higher temperatures for a longer period of time. Therefore, the conclusions of the Unit 1 non-destructive concrete testing at the main steam penetrations apply to the elevated concrete temperatures at the Units 2 and 3 main steam penetrations. The staff also noted that the Units 2 and 3 concrete was visually inspected for signs of degradation due to high temperatures. Based on its review, the staff finds the applicant's response acceptable because it explains that the elevated temperatures at Unit 1 did not impact the concrete and that the OE at Unit 1 bounds that at Units 2 and 3 because Unit 1 concrete has been exposed to the elevated temperatures for a longer time. Therefore, based on the temperature history and the visual inspection results, the staff concludes that Units 2 and 3 have not experienced reductions in concrete strength due to elevated temperatures. Based on its audit and review of the application and of the applicant's response to RAI 3.5.2.2.1.2-1, the staff finds that the conditions and OE at the plant are bounded by those for which the ASME Section XI, Subsection IWL program was evaluated.

UFSAR Supplement. SLRA Section A2.29 provides the UFSAR supplement for the ASME Section XI, Subsection IWL program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in GALL-SLR Report Table XI-01. The staff also noted that the applicant committed to ongoing implementation of the existing ASME Section XI, Subsection IWL program for managing the effects of aging for applicable components during the subsequent period of extended operation. The staff also noted that the applicant committed to implement the enhancements no later than 6 months prior to the subsequent period of extended operation. The staff finds that the information in the FSAR supplement is an adequate summary description of the program.

Conclusion. Based on its review of the applicant's ASME Section XI, Subsection IWL Program, the staff concludes that those program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent. The staff also reviewed the exception and the enhancements and finds that, with the exception and the enhancements when implemented, the AMP will be adequate to manage the applicable aging effects. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.20 ASME Section XI, Subsection IWF

SLRA Section B2.1.30 states that the ASME Section XI, Subsection IWF AMP is an existing program with enhancements that will be consistent with the program elements in the GALL-SLR Report AMP XI.S3, "ASME Section XI, Subsection IWF." The applicant amended this SLRA section by Supplement 2 dated November 11, 2021; by Supplement 3 dated December 15, 2021; and by letter dated February 14, 2022 (ADAMS Accession Nos. ML2315A012, ML21349A005, and ML22045A019, respectively).

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL-SLR Report. The staff compared the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements of the SLRA to the corresponding program elements of GALL-SLR Report AMP XI.S3.

During review of the SLRA, as amended by Supplement 3 dated December 15, 2021, and by letter dated December 17, 2021, and as confirmed by RCI B2.1.30-A, the staff noted that ONS Units 1, 2, and 3 do not have class metallic containment (MC) component supports and that component supports in the scope of the ASME Section XI, Subsection IWF AMP do not have vibration isolation elements; therefore, these components are not applicable to the scope of the ONS ASME Section XI, Subsection IWF AMP.

For the “detection of aging effects” program element, the staff determined the need for additional information, which resulted in the issuance of an RAI. RAI B2.1.30-1 and the applicant’s response are documented in ADAMS Accession No. ML22045A021.

In its response, the applicant clarified that existing nuclear chemical control procedural guidance, approval process, requirements, and limitations for materials to be used in contact with safety-related plant SSCs restrict the use of MoS_2 as a bolting thread lubricant; as such, a product containing MoS_2, which is a potential contributor to SCC, is not and would not be approved for use as a bolting lubricant at the plant. The applicant also revised the SLRA to include an enhancement to explicitly document the prohibition of the use of bolting thread lubricants containing MoS_2 and other lubricants containing sulfur in the fleet work planning procedures.

During its evaluation of the applicant’s response to RAI B2.1.30-1, the staff noted that ASTM A490 bolting used for the reactor vessel support and the replacement steam generator supports are the only high-strength bolting greater than 1 inch in diameter used at ONS, and these bolts are not located in areas prone to high moisture or aqueous environments that cause SCC. The staff also noted that plant-specific OE has not identified SCC for structural high-strength bolting at ONS. The staff finds the applicant’s response and changes to the SLRA acceptable because the plant OE, existing procedural guidance, environment, and enhancement (evaluated below as Enhancement 7) to explicitly document prohibition of use of bolting containing MoS_2 provide preventive actions consistent with the GALL-SLR Report recommendations to minimize susceptibility of high-strength bolting to SCC.

The staff also reviewed the portions of the “scope of program,” “preventive actions,” “detection of aging effects,” and “monitoring and trending” program elements associated with enhancements to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff’s evaluation of the seven enhancements is as follows.

Enhancement 1. SLRA Section B2.1.30, as amended by Supplement 3 dated December 15, 2021, includes an amended enhancement to the “scope of program” program element that relates to periodic evaluation of the acceptability of inaccessible areas of supports (examples included portions of supports encased in concrete or grout or covered by insulation) based on conditions found in accessible areas. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.S3 and finds it acceptable because, when it is implemented, the program will evaluate, every 10 years during the subsequent period of extended operation, the acceptability of inaccessible areas of supports when conditions in accessible areas indicate the presence of, or result in, degradation to such inaccessible areas; this is consistent with the recommendation in the GALL-SLR AMP XI.S3 for aging management of inaccessible areas of supports, which also included portions encased in grout or covered by insulation.

Enhancement 2. SLRA Section B2.1.30, as amended by Supplement 3 dated December 15, 2021, includes an enhancement to the “preventive actions” program element that relates to specifying, for structural bolting consisting of ASTM A325, ASTM A490, and their twist-off equivalent (ASTM F1852, F2280) structural bolting, the preventative actions for storage, lubricants, and SCC potential discussed in Section 2 of the RCSC publication “Specification for Structural Joints Using ASTM A325 or A490 Bolts.” The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.S3 and finds it acceptable because, when it is implemented, it will provide the preventive measures for the stated structural bolting consistent with the industry standard recommended in the GALL-SLR AMP XI.S3.

Enhancement 3. SLRA Section B2.1.30 includes an enhancement to the “preventive actions” program element that relates to specifying bolting material, installation torque or tension, and use of lubricants and sealants for replacement bolting in accordance with industry standards EPRI NP-5769, EPRI TR-104213, and NUREG-1339. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.S3 and finds it acceptable because, when it is implemented, the program will include actions for proper selection of bolting material and lubricants and appropriate installation torque consistent with industry standards recommended in the GALL-SLR AMP XI.S3.

Enhancement 4. SLRA Section B2.1.30 includes an enhancement to the “detection of aging effects” program element that relates to a one-time inspection of an additional 5 percent sample of the code sample populations for Class 1, 2, and 3 supports. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.S3 and finds it acceptable because, when it is implemented, it will provide inspections of an additional sample of component supports not previously inspected by the program to ensure that the routinely inspected sample represents the aging of the remaining population of supports, consistent with recommendations in GALL-SLR Report XI.S3.

Enhancement 5. SLRA Section B2.1.30, as amended by Supplement 2 dated November 11, 2021, and the response to RAI B2.1.30-1 evaluated previously, includes an enhancement to the “detection of aging effects” program element that relates to performing volumetric examinations comparable to Table IWB-2500-1 (Examination Category B-G-1) to detect cracking due to SCC in high-strength bolting greater than 1 inch in diameter for nuclear steam supply system (NSSS) component supports. The amended enhancement also states that volumetric examinations will be performed on a 10-year interval during the subsequent period of extended operation on a sample that will consist of 20 percent or a maximum of 17 high-strength bolts in each unit that are most susceptible to age-related degradation. The applicant justified this sample size as appropriate because design, operation, and environmental conditions between the units are similar enough such that aging effects are not occurring differently. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.S3 and finds it acceptable because, when it is implemented, it will ensure that a representative sample of susceptible high-strength bolting is volumetrically examined for cracking due to SCC once in every 10-year interval during the subsequent period of extended operation. Further, sampling from NSSS component supports is representative because, as indicated in the SLRA as amended and the response to RAI B2.1.30-1, the only high-strength bolting greater than 1 inch in diameter in the scope of the IWF AMP are located on NSSS component supports, specifically the reactor vessel support and replacement steam generator supports. As confirmed by RCI B2.1.30-B by letter dated December 17, 2021, plant-specific OE to-date has not identified cracking due to SCC for such high-strength structural bolting greater than 1 inch in diameter at ONS and, based on the response to RAI B2.1.30-1, restriction or prohibition of the use of MoS2 lubricant and lack of an aqueous environment around the high-strength bolting minimizes susceptibility to SCC. Therefore, the proposed volumetric examination method, sample size, and inspection frequency are reasonable, consistent with recommendations in the GALL-SLR Report for three-unit plants based on similarity of material and environment between units, and provide reasonable assurance that SCC is not occurring for the entire population of susceptible high-strength bolts during the subsequent period of extended operation.

Enhancement 6. SLRA Section B2.1.30 includes an enhancement to the "monitoring and trending" program element that relates to increasing or modifying the component support inservice inspection sample of Class 1, 2, and 3 piping and component supports when a component within the inspection sample is repaired to as-new condition. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.S3 and finds it acceptable because, when it is implemented, it will ensure that the program inspects a sample that represents the aging effects of the remaining population of supports, consistent with recommendations in GALL-SLR Report XI.S3.

Enhancement 7. SLRA Section B2.1.30, as amended by response to RAI B2.1.30-1 by letter dated February 14, 2022, includes an enhancement to the "preventive actions" program element that specifically clarifies the prohibition of the use of products containing MoS_2 and other lubricants containing sulfur that could contribute to SCC as bolting thread lubricants. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.S3 and finds it acceptable because, when it is implemented, it ensures with explicit clarity that molybdenum disulfide and other lubricants containing sulfur are not used on high-strength bolting, consistent with recommendations in GALL-SLR Report AMP XI.S3.

Based on a review of the SLRA, enhancements and the applicant's responses to RCIs B2.1.30-A and B2.1.30-B and RAI B2.1.30-1, the staff finds that the "parameters monitored or inspected," "acceptance criteria," and "corrective actions" program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent with the corresponding program elements of GALL-SLR Report AMP XI.S3, as applicable to ONS. In addition, the staff reviewed the enhancements associated with the "scope of program," "preventive actions," "detection of aging effects," and "monitoring and trending" program elements and finds that, when implemented, they will make the AMP adequate to manage the applicable aging effects.

<u>OE</u>. SLRA Section B2.1.30, as amended by Supplement 3 dated December 15, 2021, summarizes OE related to the ASME XI, Subsection IWF AMP. The staff reviewed OE information in the application and during the audit. As discussed in the audit report, the staff reviewed the plant OE information the applicant provided for this program to (a) identify examples of age-related degradation, and (b) provide a basis for the staff's conclusions on the ability of the applicant's proposed AMPs to manage the effects of aging in the subsequent period of extended operation. The staff did not identify any OE indicating that the applicant should modify its proposed program.

Based on its audit and review of the application as amended, the staff finds that the conditions and OE at the plant are bounded by those for which the ASME XI, Subsection IWF AMP was evaluated.

<u>UFSAR Supplement</u>. SLRA Section A2.30, as amended by Supplement 2 dated November 11, 2021, and the response to RAI B2.1.30-1 dated February 14, 2021, provides the UFSAR supplement for the ASME Section XI, Subsection IWF AMP. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in GALL-SLR Report Table XI-01. The staff also noted that the applicant committed to ongoing implementation of the existing ASME XI, Subsection IWF AMP for managing the effects of aging for applicable components during the subsequent period of extended operation. The staff further noted that the applicant committed to implement the enhancements no later than 6 months or the last refueling outage prior to the subsequent period of extended operation and complete the one-time inspections within the 5-year period

immediately prior to entering the subsequent period of extended operation. The staff finds that the information in the FSAR supplement is an adequate summary description of the program.

Conclusion. Based on its review of the applicant's ASME Section XI, Subsection IWF AMP, the staff concludes that those program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent, as applicable to ONS. The staff also reviewed the enhancements, and finds that, with the enhancements when implemented, the AMP will be adequate to manage the applicable aging effects. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.21 Masonry Walls

SLRA Section B2.1.32 states that the Masonry Walls program is an existing program with enhancements that will be consistent with the program elements in the GALL-SLR Report AMP XI.S5, "Masonry Walls." The applicant amended this SLRA section by Supplement 3 dated December 15, 2021.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL-SLR Report. The staff compared the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements of the SLRA to the corresponding program elements of GALL-SLR Report AMP XI.S5.

For the "detection of aging effects" program element, the staff determined the need for additional information, which resulted in the issuance of an RAI. RAI B2.1.33-4 and the applicant's response are documented in ADAMS Accession No. ML22045A021.

In its response, the applicant added an enhancement to the Structures Monitoring program (Commitment 33 in SLRA Table A6.0-1) that opportunistic engineering inspections should be performed on structural elements covered by metal siding when portions are exposed for any reason (e.g., maintenance activities, modification, etc.), and stated that this enhancement is applicable to the Masonry Walls program. The applicant also revised SLRA Section A2.32, "Masonry Walls," to include descriptions of the programmatic actions associated with monitoring of inaccessible areas covered by metal siding.

During its evaluation of the applicant's response to RAI B2.1.33-4, the staff noted that the applicant added a new enhancement to the Structures Monitoring program that is also applicable to the Masonry Walls program and revised the applicable UFSAR supplements. The staff finds the applicant's response and changes to the SLRA Sections B2.1.32, A2.32, and Table A6.0-1 acceptable because the changes and enhancement to the programs will ensure that inaccessible areas of masonry walls covered by metal siding will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the subsequent period of extended operation.

The staff also reviewed the portions of the "parameters monitored or inspected" and "detection of aging effects" program elements associated with enhancements to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of these two enhancements follows.

Enhancement 1. SLRA Section B2.1.32 includes an enhancement to the "parameters monitored or inspected" program element that relates to identifying potential shrinkage and/or separation of masonry walls and monitoring loss of material in addition to the currently managed cracking at joints. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.S5 and finds it acceptable because, when it is implemented, it will it be consistent with the GALL-SLR Report recommendation to monitor and inspect potential shrinkage and/or separation of masonry walls and loss of material at joints that could impact the intended function or potentially invalidate its evaluation basis.

Enhancement 2. SLRA Section B2.1.32, as amended by Supplement 3 dated December 15, 2021, includes an enhancement to the "detection of aging effects" program element that relates to performing periodic and opportunistic visual inspections of a representative sample of exterior masonry walls that are covered by metal siding on a 5-year inspection frequency. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.S5 and finds it acceptable because, when it is implemented, it will be consistent with the GALL-SLR Report recommendation to ensure that inaccessible areas of masonry walls covered by metal siding will be adequately managed so that the intended function(s) will be maintained.

Based on a review of the SLRA, supplements to the SLRA, and the applicant's response to RAI B2.1.33-4, the staff finds that the "scope of program," "preventive actions," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent with the corresponding program elements of GALL-SLR Report AMP XI.X5. In addition, the staff reviewed the enhancements associated with the "parameters monitored or inspected" and "detection of aging effects" program elements and finds that, when implemented, they will make the AMP adequate to manage the applicable aging effects.

OE. SLRA Section B2.1.32 summarizes OE related to the Masonry Walls program. The staff reviewed OE information in the application and during the audit. As discussed in the Audit Report, the staff reviewed the plant OE information the applicant provided for this program to (a) identify examples of age-related degradation, and (b) provide a basis for the staff's conclusions on the ability of the applicant's proposed AMPs to manage the effects of aging in the subsequent period of extended operation. The staff did not identify any OE indicating that the applicant should modify its proposed program. Based on its audit and review of the application, and review of the applicant's response to RAI B2.1.33-4, the staff finds that the conditions and OE at the plant are bounded by those for which the Masonry Walls program was evaluated.

UFSAR Supplement. SLRA Section A2.32 provides the UFSAR supplement for the Masonry Walls program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in GALL-SLR Report Table XI-01. The staff noted that the applicant committed to ongoing implementation of the existing Masonry Walls program for managing the effects of aging for applicable components during the subsequent period of extended operation. The staff also noted that the applicant committed to implementing the AMP enhancements by no later than 6 months prior to the subsequent period of extended operation. The staff finds that the information in the UFSAR supplement, as amended by the RAI B2.1.33-4 response, is an adequate summary description of the program.

Conclusion. Based on its review of the applicant's the Masonry Walls program, the staff concludes that those program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent. The staff also reviewed the enhancements and finds that, with the enhancements when implemented, the AMP will be adequate to manage the applicable aging effects. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.22 Structures Monitoring

SLRA Section B2.1.33 states that the Structures Monitoring program is an existing program with enhancements that will be consistent with the program elements in the GALL-SLR Report AMP XI.S6, "Structures Monitoring," except for the exception identified in the SLRA. The applicant amended this SLRA section by Supplement 3 dated December 15, 2021; by letter dated February 14, 2022; and by Supplement 4 dated June 7, 2022.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL-SLR Report. The staff compared the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements of the SLRA to the corresponding program elements of GALL-SLR Report AMP XI.S6.

For the "scope of program" and "parameters monitored or inspected" program elements, the staff determined the need for additional information, which resulted in the issuance of an RAI. RAI B2.1.33-1 and the applicant's response are documented in ADAMS Accession No. ML22045A021.

In its response, the applicant stated that not all components identified in SLRA Section 2.4.8 are specifically addressed in the existing procedure of the Structures Monitoring program but are considered bounded by the categories already identified in the procedure. Therefore, the applicant revised Enhancement 2 to the Structures Monitoring program to ensure that the components listed in SLRA Section 2.4.8 are explicitly included in the scope of the program. The applicant also stated that that the fire barriers and penetration seals are managed by the Fire Protection program, and the SS fuel transfer tube is managed by the One-Time Inspection program. For the steel bracing and edge supports components associated with the masonry walls, the applicant stated that steel structures in the procedure include these components, and they are inspected by the Structures Monitoring program for twisting, loose bolts, and loss of material due to corrosion. However, deflection and distortion were not addressed in the current procedures, as recommended by GALL-SLR Report AMP XI.S6. Therefore, the applicant revised SLRA Section B2.1.33 to include a new enhancement (Enhancement 24) for the Structures Monitoring program to ensure that the steel components associated with the masonry walls are inspected for deflection or distortion, loose bolts, and loss of material due to corrosion.

As discussed above, during its evaluation of the applicant's response to RAI B2.1.33-1, the staff noted that the applicant revised the SLRA by revising an existing enhancement and adding a new one to specifically address the issues identified in the RAI. The staff finds the applicant's response and changes to SLRA Sections B2.1.33 and A2.33 and Table A6.0-1 acceptable because, when implemented, the program will be consistent with the GALL-SLR Report recommendations to (a) ensure that the program includes all SC in the scope of the SLR that are not covered by other structural AMPs, and (b) ensure that steel bracing and edge supports associated with masonry walls are inspected for deflection or distortion, loose bolts, and loss of material due to corrosion.

For the “detection of aging effects” program element, the staff determined the need for additional information, which resulted in the issuance of an RAI. RAI B2.1.33-2 and the applicant’s responses are documented in ADAMS Accession No. ML22045A021.

In its response, the applicant stated that ONS intends to monitor all SC on an interval not to exceed 5 years. Therefore, the applicant revised the SLRA to add a new enhancement to the Structures Monitoring program that will ensure that current statements allowing for extending the inspection frequency to a 10-year interval are removed from existing procedures. The applicant also revised the SLRA to add an enhancement that will ensure that the existing procedure allows for more frequent inspections based on the evaluation of observed degradation.

During its evaluation of the applicant’s response to RAI B2.1.33-2, the staff noted that the applicant added two new enhancements (Enhancements 20 and 21) to address the issues identified in the RAI. The staff finds the applicant’s response and changes to the SLRA Sections B2.1.33 and A2.33 and Table A6.0-1 acceptable because, when implemented, the program will be consistent with the GALL-SLR Report recommendation to ensure that (a) all structures will be monitored on an interval not to exceed 5 years, and (b) it includes a provision for more frequent inspections based on an evaluation of observed degradation.

For the “detection of aging effects” program element, the staff determined the need for additional information, which resulted in the issuance of an RAI. RAI B2.1.33-3 and the applicant’s response are documented in ADAMS Accession No. ML22045A021.

In its response, the applicant revised the SLRA to include a new enhancement to the Structures Monitoring program to ensure that evaluation of inspection results does consider the acceptability of inaccessible areas when conditions exist in accessible areas that could indicate the presence of, or result in, degradation to such inaccessible areas.

During its evaluation of the applicant’s response to RAI B2.1.33-3, the staff noted that the applicant added a new enhancement (Enhancement 22) to the Structures Monitoring program to address the issue identified in the RAI. The staff finds the applicant’s response and changes to the SLRA Sections B2.1.33 and A2.33 and Table A6.0-1 acceptable because, when implemented, the program will be consistent with the GALL-SLR Report recommendation to ensure that the inspection program properly evaluates the acceptability of inaccessible areas when conditions exist in accessible areas that could indicate the presence of, or result in, degradation to such inaccessible areas.

For the “acceptance criteria” program element, the staff determined the need for additional information, which resulted in the issuance of an RAI. RAI B2.1.33-4 and the applicant’s responses are documented in ADAMS Accession No. ML22045A021.

In its response, the applicant revised the SLRA to include a new enhancement to the Structures Monitoring program to ensure that opportunistic engineering inspections are performed on structural elements covered by metal siding when exposed for any reason. The applicant also revised SLRA Sections A2.32, “Masonry Walls,” and A2.33, “Structures Monitoring,” to ensure that the UFSAR description for the programs includes the actions associated with the monitoring of inaccessible areas covered by metal siding. In its response, the applicant further stated that plant-specific OE revealed that no examples of inspections of accessible concrete areas have indicated the presence of, or resulted in, degradation to above-grade inaccessible structural elements.

During its evaluation of the applicant's response to RAI B2.1.33-4, the staff noted that the applicant included a new enhancement to the Structures Monitoring program and the Masonry Walls program, revised the applicable UFSAR supplements, and discussed plant-specific OE associated with the inaccessible areas to address the issues identified in the RAI. The staff finds the applicant's response and changes to the SLRA Sections B2.1.32, B2.1.33, A2.32, and A2.33 and Table A6.0-1 acceptable because, when implemented, the programs will ensure that inaccessible areas covered by metal siding are adequately managed so that the intended function(s) will be maintained consistent with the CLB for the subsequent period of extended operation.

For the "detection of aging effects" program element, the staff determined the need for additional information, which resulted in the issuance of an RAI. RAI B2.1.33-5 and the applicant's response are documented in ADAMS Accession No. ML22045A021.

In its response, the applicant revised SLRA Table 3.5.2-1 to add a new AMR line item addressing the aging effect of loss of adhesion for the fiber reinforced polymer (FRP). This aging effect is associated with the adhesion pull-off testing performed under the Structures Monitoring program. The applicant also revised SLRA Section B2.1.33 to clarify that the program includes an exception to the GALL-SLR Report and revised the UFSAR supplement in Section A2.33 to include the plant-specific activities associated with the aging management of the FRP used in portions of the masonry walls. The applicant further stated that the Structures Monitoring program will continue to use the same inspection parameters, inspection criteria, and methods described in the license amendment request that the staff authorized on June 27, 2011 (ADAMS Accession No. ML11164A257).

During its evaluation of the applicant's response to RAI B2.1.33-5, the staff noted that the applicant revised the SLRA to address the issues identified in the RAI and clarified that the program will continue to use the same inspection parameters, inspection criteria, and methods described in the prior NRC-approved license amendment request. The staff finds the applicant's response and changes to SLRA Sections B2.1.33 and A2.33 and Table 3.5.2-1 acceptable because, when implemented, they will ensure that the aging effects of FRP components are adequately managed by the Structures Monitoring program so that the intended functions will be maintained consistent with the CLB for the subsequent period of extended operation.

The staff also reviewed the portions of the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," and "acceptance criteria" program elements associated with the exception and enhancements to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of this 1 exception and the 25 enhancements follow.

Exception. SLRA Section B2.1.33, as amended by Supplement 3 dated December 15, 2021, includes an exception to the "detection of aging effects" program element related to the inspection and testing frequency of the FRP used in portions of the masonry walls. These inspections and testing are performed on a 6-year inspection frequency instead of a 5-year inspection frequency as recommended by the GALL-SLR Report. The staff reviewed this exception against the corresponding program element in GALL-SLR Report AMP XI.S6 and finds it acceptable because (a) plant-specific OE from inspections and testing results of the FRP continues to observe no degradation, (b) the FRP is considered a relatively new structural component that is expected to remain exposed to a non-hostile environment as it is shielded from sunlight and other adverse weather conditions by the metal siding that covers it, and (c) visual inspections will continue to be supplemented by adhesion pull-off testing of the control panels during the subsequent period of extended operation.

Enhancement 1. SLRA Section B2.1.33, as amended by Supplement 3 dated December 15, 2021, and by Supplement 4 dated June 7, 2022, includes an enhancement to the "scope of program" program element that relates to adding the site assembly siren equipment house, technical support building cable vault, 100-kilovolt (kv) structures, protected service water building and duct banks, borated water storage tank superstructure, health physics office building, administration building, and the Keowee breaker vault to the scope of the program. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.S6 and finds it acceptable because, when it is implemented, it will be consistent with the GALL-SLR Report recommendation to include all structures in the scope of SLR that are not covered by other structural AMPs to ensure that they are being adequately managed for the subsequent period of extended operation.

Enhancement 2. SLRA Section B2.1.33, as amended by letter dated February 14, 2022, and by Supplement 4 dated June 7, 2022, includes an enhancement to the "scope of program" program element that relates to revising the existing procedure to specify additional structural components that will be inspected by the Structures Monitoring program (as listed in SLRA Section B2.1.33, as amended by Supplement 4 dated June 7, 2022). In its response to RAI B2.1.33-1, the applicant revised this enhancement to ensure that it includes all applicable components identified in the SLRA Section 2.4.8 as within the scope of the program. The staff reviewed this enhancement, as revised by the RAI response, against the corresponding program element in GALL-SLR Report AMP XI.S6 and finds it acceptable because, when it is implemented, it will be consistent with the GALL-SLR Report recommendation to include all structural components in the scope of SLR that are not covered by other structural AMPs, or components for which the Structures Monitoring program is credited (i.e., polymeric plexiglass covers), to ensure that they are being adequately managed for the subsequent period of extended operation.

Enhancement 3. SLRA Section B2.1.33, as amended by Supplement 3 dated December 15, 2021, includes an enhancement to the "scope of program," "parameters monitored or inspected," and "detection of aging effects" program elements that relates to expanding the scope of raw water and groundwater chemistry to include evaluation for pH, chlorides, and sulfates. The enhancement also relates to the monitoring of sampling locations that are representative, on a frequency not to exceed 5 years, in a manner that accounts for seasonal variations. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.S6 and finds it acceptable because, when it is implemented, it will be consistent with the GALL-SLR Report recommendation to ensure that (a) the program includes periodic sampling and testing of groundwater to assess the impact from any changes in pH, chlorides, and sulfates on below-grade concrete structures, and (b) groundwater is sampled from a location that represents the groundwater in contact with structures within the scope of SLR on an interval not to exceed 5 years as long as the evaluation accounts for seasonal variations.

Enhancement 4. SLRA Section B2.1.33, as amended by letter dated February 14, 2022, includes an enhancement to the “preventive actions” program element that relates to revising existing procedures to ensure that sufficient guidance, in accordance with applicable industry specifications, is provided for bolting storage and lubricants selection to minimize the potential for SCC in high-strength bolts. In its response to RAI B2.1.28-1, the applicant revised this enhancement to ensure that guidance for proper selection of bolting and coating materials is also included in the procedures. The staff reviewed this enhancement, as revised by the RAI response, against the corresponding program element in GALL-SLR Report AMP XI.S6 and finds it acceptable because, when it is implemented, it will be consistent with the GALL-SLR Report recommendations for ensuring that preventive actions are in place, in accordance with applicable industry guidelines and specifications, for storage, lubricant selection, and bolting and coating material selection to ensure that structural bolting integrity is maintained.

Enhancement 5. SLRA Section B2.1.33 includes an enhancement to the “preventive actions” program element that relates to revising existing procedures to ensure that guidance for bolting material selection, installation torque or tension, and the use of lubricants and sealants is in accordance with the guidelines of EPRI NP-5769 and TR-104213 and additional recommendations from NUREG-1339. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.S6 and finds it acceptable because, when it is implemented, it will be consistent with the GALL-SLR Report recommendations for ensuring that preventive actions are in place, in accordance with applicable industry guidelines, to ensure that structural bolting integrity is maintained.

Enhancement 6. SLRA Section B2.1.33 includes an enhancement to the “preventive actions” program element that relates to revising existing procedures to ensure that guidance is provided for proper specification of new high-strength bolting material and lubricants in accordance with the guidelines of EPRI NP-5769 and TR-104213 and additional recommendations from NUREG-1339. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.S6 and finds it acceptable because, when it is implemented, it will be consistent with the GALL-SLR Report recommendations for ensuring that preventive actions are in place, in accordance with applicable industry guidelines and specifications, to ensure that structural bolting integrity is maintained.

Enhancement 7. SLRA Section B2.1.33 includes an enhancement to the “parameters monitored or inspected” program element that relates to revising existing procedures to include details regarding the inspection and evaluation of steel liners. The staff noted that SLRA Table 3.5.2-1 includes some of the aging effects associated with liners in-scope of the Structures Monitoring program. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.S6 and finds it acceptable because, when it is implemented, it will be consistent with the GALL-SLR Report recommendations for ensuring that parameters associated with the liners will be monitored or inspected by the program.

Enhancement 8. SLRA Section B2.1.33 includes an enhancement to the “parameters monitored or inspected” and “acceptance criteria” program elements that relates to revising existing procedures to include quantitative acceptance criteria based on the second-tier criteria in American Concrete Institute (ACI) 349.3R for the inspection and evaluation of structural concrete components. The enhancement also adds the following parameters to the scope of the monitoring program: changes in material properties, increase in porosity and permeability, loss of strength, and pattern cracking with darkened edges. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.S6 and finds it acceptable because, when it is implemented, it will be consistent with the GALL-SLR

Report recommendations for ensuring (1) that parameters monitored or inspected are commensurate with industry codes, standards, and guidelines and (2) the acceptance criteria are derived from applicable codes and standards like ACI 349.3R.

Enhancement 9. SLRA Section B2.1.33, as amended by Supplement 3 dated December 15, 2021, includes an enhancement to the “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” and “corrective actions” program elements that relate to developing a new implementing procedure or revising an existing procedure to address the aging management of (below-grade) inaccessible areas when found to be potentially exposed to an aggressive groundwater or soil environment. The staff noted that this enhancement implements plant-specific actions to evaluate the condition of below-grade structures when aggressive groundwater or soil is identified and to perform focused inspections of either a representative, accessible (leading indicator) structural element or by excavating and inspecting the affected structural element once the condition is identified. The enhancement also relates to ensuring that degraded conditions exceeding the second-tier criteria of ACI 349.3R for concrete structures will be addressed through the “corrective actions” program. Because this is a plant-specific enhancement, the staff reviewed this enhancement against the corresponding program elements in SRP-SLR Section A.1.2.3 and finds it acceptable because, when it is implemented, it will ensure that plant-specific actions are in place when an aggressive groundwater or soil environment is identified so that the extent of degradation can be detected and evaluated and corrective actions taken before a loss of intended function.

Enhancement 10. SLRA Section B2.1.33 includes an enhancement to the “parameters monitored or inspected,” “detection of aging effects,” and “monitoring and trending” program elements that relates to revising existing procedure to monitor and trend through-wall groundwater leakage and the infiltration volume and water chemistry for signs of concrete or steel reinforcement degradation (when leakage volumes allow). It also adds the development of additional engineering evaluations, more frequent inspections, and destructive testing of the affected concrete to validate existing concrete properties and leakage results. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.S6 and finds it acceptable because, when it is implemented, it will be consistent with the GALL-SLR Report recommendations for ensuring that leakage volumes and chemistry are monitored and trended for signs of degradation, and more frequent inspections or destructive testing of affected concrete are performed to validate existing concrete properties to ensure that their intended function is maintained.

Enhancement 11. SLRA Section B2.1.33 includes an enhancement to the “parameters monitored or inspected” and “acceptance criteria” program elements that relate to revising existing procedure to monitor accessible sliding surfaces for indications of significant loss of material and accumulation of debris or dirt. The enhancement also establishes the acceptance criteria as no significant loss of material due to wear or corrosion and no debris or dirt that could restrict or prevent sliding of the surfaces. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.S6 and finds it acceptable because, when it is implemented, it will be consistent with the GALL-SLR Report recommendations for (a) ensuring that sliding surfaces are monitored for indications of excessive loss of material and the presence of debris or dirt, and (b) establishing an acceptance criteria that ensures that the need for corrective actions is identified before there is a loss of intended function.

Enhancement 12. SLRA Section B2.1.33, as amended by Supplement 3 dated December 15, 2021, includes an enhancement to the “parameters monitored or inspected,” "detection of aging effects," and "acceptance criteria" program elements that relates to revising existing procedures to monitor elastomeric vibration isolators, bearing pads, structural sealants, and seismic joint fillers for indications of crack, loss of material, and hardening. The enhancement also supplements the visual inspection of elastomeric elements with tactile inspection to detect hardening and provides for the applicable acceptance criteria. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.S6 and finds it acceptable because, when it is implemented, it will be consistent with the GALL-SLR Report recommendations for (a) ensuring that elastomeric vibration isolators, structural sealants, and seismic joint fillers are monitored for cracking, loss of material, and hardening; (b) ensuring that visual inspection of elastomeric elements is supplemented by tactile inspection; and (c) ensuring that corrective action is taken before the observed conditions result in a loss of sealing.

Enhancement 13. SLRA Section B2.1.33 includes an enhancement to the "detection of aging effects" program element that relates to revising existing procedure to require that personnel performing inspections and evaluations meet the qualifications requirements in ACI 349.3R with respect to knowledge of inservice inspection of concrete and visual acuity requirements. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.S6 and finds it acceptable because, when it is implemented, it will be consistent with the GALL-SLR Report recommendations for ensuring that inspector qualifications be consistent with industry guidelines and standards and guidelines for implementing the requirements of 10 CFR 50.65.

Enhancement 14. SLRA Section B2.1.33 includes an enhancement to the "detection of aging effects," and "monitoring and trending" program elements that relates to performing inspections to ensure that quantitative baseline inspection data with sufficient details is established prior to the subsequent period of extended operations. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.S6 and finds it acceptable because, when it is implemented, it will be consistent with the GALL-SLR Report recommendation to ensure that quantitative baseline inspection data is established prior to the subsequent period of extended operation so inspection results can be effectively compared to previous results to identify changes from prior inspections.

Enhancement 15. SLRA Section B2.1.33 includes an enhancement to the "acceptance criteria" program element that relates to revising existing procedure to ensure that acceptance criteria are derived from applicable industry codes and standards and to ensure that a quantitative acceptance criterion is used when applicable. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.S6 and finds it acceptable because, when it is implemented, it will be consistent with the GALL-SLR Report recommendation to ensure that the need for corrective actions is identified before loss of intended functions by using justified quantitative acceptance criteria whenever applicable and by deriving the criteria from applicable codes and standards.

Enhancement 16. SLRA Section B2.1.33 includes an enhancement to the "acceptance criteria" program element that relates to revising existing procedures to ensure that second-tier criteria of Chapter 5 in ACI 349.3R is used as the acceptance criteria for the evaluation of surface concrete degradation. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.S6 and finds it acceptable because, when it is implemented, it will be consistent with the GALL-SLR Report recommendation to ensure that that the need for corrective actions is identified before loss of intended functions by using criteria derived from applicable codes.

Enhancement 17. SLRA Section B2.1.33 includes an enhancement to the "acceptance criteria" program element that relates to revising existing procedures to ensure that loose bolts and nuts are not acceptable unless accepted by engineering evaluation. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.S6 and finds it acceptable because, when it is implemented, it will be consistent with the GALL-SLR Report recommendation to ensure that the need for corrective actions is identified before loss of intended functions by ensuring that loose bolts and nuts are found acceptable only by engineering evaluation.

Enhancement 18. SLRA Section B2.1.33, as amended by Supplement 3 dated December 15, 2021, includes an enhancement to the "detection of aging effects" and "monitoring and trending" program elements that relates to ensuring that inspection results not meeting the acceptance criteria are entered into the "corrective actions" program and evaluated by engineering. This enhancement also ensures that degraded conditions are projected to the next scheduled inspection or their inspection frequency be adjusted to ensure no loss of intended function prior to the next scheduled inspection. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.S6 and finds it acceptable because, when it is implemented, it will be consistent with the GALL-SLR Report recommendation to ensure that aging degradation is detected and quantified before there is loss of intended function and inspection frequency be adjusted based on an evaluation of the observed degradation.

Enhancement 19. SLRA Section B2.1.33, as amended by Supplement 3 dated December 15, 2021, includes an enhancement to the "parameters monitored or inspected" and "acceptance criteria" program elements that relates to revising existing procedures to include the monitoring of wear plates for loss of material and to define its acceptance criteria. In its response to RAI B2.1.28-1, the applicant revised this enhancement and changed it to monitor SS components, instead, for indication of significant loss of material and cracking through visual inspections. The enhancement also defines the acceptance criteria for SS components as no significant loss of material or cracking that could result in a loss of intended function. The staff noted that SS components are not generically addressed in GALL-SLR Report AMP XI.S6. Because this is a plant-specific enhancement, the staff reviewed this enhancement, as revised by the RAI response, against the corresponding program elements in SRP-SLR Sections A.1.2.3.3 and A.1.2.3.6 and finds it acceptable because, when it is implemented, (a) the enhancement will ensure that the aging effects for SS components that function as a structural support will be monitored to ensure adequate aging management, and (b) the acceptance criteria will ensure that the need for corrective actions is identified before a loss of intended functions.

Enhancement 20. SLRA Section B2.1.33, as amended by letter dated February 14, 2022, includes an enhancement to the "detection of aging effects" program element that relates to removing statements from existing procedures that allow for extending inspection frequency to a 10-year interval. In its response to RAI B2.1.33-2, the applicant stated that it will ensure that all SC are monitored on an interval not to exceed 5 years. The staff reviewed this enhancement, as revised by the RAI response, against the corresponding program element in GALL-SLR Report AMP XI.S6 and finds it acceptable because, when it is implemented, it will be consistent with the GALL-SLR Report recommendation to ensure that inspection frequency depends on safety significance and the condition of the structures.

Enhancement 21. SLRA Section B2.1.33, as amended by letter dated February 14, 2022, includes an enhancement to the "detection of aging effects" program element that relates to including a provision for more frequent inspection. In its response to RAI B2.1.33-2, the applicant stated that this enhancement will revise existing procedures to state that more frequent inspection may be needed based on an evaluation of observed degradation. The staff reviewed this enhancement, as revised by the RAI response, against the corresponding program element in GALL-SLR Report AMP XI.S6 and finds it acceptable because, when it is implemented, it will be consistent with the GALL-SLR Report recommendation to ensure that inspection frequency depends on safety significance and the condition of the structures.

Enhancement 22. SLRA Section B2.1.33, as amended by letter dated February 14, 2022, includes an enhancement to the "detection of aging effects" program element that relates to the detection of aging effects for inaccessible and below-grade concrete elements. In its response to RAI B2.1.33-3, the applicant stated that it will revise the existing procedure to ensure that the evaluation of inspection results includes consideration for the acceptability of inaccessible areas when conditions exist in accessible areas that could indicate the presence of, or result in, degradation to such inaccessible areas (i.e., for structural elements exposed to groundwater/soil environments and structural components covered by metal siding). The staff reviewed this enhancement, as revised by the RAI response, against the corresponding program element in GALL-SLR Report AMP XI.S6 and finds it acceptable because, when it is implemented, it will be consistent with the GALL-SLR Report recommendation to ensure that aging degradation is detected and quantified before there is loss of intended function by evaluating the acceptability of inaccessible areas when conditions exist in accessible areas that could indicate degradation to such inaccessible areas.

Enhancement 23. SLRA Section B2.1.33, as amended by letter dated February 14, 2022, includes an enhancement to the "detection of aging effects" program element that relates to the detection of aging effects for inaccessible areas covered by metal siding during opportunistic inspections. In its response to RAI B2.1.33-4, the applicant stated that the program will be enhanced to ensure that opportunistic engineering inspections are performed on structural elements covered by metal siding when exposed for any reason. The staff reviewed this enhancement, as revised by the RAI response, against the corresponding program element in GALL-SLR Report AMP XI.S6 and finds it acceptable because, when it is implemented, it will be consistent with the GALL-SLR Report recommendation to ensure that aging degradation is detected and quantified before there is loss of intended function by performing visual inspections of the inaccessible areas when exposed for any reason.

Enhancement 24. SLRA Section B2.1.33, as amended by letter dated February 14, 2022, includes an enhancement to the "parameters monitored or inspected" program element that relates to the inspection of structural steel bracing and edge supports associated with masonry walls. In its response to RAI B2.1.33-1, the applicant stated that the program will be enhanced to ensure that structural steel bracing and edge supports associated with masonry walls are inspected for deflection or distortion, loose bolts, and loss of material due to corrosion. The staff reviewed this enhancement, as revised by the RAI response, against the corresponding program element in GALL-SLR Report AMP XI.S6 and finds it acceptable because, when it is implemented, it will be consistent with the GALL-SLR Report recommendation to ensure that specific parameters associated with particular structural components (e.g., masonry walls) are being monitored or inspected and that they are commensurate with industry codes, standards, and guidelines.

Enhancement 25. SLRA Section B2.1.33, as amended by Supplement 4 dated June 7, 2022, includes an enhancement to the "parameters monitored or inspected," "detection of aging effects," and "acceptance criteria" program elements that relates to expanding the program to monitor polymeric materials (i.e., plexiglass covers) for cracking or blistering, loss of material, and loss of strength and establish corresponding acceptance criteria. The staff reviewed this enhancement against the corresponding program element acceptance criteria in Section A.1.2.3 "Aging Management Program Elements" of Appendix A to SRP-SLR and finds it acceptable because, when it is implemented, it will make the program adequate to monitor and manage the applicable aging effects for polymeric plexiglass covers, given that its intended function of directing air flow in the Auxiliary Building is a structural function and not a mechanical function. This will be accomplished through periodic visual examinations at an interval not to exceed 5 years, with a provision for more frequent inspections based on evaluation of observed degradation to ensure that corrective action can be taken prior to loss of structural intended function of directing air flow.

Based on a review of the SLRA, amendments, and the applicant's responses to RAIs B2.1.33-1, B2.1.33-2, B2.1.33-3, B2.1.33-4, B2.1.33-5, and B2.1.28-1, the staff finds that the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent with the corresponding program elements of GALL-SLR Report AMP XI.S6. The staff also reviewed the exception associated with the "detection of aging effects" program element and its justification and finds that the AMP, with the exception, is adequate to manage the applicable aging effects. In addition, the staff reviewed the enhancements associated with the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," and "acceptance criteria" program elements and finds that, when implemented, they will make the AMP adequate to manage the applicable aging effects.

<u>OE</u>. SLRA Section B2.1.33 summarizes OE related to the Structures Monitoring program. The staff reviewed OE information in the application and during the audit. As discussed in the audit report, the staff reviewed the plant OE information the applicant provided for this program to (a) identify examples of age-related degradation, and (b) provide a basis for the staff's conclusions on the ability of the applicant's proposed AMPs to manage the effects of aging in the subsequent period of extended operation. The staff did not identify any OE indicating that the applicant should modify its proposed program beyond that incorporated during the development of the SLRA. Based on its audit and review of the application and amendments, the staff finds that the conditions and OE at the plant are bounded by those for which the Structures Monitoring program was evaluated.

<u>UFSAR Supplement</u>. SLRA Section A2.33, as amended by Supplement 3 dated December 15, 2021; by letter dated February 14, 2022; and by Supplement 4 dated June 7, 2022, provides the UFSAR supplement for the Structures Monitoring program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in GALL-SLR Report Table XI-01. The staff also noted that the applicant committed to ongoing implementation of the existing Structures Monitoring program for managing the effects of aging for applicable components during the subsequent period of extended operation. The staff also noted that the applicant committed to implement the program enhancements 6 month prior to the subsequent period of extended operation. The staff finds that the information in the UFSAR supplement, as amended, is an adequate summary description of the program.

<u>Conclusion</u>. Based on its review of the applicant's Structures Monitoring program, as amended, the staff concludes that those program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent. The staff also reviewed the exception and the

enhancements and finds that, with the exception and the enhancements, the AMP will be adequate to manage the applicable aging effects. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement, as amended, for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.23 Inspection of Water-Control Structures Associated with Nuclear Power Plants

SLRA Section B2.1.34 states that the Inspection of Water-Control Structures Associated with Nuclear Power Plants program is an existing program with enhancements that will be consistent with the program elements in the GALL-SLR Report AMP XI.S7, "Inspection of Water-Control Structures Associated with Nuclear Power Plants." The applicant amended this SLRA section by letter dated December 2, 2021 (Response to RCI B2.1.34-A), and by Supplement 3 dated December 15, 2021.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL-SLR Report. The staff compared the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements of the SLRA to the corresponding program elements of GALL-SLR Report AMP XI.S7.

The staff also reviewed the portions of the "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," and "acceptance criteria" program elements associated with enhancements to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of these 15 enhancements are as follows.

Enhancements 1, 2, and 3. SLRA Section B2.1.34, as amended by Supplement 3 dated December 15, 2021, includes enhancements to the "preventive actions" program element that relate to maintaining structural bolting integrity. The staff reviewed these enhancements against the corresponding program element in GALL-SLR Report AMP XI.S7 and finds them acceptable because, when they are implemented, they will make the AMP consistent with the GALL-SLR Report recommendations to ensure (a) proper selection of bolting and coating material, (b) appropriate installation torque or tension to prevent or minimize loss of bolting preload and cracking of high-strength bolting, and (c) preventive actions for storage, use of lubricants and sealants, and bolting and coating material selection consistent with industry standards and guidelines and to provide reasonable assurance that structural bolting integrity is maintained.

Enhancement 4. SLRA Section B2.1.34 includes an enhancement to the "parameters monitored or inspected" program element that relates to inspection attributes for monitoring movements (e.g., settlement, heaving, and deflection), conditions at junctions with abutments and embankments, pattern cracking with darkened edges, the changes in material properties of increase in porosity and permeability, and loss of strength. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.S7 and finds it acceptable because, when it is implemented, it will make the AMP consistent with the GALL-SLR Report recommendations to ensure that specific parameters will be monitored and inspected against their acceptance criteria and that aging degradation will be detected and quantified before there is a loss of intended function.

Enhancement 5. SLRA Section B2.1.34, as amended by Supplement 3 dated December 15, 2021, includes an enhancement applicable to the “parameters monitored or inspected” program element that relates to including inspection attributes for accessible sliding surfaces and to the “acceptance criteria” program element that relates to establishing acceptance criteria for sliding surfaces as no significant loss of material due to wear or corrosion and no debris or dirt that could restrict or prevent sliding of the surfaces, as required by design. The staff reviewed the enhancements against the corresponding program elements in GALL-SLR Report AMP XI.S7 and finds them acceptable because, when they are implemented, they will make the AMP consistent with the GALL-SLR Report recommendations to ensure that specific parameters for accessible sliding surfaces will be monitored or inspected against their acceptance criteria and that aging degradation will be detected and evaluated before there is a loss of intended function.

Enhancement 6. SLRA Section B2.1.34 includes an enhancement to the “detection of aging effects” program element that relates to personnel qualifications. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.S7 and finds it acceptable because, when it is implemented, the AMP will include provisions to ensure that personnel performing inspections and evaluations will meet the qualifications specified within ACI 349.3R, consistent with the GALL-SLR Report recommendation.

Enhancement 7. SLRA Section B2.1.34 includes an enhancement to the “detection of aging effects” program element that relates to including provisions for special inspections immediately following the occurrence of significant natural phenomena. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.S7 and finds it acceptable because, when it is implemented, the AMP will include provisions for special inspections immediately following the occurrence of significant natural phenomena, consistent with the GALL-SLR Report recommendation.

Enhancement 8. SLRA Section B2.1.34 includes an enhancement to the “detection of aging effects” program element that relates to the evaluation of raw water and groundwater chemistry. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.S7 and finds it acceptable because, when it is implemented, it will make the AMP consistent with the GALL-SLR Report recommendation to evaluate raw water and groundwater chemistry sampled from a location that represents water in contact with structures within the scope of SLR with an interval not to exceed 5 years and account for seasonal variations (e.g., quarterly monitoring every 5th year).

Enhancement 9. SLRA Section B2.1.34 includes an enhancement to the “detection of aging effects” program element that relates to developing a new implementing procedure or revising an existing implementing procedure to enhance the aging management of inaccessible areas exposed to potentially aggressive groundwater/soil environments. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.S7 and finds it acceptable because, when it is implemented, it will make the AMP consistent with the GALL-SLR Report recommendations to ensure that raw water and groundwater chemistry will be monitored and its adverse results or degradation of structural components will be detected, evaluated, and corrected before there is a loss of intended function.

Enhancement 10. SLRA Section B2.1.34 includes an enhancement to the “detection of aging effects” program element that relates to monitoring and trending through-wall groundwater leakage, infiltration volumes, and leakage water chemistry for signs of concrete or steel reinforcement degradation and developing additional engineering evaluations, which consider more frequent inspections as well as destructive testing of affected concrete to validate existing concrete properties and leakage water chemistry results. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.S7 and finds it acceptable because, when it is implemented, it will make the AMP consistent with the GALL-SLR Report recommendation to ensure that indications of groundwater infiltration or through-concrete leakage will be assessed for aging effects and that aging degradation of concrete or steel reinforcing will be detected and quantified before there is a loss of intended function.

Enhancement 11. SLRA Section B2.1.34 includes an enhancement to the “monitoring and trending” program element that relates to establishing quantitative baseline inspection data to a sufficient detail to allow for trending prior to the subsequent period of extended operation. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.S7 and finds it acceptable because, when it is implemented, it will make the AMP consistent with the GALL-SLR Report recommendation to ensure that periodic inspection results will be compared to previous results to identify changes from prior inspections for trending and that aging degradation will be detected and quantified before there is a loss of intended function.

Enhancement 12. SLRA Section B2.1.34 includes an enhancement to the “acceptance criteria” program element that relates to establishing evaluation criteria for structural concrete using the quantitative second-tier criteria of ACI 349.3R, Chapter 5. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.S7 and finds it acceptable because, when it is implemented, it will make the AMP consistent with the GALL-SLR Report recommendation to ensure that acceptance criteria used for structural concrete will be commensurate with industry codes, standards, and guidelines and that aging degradation will be detected and quantified before there is a loss of intended function.

Enhancement 13. SLRA Section B2.1.34 includes an enhancement to the “acceptance criteria” program element that relates to clarification of acceptance for loose bolts and nuts. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.S7 and finds it acceptable because, when it is implemented, it will make the AMP consistent with the GALL-SLR Report recommendation to ensure that loose bolts and nuts will be accepted based on engineering evaluation.

Enhancement 14. SLRA Section B2.1.34 includes an enhancement to the “acceptance criteria” program element that relates to accepting degradation of sheet piles by engineering evaluation or subject to corrective actions. As confirmed by the applicant in response to RCI B2.1.34-A (ADAMS Accession No. ML21336A001), the staff noted that there is no sheeting within the scope of SLR, and the applicant corrected the component to read “sheet piles.” The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.S7 and finds it acceptable because, when it is implemented, it will make the AMP consistent with the GALL-SLR Report recommendation to provide acceptance criteria to evaluate degradation of the sheet piles.

Enhancement 15. SLRA Section B2.1.34 includes an enhancement to the “acceptance criteria” program element that relates to revising inspection procedures to base inspection acceptance criteria on quantitative requirements derived from industry codes and standards or specifications and considering industry and plant OE. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.S7 and finds it acceptable because, when it is implemented, it will make the AMP consistent with the GALL-SLR Report recommendation to ensure that acceptance criteria used for these components are commensurate with applicable industry codes, standards, and specifications, and that aging degradation will be detected and quantified before there is a loss of intended function.

Based on a review of the SLRA, as amended by Supplement 3 dated December 15, 2021, and the applicant's response to RCI B2.1.34-A, the staff finds that the "scope of program" and "corrective actions" program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent with the corresponding program elements of GALL-SLR Report AMP XI.S7. In addition, the staff reviewed the enhancements associated with the "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," and "acceptance criteria" program elements and finds that, when implemented, they will make the AMP adequate to manage the applicable aging effects.

OE. SLRA Section B2.1.34 summarizes OE related to the Inspection of Water-Control Structures Associated with Nuclear Power Plants program. The staff reviewed OE information in the application and during the audit. As discussed in the audit report, the staff reviewed the plant OE information the applicant provided for this program to (a) identify examples of age-related degradation, and (b) provide a basis for the staff's conclusions on the ability of the applicant's proposed AMPs to manage the effects of aging in the subsequent period of extended operation. The staff did not identify any OE indicating that the applicant should modify its proposed program. Based on its audit and review of the application, the staff finds that the conditions and OE at the plant are bounded by those for which the Inspection of Water-Control Structures Associated with Nuclear Power Structures program was evaluated.

UFSAR Supplement. SLRA Section A2.34 provides the UFSAR supplement for the Inspection of Water-Control Structures Associated with Nuclear Power Plants program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in GALL-SLR Report Table XI-01. The staff also noted that the applicant committed to implement AMP enhancements for SLR no later than 6 months prior to the subsequent period of extended operation. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. Based on its review of the applicant's Inspection of Water-Control Structures Associated with Nuclear Power Plants program, the staff concludes that those program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent. The staff also reviewed the enhancements, and finds that, with the enhancements when implemented, the AMP will be adequate to manage the applicable aging effects. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.24 Protective Coating Monitoring and Maintenance

SLRA Section B2.1.35 states that the Protective Coating Monitoring and Maintenance program is an existing program that, with enhancements, will be consistent with NUREG-2191, Section XI.S8, "Protective Coating Monitoring and Maintenance," as modified by SLR-ISG-2021-03-STRUCTURES, "Updated Aging Management Criteria for Structures Portions of Subsequent License Renewal Guidance" (ADAMS Accession No. ML20181A381).

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL-SLR Report. The staff compared the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements of the SLRA to the corresponding program elements of GALL-SLR Report AMP XI.S8, as modified by SLR-ISG-2021-03-STRUCTURES.

The staff also reviewed the portions of the "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," and "acceptance criteria" program elements associated with the enhancements to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of the enhancements is as follows.

Enhancement 1. SLRA Section B2.1.35 includes an enhancement to the "parameters monitored or inspected" program element to revise and enhance procedures to explicitly state that peeling and physical damage are considered in the condition assessment. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.S8 and finds it acceptable because, when it is implemented, it will be consistent with the recommendations in the GALL-SLR Report.

Enhancement 2. SLRA Section B2.1.35 includes an enhancement to the "parameters monitored or inspected" program element to revise procedures to reference ASTM D5163-08. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.S8 and finds it acceptable because, when it is implemented, it will be consistent with the recommendations in the GALL-SLR Report.

Enhancement 3. SLRA Section B2.1.35 includes an enhancement to the "detection of aging effects" program element to revise procedures to reference ASTM D5163-08. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.S8 and finds it acceptable because, when it is implemented, it will be consistent with the recommendations in the GALL-SLR Report.

Enhancement 4. SLRA Section B2.1.35 includes an enhancement to the "monitoring and trending" program element to revise procedures to reference ASTM D5163-08. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.S8 and finds it acceptable because, when it is implemented, it will be consistent with the recommendations in the GALL-SLR Report.

Enhancement 5. SLRA Section B2.1.35 includes an enhancement to the "acceptance criteria" program element to revise procedures to reference ASTM D5163-08. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.S8 and finds it acceptable because, when it is implemented, it will be consistent with the recommendations in the GALL-SLR Report.

OE. SLRA Section B2.1.35 summarizes OE related to the Protective Coating Monitoring and Maintenance program. The staff evaluated OE information by reviewing the SLRA and conducting an audit. As discussed in the audit report, the staff reviewed the plant OE information the applicant provided for this program to (a) identify examples of age-related degradation, and (b) provide a basis for the staff's conclusions on the ability of the applicant's proposed AMPs to manage the effects of aging in the subsequent period of extended operation. The staff did not identify any OE indicating that the applicant should modify its proposed program. Based on its audit and review of the application, the staff finds that the conditions and OE at the plant are bounded by those for which the Protective Coating Monitoring and Maintenance program was evaluated.

UFSAR Supplement. SLRA Appendix A, Section A2.35, provides the UFSAR supplement for the Protective Coating Monitoring and Maintenance program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in GALL-SLR Report Table XI-01. The staff also noted that the applicant committed to ongoing implementation of the existing Protective Coating Monitoring and Maintenance program for managing the effects of aging for applicable components during the subsequent period of extended operation. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. Based on its review of the applicant's Protective Coating Monitoring and Maintenance program, the staff concludes that those program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent. Also, the staff reviewed the enhancements and concluded that their implementation prior to the subsequent period of extended operation will make the AMP adequate to manage the applicable aging effects. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.25 Electrical Insulation for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements

SLRA Section B2.1.36 states that the Electrical Insulation for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program is an existing program that will be consistent with the ten elements of AMP XI.E1, "Electrical Insulation for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements," specified in NUREG-2191 (GALL-SLR) after the proposed enhancements are incorporated.

Staff Evaluation. The staff reviewed the applicant's program for consistency with the GALL-SLR Report. The staff compared the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements described in the SLRA to the corresponding program elements of GALL-SLR Report AMP XI.E1. The staff also reviewed the portions of the "detection of aging effects" program element associated with enhancements to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of these three enhancements follows.

Enhancement 1. SLRA Section B2.1.36 includes an enhancement to the "detection of aging effects" program element to add, as part of the periodic inspections, reviews of previously identified and mitigated adverse localized environments' cumulative aging effects applicable to in-scope cable and connection insulation to confirm that the insulation's intended functions continue to be supported during the subsequent period of extended operation. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.E1 and finds it acceptable because, when it is implemented, it will be consistent with AMP X1.E1.

Enhancement 2. SLRA Section B2.1.36 includes an enhancement to the “detection of aging effects” program element to clarify that if cable testing is warranted for a large number of cables and connections, sampling methodology consistent with the guidance of Section XI.E1 of NUREG-2191 should be used. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.E1 and finds it acceptable because, when it is implemented, it will be consistent with AMP X1.E1.

Enhancement 3. SLRA Section B2.1.36 includes an enhancement to the “acceptance criteria” program element to add acceptance criteria for potential testing of accessible cables and connections when unacceptable visual inspection results are noted. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.E1 and finds it acceptable because, when it is implemented, it will be consistent with AMP X1.E1.

Based on a review of the SLRA, the staff finds that the “scope of program,” “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” “acceptance criteria,” and “corrective actions” program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent with the corresponding program elements of GALL-SLR Report AMP XI.E1. In addition, the staff reviewed the enhancements associated with the “detection of aging effects” program element and finds that, when implemented, they will make the AMP adequate to manage the applicable aging effects.

OE. SLRA Section B2.1.36 summarizes OE related to the Electrical Insulation for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program. The applicant has documented results of two self-assessments performed in June 2012 and September 2019. The applicant stated that there were no significant adverse findings from these assessments. The applicant identified areas of improvement and considers self-assessments as a method to evaluate existing AMP-related inspections and documentation for identifying and resolving cable insulation aging-related degradation concerns that could lead to a loss of intended function. Section B2.1.36 also documents results of walkdowns and inspections performed from September 2009 to April 2012 and from May 2018 to November 2019. The scope of visual inspections of accessible cables and connections included inspections of surface anomalies in accessible cable jackets and connector coverings. The applicant has provided a few examples of heat-related degradation of cable jackets or conduits due to external sources and stated that the cable insulation was not degraded and cable functionality was maintained. The applicant has concluded that the ongoing periodic visual inspections of accessible cables and connections exposed to adverse localized environments caused by heat, radiation, or moisture are effective for identifying insulation aging-related degradation prior to loss of intended function.

The staff reviewed OE information in the application and during the audit. As discussed in the audit report, the staff reviewed the plant OE information the applicant provided for this program to (a) identify examples of age-related degradation, and (b) provide a basis for the staff’s conclusions on the ability of the applicant’s proposed AMPs to manage the effects of aging in the subsequent period of extended operation. The staff did not identify any OE indicating that the applicant should modify its proposed program. Based on its audit and review of the application, the staff finds that the conditions and OE at the plant are bounded by those for which the Electrical Insulation for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program was evaluated.

UFSAR Supplement. SLRA Section A2.36 provides the UFSAR supplement for the Electrical Insulation for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental

Qualification Requirements program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in GALL-SLR Report Table XI-01. The staff also noted that the applicant committed to ongoing implementation of the existing program for managing the effects of aging for applicable components during the subsequent period of extended operation. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. Based on its review of the applicant's Electrical Insulation for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program, the staff concludes that those program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent. The staff also reviewed the enhancements and finds that, with the enhancements when implemented, the AMP will be adequate to manage the applicable aging effects. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.26 Electrical Insulation for Inaccessible Medium-Voltage Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements

SLRA Section B2.1.38 states that the Electrical Insulation for Inaccessible Medium-Voltage Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program is an existing program that, following enhancements, will be consistent with program elements in GALL-SLR Report AMP XI.E3A, "Electrical Insulation for Medium-Voltage Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements," as modified by SLR-ISG-2021-04-ELECTRICAL, "Updated Aging Management Criteria for Electrical Portions of Subsequent License Renewal Guidance."

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL-SLR Report. The staff compared the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements of the SLRA to the corresponding program elements of GALL-SLR Report AMP XI.E3A.

The staff also reviewed the portions of the "preventive actions," "parameters monitored or inspected," "detection of aging effects," and "acceptance criteria" program elements associated with enhancements to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of these four enhancements follows.

Enhancement 1. SLRA Section B2.1.38 includes an enhancement to the "preventive actions" program element to add inspections to be performed for water accumulation after event-driven occurrences, such as heavy rain, rapid thawing of heavy ice and snow, or flooding. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.E3A and finds it acceptable because inspecting for water accumulation after event-driven occurrences is consistent with that in GALL-SLR Report AMP XI.E3A.

Enhancement 2. SLRA Section B2.1.38 includes an enhancement to the "preventive actions" and "acceptance criteria" program elements for the periodic water accumulation inspections, which is to add documented verification that either automatic or passive drainage systems or manual pumping are effective in preventing medium-voltage cable exposure to significant moisture. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.E3A and finds it acceptable because verifying that either automatic or passive drainage systems are effective in preventing medium-voltage power cable exposure to significant moisture is consistent with that in GALL-SLR Report AMP XI.E3A.

Enhancement 3. SLRA Section B2.1.38 includes an enhancement to “parameters monitored or inspected” program element to remove from program descriptions the original “significant voltage” portions of exposures to determine the inaccessible medium-voltage cables for testing. The applicant defined significant voltage as when the cable is energized more than 25 percent of the time. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.E3A and finds it acceptable because inaccessible medium-voltage cable exposure to significant moisture is tested regardless of whether the cables are energized.

Enhancement 4. SLRA Section B2.1.38 includes an enhancement to the “detection of aging effects” program element to revise the inaccessible medium-voltage cable testing and water accumulation inspection matrix to include inspection methods, test methods, and acceptance criteria. The staff reviewed these enhancements against the corresponding program element in GALL-SLR Report AMP XI.E3A and finds them acceptable because revising the cable testing matrix to include inspection methods, testing methods, and acceptance criteria for each cable type is consistent with those in GALL-SLR Report AMP XI.E3A.

Based on a review of the SLRA, the staff finds that the “scope of program,” “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” “acceptance criteria,” and “corrective actions” program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent with the corresponding program elements of GALL-SLR Report AMP XI.E3A. In addition, the staff reviewed the enhancements associated with the “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” and “acceptance criteria” program elements and finds that, when implemented, they will make the AMP adequate to manage the applicable aging effects.

OE. SLRA Section B2.1.38 summarizes OE related to the Electrical Insulation for Inaccessible Medium-Voltage Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program. The staff reviewed OE information in the application and during the audit. As discussed in the audit report, the staff reviewed the plant OE information the applicant provided for this program to (a) identify examples of age-related degradation, and (b) provide a basis for the staff’s conclusions on the ability of the applicant’s proposed AMPs to manage the effects of aging in the subsequent period of extended operation. The staff did not identify any OE indicating that the applicant should modify its proposed program. Based on its audit and review of the application, the staff finds that the conditions and OE at the plant are bounded by those for which the Electrical Insulation for Inaccessible Medium-Voltage Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program was evaluated.

UFSAR Supplement. SLRA Section A2.38 provides the UFSAR supplement for the Electrical Insulation for Inaccessible Medium-Voltage Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in GALL-SLR Report Table XI-01. The staff also noted that the applicant committed to implement the program enhancements no later than 6 months prior to the subsequent period of extended operation or no later than the last refueling outage prior to the subsequent period of extended operation for managing the effects of aging for applicable components during the subsequent period of extended operation. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. Based on its review of the applicant's Electrical Insulation for Inaccessible Medium-Voltage Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program, the staff concludes that those program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent. The staff also reviewed the enhancements and finds that, with the enhancements when implemented, the AMP will be adequate to manage the applicable aging effects. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.27 Electrical Insulation for Inaccessible Low-Voltage Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements

SLRA Section B2.1.40 describes the new Electrical Insulation for Inaccessible Low-Voltage Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program that will be consistent with GALL-SLR Report AMP XI.E3C, "Electrical Insulation for Low-Voltage Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements," as modified by SLR-ISG-2021-04-ELECTRICAL, "Updated Aging Management Criteria for Electrical Portions of Subsequent License Renewal Guidance," except for the exceptions identified in the SLRA.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL-SLR Report. The staff compared the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements of the SLRA to the corresponding program elements of GALL-SLR Report AMP XI.E3C.

The staff also reviewed the portions of the "detection of aging effects" and "corrective actions" program elements associated with exceptions to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of these two exceptions follows.

Exception 1. SLRA Section B2.1.40 includes an exception to the "detection of aging effects" program element related to testing of installed in-service low-voltage power cables. The staff reviewed this exception against the corresponding program element in GALL-SLR Report AMP XI.E3C and finds it acceptable because it will better align with the detection of aging effects element for the ONS AMP consistent with Element 4 of XI.E3C, as modified by SLR-ISG-2021-04-ELECTRICAL, and it will continue to provide reasonable assurance that insulation material for electrical cables will perform its intended function for the subsequent period of extended operation.

Exception 2. SLRA Section B2.1.40 includes an exception to the second paragraph of "corrective actions" program element related to additional manhole inspections. The staff reviewed this exception against the corresponding program element in GALL-SLR Report AMP XI.E3C and finds it acceptable because it will better align with the corrective actions for the ONS AMP consistent with Element 7 of XI.E3A and XI.E3B, as modified by SLR-ISG-2021-04-

ELECTRICAL-Appendix C, and it will continue to provide reasonable assurance that insulation material for electrical cables will perform its intended function for the subsequent period of extended operation.

Based on a review of the SLRA, the staff finds that the “scope of program,” “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” “acceptance criteria,” and “corrective actions” program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent with the corresponding program elements of GALL-SLR Report AMP XI.E3C. The staff also reviewed the exceptions associated with the “detection of aging effects” and “corrective actions” program elements and their justifications and finds that the AMP, with the exceptions, is adequate to manage the applicable aging effects.

OE. SLRA Section B2.1.40 summarizes OE related to the Electrical Insulation for Inaccessible Low-Voltage Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program. The staff reviewed OE information in the application and during the audit. As discussed in the audit report, the staff reviewed the plant OE information the applicant provided for this program to (a) identify examples of age-related degradation, and (b) provide a basis for the staff’s conclusions on the ability of the applicant’s proposed AMPs to manage the effects of aging in the subsequent period of extended operation. The staff did not identify any OE indicating that the applicant should modify its proposed program. Based on its audit and review of the application, the staff finds that the conditions and OE at the plant are bounded by those for which the Electrical Insulation for Inaccessible Low-Voltage Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program was evaluated.

UFSAR Supplement. SLRA Section A2.40 provides the UFSAR supplement for the Electrical Insulation for Inaccessible Low-Voltage Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in GALL-SLR Report Table XI-01. The staff also noted the applicant committed to implement this new program 6 months prior to the subsequent period of extended operation or no later than the last refueling outage prior to the subsequent period of extended operation for managing the effects of aging for applicable components. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. Based on its review of the applicant’s Electrical Insulation for Inaccessible Low-Voltage Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program, the staff concludes that those program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent. The staff also reviewed the exceptions and finds that, with the exceptions when implemented, the AMP will be adequate to manage the applicable aging effects. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.28 Fatigue Monitoring

SLRA Section B3.1 states that the Fatigue Monitoring program is an existing program with enhancements that will be consistent with the program elements in the GALL-SLR Report

AMP X.M1, “Fatigue Monitoring.” The applicant amended this SLRA section by letter dated January 7, 2022 (ADAMS Accession No. ML22007A015).

Staff Evaluation. During its audit, the staff reviewed the applicant’s claim of consistency with the GALL-SLR Report. The staff compared the “scope of program,” “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” “acceptance criteria,” and “corrective actions” program elements of the SLRA to the corresponding program elements of GALL-SLR Report AMP X.M1. For the portions of the program elements not associated with the program enhancements, the staff found that these program elements of the SLRA are consistent with the corresponding program elements of GALL-SLR Report AMP X.M1.

The staff also reviewed the portions of the “scope of program,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” “acceptance criteria,” and “corrective actions” program elements associated with the program enhancements to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff’s evaluation of these enhancements follows.

Enhancement 1. SLRA Section B3.1 includes an enhancement to the “scope of program,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” “acceptance criteria,” and “corrective actions” program elements. The enhancement relates to monitoring and tracking the transient cycles associated with the ASME Code, Section XI, Appendix L analysis. Specifically, the enhancement will require monitoring and tracking the transient cycles between the inspections for each ASME Code, Section XI, Appendix L location. In addition, a surveillance limit will be established to initiate corrective action prior to exceeding the transient cycle assumptions used in the ASME Code, Section XI, Appendix L analysis.

The staff noted that the applicant uses the ASME Code, Section XI, Appendix L analysis to manage the effect of fatigue for the pressurizer surge line piping and high-pressure injection piping stop-valve-to-check-valve weld. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP X.M1 and finds it acceptable because, when it is implemented, (1) the components, which rely on the ASME Code, Section XI, Appendix L analysis to manage the effect of fatigue, will be included in the scope of the fatigue monitoring, (2) the transient cycles, which are used in the Appendix L flaw tolerance analysis, will be monitored against the cycle numbers assumed between the periodic inspections based on the analysis, (3) monitoring transient cycles will ensure that the actual transient cycles do not exceed the transient cycles assumed in the analysis, and (4) the cycle monitoring and the associated corrective actions, as needed, will ensure the integrity of the components.

Enhancement 2. SLRA Section B3.1 includes an enhancement to the “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” “acceptance criteria,” and “corrective actions” program elements. The enhancement relates to performing a periodic validation of reactor coolant water chemistry parameters used to determine environmental fatigue correction (F_{en}) factors. The applicant also indicated that the Fatigue Monitoring program will rely on the Water Chemistry program (SLRA Section B2.1.2) for monitoring and validating the water chemistry parameters.

The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP X.M1 and finds it acceptable because, when it is implemented, it will ensure that the Fatigue Monitoring program uses the water chemistry parameters (e.g., dissolved oxygen), as tracked and monitored in the Water Chemistry program, in the F_{en} and cumulatively-assisted cumulative usage factor (CUF_{en}) calculations. The staff's safety evaluation of the Water Chemistry program is documented in SE Section 3.0.3.1.1.

Enhancement 3. SLRA Section B3.1 includes an enhancement to the "corrective actions" program element. The enhancement relates to expanding the existing corrective action guidance associated with exceeding a cycle-counting surveillance limit to recommend consideration of component repair; component replacement; performance of a more rigorous analysis; performance of an ASME Code, Section XI, Appendix L flaw tolerance analysis; or scope expansion to consider other locations with the highest expected CUF_{en} values.

The staff noted that the enhancement includes a list of potential corrective actions (e.g., repair and replacement of affected components, performance of a more rigorous analysis, and performance of ASME Code, Section XI, Appendix L analysis). However, the staff determined the need for additional information, which resulted in the issuance of an RAI. RAI B3.1-1, and the applicant's response is documented in ADAMS Accession No. ML22010A129, as further discussed below.

Specifically, the program enhancement states that the applicant will expand existing corrective action guidance associated with exceeding a cycle-counting surveillance limit. The staff needed clarification of the meaning of the cycle surveillance limit. The staff also needed clarification of whether the cycle-counting surveillance limit includes the cycle limits associated with the analytical flaw evaluations (SLRA Section 4.3.5), weld overlay fatigue analyses (SLRA Section 4.3.6), CUFs (cumulative usage factors, SLRA Section 4.3.2) and $CUFs_{en}$ (SLRA Section 4.3.4), in addition to the design transient cycles (SLRA Section 4.3.1).

In its response, the applicant stated that the Fatigue Monitoring program monitors and tracks the applicable plant transients and compares them to the associated design cycles. The applicant also explained that the fatigue analyses calculate the CUFs and $CUFs_{en}$ for the applicable plant components, and these analyses use the design cycles. The applicant further stated that the tracking of transient cycles would ensure that the design cycles used in the fatigue analyses would not be exceeded.

In addition, the applicant stated that the cycle-counting surveillance limit addressed in SLRA Section B3.1, Enhancement 3 requires that if any transient exceeds 80 percent of its allowable design cycles or if the minimum time to reach the allowable design cycles is less than 3 years, then the issue shall be entered into the "corrective actions" program. Accordingly, the applicant revised SLRA Section B3.1 to clarify the cycle counting surveillance limit. The applicant further clarified that the enhancement applies to the cycle and design limits associated with the fatigue analyses, such as analytical flaw evaluations, weld overlay fatigue analyses, CUFs, and $CUFs_{en}$.

The staff finds the applicant's response acceptable because (1) the applicant clarified that monitoring against the cycle surveillance limit means that if any design transient exceeds 80 percent of its allowable design cycles or if the minimum time to reach the allowable design cycles is less than 3 years, the issue is entered into the "corrective actions" program to ensure that the CUFs and $CUFs_{en}$ meet the design limit of 1.0, and (2) the enhancement also applies to the cycle and design limits associated with other fatigue analyses, such as analytical flaw evaluations and weld overlay fatigue analyses, to ensure the fatigue analyses and the associated cycle assumptions remain valid.

The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP X.M1 and finds it acceptable because, when it is implemented, it will ensure that (1) the program identifies the cycle surveillance limits, including the cycle limits associated with the analytical flaw evaluations, weld overlay fatigue analyses, CUFs, and $CUFs_{en}$, in addition to the design cycles; and (2) the program monitors actual transient cycles against the cycle surveillance limits to perform corrective actions as need so that the fatigue design limits are not exceeded and the fatigue analyses remain valid.

Based on a review of the SLRA, amendment, and applicant’s responses to RAI B3.1-1, the staff finds that the “scope of program,” “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” “acceptance criteria,” and “corrective actions” program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent with the corresponding program elements of GALL-SLR Report AMP X.M1. In addition, the staff reviewed the enhancements associated with the “scope of program,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” “acceptance criteria,” and “corrective actions” program elements and finds that, when implemented, they will make the AMP adequate to manage the applicable aging effects.

OE. SLRA Section B3.1 summarizes OE related to the Fatigue Monitoring program. The staff also reviewed OE information in the application and during the audit. As discussed in the audit report, the staff reviewed the plant OE information the applicant provided for this program to (a) identify examples of age-related degradation, and (b) provide a basis for the staff’s conclusions on the ability of the applicant’s proposed Fatigue Monitoring program to manage the effects of aging in the subsequent period of extended operation.

The staff also noted that the applicant’s evaluation of OE adequately includes the evaluation regarding RIS 2008-30, “Fatigue Analysis of Nuclear Power Plant Components.” However, the staff noted that the applicant’s evaluation of the OE in the SLRA does not clearly address an evaluation regarding RIS 2011-14, “Metal Fatigue Analysis Performed by Computer Software.” RIS 2011-14, in part, addresses the concern that the fatigue calculations of the WESTEMS software package may involve the algebraic summation of three orthogonal moment vectors, which is not consistent with ASME Code, Section III, Subsection NB, Subarticle NB-3650. RIS 2011-14 also states that the staff encourages addressees of this RIS to review the documents discussed above and to consider actions, as appropriate, to ensure compliance with the requirements for ASME Code fatigue calculations and quality assurance programs, as described in 10 CFR 50.55a and Appendix B to 10 CFR Part 50, respectively. Therefore, the staff determined the need for additional information, which resulted in the issuance of an RAI. RAI B3.1-2, and the applicant’s response is documented in ADAMS Accession No. ML22010A129.

In its response, the applicant explained that RIS 2011-14 was evaluated in the applicant corrective action system and that the evaluation determined the need for communication to various corporate groups for awareness. The applicant also confirmed that ONS does not use the WESTEMS software package for fatigue monitoring, and therefore the conclusion of the evaluation for RIS 2011-14 found that no actions or responses to the NRC were required in relation to RIS 2011-14.

The staff finds the applicant’s response acceptable because (1) the applicant evaluated the OE and concerns discussed in RIS 2011-14 in its corrective action system, and (2) the applicant confirmed that the WESTEM software is not used in the Fatigue Monitoring program, and therefore the concerns addressed in RIS 2011-14 do not apply to the Fatigue Monitoring program.

As discussed above, the staff did not identify any OE indicating that the applicant should modify its proposed program.

UFSAR Supplement. SLRA Section A3.1 provides the UFSAR supplement for the Fatigue Monitoring program. The staff also noted that the applicant committed to implement the program enhancements no later than 6 months prior to the subsequent period of extended operation, as described in SLRA Section A6.0. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. Based on its review of the applicant's Fatigue Monitoring program, the staff concludes that those program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent. The staff also reviewed the enhancements and finds that, with the enhancements when implemented, the AMP will be adequate to manage the applicable aging effects. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.29 Environmental Qualification of Electric Equipment

The SLRA notes that AMP B3.3, "Environmental Qualification of Electric Equipment," is an existing program with enhancements that will be consistent with the program elements in GALL-SLR Report AMP X.E1, "Environmental Qualification of Electric Equipment."

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL-SLR Report. The staff compared the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements of the SLRA to the corresponding elements of the GALL-SLR Report AMP X.E1.

The staff also reviewed the portions of the "detection of aging effects" and "acceptance criteria" program elements associated with enhancements to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of the enhancements follows.

Enhancement 1. SLRA Section B3.3 includes an enhancement to the "detection of aging effects" program element related to the addition of visual inspections of accessible, passive EQ electric equipment located in adverse localized environments at least once every 10 years. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP X.E1 and finds it acceptable because, when it is implemented, it will be consistent with AMP X.E1 and will provide reasonable assurance that the effects of aging will be managed so that the intended functions of environmentally qualified electric components within the scope of the AMP will be maintained consistent with the CLB.

Enhancement 2. SLRA Section B3.3 includes an enhancement to the "acceptance criteria" program element related to establishing acceptance criteria for the visual inspection of accessible passive EQ electric equipment located in adverse localized environments. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP X.E1 and finds it acceptable because, when it is implemented, it will be consistent with AMP X.E1 and will provide reasonable assurance that the effects of aging will be managed so that the intended functions of environmentally qualified electric components within the scope of the AMP will be maintained consistent with the CLB.

Based on its review of the SLRA, the staff finds that the “scope of program,” “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” “acceptance criteria,” and “corrective actions” program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent with the corresponding program elements of the GALL-SLR Report AMP X.E1. In addition, the staff reviewed the enhancements associated with the “detection of aging effects” and “acceptance criteria” program elements and finds that, when implemented, they will make the AMP adequate to manage the applicable aging effects.

OE. SLRA Section B3.3 summarizes OE related to the EQ of Electric Equipment program. The staff reviewed OE information in the application and during the audit. As discussed in the audit report, the staff reviewed the plant OE information the applicant provided for this program to (a) identify examples of age-related degradation, and (b) provide a basis for the staff’s conclusions on the ability of the applicant’s proposed AMPs to manage the effects of aging in the subsequent period of extended operation. The staff did not identify any OE indicating that the applicant should modify its proposed program. Based on its audit and review of the application, the staff finds that the conditions and OE at the plant are bounded by those for which the EQ of Electric Equipment program was evaluated.

UFSAR Supplement. SLRA Section A3.3 provides the UFSAR supplement for the EQ of Electric Equipment program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in GALL-SLR Report Table X-01. The staff also noted that the applicant committed to ongoing implementation of the existing EQ of Electric Equipment program for managing the effects of aging for applicable components during the subsequent period of extended operation.

The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. Based on its review of the applicant’s EQ of Electric Equipment program, the staff concludes that those program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent. The staff also reviewed the enhancements and finds that, with the enhancements when implemented, the AMP will be adequate to manage the applicable aging effects. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.30 Concrete Containment Unbonded Tendon Prestress

SLRA Section B3.4 states that the Concrete Containment Unbonded Tendon Prestress program is an existing program that will be consistent with the program elements in the GALL-SLR Report AMP X.S1, “Concrete Containment Unbonded Tendon Prestress,” except for the exceptions identified in the SLRA. The applicant amended this SLRA section by Supplement 2 dated November 11, 2021 (ADAMS Accession No. ML21315A012).

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL-SLR Report. The staff compared the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements of the SLRA to the corresponding program elements of GALL-SLR Report AMP X.S1.

The staff also reviewed the portions of the "parameters monitored or inspected" and "monitoring and trending" program elements associated with the exceptions to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of these two exceptions is as follows.

Exception 1. SLRA Section B3.4 includes an exception to the "parameters monitored or inspected" program element related to only the first-year prestress lift-off force data being used prior to 1997 for developing the trend lines. The GALL-SLR Report program recommends that all measured data be used to develop the trend lines for prestressing losses; however, prior to 1997, the ONS tendon surveillance program inspected a fixed population of tendons. This led to detensioning and retensioning the same tendons, which degraded the tendons over time and caused them to no longer represent the larger group. The staff reviewed this exception against the corresponding program elements in GALL-SLR Report AMP X.S1 and finds it acceptable because, after 1997, the applicant implemented a program that aligns with the GALL-SLR Report AMP and uses all data points since 1997, along with the first-year data, to develop the trend lines. Additionally, the losses have been predicted out to the end of the subsequent period of extended operation, and they remain above the minimum required value (MRV).

Exception 2. SLRA Section B3.4 includes an exception to the "monitoring and trending" program element related to not plotting all previous examination results against time. As explained above in Exception 1, other than the first year of data, the examination results prior to 1997 are not included in the current trend lines because the earlier data does not represent the entire containment tendon population. The staff reviewed this exception against the corresponding program element in GALL-SLR Report AMP X.S1 and finds it acceptable because the program implemented since 1997 aligns with the GALL-SLR Report recommendations, and the data collected since 1997 is adequate to define reasonable trend lines for tendon prestress forces. Additionally, the losses have been predicted out to the end of the subsequent period of extended operation, and they remain above the MRV.

Based on a review of the SLRA and supplements, the staff finds that the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent with the corresponding program elements of GALL-SLR Report AMP X.S1. The staff also reviewed the exceptions associated with the "parameters monitored or inspected" and "monitoring and trending" program elements and their justifications and finds that the AMP, with the exceptions, is adequate to manage the applicable aging effects.

OE. SLRA Section B3.4 summarizes OE related to the Concrete Containment Unbonded Tendon Prestress program. The staff reviewed OE information in the application and during the audit. As discussed in the audit report, the staff reviewed the plant OE information the applicant provided for this program to (a) identify examples of age-related degradation, and (b) provide a basis for the staff's conclusions on the ability of the applicant's proposed AMPs to manage the effects of aging in the subsequent period of extended operation. The staff did not identify any OE indicating that the applicant should modify its proposed program. Based on its audit and review of the application, the staff finds that the conditions and OE at the plant are bounded by those for which the Concrete Containment Unbonded Tendon Prestress program was evaluated.

UFSAR Supplement. SLRA Section A3.4 provides the UFSAR supplement for the Concrete Containment Unbonded Tendon Prestress program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in GALL-SLR Report Table X-01. The staff also noted that the applicant committed to ongoing implementation of the existing Concrete Containment Unbonded Tendon Prestress program for managing the effects of aging for applicable components during the subsequent period of extended operation. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. Based on its review of the applicant's Concrete Containment Unbonded Tendon Prestress program, the staff concludes that those program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent. The staff also reviewed the exceptions, and finds that, with the exceptions, the AMP will be adequate to manage the applicable aging effects. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.3 AMPs Not Consistent with or Not Addressed in the GALL-SLR Report

In SLRA Appendix B, the applicant identified the following AMPs as plant-specific:

- Secondary Shield Wall (SSW) Tendon Surveillance

For an AMP not consistent with or not addressed in the GALL-SLR Report, the staff performed a complete review to determine its adequacy to monitor or manage aging. The following section documents the staff's review of this plant-specific AMP.

SLRA Section B4.1 describes the existing SSW Tendon Surveillance AMP as plant-specific. The applicant amended this SLRA section by letters dated February 14, 2022, and April 20, 2022.

Staff Evaluation. The staff reviewed the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements of the applicant's program against the acceptance criteria for the corresponding elements as stated in SRP-SLR Section A.1.2.3. The staff's review focused on how the applicant's program manages aging effects through the effective incorporation of these program elements. The staff's evaluation of each of these program elements follows. The staff's review of the "confirmation process," "administrative controls," and compliance with 10 CFR Part 50, Appendix B, Criterion XVI, "Corrective Action," of the "corrective action" programs elements are documented in SE Section 3.0.4.

Scope of Program. The staff reviewed the applicant's "scope of program" program element against the criteria in SRP-SLR Section A.1.2.3.1. The applicant described that the plant-specific SSW Tendon Surveillance AMP is an existing condition monitoring program that manages aging effects associated with the tendons and tendon anchorage hardware—including bearing plates, anchor-heads, bushing, buttonheads, and shims—in the reactor building SSW tendons of ONS Units 1, 2, and 3. The staff finds the applicant's "scope of program" program element to be adequate because the applicant identified the specific program of condition monitoring that manages the aging effects of SSW tendons and anchorage hardware through the subsequent period of extended operation.

Preventive Actions. The staff reviewed the applicant's "preventive actions" program element against the criteria in SRP-SLR Section A.1.2.3.2. The applicant described that the existing plant-specific SSW Tendon Surveillance AMP is a condition monitoring program and concluded that preventative or mitigative activities are not required. The staff finds that implementation of the "preventive actions" program element is not required because the applicant will be performing the condition monitoring activities described in the "detection of aging effects" and "monitoring and trending" program elements as described below. Therefore, the staff finds the applicant's "preventive actions" program element acceptable.

Parameters Monitored or Inspected. The staff reviewed the applicant's "parameters monitored or inspected" program element against the criteria in SRP-SLR Section A.1.2.3.3. The applicant noted that visual inspections and lift-off tests would be conducted on three randomly selected horizontal tendons every other refueling outage. During the audit, the staff noted that there are three types of tendon groups in the SSW: vertical, horizontal, and diagonal. It was unclear to the staff why inspections would only be conducted on the horizontal tendons. This led to RAI B4.1-1 and follow-up RAI B4.1-3 and the applicant's responses, which are documented in ADAMS Accession Nos. ML22045A021 and ML22110A207, respectively. The response to RAI B4.1-3 described that the SSW Tendon Surveillance program will be enhanced to conduct visual inspections and randomly selected lift-off tests every other outage on five (5) tendons: three (3) horizontal, one (1) diagonal, and one (1) vertical. Visual inspections will also be performed on the tendon anchorages, bearing plates, shims, tendon wires, and buttonheads for loss of material, cracking, breakage, and splits. The response further explained that the tendon sample size was appropriate based on the percentage of tendons that would be inspected each interval (6 percent horizontal, 13 percent vertical, and 6 percent diagonal). The staff finds the applicant's response and the "parameters monitored or inspected" program element to be adequate because the SSW Tendon Surveillance program includes visual inspections and lift-off tests that can properly detect the relevant aging effects. In addition, the inspections are conducted on a reasonable sample size that includes all three tendon types. Additional details on the staff's review of the tendon sample size and associated RAIs can be found in the "detection of aging effects" below.

Detection of Aging Effects. The staff reviewed the applicant's "detection of aging effects" program element against the criteria in SRP-SLR Section A.1.2.3.4. The applicant described that the visual inspections and lift-off tests are performed on three (3) randomly selected horizontal tendons every other outage. Based on the review of the applicant's "detection of aging effects" program element, it was not clear to the staff why the SSW tendon inspections are limited to the horizontal tendons only. Therefore, the staff issued RAI B4.1-1 (ADAMS Accession No. ML22012A039) requesting the applicant justify why vertical and diagonal tie tendons are not considered for visual inspections and tendon lift-off tests. In its response (ADAMS Accession No. ML22045A021), the applicant enhanced the SSW Tendon Surveillance program to perform SSW tendon lift-off testing on each of the three units for one (1) horizontal, one (1) diagonal, and one (1) vertical tendon. These tendons would be identified as common tendons and would be used for all future lift-off testing. At a follow-up public meeting on March 7, 2022 (ADAMS Accession No. ML22074A002), the staff asked the following three questions:

(1) Why is it appropriate to reduce the lift-off testing of the horizontal tendons from 3 tendons to 1 tendon?

(2) Why is 1 tendon appropriate for each sample size (1 horizontal, 1 vertical, and 1 diagonal) for lift-off testing?

(3) Provide technical justification for going from random tendons to common tendons for lift-off testing.

The applicant provided preliminary responses to the staff's questions during the March 7, 2022, public meeting via an email on March 11, 2022 (ADAMS Accession No. ML22074A002). In the email, the applicant proposed performing common lift-off testing on three horizontal tendons as well as the previously described programmatic enhancement item of adding common lift-off testing on one vertical tendon and one diagonal tendon. The applicant also described the common tendon concept of pulling the same five tendons each time (common tendons). The tendons, per unit, will be selected based on the existing lift-off data and practical access limitations, and this approach will ensure consistent data for trending of the prestressing losses. Based on the review of the applicant's preliminary response, the staff issued follow-up RAI B4.1-3 (ADAMS Accession No. ML22081A003) requesting that the applicant provide the technical justifications for the lift-off testing of sample size of three (3) horizontal, one (1) diagonal, and one (1) vertical tendon, and for the lift-off testing from "randomly selected tendons" to "common tendons," as described in the email, as well as requesting to provide markups to the ONS SLRA, as appropriate.

In its response (ADAMS Accession No. ML22110A207), the applicant stated that it will be performing visual inspections at both ends of the selected tendons every other refueling outage. The lift-off tests will be performed on three (3) of fifty-three (53) horizontal tendons every other refueling outage. That represents 5.5 percent of the total horizontal tendons sample size of fifty-three (53). The lift-off test will be performed on one (1) of eight (8) vertical tendons every other refueling outage. That represents 13 percent of the total vertical tendons sample size of eight (8). The lift-off test will be performed on one (1) of sixteen (16) diagonal tendons every other refueling outage. That represents 6 percent of the total diagonal tendons sample of sixteen (16). The applicant identified that the SSW Tendon Surveillance AMP is not under the requirements of ASME Section XI, Subsection IWL rules for containment tendons; however, it meets the tendon lift-off test requirement of 2 percent in Table IWL-2521-1. The applicant recognized that a minimum value of three (3) required tendons of each type to be tested was also provided in Table IWL-2521-1. However, the applicant concluded that that the minimum number was provided for containment structures with very large numbers of unbounded tendons, so the minimum value of three (3) is not relevant for the smaller number of tendons in the SSW. Finally, the applicant will also evaluate the projections of the tendon prestress losses against the acceptance criteria to confirm that there will be no loss of intended functions of the tendons.

Based on its review of the SLRA and RAI responses, the staff finds the applicant's "detection of aging effects" program element to be adequate because the applicant will be performing visual inspections and lift-off tests of every type of SSW tendon, and the applicant will perform projection evaluations of the tendon prestress losses to ensure that there will be no loss of intended function between inspections. Additionally, the inspections are conducted on a reasonable sample size that is larger than the 2 percent sample size discussed in Table IWL-2521-1. Furthermore, the applicant will revise the station procedures, as discussed in the "monitoring and trending" section below, to include a review of previous visual inspections and lift-off data results to trend the prestressing forces by projecting tendon prestress losses to the next two operating cycles.

Monitoring and Trending. The staff reviewed the applicant's "monitoring and trending" program element against the criteria in SRP-SLR Section A.1.2.3.5. As discussed above, the applicant described that visual inspections and lift-off tests will be performed on five randomly selected tendons every other outage. The applicant will also enhance station procedures to include reviewing previous visual inspection results for the condition of tendon wires and anchorages and lift-off results for the tendons selected for inspection. However, based on the review of the applicant's "monitoring and trending" program element, it was not clear to the staff whether the applicant will be performing trending assessments of the SSW tendon losses to make projections to the next inspection. Therefore, the staff issued RAI B4.1-2 (ADAMS Accession No. ML22012A039) requesting that the applicant discuss how prestressing losses are projected for the SSW tendons. In its response (ADAMS Accession No. ML22110A207), the applicant added an enhancement to revise station procedures to use lift-off data to trend prestressing forces and to project losses through the next two operating cycles (48 months). Based on its review of the SLRA and the RAI response, the staff finds the applicant's "monitoring and trending" program element to be adequate because it includes reasonable inspection intervals and an enhancement to ensure that results will be evaluated against the acceptance criteria and projected out to the next scheduled inspection.

Acceptance Criteria. The staff reviewed the applicant's "acceptance criteria" program element against the criteria in SRP-SLR Section A.1.2.3.6. The applicant described that the station procedures define the limits of acceptability of visual indications and measured lift-off forces. Indications and measured lift-off forces that do not meet the acceptance criteria are subjected to evaluation for continued service or are repaired via retensioning or replacement. The staff finds the applicant's "acceptance criteria" program element to be adequate because the SSW Tendon Surveillance program includes the limits of acceptability for the visual indications and lift-off tests in the procedure and, if required, the implementation of appropriate corrective actions to maintain the intended functions through the subsequent period of extended operation.

Corrective Actions. The staff reviewed the applicant's "corrective actions" program element against the criteria in SRP-SLR Section A.1.2.3.7. The applicant described that the "corrective actions" program is implemented in accordance with the requirements of 10 CFR 50, Appendix B, Criterion XVI. This requirement is implemented by the Quality Assurance Program, which is described in the applicant Corporation Topical Report, "Quality Assurance Program Description, Operating Fleet" (DUKE-QAPD-001-A). This topical report is incorporated by reference into the ONS UFSAR. The applicant described that once the conditions adverse to quality are identified, they are promptly corrected. The applicant will also perform testing and inspections (lift-off and visual) in accordance with station procedures to determine if the tendons are acceptable as-is or are in need of repairs, such as retensioning with reinspection during the subsequent inspection, or replacement. This process ensures that the tendons' intended function will be maintained consistent with the CLB through the subsequent period of extended operation. The staff finds the applicant's "corrective actions" program element to be adequate because the "corrective actions" program ensures that the tendons' intended function will be maintained consistent with the CLB through the subsequent period of extended operation as implemented in accordance with the requirements of 10 CFR 50, Appendix B, Criterion XVI.

<u>OE</u>. SLRA Section B4.1 summarizes OE related to the SSW Tendon Surveillance AMP. The staff reviewed OE information in the application and during the audit against the acceptance criteria in SRP-SLR Section A.1.2.3.10. As discussed in the audit report, the staff conducted an independent search of the plant OE information. As discussed in the audit report, the staff reviewed the plant OE information the applicant provided for this program to (a) identify examples of age-related degradation, and (b) provide a basis for the staff's conclusions on the ability of the applicant's proposed AMPs to manage the effects of aging in the subsequent period of extended operation. The staff did not identify any OE indicating that the applicant should modify its proposed program. Based on its audit and review of the application, the staff finds that the conditions and OE at the plant are bounded by those for which the SSW Tendon Surveillance AMP was evaluated.

<u>UFSAR Supplement</u>. SLRA Section A5.1 provides the UFSAR supplement for the SSW Tendon Surveillance AMP. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in GALL-SLR Report Table XI-01. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

<u>Conclusion</u>. Based on its technical review of the applicant's SSW Tendon Surveillance AMP, the staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.4 QA Program Attributes Integral to Aging Management Programs

The regulations at 10 CFR 54.21(a)(3) require SLR applicants to demonstrate that, for SCs subject to an AMR, they will adequately manage aging in a way that maintains intended function(s) consistent with the CLB for the subsequent period of extended operation. SRP-SLR, Appendix A.1, Branch Technical Position (BTP) RLSB-1, "Aging Management Review—Generic," describes 10 elements of an acceptable AMP. Program elements 7, 8, and 9 are associated with the QA activities of corrective actions, confirmation process, and administrative controls, respectively. BTP RLSB-1, Table A.1-1, "Elements of an Aging Management Program for Subsequent License Renewal," provides the following description of these program elements:

- Corrective Actions—Corrective actions, including root cause determination and prevention of recurrence, should be timely.
- Confirmation Process—Confirmation process should ensure that corrective actions have been completed and are effective.
- Administrative Controls—Administrative controls should provide a formal review and approval process.

SRP-SLR, Appendix A.2, BTP IQMB-1, "Quality Assurance for Aging Management Programs," notes that AMP aspects that affect the quality of safety-related SSCs are subject to the QA requirements of 10 CFR Part 50, Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants." Additionally, the SRP-SLR states that, for nonsafety-related SCs subject to an AMR, applicants may use the existing 10 CFR Part 50, Appendix B, "Quality Assurance Program," to address Program Element 7 ("corrective actions"), Program Element 8 ("confirmation process"), and Program Element 9 ("administrative controls"). BTP IQMB-1 provides the following guidance on the QA attributes of AMPs:

- Safety-related SCs are subject to 10 CFR Part 50 Appendix B requirements, which are adequate to address all quality-related aspects of an AMP consistent with the CLB of the facility for the subsequent period of extended operation.
- For nonsafety-related SCs that are subject to an AMR for SLR, an applicant has the option to expand the scope of its 10 CFR Part 50 Appendix B program to include these SCs to address [Program Element 7] corrective actions, [Program Element 8] confirmation process, and [Program Element 9] administrative controls, for aging management during the subsequent period of extended operation. The reviewer verifies that the applicant has documented such a commitment in the Final Safely Analysis Report supplement in accordance with 10 CFR 54.21(d).
- If an applicant chooses an alternative means to address corrective actions, confirmation process, and administrative controls, for managing aging of nonsafety-related SCs that are subject to an AMR for SLR, the applicant's proposal is reviewed on a case-by-case basis following the guidance in BTP RLSB1.

3.0.4.1 Summary of Technical Information in the Application

SLRA Appendix A, "UFSAR Supplement," Section A1.0, "Introduction," and SLRA Appendix B, "Aging Management Program," Section B1.3, "Quality Assurance Program and Administrative Controls," describe the elements of corrective actions, confirmation process, and administrative controls that are applied to the AMPs for both safety-related and nonsafety-related components.

SLRA Appendix A, Section A1.0, states, in part:

> The Quality Assurance (QA) Program is described in Topical Report DUKE-QAPD-001-A, "Quality Assurance Program Description, Operating Fleet" which implements the requirements of 10 CFR 50, Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants." The QA Program is consistent with the summary in Appendix A.2, "Quality Assurance for AMPs (Branch Technical Position IQMB-1)" of NUREG-2192. The QA Program provides the basis for the corrective actions, confirmation process, and administrative controls elements of AMPs. The scope of the existing QA Program is expanded to include nonsafety related structures and components that are subject to an AMR for LR. The QA Program is applicable to the safety related and nonsafety related structures, components, and commodity groups that are subject to AMR.

SLRA Appendix B, Section B1.3, states, in part:

> The QA Program is described in the applicant's Corporation Topical Report DUKE-QAPD 001- A, "Quality Assurance Program Description, Operating Fleet" which implements the requirements of 10 CFR 50, Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants." The QA Program is consistent with the summary in Appendix A.2, "Quality Assurance for Aging Management Programs (Branch Technical Position IQMB-1)" of NUREG- 2192. The QA Program includes the three elements of corrective actions, confirmation process, and administrative controls, which are applicable

to the safety related and nonsafety related structures, components and commodity groups that are subject to aging management review.

3.0.4.2 Staff Evaluation

The staff reviewed SLRA Appendix A, Section A1.0, and SLRA Appendix B, Section B.1.3, which describe how the applicant's existing QA Program includes the QA-related elements (corrective actions, confirmation process, and administrative controls) for AMPs, consistent with the staff's guidance described in BTP IQMB-1 and is applicable to safety-related and nonsafety-related SSCs and commodity groups within the scope of AMPs. Based on its review, the staff determined that the QA attributes presented in the AMP basis documents and the associated AMPs are consistent with the staff's position on QA for aging management.

3.0.4.3 Conclusion

On the basis of the staff's review of SLRA Appendix A, Section A1.0, and SLRA Appendix B, Section B1.3, the staff concludes that the QA attributes presented in the AMP basis documents and the associated AMPs are consistent with SRP-SLR, BTP RLSB-1, and BTP IQMB-1, and that the QA attributes will be maintained such that the applicant will adequately manage aging in a way that maintains intended function(s) consistent with the CLBs for the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3).

3.0.5 OE for Aging Management Programs

3.0.5.1 Summary of Technical Information in the Application

SLRA Appendix A, "UFSAR Supplement," Section A1.0, "Introduction," and SLRA Appendix B, "Aging Management Program," Section B.1.4, "Operating Experience," describe the consideration of OE for AMPs. These sections state that the applicant systematically reviews plant-specific and industry OE concerning aging management and age-related degradation to ensure that the SLR AMPs will be effective in managing the aging effects for which they are credited. OE for the programs credited with managing the effects of aging are reviewed to identify corrective actions that may result in program enhancements.

3.0.5.2 Staff Evaluation

3.0.5.2.1 Overview

In accordance with 10 CFR 54.21(a)(3), an applicant is required to demonstrate that the effects of aging on SCs subject to an AMR will be adequately managed so that their intended functions will be maintained in a way that is consistent with the CLB for the subsequent period of extended operation. SRP-SLR, Appendix A.4, "OE for Aging Management Programs," states that the systematic review of plant-specific and industry OE, including relevant research and development concerning aging management and age-related degradation, ensures that the SLR AMPs are, and will continue to be, effective in managing the aging effects for which they are credited. In addition, the SRP-SLR states that the AMPs should either be enhanced or new AMPs developed, as appropriate, when it is determined through the evaluation of OE that the effects of aging may not be adequately managed. AMPs should be informed by the review of OE on an ongoing basis, regardless of the AMPs' implementation schedule.

3.0.5.2.2 Consideration of Future OE

The staff reviewed SLRA Appendix A, Section A1.0, and SLRA Appendix B, Section B1.4, to determine how the applicant will use future OE to ensure that the AMPs are effective. The staff evaluated the applicant's OE review activities, as described in the SLRA, in SE Section 3.0.3 for each AMP.

3.0.5.2.3 Acceptability of Existing Programs

SRP-SLR Section A.4.2, "Position," describes existing programs generally acceptable to the staff for the capture, processing, and evaluating of OE concerning age-related degradation and aging management during the term of a subsequent renewed operating license. The acceptable programs are those relied on to meet the requirements of 10 CFR Part 50, Appendix B, and Item I.C.5, "Procedures for Feedback of Operating Experience to Plant Staff" in NUREG-0737, "Clarification of TMI Action Plan Requirements," issued November 1980 (ADAMS Accession No. ML051400209), as incorporated into the applicant's technical specifications. SRP-SLR Section A.4.2 also states that, as part of meeting the requirements of NUREG-0737, Item I.C.5, the applicant's OE program should rely on active participation in the Institute of Nuclear Power Operations (INPO) OE program (formerly the INPO Significant Event Evaluation and Information Network [SEE-IN]) endorsed in Generic Letter (GL) 82-04, "Use of INPO SEE-IN Program," dated March 9, 1982.

SLRA Appendix A, Section A1.0, and SLRA Appendix B, Section B1.4, state that the applicant uses its OE program to systematically capture and review OE from plant-specific and industry sources. The SLRA also states that the OE program meets the requirements of NUREG-0737. The SLRA further states that the OE program interfaces and relies on active participation in the INPO OE program. Based on this information, the staff determined that the applicant's OE program is consistent with the programs described in SRP-SLR Section A.4.2.

3.0.5.2.4 Areas of Further Review

Application of Existing Programs and Procedures to the Processing of OE Related to Aging. SRP-SLR Section A.4.2 states that the programs and procedures relied on to meet the requirements of 10 CFR Part 50, Appendix B, and NUREG-0737, Item I.C.5, should not preclude the consideration of OE on age-related degradation and aging management.

SLRA Appendix A, Section A1.0, and SLRA Appendix B, Section B1.4, state that OE from plant-specific and industry sources is systematically captured and reviewed on an ongoing basis in accordance with the QA Program, which is consistent with 10 CFR Part 50, Appendix B, and the OE program, which is consistent with NUREG-0737, Item I.C.5. The SLRA also states that the ongoing evaluation of OE includes a review of corrective actions, which may result in program enhancements. The SLRA further states that trending reports, program health reports, assessments, and corrective actions program items were reviewed to determine whether aging effects have been identified on applicable components.

Based on this information, the staff determined that the processes implemented under the applicant's QA, "corrective actions," and OE programs would not preclude consideration of age-related OE, which is consistent with the guidance in SRP-SLR Section A.4.2.

In addition, SRP-SLR Section A.4.2 states that the applicant should use the option described in SRP-SLR Appendix A.2 to expand the scope of the QA Program under 10 CFR Part 50,

Appendix B, to include nonsafety-related SCs. SLRA Appendix A, Section 1.0, and SLRA Appendix B, Section B.1.3, state that the applicant's QA Program includes nonsafety-related SCs, which the staff finds consistent with the guidance in SRP-SLR Section A.2 and therefore consistent with SRP-SLR Section A.4.2 as well. SE Section 3.0.4 documents the staff's evaluation of SLRA Appendix A, Section A1.0, and SLRA Appendix B, Section B1.3, relative to the application of the QA Program to nonsafety-related SSCs.

Consideration of Guidance Documents as Industry OE. SRP-SLR Section A.4.2 states that NRC and industry guidance documents and standards applicable to aging management, including revisions to the GALL-SLR Report, should be considered as sources of industry OE and evaluated accordingly.

SLRA Appendix B, Section B1.4, states that the sources of external OE include the INPO OE program, GALL-SLR Report revisions, and other NRC review and guidance documentation.

The staff finds that the applicant will consider an appropriate breadth of industry OE for impacts on its aging management activities, which includes sources that the staff considers to be the primary sources of external OE information. Based on the completion of the staff's review and the consistency of consideration of guidance documents as industry OE with the guidance in SRP-SLR Section A.4.2, the staff finds the program to be acceptable.

Screening of Incoming OE. SRP-SLR Section A.4.2 states that all incoming plant-specific and industry OE should be screened to determine whether it involves age-related degradation or impacts to aging management activities.

SLRA Appendix A1, SLRA Section A1.0, and SLRA Appendix B, Section B1.4, state that internal and external OE is captured and systematically reviewed on an ongoing basis and that the OE program provides for evaluation of site-specific and industry OE items that are screened to determine whether they involve lessons learned that may impact AMPs. Items are evaluated, and affected AMPs are either enhanced or new AMPs are developed, as appropriate, when it is determined that the effects of aging are not adequately managed. The staff finds that the applicant's OE review processes will include screening of all new OE to identify and evaluate items that can impact the aging management activities. Based on the completion of the staff's review and the consistency of screening of incoming OE with the guidance in SRP-SLR Section A.4.2, the staff finds the program to be acceptable.

Identification of OE Related to Aging. SRP-SLR Section A.4.2 states that coding should be used within the plant corrective actions program to identify OE involving age-related degradation applicable to the plant. The SRP-SLR also states that the associated entries should be periodically reviewed, and any adverse trends should receive further evaluation.

SLRA Appendix B, Section B1.4, states that the "corrective actions" program identifies either plant-specific OE related to aging or industry OE related to aging, allowing the tracking and trending of this information.

Based on the completion of the staff's review and the consistency of the identification of OE related to aging with the guidance in SRP-SLR, Section A.4.2, the staff finds the program to be acceptable.

Information Considered in OE Evaluations. SRP-SLR Section A.4.2 states that OE identified as involving aging should receive further evaluation based on consideration of the information, such as the affected SSCs, materials, environments, aging effects, aging mechanisms, and AMPs. The SRP-SLR also states that actions should be initiated within the "corrective actions" program to either enhance the AMPs or develop and implement new AMPs if an OE evaluation finds that the effects of aging may not be adequately managed.

SLRA Appendix A, Section A1.0, and SLRA Appendix B, Section B1.4, state that the applicant's program requires that, when evaluations indicate that the effects of aging are not being adequately managed, the affected AMPs are either enhanced or new AMPs are developed, as appropriate.

The staff determined that the applicant's evaluations of age-related OE include the assessment of appropriate information to determine potential impacts on the aging management activities. The staff also determined that the applicant's OE program, in conjunction with the "corrective actions program," would implement any changes necessary to manage the effects of aging, as determined through its OE evaluations. Therefore, the staff finds that the information considered in the applicant's OE evaluations and the use of the OE program and the "corrective actions" program to ensure that the effects of aging are adequately managed is consistent with the guidance in SRP-SLR Section A.4.2.

Evaluation of AMP Implementation Results. SRP-SLR Section A.4.2 states that the results of implementing the AMPs, such as data from inspections, tests, and analyses, should be evaluated regardless of whether the acceptance criteria of the particular AMP have been met. SRP-SLR Section A.4.2 states that this information should be used to determine whether it is necessary to adjust the inspection activities for aging management. In addition, SRP-SLR Section A.4.2 states that actions should be initiated within the plant "corrective actions" program to either enhance the AMPs or develop and implement new AMPs if these evaluations indicate that the effects of aging may not be adequately managed.

SLRA Appendix B, Section B1.4, states that internal OE is found in health reports, program assessments, and the 10 CFR Part 50, Appendix B, "corrective actions" program. In addition, SLRA Appendix A, Section A1.0, and SLRA Appendix B, Section B1.4, state that either AMPs are enhanced or new AMPs developed, as appropriate, when it is determined through the evaluation of OE that the effects of aging may not be adequately managed. SLRA Appendix B, Section B1.4, states that the OE program also meets the requirements of NEI 14-12, "Aging Management Program Effectiveness," for periodic program assessments. In addition, SLRA Appendix B, Section B1.4, states that AMP and OE assessments would be performed on a periodic basis not to exceed 5 years.

Based on the completion of the staff's review and the consistency of the applicant's treatment of AMP implementation results as OE with the guidance in SRP-SLR Section A.4.2, the staff finds the program to be acceptable.

Training. SRP-SLR Section A.4.2 states that training on age-related degradation and aging management should be provided to those personnel responsible for implementing the AMPs and those personnel that may submit, screen, assign, evaluate, or otherwise process plant-specific and industry OE. SRP-SLR Section A.4.2 also states that the training should be periodic and include provisions to accommodate the turnover of plant personnel.

SLRA Appendix A1, Section A1.0, states that the OE program provides for training for those responsible for activities including screening, evaluating, and processing OE items related to aging management and age-related degradation.

Based on the completion of the staff's review and the consistency of the scope of personnel included in the applicant's training program with the guidance in SRP-SLR Section 4.2, the staff determined the program to be acceptable.

Reporting OE to the Industry. SRP-SLR Section A.4.2 states that guidelines should be established for reporting plant-specific OE to the industry on age-related degradation and aging management.

SLRA Appendix A, Section A1.0, and SLRA Appendix B, Section B1.4, state that the applicant's OE program actively participates in the INPO OE program. Based on the completion of the staff's review and the consistency of the applicant's reporting of OE to the industry with the guidance in SRP-SLR Section 4.2, the staff determined the program to be acceptable.

Schedule for Implementing the OE Review Activities. SRP-SLR Section A.4.2 states that the OE review activities should be implemented on an ongoing basis throughout the term of a subsequent renewed license.

SLRA Appendix B, Section B1.4, states that the applicant's self-assessment process provides for periodic evaluation of the effectiveness of the OE program described in the UFSAR supplement. SLRA Appendix B, Section B1.4, states that the OE program will be implemented on an ongoing basis throughout the terms of the subsequent renewed licenses. SLRA Appendix A, Section A1.0, provides the UFSAR supplement summary description of the applicant's enhanced programmatic activities for the ongoing review of OE. Upon issuance of the subsequent renewed licenses in accordance with 10 CFR 54.3(c), this summary description will be incorporated into the CLB, and, at that time, the applicant will be obligated to conduct its OE review activities accordingly.

The staff finds the implementation schedule to be acceptable because the applicant will implement the OE review activities on an ongoing basis throughout the term of the subsequent renewed operating license.

3.0.5.2.5 Conclusion

Based on its review of the SLRA, the staff determined that the applicant's programmatic activities for the ongoing review of OE are acceptable for (a) the systematic review of plant-specific and industry OE to ensure that the subsequent license renewal AMPs are, and will continue to be, effective in managing the aging effects for which they are credited, and (b) the enhancement of AMPs or the development of new AMPs when it is determined through the evaluation of OE that the effects of aging may not be adequately managed. Based on the staff's review and the consistency of the applicant's OE review activities with the guidance in SRP-SLR Section A.4.2, the staff finds the applicant's programmatic activities for the ongoing review of OE acceptable.

3.0.5.3 UFSAR Supplement

In accordance with 10 CFR 54.21(d), the UFSAR supplement must, in part, contain a summary description of the programs and activities for managing the effects of aging. SLRA Appendix A, Section A1.0, provides the UFSAR supplement summary description of the applicant's programmatic activities for the ongoing review of OE that will ensure that plant-specific and industry OE related to aging management will be used effectively.

Based on its review, the staff determined that the content of the applicant's summary description is consistent with guidance and also is sufficiently comprehensive to describe the applicant's programmatic activities for evaluating OE to maintain the effectiveness of the AMPs. Therefore, the staff finds the applicant's UFSAR supplement summary description acceptable.

3.0.5.4 Conclusion

Based on its review of the applicant's programmatic activities for the ongoing review of OE, the staff finds that the applicant has demonstrated that OE will be reviewed to ensure that the effects of aging will be adequately managed so that the intended functions will remain consistent with the CLB for the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for these activities and finds that it provides an adequate summary description, as required by 10 CFR 54.21(d).

3.1 Aging Management of Reactor Vessels, Reactor Internals, and Reactor Coolant System

3.1.1 Summary of Technical Information in the Application

SLRA Section 3.1 provides AMR results for those components that the applicant identified in SLRA Section 2.3.1, "Reactor Vessel, Internals, and Reactor Coolant System," as being subject to an AMR. SLRA Table 3.1.1, "Summary of Aging Management Programs for Reactor Vessel, Internals, and Reactor Coolant System Evaluated in Chapter IV of the GALL-SLR Report," is a summary comparison of the applicant's AMR results with those provided in the GALL-SLR Report for the RCS components and component groups.

3.1.2 Staff Evaluation

Table 3.1-1 below summarizes the staff's evaluation of the component groups listed in SLRA Section 3.1 and addressed in the GALL-SLR Report.

Table 3.1-1 Staff Evaluation for Reactor Vessel, Internals, and Reactor Coolant System Components Evaluated in the GALL-SLR Report

Component Group (SRP-SLR Item No.)	Staff Evaluation
3.1.1-001	Consistent with the GALL-SLR Report (see SE Section 3.1.2.2.1)
3.1.1-002	Consistent with the GALL-SLR Report (see SE Section 3.1.2.2.1)
3.1.1-003	Consistent with the GALL-SLR Report (see SE Section 3.1.2.2.1)
3.1.1-004	Consistent with the GALL-SLR Report (see SE Section 3.1.2.2.1)
3.1.1-005	Consistent with the GALL-SLR Report (see SE Section 3.1.2.2.1)
3.1.1-006	Not applicable to PWRs (see SE Section 3.1.2.2.1)
3.1.1-007	Not applicable to PWRs (see SE Section 3.1.2.2.1)
3.1.1-008	Consistent with the GALL-SLR Report (see SE Section 3.1.2.2.1)
3.1.1-009	Consistent with the GALL-SLR Report (see SE Section 3.1.2.2.1)
3.1.1-010	Consistent with the GALL-SLR Report (see SE Section 3.1.2.2.1)
3.1.1-011	Consistent with the GALL-SLR Report (see SE Section 3.1.2.2.1)
3.1.1-012	Not applicable to Oconee (see SE Sections 3.1.2.2.2, items 1 and 2)
3.1.1-013	Consistent with the GALL-SLR Report (see SE Section 3.1.2.2.3, item 1)
3.1.1-014	Consistent with the GALL-SLR Report (see SE Section 3.1.2.2.3, item 2)

Component Group (SRP-SLR Item No.)	Staff Evaluation
3.1.1-015	Consistent with the GALL-SLR Report (see SE Section 3.1.2.2.3, item 3)
3.1.1-016	Not applicable to PWRs (see SE Section 3.1.2.2.4, item 1)
3.1.1-017	Not applicable to PWRs (see SE Section 3.1.2.2.4, item 2)
3.1.1-018	Consistent with the GALL-SLR Report (see SE Section 3.1.2.2.5)
3.1.1-019	Not applicable to Oconee. Addressed by 3.1.1-045 (see SE Section 3.1.2.2.6, item 1)
3.1.1-020	Consistent with the GALL-SLR Report (see SE Section 3.1.2.2.6, item 2)
3.1.1-021	Not applicable to PWRs (see SE Section 3.1.2.2.7)
3.1.1-022	Not applicable to Oconee (see SE Section 3.1.2.2.8)
3.1.1-023	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.1.1-024	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.1.1-025	Not applicable to Oconee (see SE Sections 3.1.2.2.11 items 1 and 2)
3.1.1-026	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.1.1-027	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.1.1-028	Not applicable to Oconee (see SE Section 3.1.2.2.9)
3.1.1-029	Not applicable to PWRs (see Section 3.1.2.2.12)
3.1.1-030	Not applicable to PWRs
3.1.1-031	Not applicable to PWRs
3.1.1-032	This item was removed as part of SLR-ISG-2021-01-PWRVI
3.1.1-033	Consistent with the GALL-SLR Report
3.1.1-034	Not applicable to Oconee
3.1.1-035	Consistent with the GALL-SLR Report
3.1.1-036	Consistent with the GALL-SLR Report
3.1.1-037	Consistent with the GALL-SLR Report
3.1.1-038	Consistent with the GALL-SLR Report
3.1.1-039	Consistent with the GALL-SLR Report
3.1.1-040	Consistent with the GALL-SLR Report
3.1.1-040a	Consistent with the GALL-SLR Report
3.1.1-041	Not applicable to PWRs (see SE Section 3.1.2.2.12)
3.1.1-042	Consistent with the GALL-SLR Report
3.1.1-043	Not applicable to PWRs
3.1.1-044	Consistent with the GALL-SLR Report
3.1.1-045	Consistent with the GALL-SLR Report
3.1.1-046	Consistent with the GALL-SLR Report
3.1.1-047	Consistent with the GALL-SLR Report
3.1.1-048	Consistent with the GALL-SLR Report
3.1.1-049	Consistent with the GALL-SLR Report
3.1.1-050	Consistent with the GALL-SLR Report
3.1.1-051a	Consistent with the GALL-SLR Report (see SE Section 3.1.2.2.9)
3.1.1-051b	Consistent with the GALL-SLR Report (see SE Section 3.1.2.2.9)
3.1.1-052a	Not applicable to Oconee (see SE Section 3.1.2.2.9)
3.1.1-052b	Not applicable to Oconee (see SE Section 3.1.2.2.9)
3.1.1-052c	Not applicable to Oconee (see SE Section 3.1.2.2.9)
3.1.1-053a	Not applicable to Oconee (see SE Section 3.1.2.2.9)
3.1.1-053b	Not applicable to Oconee (see SE Section 3.1.2.2.9)

Component Group (SRP-SLR Item No.)	Staff Evaluation
3.1.1-053c	Not applicable to Oconee (see SE Section 3.1.2.2.9)
3.1.1-054	Not applicable to Oconee
3.1.1-055a	Consistent with the GALL-SLR Report (see SE Section 3.1.2.2.9)
3.1.1-055b	Not applicable to Oconee (see SE Section 3.1.2.2.9)
3.1.1-055c	Not applicable to Oconee (see SE Section 3.1.2.2.9)
3.1.1-056a	Not applicable to Oconee (see SE Section 3.1.2.2.9)
3.1.1-056b	Not applicable to Oconee (see SE Section 3.1.2.2.9)
3.1.1-056c	Not applicable to Oconee (see SE Section 3.1.2.2.9)
3.1.1-057	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.1.1-058a	Consistent with the GALL-SLR Report (see SE Section 3.1.2.2.9)
3.1.1-058b	Consistent with the GALL-SLR Report (see SE Section 3.1.2.2.9)
3.1.1-059a	Not applicable to Oconee (see SE Section 3.1.2.2.9)
3.1.1-059b	Not applicable to Oconee (see SE Section 3.1.2.2.9)
3.1.1-059c	Not applicable to Oconee (see SE Section 3.1.2.2.9)
3.1.1-060	Not applicable to PWRs
3.1.1-061	Consistent with the GALL-SLR Report
3.1.1-062	Consistent with the GALL-SLR Report
3.1.1-063	Not applicable to PWRs
3.1.1-064	Consistent with the GALL-SLR Report
3.1.1-065	Not applicable to Oconee
3.1.1-066	Consistent with the GALL-SLR Report
3.1.1-067	Consistent with the GALL-SLR Report
3.1.1-068	Not applicable to Oconee
3.1.1-069	Consistent with the GALL-SLR Report
3.1.1-070	Consistent with the GALL-SLR Report
3.1.1-071	Consistent with the GALL-SLR Report
3.1.1-072	Consistent with the GALL-SLR Report
3.1.1-073	Not applicable to Oconee
3.1.1-074	Not applicable to Oconee
3.1.1-075	Not applicable to Oconee
3.1.1-076	Not applicable to Oconee
3.1.1-077	Consistent with the GALL-SLR Report
3.1.1-078	Consistent with the GALL-SLR Report
3.1.1-079	Not applicable to PWRs
3.1.1-080	Not applicable to Oconee
3.1.1-081	Consistent with the GALL-SLR Report
3.1.1-082	Not applicable to Oconee
3.1.1-083	Consistent with the GALL-SLR Report
3.1.1-084	Not applicable to PWRs
3.1.1-085	Not applicable to PWRs
3.1.1-086	Not applicable to Oconee
3.1.1-087	Consistent with the GALL-SLR Report
3.1.1-088	Consistent with the GALL-SLR Report
3.1.1-089	Not applicable to Oconee

Component Group (SRP-SLR Item No.)	Staff Evaluation
3.1.1-090	Not applicable to Oconee
3.1.1-091	Not applicable to PWRs
3.1.1-092	Consistent with the GALL-SLR Report
3.1.1-093	Not applicable to Oconee
3.1.1-094	Not applicable to PWRs
3.1.1-095	Not applicable to PWRs
3.1.1-096	Not applicable to PWRs
3.1.1-097	Not applicable to PWRs
3.1.1-098	Not applicable to PWRs
3.1.1-099	Not applicable to PWRs (see SE Section 3.1.2.2.13)
3.1.1-100	Not applicable to PWRs (see SE Section 3.1.2.2.13)
3.1.1-101	Not applicable to PWRs
3.1.1-102	Not applicable to PWRs
3.1.1-103	Not applicable to PWRs (see SE Section 3.1.2.2.12)
3.1.1-104	Not applicable to PWRs
3.1.1-105	Not applicable to Oconee (see SE Section 3.1.2.2.15)
3.1.1-106	Consistent with the GALL-SLR Report
3.1.1-107	Consistent with the GALL-SLR Report
3.1.1-108	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.1.1-109	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.1.1-110	Not applicable to PWRs
3.1.1-111	Consistent with the GALL-SLR Report
3.1.1-112	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.1.1-113	Not applicable to PWRs
3.1.1-114	Not applicable to Oconee. Addressed by 3.1.1-020, 3.1.1-033, 3.3.1-037, 3.1.1-039, 3.1.1-042, 3.1.1-088, 3.1.1.-116
3.1.1-115	Not applicable to Oconee (see SE Section 3.1.2.2.15)
3.1.1-116	Not applicable to Oconee (see SE Section 3.1.2.2.10, item 1)
3.1.1-117	Not applicable to Oconee (see SE Section 3.1.2.2.10, item 2)
3.1.1-118	Consistent with the GALL-SLR Report (see SE Section 3.1.2.2.9)
3.1.1-119	Consistent with the GALL-SLR Report (see SE Section 3.1.2.2.9)
3.1.1-120	Not applicable to PWRs (see SE Section 3.1.2.2.14)
3.1.1-121	Not applicable to PWRs
3.1.1-122	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.1.1-123	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.1.1-124	Consistent with the GALL-SLR Report
3.1.1-125	Consistent with the GALL-SLR Report
3.1.1-126	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.1.1-127	Consistent with the GALL-SLR Report
3.1.1-128	Not applicable to PWRs
3.1.1-129	Not applicable to PWRs
3.1.1-130	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.1.1-131	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.1.1-132	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.1.1-133	Not applicable to PWRs

Component Group (SRP-SLR Item No.)	Staff Evaluation
3.1.1-134	Consistent with the GALL-SLR Report
3.1.1-135	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.1.1-136	Consistent with the GALL-SLR Report (see SE Section 3.1.2.2.16)
3.1.1-137	Not applicable to Oconee. Addressed by 3.3.1-114
3.1.1-138	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.1.1-139	Consistent with the GALL-SLR Report (see SE Section 3.1.2.2.6, item 3)

The staff's review of component groups, as described in SE Section 3.0.2.2, is summarized in the following three sections:

(4) SE Section 3.1.2.1 discusses AMR results for components that the applicant states are either not applicable to Oconee or are consistent with the GALL-SLR Report. Section 3.1.2.1.1 summarizes the staff's review of items that are not applicable or not used and documents any RAIs issued and the staff's conclusions.

(5) SE Section 3.1.2.2 discusses AMR results for which the GALL-SLR Report and SRPSLR recommend further evaluation.

(6) SE Section 3.1.2.3 discusses AMR results for components that the applicant states are not consistent with, or not addressed in, the GALL-SLR Report. These AMR results typically are identified by generic notes F through J and plant-specific notes in the SLRA.

3.1.2.1 Aging Management Review Results Consistent with the GALL-SLR Report

The following subsections document the staff's review of AMR results listed in SLRA Tables 3.1.2-1 through 3.1.2-4 that the applicant determined to be consistent with the GALL-SLR Report. The staff audited and reviewed the information in the SLRA. The staff did not repeat its review of the matters described in the GALL-SLR Report. The staff verified that the material presented in the SLRA was applicable and that the applicant identified the appropriate GALL-SLR Report AMRs. For those AMR items that the staff found to be consistent with the GALL-SLR Report, and for which no additional evaluation or RAI applies, the GALL-SLR Report provides a basis for acceptability of the AMR items. The staff's conclusion of "Consistent with the GALL-SLR Report" is documented in SE Table 3.1-1, and no separate writeup is provided.

The staff notes that the applicant changed the designation for Table 3.1.1, AMR items 3.1.1-071 (IV.D1.RP-226 and IV.D1.RP.384) from "Not applicable to ONS steam generators. The associated NUREG-2191 aging items are not used" in the original submission to "Consistent with NUREG-2191, except that the associated NUREG-2191 item is aligned to stainless steel Babcock & Wilcox Once Through Steam Generator Tube Support Plate Assembly support rods and tube support plates" as part of the response to RAI B2.1.10-2a, dated April 22, 2022 (ADAMS Accession No. ML22112A016). Supplement 3, dated December 15, 2021 (ADAMS Accession No. ML21349A005), and the response to RAI B2.1.10-3, dated February 14, 2022 (ADAMS Accession No. ML22045A021), revised SLRA Table 3.1.2-4 to cite AMR items 3.1.1-071 (IV.D1.RP-226 and IV.D1.RP.384) for managing loss of material and cracking of the tube support plate assembly support rods and tube support plates. The staff finds these changes acceptable as discussed in the staff's evaluation of the Steam Generator program in SE Section 3.0.3.1.

Section 3.1.2.1.1 documents the staff's review of AMR items for which the GALL-SLR Report does not recommend further evaluation that the applicant determined to either not be applicable or not used.

3.1.2.1.1 Aging Management Review Results Identified as Not Applicable or Not Used

For SLRA Table 3.1.1, Items 3.1.1-012, 3.1.1-019, 3.1.1-022, 3.1.1-025, 3.1.1-028, 3.1.1-034, 3.1.1-052a, 3.1.1-052b, 3.1.1-052c, 3.1.1-053a, 3.1.1-053b, 3.1.1-053c, 3.1.1-054, 3.1.1-055b, 3.1.1-055c, 3.1.1-056a, 3.1.1-056b, 3.1.1-056c, 3.1.1-059a, 3.1.1-059b, 3.1.1-059c, 3.1.1-065, 3.1.1-068, 3.1.1-073, 3.1.1-074, 3.1.1-075, 3.1.1-076, 3.1.1-080, 3.1.1-082, 3.1.1-086, 3.1.1-089, 3.1.1-090, 3.1.1-093, 3.1.1 105, 3.1.1-114, 3.1.1-115, 3.1.1-116, 3.1.1-117, and 3.1.1-137, the applicant claims that the corresponding AMR items in the GALL-SLR Report are not applicable to ONS. The staff reviewed the SLRA and UFSAR and confirmed that the applicant's SLRA does not have any AMR results that are applicable for these items or in-scope components in corresponding environments.

For SLRA Table 3.1.1, Items 3.1.1-006, 3.1.1-007, 3.1.1-016, 3.1.1-017, 3.1.1-021, 3.1.1-029, 3.1.1-030, 3.1.1-031, 3.1.1-041, 3.1.1-043, 3.1.1-060, 3.1.1-063, 3.1.1-079, 3.1.1-084, 3.1.1-085, 3.1.1-091, 3.1.1-094, 3.1.1-095, 3.1.1-096, 3.1.1-097, 3.1.1-098, 3.1.1-099, 3.1.1-100, 3.1.1-101, 3.1.1-102, 3.1.1-103, 3.1.1-104, 3.1.1-110, 3.1.1-113, 3.1.1-120, 3.1.1-121, 3.1.1-128, 3.1.1-129, 3.1.1-133, and 3.1.1-137, the applicant claims that the corresponding AMR items in the GALL-SLR Report are not applicable because the associated items are only applicable to boiling-water reactors (BWRs). The staff reviewed the SRP-SLR, confirmed that these items only apply to BWRs, and finds that these items are not applicable to ONS because it is a PWR.

For the following SLRA Table 3.4-1 items, the applicant claimed that the corresponding item in the GALL-SLR Report is not applicable and it is addressed by another SLRA Table 1, AMR item: 3.1.1-019 (addressed by 3.1.1-045), 3.1.1-114 (addressed by 3.1.1-020, 3.1.1-033, 3.1.1-037, 3.1.1-039, 3.1.1-042, 3.1.1-088, and 3.1.1-116) and 3.1.1-137 (addressed by 3.1.1-114). The staff reviewed the SLRA and confirmed that the aging effects for each of these items will be addressed by other SLRA Table 1 AMR items. Therefore, the staff finds the applicant's proposal to use alternate items acceptable.

3.1.2.2 Aging Management Review Results for Which Further Evaluation Is Recommended by the GALL-SLR Report

In SLRA Section 3.1.2.2, the applicant further evaluates aging management for certain RCS components as recommended by the GALL-SLR Report and provides information concerning how it will manage the applicable aging effects. The staff reviewed the applicant's evaluation of these component groups against the criteria contained in SRP-SLR Section 3.1.2.2. The following subsections document the staff's review.

3.1.2.2.1 Cumulative Fatigue Damage

SLRA Section 3.1.2.2.1 is associated with SLRA Table 3.1.1, Items 3.1.1-001, 3.1.1-002, 3.1.1-003, 3.1.1-004, 3.1.1-005, 3.1.1-008, 3.1.1-009, 3.1.1-010, and 3.1.1-011. The section states that the TLAAs on cumulative fatigue damage in RCS components are evaluated in accordance with 10 CFR 54.21(c)(1) and addressed in SLRA Section 4.3. This is consistent with SRP-SLR Section 3.1.2.2.1 and is therefore acceptable. The staff's evaluation of the TLAAs for RCS components is documented in SE Sections 4.3.1, 4.3.2, 4.3.4, 4.3.5, and 4.3.6.

3.1.2.2.2 Loss of Material Due to General, Pitting, and Crevice Corrosion

The staff reviewed SLRA Section 3.1.2.2.2 against the criteria in SRP-SLR Section 3.1.2.2.2, which divided this degradation into two parts, Items 1 and 2.

SLRA Section 3.1.2.2.2, Items 1 and 2, are addressed in SLRA Table 3.1.1, Item 3.1.1-012, which requires further evaluation for loss of material due to general, pitting, and crevice corrosion of Westinghouse Model 44 and 51 steam generators. The applicant stated that the further evaluation items apply to Westinghouse steam generators and are not applicable to B&W steam generators at Oconee Units 1, 2, and 3. The staff noted that the associated items in SLRA are not applicable to the Oconee Units 1, 2, and 3 B&W steam generators and therefore finds the applicant's claim acceptable.

3.1.2.2.3 Loss of Fracture Toughness Due to Neutron Irradiation Embrittlement

Item 1. SLRA Section 3.1.2.2.3, Subsection 3.1.1-013, associated with SLRA Table 3.1.1, AMR item 3.1.1-013, states that TLAAs are evaluated in accordance with 10 CFR 54.21(c)(1) and that evaluation of the neutron embrittlement analysis for the base metal and weld components in the beltline and extended beltline regions of the RPVs is given in SLRA Section 4.2, "Reactor Vessel Neutron Embrittlement," which includes the following five subsections for the TLAA in SLRA Section 4.2: (1) SLRA Section 4.2.1, "Neutron Fluence Projections"; (2) SLRA Section 4.2.2, "Upper-Shelf Energy"; (3) SLRA Section 4.2.3, "Pressurized Thermal Shock"; (4) SLRA Section 4.2.4, "Pressure-Temperature Limits"; and (5) SLRA Section 4.2.5, "Low Temperature Overpressure Protection."

As part of its audit activities for the SLRA review, the staff reviewed the component-specific screening results for the ONS Unit 1, 2, and 3 RPVs and the Table 2 type AMR items for RPV components in SLRA Table 3.1.2-1 for consistency with the design configurations of the ONS Unit 1, 2, and 3 RPVs in Figures 5-14, 5-15, and 5-16 of the Oconee UFSAR. As documented in the audit report for the SLRA, the staff observed issues with the component-specific screening results reported for RPV components in SLRA Table 2.3.1-1 and the corresponding Table 2 AMR item results reported for RPV components in SLRA Table 3.1.2-2. As documented and defined in the audit report, the staff discussed these RPV screening results and AMR item issues with the applicant during a virtual teleconference meeting held on July 13, 2021.

By Supplement 1 dated October 28, 2021 (ADAMS Accession No. ML21302A208), the applicant submitted SLRA Supplement 1 to address the RPV screening and AMR item issues that were discussed with the applicant in the July 13, 2021, teleconference. In this SLRA supplement, the applicant amended both the component-specific screening results for the ONS Unit 1, 2, and 3 RPVs in SLRA Table 2.3.1-1 and the corresponding Table 2 AMR item results for the RPV components in SLRA Table 3.1.2-1 (including those Table 2 AMR items in SLRA Table 3.1.2-1 that link to SLRA Table 3.1.1, Item 3.1.1-013 and the related RPV neutron embrittlement TLAA evaluations in SLRA Section 4.2).

The staff reviewed the applicant's amendments of the component-specific screening results for RPV components in SLRA Table 2.3.1-1 and confirmed that the amended RPV-specific screening results appropriately account for (1) all RPV beltline and non-beltline base metal and weld components that are included in the ONS Unit 1, 2, and 3 RPV designs, and (2) the difference in the component-specific configuration of the ONS Unit 1 RPV design from the configurations of the corresponding RPV designs in ONS Units 2 and 3.

The staff also reviewed the applicant's amendments of the Table 2 AMR results for RPV components in SLRA Table 3.1.2-1. For those RPV beltline components (including extended beltline components) that needed amendment of the existing AMR item or development of a new AMR item and that would need to cross-reference to SLRA Table 1 Item 3.1.1-013, the staff confirmed that the applicant either updated the component description of the existing Table 2 AMR item or added a new Table 2 AMR item for the component that links to SLRA Table 1 AMR Item 3.1.1-013 and to the applicant's RPV neutron embrittlement TLAAs in SLRA Section 4.2. Thus, for AMR items in the SLRA that would need to appropriately cross-reference to SLRA Table 1 AMR Item 3.1.1-013 and to the RPV neutron embrittlement TLAAs in SLRA Section 4.2, the staff found the amendments of the AMR items to be consistent with both the updated screening results for the RPV beltline components in SLRA Table 2.3.1-1 and applicable RPV beltline configurations for the units as depicted in UFSAR Figures 5-14, 5-15, and 5-16 (including the difference in the RPV beltline configuration for Unit 1 [designed with three RPV beltline shell courses] from the corresponding RPV beltline configurations for Units 2 and 3 [designed with two RPV beltline shell courses]).

Therefore, based on the AMR item updates provided in SLRA Supplement 1, the staff finds that the applicant's AMR items for RPV components (as amended in SLRA Supplement 1) that are subject to the RPV neutron embrittlement TLAAs to be consistent with the guidance in SRP-SLR Section 3.1.2.2.3, Item 1, and are therefore acceptable. The staff also finds the updated screening results for the RPV components in SLRA 2.3.1-1 to be acceptable because they are now consistent with the unit-specific design configurations for the ONS Unit 1, 2, and 3 RPVs (as depicted in UFSAR Figure 5-14 for the Unit 1 RPV, UFSAR Figure 5-15 for the Unit 2 RPV, and UFSAR Figure 5-16 for the Unit 3 RPV). The staff's evaluations regarding the five TLAAs related to neutron embrittlement of the RPV components are documented in SE Sections 4.2.1, 4.2.2, 4.2.3, 4.2.4, and 4.2.5.

Item 2. SLRA Section 3.1.2.2.3, Subsection 3.1.1-014, associated with SLRA Table 3.1.1, AMR Item 3.1.1-014, addresses LOFT due to neutron irradiation embrittlement in RPV base metal and weld components exposed to a reactor coolant with a neutron flux environment, which will be managed by the AMPs in SLRA Section B2.1.19, "Reactor Vessel Material Surveillance," and SLRA Section B3.2, "Neutron Fluence Monitoring." The staff reviewed the applicant's proposal against the criteria in SRP-SLR Section 3.1.2.2.3, Item 2.

As part of its audit activities for the SLRA review, the staff reviewed the component-specific screening results for the ONS Unit 1, 2, and 3 RPVs and the Table 2 AMR items for RPV components in SLRA Table 3.1.2-1 for consistency with the design configurations of the ONS Unit 1, 2, and 3 RPVs in Figures 5-14, 5-15, and 5-16 of the ONS UFSAR. As documented in the audit report for the SLRA, the staff observed some issues with the component-specific screening results reported for RPV components in SLRA Table 2.3.1-1 and the corresponding Table 2 AMR item results reported for RPV components in SLRA Table 3.1.2-2. As documented and defined in the audit report, the staff discussed these RPV screening results and AMR item issues with the applicant during a virtual teleconference meeting held with the applicant on July 13, 2021.

By Supplement 1 dated October 28, 2021 (ADAMS Accession No. ML21302A208), the applicant submitted SLRA Supplement 1 to address the RPV screening and AMR item issues that were discussed with the applicant in the July 13, 2021, teleconference. In this SLRA supplement, the applicant amended both the component-specific screening results for the ONS Unit 1, 2, and 3 RPVs in SLRA Table 2.3.1-1 and the corresponding Table 2 AMR item results for the RPV components in SLRA Table 3.1.2-1 (including those Table 2 AMR items in SLRA

Table 3.1.2-1 that link to SLRA Table 3.1.1, Item 3.1.1-014, and the related Reactor Vessel Material Surveillance AMP in SLRA Section B2.1.19 and Neutron Fluence Monitoring AMP in SLRA Section B3.2).

The staff reviewed the applicant's amendments of the component-specific screening results for RPV components in SLRA Table 2.3.1-1; the staff confirmed that the amended RPV-specific screening results appropriately account for (1) all RPV beltline and non-beltline base metal and weld components that are included in the ONS Unit 1, 2, and 3 RPV designs, and (2) the difference in the component-specific configuration of the ONS Unit 1 RPV design from the configurations of the corresponding RPV designs in ONS Units 2 and 3.

The staff also reviewed the applicant's amendments of the Table 2 AMR item results for RPV components in SLRA Table 3.1.2-1. For those RPV beltline components that needed amendment of the existing AMR item or development of a new AMR item and that needed to cross-reference to SLRA Table 1, Item 3.1.1-014, the staff confirmed that the applicant either updated the component description of the existing Table 2 AMR item or added a new Table 2 AMR item for the component that links to SLRA Table 1 AMR Item 3.1.1-014 and to the applicant's Reactor Vessel Materials Surveillance and Neutron Fluence Monitoring AMPs (SLRA Sections B2.1.9 and B3.2). Thus, for AMR Items in the SLRA that needed to appropriately cross-reference to SLRA Table 1, AMR Item 3.1.1-014, and to the referenced AMPs, the staff found the amendments of the AMR items to be consistent with both the updated screening results for the RPV beltline components in SLRA Table 2.3.1-1 and applicable RPV beltline configurations for the units as depicted in UFSAR Figures 5-14, 5-15, and 5-16 (including the difference in the RPV beltline configuration for Unit 1, which is designed with three RPV beltline shell courses from the corresponding RPV beltline configurations for Units 2 and 3, which are designed with two RPV beltline shell courses).

Therefore, based on the AMR item updates provided in SLRA Supplement 1, the staff finds that the applicant's AMR items for RPV components (as amended in SLRA Supplement 1) that are within the scope of the applicant's Reactor Vessel Materials Surveillance and Neutron Fluence Monitoring AMPs are consistent with the guidance in SRP-SLR Section 3.1.2.2.3, Item 2, and are therefore acceptable. The staff also finds the updated screening results for the RPV components in SLRA 2.3.1-1 to be acceptable because they are now consistent with the unit-specific design configurations for the ONS Unit 1, 2, and 3 RPVs (as depicted in UFSAR Figure 5-14 for the Unit 1 RPV, UFSAR Figure 5-15 for the Unit 2 RPV, and UFSAR Figure 5-16 for the Unit 3 RPV). The staff's evaluation of SLRA AMP B2.1.19, "Reactor Vessel Materials Surveillance," is documented in SE Section 3.0.3.2.13. The staff's evaluation of SLRA AMP B3.2, "Neutron Fluence Monitoring," is documented in SE Section 3.0.3.1.17.

Item 3. SLRA Section 3.1.2.2.3, Subsection 3.1.1-015, as amended in Supplement 2 dated November 11, 2021 (ADAMS Accession No. ML21315A012), and associated with SLRA Table 3.1.1, AMR item 3.1.1-015, states that TLAAs are evaluated in accordance with 10 CFR 54.21(c)(1) and that evaluation of the reduction of ductile fracture toughness analysis for the RVI components is evaluated in SLRA Section 4.7, "Other Plant-Specific Time-Limited Aging Analyses." The staff confirmed that the applicant provides its evaluations of the reduction of ductility TLAA for RVI components and the evaluations of the flow-induced vibration TLAA and neutron fluence exposure TLAA for the RVI components in SLRA Section 4.7.1, Subsections 4.7.1.1, 4.7.1.2, and 4.7.1.3. This is consistent with SRP-SLR Section 3.1.2.2.3, Item 3, and is therefore acceptable. The staff's evaluations regarding the three TLAAs related to the RVI components are documented in SE Sections 4.7.1.1, 4.7.1.2, and 4.7.1.3.

3.1.2.2.4 Cracking Due to Stress Corrosion Cracking and Intergranular Stress Corrosion Cracking

Item 1. SLRA Section 3.1.2.2.4, Item 1, associated with SLRA Table 3.1.1, Item 3.1.1-016, addresses cracking due to SCC and IGSCC of the SS or nickel-alloy reactor vessel top head enclosure flange leakage detection line exposed to air-indoor uncontrolled and reactor coolant leakage. The applicant stated that this item is not applicable. The staff evaluated the applicant's claim against the criteria in SRP-SLR Section 3.1.2.2.4, Item 1, and finds it acceptable because, as stated in the SRP-SLR, this issue is associated with a BWR plant.

Item 2. The staff reviewed SLRA Section 3.1.2.2.4, Item 2, associated with SRP-SLR Table 3.1.1, Item 3.1.1-017, against the criteria in SRP-SLR Section 3.1.2.2.4. The applicant stated that this item is for BWRs and therefore is not applicable to ONS Units 1, 2 and 3, which are PWR units. The staff confirmed that this item is associated only with BWRs and therefore finds the applicant's claim acceptable.

3.1.2.2.5 Crack Growth Due to Cyclic Loading

SLRA Section 3.1.2.2 states that TLAAs are evaluated in accordance with 10 CFR 54.21(c)(1) and that the evaluation of this TLAA, crack growth due to cyclic loading in RPV shell forgings clad with SS using a high-heat-input welding process, is addressed in SLRA Section 4.7.2. This is consistent with SRP-SLR Section 3.1.2.2.5 and is therefore acceptable. The staff's evaluation regarding the TLAA for RPV shell forgings clad with SS using a high-heat-input welding process is documented in SE Section 4.7.2.

3.1.2.2.6 Cracking Due to Stress Corrosion Cracking

Item 1. The staff reviewed SLRA Section 3.1.2.2.6, Item 1, associated with SLRA Table 3.1.1, Item 3.1.1-019, against the criteria in SRP-SLR Section 3.1.2.2.6. SLRA Section 3.1.2.2.6, Item 1, is associated with SLRA Table 3.1.1, Item 3.1.1-019, which addresses cracking due to stress corrosion of PWR SS bottom-mounted instrument guide tubes. SRP-SLR Section 3.1.2.2.6 recommends further evaluation to ensure that these aging effects are adequately managed. By Supplement 2 dated November 11, 2021 (ADAMS Accession No. ML21315A012), the applicant amended this section of the SLRA and stated that Item 3.1.1-019 is not applicable because its bottom-mounted instrument guide tubes are nickel alloy and are addressed by SRP item 3.1.1-045. The staff noted that applicant's SLRA Table 3.1.1, Item 3.1.1-045, includes a line item for nickel-alloy bottom-mounted instrument tubes and claims consistency with GALL-SLR Report. SRP-SLR Table 3.1-1 recommends using a combination of the GALL-SLR Report AMP XI.M2, "Water Chemistry"; AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD"; and AMP XI.M111B, "Cracking of Nickel-Alloy Components and Loss of Material Due to Boric Acid-Induced Corrosion in Reactor Coolant Pressure Boundary Components," to manage the applicable aging effects. Additionally, the SRP-SLR does not have a further evaluation recommendation for this nickel-alloy component group. Therefore, the staff finds the applicant's claim to be acceptable.

Item 2. SLRA Section 3.1.2.2.6, associated with SLRA Table 3.1.1, AMR Item 3.1.1-020, addresses cracking due to SCC for the CASS Class 1 reactor coolant piping and piping components exposed to the reactor coolant, which will be managed by the Water Chemistry program (B2.1.2) and the ASME Section XI, "Inservice Inspection," Subsections IWB, IWC, and IWD program (B2.1.1). The applicant stated that its review of industry and Oconee OE did not identify any occurrences of SCC in the CASS piping and piping components exposed to PWR reactor coolant.

SRP-SLR Section 3.1.2.2.6, Item 2, states that although the Water Chemistry program is generally effective in mitigating SCC, cracking due to SCC could occur in CASS components. SRP-SLR recommends further evaluation of a plant-specific program for CASS Class 1 reactor coolant piping and piping components to ensure that this aging effect is adequately managed. The staff reviewed the applicant's proposal against the criteria in SRP-SLR Section 3.1.2.2.6, Item 2. In its review of components associated with AMR Item 3.1.1-020, the staff finds that the applicant has met the further evaluation criteria because the applicant uses the Water Chemistry program to mitigate potential cracking and the ASME Section XI, "Inservice Inspection," Subsections IWB, IWC, and IWD program to monitor these components for potential cracking. The staff's evaluation of the ASME Section XI, "Inservice Inspection," Subsections IWB, IWC, and IWD program and the Water Chemistry program are documented in SE Sections 3.0.3.2.1 and 3.0.3.2.1, respectively.

For the components associated with SLRA Section 3.1.2.2.6, Item 2, the staff concludes that the SLRA is consistent with the GALL-SLR Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3).

Item 3. SLRA Section 3.1.2.2.6, associated with SLRA Table 3.1.1, AMR Item 3.1.1-139, addresses cracking due to SCC in SS or nickel-alloy reactor vessel flange leak detection lines. The applicant stated that OE identified that a subset of these lines was susceptible to inner-diameter-initiated cracking in a localized vertical region of NSSS vendor-supplied piping where contaminants could concentrate. Based on the results of metallurgical investigation, plant modifications were implemented between 2004 and 2008 on all three units to cut and cap the affected lines above the area of concern. This design change alleviated the potential for cracking associated with this OE. No evidence of cracking or leakage has been identified in the remaining segments of capped piping or in the unaffected reactor vessel leakage detection lines. The staff evaluated the applicant's claim against the criteria in SRP-SLR Section 3.1.2.2.6, Item 3, and finds it acceptable because, even though there was OE for the leak detection line, plant modifications have been made to address this issue, and no evidence of cracking or leakage has been identified in the remaining segments. Additionally, the One-Time Inspection program will be used to verify that cracking is not occurring in the remaining reactor vessel leakage detection piping, including the capped piping segments. Based on the program identified, the staff concludes that the applicant's program meets SRP-SLR Section 3.1.2.2.6, Item 3. For those AMR items associated with SLRA Section 3.1.2.2.6, the staff concludes that the SLRA is consistent with the GALL-SLR Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the subsequent period of extended operation as required by 10 CFR 54.21(a)(3).

3.1.2.2.7 Cracking Due to Cyclic Loading

The staff reviewed SLRA Section 3.1.2.2.7 against the criteria in SRP-SLR Section 3.1.2.2.7. The applicant stated that Item 3.1.1-021 is not applicable to ONS Units 1, 2, and 3, which are PWR units, because the associated item in SLRA Table 3.1-1 is applicable to BWRs only. The staff confirmed that this item is associated only with BWRs and therefore finds the applicant's claim to be acceptable.

3.1.2.2.8 Loss of Material Due to Erosion

SLRA Section 3.1.2.2.8, associated with SLRA Table 3.1-1, AMR Item 3.1-1-022, addresses loss of material due to erosion for steel steam generator (SG) feedwater impingement plates and supports exposed to secondary feedwater. The applicant stated that this AMR item is not applicable. The staff evaluated the applicant's claim against the criteria in SRP-SLR Section 3.1.2.2.8 and finds it acceptable because the applicant's SGs do not have feedwater impingement plates and the associated supports.

3.1.2.2.9 Aging Management of Pressurized Water Reactor Vessel Internals

SLRA Section 3.1.2.2.9 provides the applicant's AMR of the RVI components in the ONS reactor units. The applicant performed its AMR of the RVI components in accordance with the staff's acceptance criteria for PWR RVI components in SRP-SLR Section 3.1.2.2.9, which was updated and included in ISG No. SLR-ISG-2021-01-PWRVI (ADAMS Accession No. ML20217L203).

The staff's guidance in SRP-SLR Section 3.1.2.2.9 identifies that PWR RVI components may be managed using an AMP that is based on (1) the staff's programmatic guidance of the AMP defined in Section XI.M16A, "PWR Vessel Internals," of NUREG-2191, Volume 2 (ML17187A204; henceforth, this AMP will be referred to as GALL-SLR AMP XI.M16A); and (2) the I&E guidance criteria set forth for PWR RVI components in EPRI Report No. 3002017168, "Materials Reliability Program: Pressurized Water Reactor Internals Inspection and Evaluation Guidelines (MRP-227, Revision 1-A)" (ADAMS Accession No. ML20175A112; henceforth, this topical report will be referred to as MRP-227, Revision 1-A). The staff's program description in GALL-SLR AMP XI.M16A defines these AMPs as risk-informed, sampling-based AMPs for PWR RVI components; however, due to the complexity of these AMPs, the next several paragraphs explain how these EPRI MRP-227-based programs are established as risk-informed, sampling-based AMPs for PWR RVI components.

Specifically, the staff-approved guidelines and I&E criteria in MRP-227, Revision 1-A, are based on an assessment of aging effects or aging mechanisms over a cumulative 60-year service life. Therefore, the staff's guidance in SRP-SLR Section 3.1.2.2.9 establishes the following additional "acceptance criteria" for PWR vessel internals programs to ensure that the I&E criteria in MRP-227, Revision 1-A (if applied as the initial programmatic starting basis for RVI components within the scope of a PWR vessel internals AMP) are sufficiently conservative for the management of PWR RVI component-specific aging effects over a cumulative 80-year licensed service life:

> "As described in GALL-SLR Report AMP XI.M16A, the applicant may use the MRP-227, Revision 1-A based AMP as an initial reference basis for developing and defining the AMP that will be applied to the RVI components for the subsequent period of extended operation. However, to use this alternative basis, GALL-SLR Report AMP XI.M16A recommends that the MRP-227, Revision 1-A based AMP be enhanced to include a gap analysis of the components that are within the scope of the AMP. The gap analysis is a basis for identifying and justifying changes to the MRP-227, Revision 1-A based program that are necessary to provide reasonable assurance that the effects of age-related degradation will be managed during the subsequent period of extended operation. The criteria for the gap analysis are described in GALL-SLR Report AMP XI.M16A. If a gap analysis is needed to establish the appropriate aging

> management criteria for the RVI components, the applicant has the option of including the gap analysis in the SLRA or making the gap analysis and any supporting gap analysis documents available in the in-office audit portal for the SLRA review."

Alternatively, the guidance in SRP-SLR Section 3.1.2.2.9 permits an SLR applicant of a PWR facility to use an AMP that is based on a staff-approved version of MRP-227 covering an 80-year cumulative assessment period (without the need for performing an RVI gap analysis). In terms of PWR RVI risk and sampling categorizations, the guidance in GALL-SLR AMP XI.M16-A and in MRP-227, Revision 1-A, establishes that each RVI component in the site facility is placed into one of the following types of sampling-based aging management categories, as based on the component-specific sample selection process defined in Chapter 2 of MRP-227, Revision 1-A, and discussed below:

> "The result of this four-step sample selection process is a set of "Primary" internals component locations for each of the three plant designs that are inspected because they are expected to show the leading indications of the degradation effects. The category of "Expansion" internals component locations is specified to expand the sample should the indications from the "Primary" components be more severe than anticipated.
>
> The degradation effects in a third set of internals locations (which apply only to the RVI components in Westinghouse- or CE-designed PWRs) are deemed to be adequately managed by "Existing Programs," such as American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI, Examination Category B-N-3, examinations of core support structures. A fourth set of internals locations are deemed to require 'No Additional Measures.'"
>
> In the absence of an acceptable generic report such as an approved revision of MRP-227 that considers an operating period of 80 years, the gap analysis . . . is used to provide reasonable assurance that the aging management activities designated for the RVI components identified in the four groups is appropriate for 80 years of operation. The gap analysis may include and incorporate supplemental guidelines developed and recommended for the RVI components."

The staff's AMR items for PWR RVI component commodity groupings (i.e., AMR items that are based on a specified grouping or set of RVI components) in SRP-SLR Table 3.1-1 (as invoked by SRP-SLR Section 3.1.2.2.9) are defined in terms of both the NSSS-vendor design and the EPRI inspection category of the set of RVI components included in the commodity grouping of the specified AMR item. The staff provides these AMR items in Items 028, 051a, 051b, 052a, 052b, 052c,053a, 053b, 053c, 055a, 055b, 055c, 056a, 056b, 056c, 058a, 058b, 059a, 059b, 059c, 118 and 119 of Table 3.1-1 of the SRP-SLR. The staff's component-specific AMR items for PWR RVI components that derive from these commodity group-based AMR items are given in Tables IV.B2, IV.B3, and IV.B4 of the GALL-SLR Report, with GALL-SLR Report Table IV.B4 (as amended, inclusive of changes to the table in SLR-ISG-2021-01-PWRVI) being the GALL-SLR Report AMR table that applies to the B&W-designed RVI components at ONS.

The applicant's AMR items in SRLA Table 3.1.1 include the applicant's commodity group-based AMR items for ONS RVI commodity groupings that correlate to those for PWR RVI commodity groupings in SRP-SLR Table 3.1-1. SLRA Table 3.1.2-2 provides the component-specific AMR items for ONS RVI components that derive from the AMR items for specified PWR RVI commodity groupings in SLRA Table 3.1.1. The applicant amended its AMR items for the ONS RVI components in the applicant's letters of February 14, 2022 (ADAMS Accession No. ML22045A020; ML22045A021 for the redacted, publicly available version of the letter) and September 2, 2022 (ADAMS Accession No. ML22245A009; ML22245A010 for the redacted, publicly available version of the letter).

The staff evaluate SLRA Section 3.1.2.2.9 and the associated AMR items for ONS RVI commodity groupings in SLRA Tables 3.1.1 and ONS-specific RVI components in SLRA Table 3.1.2-2 in the following subsections.

Item 3.1.1-028, 3.1.1-052a, 3.1.1-052b, 3.1.1-052c, 3.1.1-053a, 3.1.1-053b, 3.1.1-053c, 3.1.1-056a, 3.1.1-055b, 3.1.1-055c, 3.1.1-056b, 3.1.1-056c, 3.1.1-059a, 3.1.1-059b, and 3.1.1-059c – Not Applicable.

SLRA Section 3.1.2.2.9, as associated with SLRA Table 3.1.1, AMR item 3.1.1-028, addresses loss of material and cracking in Westinghouse control rod guide tube (CRGT) support pins exposed to a reactor coolant with neutron flux environment. The applicant stated that this AMR item is not applicable to the SLRA.

SLRA Section 3.1.2.2.9, associated with SLRA Table 3.1.1, AMR items 3.1.1-052a, 3.1.1-052b, 3.1.1-052c, 3.1.1-053a, 3.1.1-053b, and 3.1.1-053c address cracking in specific types or categories of Combustion Engineering (CE)-design or Westinghouse-design RVI components exposed to a reactor coolant with neutron flux environment and are managed by an AMP that corresponds to GALL-SLR AMP XI.16A, "PWR Vessel Internals" (as updated in SLR-ISG-2021-01-PWRVI).

SLRA Section 3.1.2.2.9, associated with SLRA Table 3.1.1, AMR Items 3.1.1-055b and 3.1.1-055c, addresses those CE-design or Westinghouse-design RVI components defined in GALL-SLR AMP XI.M16A, "PWR Vessel Internals" as being within the scope of the NAM category for the risk-informed PWR Vessel Internals Program and that do not need to be subjected to any aging management activities during the subsequent period of extended operation.

SLRA Section 3.1.2.2.9, associated with SLRA Table 3.1.1, AMR items 3.1.1-056a, 3.1.1-056b, 3.1.1-056c, 3.1.1-59a, 3.1.1-59b, and 3.1.1-059c, addresses the non-cracking aging effect and mechanism combinations of loss of material due to wear (LOM-wear), LOFT-IE, LOFT-TE, changes in dimension due to void swelling or distortion (CID-VS/distortion), or loss of preload due to irradiation-assisted stress relaxation or creep in specific types or categories of CE-design or Westinghouse-design RVI components exposed to a reactor coolant (with neutron flux) environment and are managed by an AMP that corresponds to GALL-SLR AMP XI.16A, "PWR Vessel Internals" (as updated in SLR-ISG-2021-01-PWRVI).

The applicant stated that these AMR items are not applicable to the SLRA. Based on this, SLRA Table 3.1.2-2 does not include any component-specific AMR items for ONS RVI components that correlate to SLRA Items 3.1.1-028, 3.1.1-052a, 3.1.1-052b, 3.1.1-052c, 3.1.1-053a, 3.1.1-053b, and 3.1.1-053c, 3.1.1-055b, 3.1.1-055c, 3.1.1-056a, 3.1.1-056b, 3.1.1-056c, 3.1.1-059a, 3.1.1-059b, or 3.1.1-059c.

The staff reviewed the applicant's proposal against the criteria in SRP-SLR Section 3.1.2.2.9. In regard to the AMR item in SRP-SLR Table 3.1-1 that corresponds to SLRA AMR Item 3.1.1-028, the staff noted that the AMR item only applies to the management of cracking and loss of material due to wear in Westinghouse-design CRGT support pins (split pins). In regard to the

AMR items in SRP-SLR Table 3.1-1 that correspond to SLRA AMR Items 3.1.1-052a, 3.1.1-052b, 3.1.1-052c, 3.1.1-053a, 3.1.1-053b, or 3.1.1-053b, the staff noted the AMR items apply only to the commodity groupings for CE-design or Westinghouse-design RVI components that (1) are as defined as Primary, Expansion, or Existing Program category components for inspection in MRP-227, Revision 1-A; and (2) screen in and are managed for the cracking mechanisms of SCC, IASCC, or fatigue.

In regard to the AMR items in SRP-SLR Table 3.1-1 that correspond to SLRA AMR Items 3.1.1-055b and 3.1.1-055c, the staff noted that the AMR items only apply to the NAM category of RVI components in CE-design or Westinghouse-design PWRs and do not apply to the B&W-designed RVI NAM category components in the ONS Units or to the SLRA. Regarding the AMR items in SRP-SLR Table 3.1-1 that correspond to SLRA AMR Items 3.1.1-056a, 3.1.1-056b, 3.1.1-056c, 3.1.1-59a, 3.1.1-59b, and 3.1.1-059c, the staff noted that the AMR items only apply to those CE-design or Westinghouse-design RVI components that (1) are as defined as Primary, Expansion, or Existing Program category components for inspection in MRP-227, Revision 1-A; and (2) screen in and are managed for the non-cracking effect and mechanism combinations of LOM-wear, LOFT-IE, LOFT-TE, CID-VS/distortion, or loss of preload due to irradiation-enhanced stress relaxation or creep (LOP-ISR/IC) (which applies only to bolted, fastened, keyed, pinned, or spring loaded assemblies).

The staff also noted that the ONS UFSAR confirms that the RVI components in the ONS reactor units were fabricated by B&W and not by CE or Westinghouse. Thus, for its evaluation of SLRA AMR Items 3.1.1-028, 3.1.1-052a, 3.1.1-052b, 3.1.1-052c, 3.1.1-053a, 3.1.1-053b, and 3.1.1-053c, 3.1.1-055b, 3.1.1-055c, 3.1.1-056a, 3.1.1-056b, 3.1.1-056c, 3.1.1-059a, 3.1.1-059b, or 3.1.1-059c, the staff evaluated the applicant’s claim against the criteria in SRP-SLR Section 3.1.2.2.9 and finds it acceptable because the staff has confirmed that the referenced commodity-group-based AMR items are only affiliated with specific types or categories of PWR RVI Primary, Expansion, Existing Program, or NAM category components in CE-design or Westinghouse-design PWRs and are not applicable to the B&W-designed RVI components in the ONS Units or to the SLRA.

Item 3.1.1-055a – Consistent with AMR Item 055a in SRP-SLR Table 3.1-1

SLRA Section 3.1.2.2.9, associated with SLRA Table 3.1.1, AMR Item 3.1.1-055a, addresses those B&W-design RVI components defined in GALL-SLR AMP XI.M16A as being within the scope of the NAM category for the risk-informed AMP and that do not need to be subject to any aging management activities during the subsequent period of extended operation. The applicant stated that SLRA Item 3.1.1-055a is consistent with the corresponding AMR item in SRP-SLR Table 3.1-1, Item 055a.

The staff reviewed the applicant’s proposal against the criteria in SRP-SLR Section 3.1.2.2.9. Regarding the AMR item in SRP-SLR Table 3.1-1 that corresponds to SLRA AMR Item 3.1.1-055a, the staff noted that the AMR item applies only to those RVI components in B&W-designed PWRs (including those in the ONS Units) that (1) can be placed in the NAM category of the PWR Vessel Internals Program, and (2) can be justified as not requiring any aging management activities under the risk-informed, sampling-based PWR Vessel Internals Program (i.e., as adjusted for aging management by the results of the RVI AMP gap analysis per the guidance in SRP-SLR Section 3.1.2.2.9). The staff also noted that, from a risk-informed perspective, the NAM category of the PWR Vessel Internals Program is appropriate for RVI component-specific cases that demonstrate that (1) components will not be susceptible to any aging effects or mechanisms through the end the subsequent period of extended operation, or (2) the components may be potentially susceptible to one or more aging effects or mechanisms through the end of the subsequent period of extended operation, but where a postulated failure of the component will not impact the intended function of a safety-related component in the plant design serving a reactor coolant pressure boundary, safe shutdown, or design-basis accident mitigation intended function, as defined in 10 CFR 54.4(b).

The staff confirmed that, with the exception of those RVI components discussed in the bullets in the following list, the applicant identified all ONS RVI components that are appropriate for inclusion in the NAM category of the AMP in the line items of SLRA Table 3.1.2-2. However, the staff also noted that, as for AMR item changes included in the letter dated September 2, 2022, the applicant amended the following RVI component-specific AMR items or AMR subitems in SLRA Table 3.1.2-2 to align with the applicant's AMR item for ONS RVI NAM category components in SLRA Table 3.1.1, Item 3.1.1-055a (and with the staff's generic AMR item for B&W-design NAM category components in GALL-SLR Table IV.B4, Item IV.B4.RP-236).

- The applicant amended the AMR item in SLRA Table 3.1.2-2 for the "Baffle/Former Bolts and Screws (including dowels, baffle-to-former bolts, locking pins, baffle-to-former should screws, locking dowel, baffle-to-baffle bolts, locking rings, and barrel-to-former assembly cap screws)" to delete the five AMR subitems in the AMR item that previously referenced NEI generic Note F and replace them with a subitem that places the specified nickel-alloy baffle-former assembly components in the NAM category of the PWR Vessel Internals Program. This new subitem references SLRA Item 3.1.1-055a and GALL-SLR IV.B4.RP-236 and uses NEI generic Note A. In its response to RAI B2.1.7-5, by letter dated February 14, 2022, the applicant explained that the only components in the baffle-former assemblies that are made from nickel-based alloys are the nickel-alloy dowels; however, the applicant also explained that, under MRP-227, Revision 1-A, the baffle-former assembly dowels are placed in the NAM category of the program. The applicant also explained that the gap analysis for the AMP did not result in a change to the NAM categorization of the baffle-former assembly dowels. The staff confirmed that the baffle-former assembly dowels are placed in the NAM category of the program by the I&E protocols in MRP-227, Revision 1-A, and that the EPRI MRP does not change this basis in the Proprietary MRP-189, Revision 3 Report (ADAMS Accession No. ML20091K282) that was used for the ONS RVI component-specific gap analysis. Based on this confirmation, the staff finds the new AMR subitem in SLRA Table 3.1.2-2 for the nickel-based alloy baffle-former dowels to be acceptable because the new AMR subitem for the dowels is consistent with the staff's generic AMR item for B&W-design NAM category RVI components in GALL-SLR Item IV.B4.RP-236.
- The applicant amended the AMR items for the "Core Support Shield-to-Core Barrel Bolts" (i.e., the UCB bolts), "Core Barrel-to-Thermal Shield Bolts" (i.e., UTS bolts), "Lower Internals Assembly-to-Core Barrel Bolts" (i.e., for the LCB bolts), "Lower Internals Assembly-to-Thermal Shield Bolts" (i.e., for the LTS bolts), and the "Shell Forging-to-Flow Distributor Bolts" (i.e., the FD bolts) to include new AMR subitems for the referenced bolt-locking devices that align them to SLRA AMR Item 3.1.1-055a and the staff's AMR item for B&W-design RVI NAM category components in GALL-SLR Item IV.B4.RP-236. Based on the staff's acceptance of the applicant's RVI gap analysis changes to place the UCB, LCB, FD, UTS, and LTS bolt-locking devices in the NAM category of SLRA AMP B2.1.7, "PWR Vessel internals" (refer to the staff's evaluation in SE Section 3.0.3.2.3), the staff finds these changes to be acceptable because the staff has confirmed that they are consistent with the staff's AMR basis for B&W-design RVI NAM category components in GALL-SLR Item IV.B4.RP-236.

- The applicant amended the AMR item for the “Vent Valve Body and Retaining Rings” to include a new AMR subitem for the VV bodies that aligns to SLRA Item 3.1.1-055a and the staff’s AMR item basis for B&W-design NAM category RVI components in GALL-SLR Item IV.B4.RP-236. Based on staff’s acceptance of the applicant’s RVI gap analysis changes to place the VV bodies in the NAM category of SLRA AMP B2.1.7, “PWR Vessel internals” (refer to the staff’s evaluation in SE Section 3.0.3.2.3), the staff finds these changes to be acceptable because the staff has confirmed that they are consistent with the staff’s AMR basis for B&W-design RVI NAM category components in GALL-SLR Item IV.B4.RP-236.
- The applicant amended SLRA Table 3.1.2-2 to include an additional AMR item for all grouped SS or nickel-alloy RVI components in the NAM category of the PWR Vessel Internals Program that aligns to the staff’s AMR basis for managing loss of material due to pitting or crevice corrosion in GALL-SLR Item IV.B4.RP-087. The applicant’s Water Chemistry Program (SLRA AMP B2.1.2) is credited for management of the applicable loss of material mechanisms.

  The staff noted that the guidelines in MRP-227, Revision 1-A, defer the basis for managing of loss of material due to pitting or crevice corrosion in PWR RVI components to an applicant’s basis for implementing its Water Chemistry Program, which is consistent with the guidance in the “preventive actions” program element in GALL-SLR AMP XI.M16A. Consistent with the AMP bases in GALL-SLR AMP XI.M2, “Water Chemistry,” the staff confirmed that an SLRA applicant may use its Water Chemistry Program as a mitigative AMP for managing loss of material due to corrosion (including pitting and crevice corrosion mechanisms) in nickel-alloy or SS components exposed to a reactor coolant environment. Thus, the staff finds this change acceptable because it is consistent with AMR bases for managing loss of material due to pitting and crevice corrosion in B&W-design RVI components as provided in GALL-SLR Item IV.B4.RP-087 and with the “preventive actions” program element guidance in GALL-SLR AMP XI.M16A.

The staff noted that the applicant’s evaluation identifies that SLRA AMP B2.1.7, “PWR Vessel Internals,” is based on the existing framework in MRP-227, Revision 1-A, as modified by the results of the applicant’s RVI gap analysis (as discussed in the letter dated September 2, 2022). The staff’s evaluation of the SLRA AMP B2.1.7, “PWR Vessel Internals,” in SE Section 3.0.3.2.3 addresses the consistency of the program with the recommendations of GALL-SLR AMP XI.M16A and includes the staff’s bases for determining which ONS RVI components are appropriate for inclusion in the NAM category of the AMP. Thus, the staff has confirmed that the applicant has identified all ONS RVI components that are appropriate for inclusion (and have been placed) in the NAM category of the PWR Vessel Internals Program (i.e., for the version of the AMP that will be implemented during the subsequent period of extended operation).

Thus, based on this review, the staff finds that the applicant has met the further evaluation criteria in SRP-SLR Section 3.1.2.2.9 and that the AMR basis is acceptable for RVI components placed in the NAM category of the AMP because (as of RVI AMR item or AMP changes included in the letter dated September 2, 2022) the staff has confirmed that (1) the applicant has identified all ONS RVI components that are appropriate for placement and inclusion in the NAM category of SLRA AMP B2.1.7, “PWR Vessel Internals,” (2) the applicant has provided applicable AMR items or subitems in SLRA Table 3.1.2-2 for all ONS RVI components that are being included in the NAM category of the program, and (3) SLRA AMP B2.1.7, “PWR Vessel Internals” is consistent with the recommendations of GALL-SLR AMP XI.M16A, as updated in SLR-ISG-2021-01-PWRVI.

<u>SLRA Items 3.1.1-051a, 3.1.1-051b, and 3.1.1-118 – Consistent with AMR Items 051a, 051b, and 118 in SRP-SLR Table 3.1.1</u>. SLRA Section 3.1.2.2.9, associated with SLRA Table 3.1.1, AMR items 3.1.1-051a, 3.1.1-051b, and 3.1.1-118 (as amended in the applicant's letters of February 14, 2022, and September 2, 2022) address cracking in B&W-design Primary and Expansion category RVI components exposed to a reactor coolant with neutron flux environment. The applicant stated that these AMR items are consistent with the AMR items in SRP-SLR Table 3.1-1, Items 051a, 051b, and 118 (as updated in SLR-ISG-2021-01-PWRVI). The applicant also stated that it will use SLRA AMP B2.1.7, "PWR Vessel Internals," as the basis for managing cracking in the specified Primary category and Expansion category RVI components during the subsequent period of extended operation.

The staff reviewed the applicant's proposal against the criteria in SRP-SLR Section 3.1.2.2.9. The staff noted that the AMR items in SRP-SLR Table 3.1-1 that correspond to SLRA Items 3.1.1-051a and 3.1.1-051b apply to those RVI components in B&W-design PWRs that (1) are as defined as Primary or Expansion category components for inspection in the MRP-227, Revision 1-A Report, (2) screen in and are managed for the cracking mechanisms of SCC, IASCC, or fatigue, and (3) are managed using the risk-informed, sampling-based AMP defined in GALL-SLR AMP XI.M16A (as updated in SLR-ISG-2021-01-PWRVI). The staff noted that the AMR item in SLRA Item 3.1.1-118 may be applied for component-specific cases where the gap analysis of an SLRA applicant's PWR Vessel Internals Program results in a programmatic change or changes to the basis for managing cracking in a specified Primary or Expansion category RVI component from those defined and specified for the component in MRP-227, Revision 1-A.

The staff noted that, in letters dated February 14, 2022, and September 2, 2022, the applicant amended the following commodity-group-based AMR items for RVI components in SLRA Table 3.1.1 or the associated component-specific AMR items or AMR subitems for specified RVI components in SLRA Table 3.1.2-2:

In the letter dated February 14, 2022, the applicant amended the AMR item in SLRA Table 3.1.2-2 for the "Core Barrel-to-Thermal Shield Bolts" (i.e., the UTS bolts) to (1) align the AMR subitem on cracking of the bolts to the AMR item in GALL-SLR Item IV.B4.RP-246c, and (2) delete the subitems for cracking by fatigue (as aligned to the AMR items in GALL-SLR Items IV.B4.RP-248 and IV.B4.RP-248a). The staff finds the realignments of the AMR subitems on UTS bolt cracking to be acceptable because the staff has confirmed that the amended AMR subitem on cracking is consistent with the staff's AMR item in GALL-SLR Item IV.B4.RP-246c (as updated in SLR-ISG-2021-01-PWRVI) and that the RVI gap analysis in SLRA AMP B2.1.7 has appropriately screened out fatigue as a cracking mechanism for the UTS bolts.

- In the letter dated February 14, 2022, the applicant amended the AMR item in SLRA Table 3.1.2-2 for the lower grid "Guide Blocks and Bolts" to delete the AMR subitems on cracking that originally aligned to the staff's AMR item basis in GALL-SLR Item IV.B4.RP-246. The staff finds the deletion of the AMR subitem acceptable because the staff has confirmed that the AMR item basis in GALL-SLR Item IV.B4.RP-246 is only applicable to cracking that may occur in B&W-design LTS bolts.
- In the letter dated September 2, 2022, the applicant amended Item 3.1.1-118 in SLRA Table 3.1.1 to identify that the AMR item is consistent with AMR Item 3.1.1-118 in SRP-SLR Table 3.1-1. The staff confirmed that this change also includes the applicant's associated amendment of the AMR subitem in SLRA Table 3.1.2-2 for managing cracking in the "Core Barrel Cylinder" components (including CB cylinders, top flange and bottom

flange, and associated CB welds), which was amended to align to the staff's AMR item on cracking of B&W-design CB cylinder base metal and weld components in GALL-SLR Item IV.B4.R-423 under use of NEI generic Note B.

For SLRA AMR Item 3.1.1-118, the staff verified that the referenced AMR items in SRP-SLR and the GALL-SLR Report (i.e., SRP-SLR Table 3.1-1, Item 118, and GALL-SLR Item IV.B4.R-423) that correspond to SLRA AMR Item 3.1.1-118 apply and may be used for component-specific cases where the gap analysis of an SLRA applicant's PWR Vessel Internals Program results in a programmatic change in the basis for managing cracking of a specified RVI component from those defined and specified for components in MRP-227, Revision 1-A. The staff also confirmed that, in the letter dated September 2, 2022, the applicant used its gap analysis to adjust the aging management bases for managing cracking of the CB assembly components (including the CB assembly welds) from those defined for the components in Item B10.1 of Table 4-4 in MRP-227, Revision 1-A. Specifically, the staff noted that the applicant amended SLRA AMP B2.1.7, "PWR Vessel Internals," under the gap analysis of the program to redefine (1) the ONS Unit 2 CB top flange circumferential weld and Unit 2 CB cylinder center circumferential weld as newly defined Primary components for the program (i.e., for the management of cracking and LOFT-IE), and (2) the remaining CB assembly welds in ONS Unit 1, 2, and 3 newly defined Expansion components for the program (i.e., again, for the management of cracking and LOFT-IE).

Based on the RVI gap analysis changes made to the PWR Vessels Internals Program in the letter dated September 2, 2022, for the objective of managing cracking of the CB assembly components (including the CB assembly welds), the staff finds the amended AMR basis acceptable because the staff has confirmed that the amended AMR basis is consistent with the staff's AMR bases in SRP-SLR Table 3.1-1, Item 118, as updated in ISG No. SLR-ISG-2021-01-PWRVI.

The staff noted that the applicant's evaluation identifies that SLRA AMP B2.1.7, "PWR Vessel Internals," is based on the existing framework in MRP-227, Revision 1-A, as modified by the results of the applicant's RVI gap analysis (i.e., as described and discussed in the SLRA AMP and updated inclusive of changes made in the letter of September 2, 2022). The staff's evaluation of the SLRA AMP B2.1.7, "PWR Vessel Internals," in SE Section 3.0.3.2.3 addresses the consistency of the program with the recommendations of GALL-SLR AMP XI.M16A and includes the staff's basis for determining which ONS RVI components are appropriate for inclusion in the Primary or Expansion categories of the AMP based on their potential to develop cracking during the subsequent period of extended operation. Thus, the staff has confirmed that the applicant has identified all ONS RVI components that are appropriate for inclusion (and have been placed) in either the Primary or Expansion categories of the PWR Vessel Internals Program based on an assessment of the components' potential to develop cracking during the subsequent period of extended operation.

Thus, based on this review, the staff finds that the applicant has met the further evaluation criteria in SRP-SLR Section 3.1.2.2.9 and that the AMR basis is acceptable for RVI components that are susceptible to cracking and included in the Primary or Expansion categories of the AMP because (as of RVI AMR item or AMP changes inclusive of the letter dated September 2, 2022) the staff has confirmed that (1) the applicant has identified all ONS RVI components that are both susceptible to cracking and appropriate for placement and inclusion in either the Primary or Expansion category of SLRA AMP B2.1.7, "PWR Vessel Internals," (2) the applicant has provided AMR items for all ONS RVI components that have screened in for cracking mechanisms and are included in either the Primary or Expansion category of SLRA AMP B.2.1.7, "PWR Vessel Internals," (3) SLRA AMP B2.1.7, "PWR Vessel Internals" (as amended) is consistent with the recommendations of GALL-SLR AMP XI.M16A, and (4) the inspection categories and inspection, evaluation, and acceptance criteria bases for the specified Primary or Expansion category components are acceptable for implementation during the subsequent period of extended operation.

SLRA Items 3.1.1-058a, 3.1.1-058b, and 3.1.1-119 – Consistent with AMR Items 058a, 058b, and 119 in SRP-SLR Table 3.1.1.

SLRA Section 3.1.2.2.9, associated with SLRA Table 3.1.1, AMR items 3.1.1-058a, 3.1.1-058b, and 3.1.1-119 (as amended in the letter dated February 14, 2022), addresses the potential for LOM-wear, LOFT-IE, LOFT-TE, CID-VS/distortion, or LOP-ISR/IC (which applies only to bolted, fastened, keyed, pinned, or spring loaded assemblies) to occur in B&W-designed Primary and Expansion category RVI components exposed to a reactor coolant (with neutron flux) environment. The applicant stated that these AMR items are consistent with the AMR items in SRP-SLR Table 3.1-1, Items 058a, 058b, and 119 (as updated in SRP-SLR-2021-01-0PWRVI). The applicant also stated that it will use SLRA AMP B2.1.7, "PWR Vessel Internals," as the basis for managing these types of non-crack-based aging effect and mechanism combinations in the specified Primary category and Expansion category RVI components during the subsequent period of extended operation.

The staff reviewed the applicant's proposal against the criteria in SRP-SLR Section 3.1.2.2.9. The staff noted that the AMR items in SRP-SLR Table 3.1-1 that correspond to SLRA Item 3.1.1-058a and 3.1.1-058b apply to those RVI components in B&W-design PWRs that (1) are defined as Primary or Expansion category components for inspection in MRP-227, Revision 1-A; (2) screen in and are managed for the non-crack-based aging effect and mechanism combinations of LOM-wear, LOFT-IE, LOFT-TE, CID-VS/distortion, or LOP-ISR/IC; and (3) are managed using the risk-informed, sampling-based AMP defined in GALL-SLR AMP XI.M16A (as updated in SLR-ISG-2021-01-PWRVI). The staff noted that the AMR item in SLRA Item 3.1.1-119 may be applied for component-specific cases where the gap analysis of an SLRA applicant's PWR Vessel Internals Program results in a programmatic change in the basis for managing LOM-wear, LOFT-IE, LOFT-TE, CID-VS/distortion, or LOP-ISR/IC in a specified Primary or Expansion category RVI component from those defined and specified for the component in MRP-227, Revision 1-A.

The staff noted that, in the applicant's letters dated February 14, 2022, and September 2, 2022, the applicant amended the following commodity-group-based AMR items for RVI components in SLRA Table 3.1.1 or the associated component-specific AMR items or AMR subitems for specified RVI components in SLRA Table 3.1.2-2:

- In the letter dated February 14, 2022, the applicant amended SLRA Table 3.1.2-2 and the AMR subitem on loss of fracture toughness of the LTS bolts that aligns to GALL-SLR Item IV.B4.RP-260 to correct the NEI note of reference from NEI Note B to NEI Note D. The staff notes that this is an administrative change because GALL-SLR Table IV.B4, as updated in ISG No. SLR-ISG-2021-01-PWRVI, does not include any AMR item on loss of fracture toughness in B&W-designed LTS bolts; in this regard, the staff has confirmed that the applicant is conservatively using the staff's AMR item on loss of fracture toughness of B&W-designed lower grid "Guide Blocks and Bolts" (i.e., as aligned to GALL-SLR Item IV.B4.RP-260) as the AMR basis for managing loss of fracture toughness in the LTS bolts.

- In the letter dated February 14, 2022, the applicant amended SLRA Table 3.1.2-2 and the AMR item for the lower grid “Guide Blocks and Bolts” to delete the AMR subitem on loss of fracture toughness of the nickel-alloy guide block dowels that originally aligned to the staff’s AMR item basis in GALL-SLR Item IV.B4.RP-260. The staff confirmed that, in MRP-227, Revision 1-A, the nickel-alloy lower grid guide block dowels are included in the NAM category of the B&W-designed RVI management programs and that the 80-year gap analysis basis for B&W-designed RVI components in MRP-189, Revision 3, does not change this component-specific categorization basis for the specified dowels. Thus, the staff finds the deletion of this AMR subitem acceptable because the staff has confirmed that GALL-SLR Item IV.B4-RP-260 is only applicable to loss of fracture toughness in B&W-designed lower grid support pad items and because the nickel-alloy guide block dowels are now covered by the applicant’s new AMR item for generic RVI NAM components. This new AMR item was added to SLRA Table 3.1.2-2 in the letter dated February 14, 2022, and correlates to GALL-SLR Item IV.B4.RP-236 for ONS NAM category RVI components.
- In the letter dated February 14, 2022, the applicant amended SLRA Table 3.1.1, Item 3.1.1-119, to identify that the AMR item is consistent with Item 119 in SRP-SLR Table 3.1-1. The applicant also amended SLRA Table 3.1.2-2 and the AMR subitem in SLRA Table 3.1.2-2 for managing LOFT-IE in the “Core Barrel Cylinder” components (including CB cylinders, top flange and bottom flange and associated welds) to align to the staff’s AMR item in GALL-SLR Item IV.B4.R-424 under use of NEI generic Note B. The applicant amended the AMR subitems in SLRA Table 3.1.2-2 for managing LOM-wear, LOFT-IE/TE, and CID-VS/distortion in the lower grid rib sections to align to the staff’s AMR item in GALL-SLR Item IV.B4.R-424 under use of NEI generic Note B.

  In regard to the applicant’s amendments of these AMR subitems, the staff confirmed that, in the letter dated February 14, 2022, the applicant amended SLRA AMP B2.1.7, “PWR Vessel Internals,” and the RVI gap analysis of the AMP to adjust the programmatic aging management bases for managing LOFT-IE of the CB assembly components (including the CB assembly welds) and LOM-wear, LOFT-IE/TE, and CID-VS/distortion in the lower grid rib sections from those defined for the components in Items B10.1 and B10.3 in Table 4-4 of MRP-227, Revision 1-A. The staff also noted that, per programmatic amendments incorporated into the SLRA that include changes made in the applicant’s letter of September 2, 2022, the applicant amended SLRA AMP B2.1.7, “PWR Vessel Internals,” under the gap analysis of the program to (1) redefine the ONS Unit 2 CB top flange circumferential weld and Unit 2 CB cylinder center circumferential weld as newly defined Primary components for the program and the remaining CB assembly welds in ONS Units 1, 2, and 3 as newly defined Expansion category components for the program (i.e., for the objective of managing cracking and LOFT-IE in the welds); and (2) redefine the lower grid rib sections as newly defined Primary components for the program (i.e., for objective of managing LOM-wear, LOFT-IE, and CID-VI/distortion in the lower grid rib sections).

  Based on the RVI gap analysis changes made to the PWR Vessels Internals Program (and the RVI gap analysis results) for the objective of managing LOFT-IE the CB assembly components (including the CB assembly welds) and LOM-wear, LOFT-IE, and CID-VS/distortion in the lower grid rib sections, the staff finds the amended AMR basis to be acceptable because the staff has confirmed that the amended AMR basis is consistent with the staff’s AMR item basis in SRP-SLR Table 3.1-1, Item 119, as updated in ISG No. SLR-ISG-2021-01-PWRVI.

The staff noted that the applicant's evaluation identifies that SLRA AMP B2.1.7, "PWR Vessel Internals," is based on the existing framework in MRP-227, Revision 1-A, as modified by the results of the applicant's RVI gap analysis (i.e., as described and discussed in the SLRA AMP and updated inclusive of changes made in the letter dated September 2, 2022). The staff's evaluation of the SLRA AMP B2.1.7, "PWR Vessel Internals," in SE Section 3.0.3.2.3 addresses the consistency of the program with the recommendations of GALL-SLR AMP XI.M16A and includes the staff's basis for determining which ONS RVI components are appropriate for inclusion in the Primary or Expansion categories of the AMP based on their potential to develop the non-cracking effect and mechanism combinations of LOM-wear, LOFT-IE, LOFT-TE, CID-VS/distortion, or LOP-ISR/IC during the subsequent period of extended operation. Thus, the staff has confirmed that the applicant has identified all ONS RVI components that are appropriate for inclusion (and have been placed) in either the Primary or Expansion categories of the PWR Vessel Internals Program based on an assessment of the components' potential to develop LOM-wear, LOFT-IE, LOFT-TE, CID-VS/distortion, or LOP-ISR/IC during the subsequent period of extended operation.

Thus, based on this review, the staff finds that the applicant has met the further evaluation criteria in SRP-SLR Section 3.1.2.2.9 and that the AMR basis is acceptable for RVI components that are susceptible to non-cracking effects and mechanism combinations of developing LOM-wear, LOFT-IE, LOFT-TE, CID-VS/distortion, or LOP-ISR/IC and included in the Primary or Expansion categories of the AMP because the staff has confirmed that (1) the applicant has identified all ONS RVI components that are susceptible to either LOM-wear, LOFT-IE, LOFT-TE, CID-VS/distortion, or LOP-ISR/IC and appropriate for placement and inclusion in either the Primary or Expansion category of SLRA AMP B2.1.7, "PWR Vessel Internals"; (2) the applicant has provided AMR items for all ONS RVI components that have screened in for LOM-wear, LOFT-IE, LOFT-TE, CID-VS/distortion, or LOP-ISR/IC and are included in either the Primary or Expansion category of SLRA AMP B.2.1.7, "PWR Vessel Internals"; (3) SLRA AMP B2.1.7, "PWR Vessel Internals" (as amended) is consistent with the recommendations of GALL-SLR AMP XI.M16A; and (4) the inspection categories and inspection, evaluation, and acceptance criteria bases for the specified Primary or Expansion category components are acceptable for implementation during the subsequent period of extended operation.

Conclusion for SLRA AMR Items Within the Scope of SLRA Section 3.1.2.2.9.

Based on the program identified, the staff determined that the applicant's program meets the criteria of SRP-SLR Section 3.1.2.2.9. For those AMR items in SLRA Tables 3.1.1 and 3.1.2-2 that are associated with SLRA Section 3.1.2.2.9 and the ONS RVI components that are placed in either the Primary or Expansion inspection category of SLRA AMP B2.1.7, "PWR Vessel Internals," the staff concludes that the AMR items are consistent with the SRP-SLR and GALL-SLR Report. The staff also concludes that the applicant has demonstrated that the PWR Vessel Internals Program is consistent with the GALL-SLR Report and that the RVI components placed in either the Primary or Expansion category of SLRA AMP B2.1.7, "PWR Vessel Internals," will be adequately managed by the risk-informed, sampling-based AMP during the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3).

For those component-specific AMR items in SLRA Table 3.1.2-2 that are associated with SLRA Item 3.1.1-055a and the ONS RVI components that are placed in the NAM category of SLRA AMP B2.1.7, "PWR Vessel Internals," the staff concludes that the applicant has provided an adequate basis for concluding that (1) the AMR items are consistent with the GALL-SLR Report, and (2) from a risk-informed basis, the RVI components placed in the NAM category of SLRA AMP B2.1.7, "PWR Vessel Internals," do not need to be subject to any programmatic aging management activities under the requirements of 10 CFR 54.21(a)(3) for the subsequent period of extended operation.

3.1.2.2.10 Loss of Material Due to Wear

Item 1 and 2. SLRA Section 3.1.2.2.10, Subsection 1, associated with SLRA Table 3.1.1 AMR Item 3.1.1-116, addresses LOM-wear in nickel-alloy control rod drive mechanism (CRDM) penetration nozzles exposed to a reactor coolant environment. Similarly, SLRA Section 3.1.2.2.10, Subsection 2, associated with SLRA Table 3.1.1 AMR Item 3.1.1-117, addresses loss of material due to wear in SS or nickel-alloy control rod guide head penetration nozzle thermal sleeves exposed to a reactor coolant environment. The applicant stated that the AMR further evaluation bases for CRDM nozzle and CRDM nozzle thermal sleeves in SLRA Sections 3.1.2.2.10, Subsections 1 and 2, are not applicable to the design of CRDM penetration nozzles at ONS.

In SLRA Section 3.1.2.2.10, Subsections 1 and 2, the applicant explained that the design of the CRDM nozzles at ONS Units 1, 2, and 3 is based on a different design configuration that utilizes a leadscrew support tube, leadscrew support nut, and leadscrew nut locking washer; based on this design configuration, the applicant stated that the OE for CRDM nozzles and nozzle thermal sleeves (as defined in SRP-SLR Section 3.1.2.2.10, Items 1 and 2) is not applicable to the design of the CRDM nozzles in the ONS units. However, the applicant stated that, in order to confirm that LOM-wear is not occurring in the design of the CRDM nozzles at ONS, the applicant will perform a one-time inspection (OTI) of the CRDM nozzles consistent with the applicant's AMP defined in SLRA Section B2.1.20, "One-Time Inspection."

The staff observed that, consistent with References 29 and 30 in Section 3.1 of the SRP-SLR, the applicable CRDM nozzle wear operating experience is only applicable to the CRDM nozzles and nozzle thermal sleeves in RPV upper closure heads of Westinghouse-designed PWRs. In this regard, the staff confirmed that the CRDM penetration nozzles in the ONS RPV upper closure head designs were fabricated by B&W and that the generic OE is not appliable to the design of the CRDM nozzles at ONS. The staff also noted that the applicant indicated that it does not expect this type of degradation (i.e., LOM-wear) to occur in the CRDM nozzles of the ONS reactor units.

The staff noted that programmatic criteria in GALL-SLR AMP XI.M32, "One-Time Inspection," define and establish that OTIs may be used for 10 CFR 54.21(a)(3) aging management objectives and situations in which additional confirmation is appropriate; this includes potential aging effect assessment cases in which (a) an aging effect is not expected to occur, but the data are insufficient to rule it out, or (b) an aging effect is expected to progress very slowly in the specified environment, but the local environment may be more adverse than generally expected. The staff also noted that the "parameters monitored or inspected" program element in GALL-SLR AMP XI.M32 permits visual inspection methods (i.e., VT-3 techniques or better [VT-1 or EVT-1]) or volumetric inspection methods (e.g., UT) to be used for detection of component-specific loss of material incidents that may be induced by a gross-degradation mechanism (e.g., by general corrosion or wear).

The staff noted that SLRA Section B2.1.20 defines the OTI Program as a new AMP for the subsequent period of extended operation that, when implemented, will be consistent with the staff's aging management criteria for OTI programs in GALL-SLR AMP XI.M32. Based on this consistency statement, the staff confirmed that the applicant's OTI program includes applicable aging management activities to perform appropriate corrective actions (including the need to develop and apply a periodic inspection program of the CRDM nozzles) if wear is detected in the CRMD nozzles as result of implementing the scheduled OTI of the components. Thus, the staff confirmed that the applicant's basis for applying an OTI for the management of LOM-wear in the CRDM nozzles is consistent with the staff's criteria for applying OTIs as component-specific confirmatory aging management bases in GALL-SLR AMP XI.M32, "One-Time Inspection."

Based on this review, the staff finds that applicant has addressed the AMR further evaluation guidance in SRP-SLR Section 3.1.2.210, Subsections 1 and 2, and that applicant's AMR basis for the ONS CRDM nozzles is acceptable because the staff has confirmed that (1) the applicable OE discussed and evaluated in SRP-SLR Section 3.1.2.2.10, Subsections 1 and 2, is not applicable to the design of the CRDM penetration nozzles at ONS, (2) the applicant will be using its OTI program to confirm whether LOM-wear is not occurring in the CRDM penetration nozzles at ONS during the subsequent period of extended operation, and (3) the applicant's basis for applying an OTI as a confirmatory aging management basis for the ONS CRDM nozzles is consistent with the staff's criteria for applying OTIs of plant-specific structures or components in GALL-SLR AMP XI.M32, "One-Time Inspection."

3.1.2.2.11 Cracking Due to Primary Water Stress Corrosion Cracking

SLRA Section 3.1.2.2.11, associated with SLRA Table 3.1-1, AMR Item 3.1.1-025, addresses cracking for Alloy 600 material exposed to reactor coolant, which will be managed by the Steam Generators and Water Chemistry programs. The staff reviewed the applicant's proposal against the criteria in SRP-SLR Section 3.1.2.2.11.

Item 1. The Oconee SGs are B&W replacement once-through SGs and do not have divider plate assemblies; therefore, a plant-specific AMP is not required. The staff finds that the applicant has met the criteria for Item 1 in SRP-SLR Section 3.1.2.2.11 because the applicant's SGs do not have divider plate assemblies.

Item 2. The criteria for Item 2 in SRP-SLR Section 3.1.2.2.11 states that a plant-specific AMP is not required for plants with thermally treated Alloy 690 SG tubes and with tubesheet cladding using Alloy 690 type material. The staff finds that the applicant has met the criteria for Item 2 in SRP-SLR Section 3.1.2.2.11 because the applicant's SGs have thermally treated Alloy 690 SG tubes, and the tubesheet cladding is Alloy 690 type material.

3.1.2.2.12 Cracking Due to Irradiation-Assisted Stress Corrosion Cracking (IASCC)

SLRA Section 3.1.2.2.12, associated with SLRA Table 3.1.1, Items 3.1.1-029, 3.1.1-041, and 3.1.1-103, addresses IASCC for nickel-alloy and SS RVI components exposed to the BWR vessel environment. The applicant stated that this item is not applicable. The staff evaluated the applicant's claim against the criteria in SRP-SLR Section 3.1.2.2.12 and finds it acceptable because the applicant's RV design is not a BWR, and thus the RV components are not exposed to a BWR vessel environment.

3.1.2.2.13 Loss of Fracture Toughness Due to Neutron Irradiation or Thermal Aging Embrittlement

SLRA Section 3.1.2.2.13, associated with SLRA Table 3.1-1, Items 3.1.1-099 and 3.1.1-100, addresses LOFT-IE/TE for nickel-alloy and SS RVI components exposed to the BWR vessel environment. The applicant stated that this item is not applicable. The staff evaluated the applicant's claim against the criteria in SRP-SLR Section 3.1.2.2.13 and finds it acceptable because the applicant's RV design is not a BWR, and thus the RV components are not exposed to a BWR vessel environment.

3.1.2.2.14 Loss of Preload Due to Thermal or Irradiation-Enhanced Stress Relaxation

SLRA Section 3.1.2.2.14, associated with SLRA Table 3.1.1, Item 3.1.1-120, addresses loss of preload due to thermal or irradiation-enhanced stress relaxation for BWR core plate rim hold-down bolts exposed to the BWR vessel environment. The applicant stated that this item is not applicable. The staff evaluated the applicant's claim against the criteria in SRP-SLR Section 3.1.2.2.14 and finds it acceptable because the applicant's RV design is not a BWR and does not use BWR core plate rim hold-down bolts.

3.1.2.2.15 Loss of Material Due to General, Crevice, or Pitting Corrosion and Cracking Due to Stress Corrosion Cracking

As amended by Supplement 3 dated December 15, 2021 (ADAMS Accession No. ML21349A005), SLRA Section 3.1.2.2.15, associated with SLRA Table 3.1.1, Items 3.1.1-105 and 3.1.1-115, addresses (a) loss of material due to general, crevice, or pitting corrosion for steel piping and piping components exposed to concrete (Item 3.1.1-105), and (b) loss of material due to crevice or pitting corrosion and cracking due to SCC for SS piping and piping components exposed to concrete (Item 3.1.1-115). The applicant stated that these items are not applicable because there are no RCS SS or steel piping or piping components within the scope of SLR that are exposed to concrete. The staff evaluated the applicant's claim against the criteria in SRP-SLR Section 3.1.2.2.15 and finds it acceptable because, based on a review of the UFSAR, there are no steel or SS piping or piping components exposed to concrete in the RCS.

For those AMR items associated with SLRA Section 3.1.2.2.15, the staff concludes that the SLRA is consistent with the GALL-SLR Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the subsequent period of extended operation as required by 10 CFR 54.21(a)(3).

3.1.2.2.16 Loss of Material Due to Pitting and Crevice Corrosion

SLRA Section 3.1.2.2.16, associated with SLRA Table 3.1.1, Item 3.1.1-136, addresses loss of material due to pitting and crevice corrosion in SS and nickel-alloy piping and piping components exposed to air and condensation, which will be managed by the One-Time Inspection program. The staff reviewed the applicant's proposal against the criteria in SRP-SLR Section 3.1.2.2.16. In its review of components associated with AMR Item 3.1.1-136, the staff finds that the applicant has met the further evaluation criteria, and the applicant's proposal to manage the effects of aging using the One-Time Inspection program is acceptable because the program cannot be used for structures or components with known age-related degradation mechanisms. The One-Time Inspection program also relies on established nondestructive examination (NDE) techniques, including visual, ultrasonic, and surface techniques. Inspections and tests are performed by personnel qualified in accordance with site procedures and programs to perform the type of examination specified. Additionally, where an aging effect identified during an inspection does not meet acceptance criteria, or projected results of the inspections of a material, environment, and aging effect combination do not meet the acceptance criteria, a periodic inspection program is developed for the specific material, environment, and aging effect combination. The periodic inspection program is implemented at all units on site with the same combination(s) of material, environment, and aging effect.

3.1.2.2.17 Quality Assurance for Aging Management of Nonsafety-Related Components

SE Section 3.0.4 documents the staff's evaluation of the applicant's QA Program.

3.1.2.2.18 Ongoing Review of OE

SE Section 3.0.5 documents the staff's evaluation of the applicant's ongoing review of OE.

3.1.2.3 Aging Management Review Results Not Consistent with or Not Addressed in the GALL-SLR Report

3.1.2.3.1 Nickel-Alloy Reactor Pressure Vessel Bottom Head Instrument Guide Tubes Exposed to a Reactor Coolant Environment

SLRA Table 3.1.2-1 includes a plant-specific AMR item that states that there is a time-limited aging analysis for management of cracking in the nickel-alloy RPV bottom head instrument guide tubes exposed to an internal reactor coolant environment. The AMR item cites generic Note H, which indicates the aging effect for the component is not in NUREG-2191 (the GALL-SLR Report) for this component, material, and environment combination.

The staff reviewed the generic and plant-specific TLAAs evaluated in SLRA Chapter 4 to determine whether the chapter included any generic or plant-specific TLAA that would be sufficient to manage cracking (i.e., by analysis) of the RPV bottom head instrument guide tubes. The staff did not identify any TLAA on cracking in SLRA Chapter 4 that specifically mentioned that the instrument guide tubes were within the scope of the TLAA. Thus, for the plant-specific Note H referenced AMR item for the bottom head instrument guide tubes, the staff determined the need for additional information, which resulted in the issuance of RAI 3.1.2-1, Part 1. The applicant's response is documented by letter dated May 27, 2022 (ADAMS Accession No. ML22147A001).

In its response to RAI 3.1.2-1, Part 1, the applicant clarified that the applicable TLAA referenced in the plant-specific Note H AMR item of the RPV bottom head instrument guide tubes is the TLAA that evaluates the impacts of flow-induced vibration on the core support or safe shutdown functions of the Oconee RVI components (including safety-related neutron flux monitoring needs for bottom head inserted neutron monitoring instruments inserted through the guide tubes and needed for safe shutdown operations of the Units), as summarized, evaluated, and dispositioned in SLRA Section 4.7.1.2. As part of the applicant's response, the applicant amended the plant-specific Note H AMR item for the RPV bottom head instrument guide tubes to include new, plant-specific Note 3 for SLRA Table 3.1.2-1, which states:

> "3. The TLAA associated with this AMR item in flow-induced vibration of the instrument tubes and is addressed in SLRA Section 4.7.1.2 and Section 3.0 of AMP-3899P."

The staff finds that applicant's response to RAI 3.1.2-1, Part 1, and the amended version of the plant-specific AMR item to be acceptable because the applicant has amended the AMR item to clearly identify which of the TLAAs in SLRA Chapter 4 applies as the time-dependent TLAA evaluation of RPV bottom head instrument guide tubes. The matter raised in RAI 3.1.2-1, Part 1, is resolved. The staff concludes that the applicant's TLAA on RVI flow-induced vibrations and the applicant's basis for dispositioning this TLAA are in accordance with 10 CFR 54.21(c)(1)(ii) in SE Section 4.7.1.2.

3.1.2.3.2 Steel Reactor Pressure Vessel Support Skirts Exposed to an Uncontrolled, Indoor Air Environment

SLRA Table 3.1.2-1 includes a plant-specific AMR subitem for steel RPV support skirts (under exposure to an external, uncontrolled indoor air environment) that states that loss of material in the components will be managed by the SLRA AMP B2.1.1, ASME Section XI, "Inservice Inspection," Subsections IWB, IWC, and IWD program (henceforth the ISI program). The AMR subitem cites generic Note J, which indicates that neither component nor the material and environment combination are evaluated in NUREG-2191 (i.e., in the GALL-SLR Report).

The staff reviewed the associated plant-specific Note J–based AMR subitem on loss of material in the steel RPV support skirts. The staff noted that, in the applicant's response to staff RAI 3.5.2.2.2.6-2, Request 2, dated February 14, 2022 (ADAMS Accession No. ML22045A021), the applicant amended the SLRA Table 3.1.2-1 NEI Note J–based AMR subitem on loss of material of the RPV support skirts to credit SLRA AMP B2.1.30, "ASME Section XI, Subsection IWF" (ASME ISI IWF program) as the basis for managing loss of material in the support skirts. The applicant also updated the SLRA Table 3.1.1 item and GALL-SLR AMR item references for the line item, where the line item now identifies that it is consistent with the GALL-SLR-based line item for loss of material in PWR RPV support skirts in GALL-SLR AMR Item III.B1.1.T-24. Based on its review of the applicant's CLB, the staff finds that the applicant has addressed management of loss of material in the support skirt using the ASME ISI IWF program because the staff confirmed that the program implements periodic VT-3 visual inspections of the support skirts to monitor for potential indications of damage in the support skirts, including indications of damage in the components that may be induced by a loss of material or wear mechanism. Thus, the staff finds that the amendment of this plant-specific Note J AMR subitem is acceptable for the objectives managing loss of material in the subject RPV support skirts.

SLRA Table 3.1.2-1 also includes another plant-specific AMR subitem for the steel RPV support skirts that are exposed to an external uncontrolled indoor air environment. In this AMR subitem, the applicant states that there are no aging effects for the component type and that the SLRA does not need to include any AMP or TLAA for management of the component (this is indicated by use of the word "None" in the "Aging Effect" column entry of the line item and the word "None" in the "Aging Management Program" column entry of the line item). The AMR subitem cites generic Note J, which indicates that neither component nor the material and environment combination are evaluated in NUREG-2191. The AMR subitem also cites use of plant-specific Note 1, which states:

> "The RPV support skirt is the critical location of the RPV support assembly and is not susceptible to irradiation embrittlement based on the nil ductility temperature (NDT) evaluation report. The RPV support intended function will be maintained consistent with the CLB during the subsequent period of extended operation when considering damage to irradiation."

The staff reviewed the associated plant-specific Note J–based "None-None" AMR subitem for the steel RPV support skirts. However, the basis for including an NEI Note J–based "None-None" AMR subitem for the RPV support skirts (on SLRA page 3-103) was not clear to the staff because Note J would only apply if the applicant had identified that there are no aging effects requiring management for the surfaces of the steel RPV support skirts that are exposed to an external, uncontrolled indoor air environment. The staff determined that the applicant did include a GALL-SLR-based AMR item (as referenced in SLRA Table 3.1.1, Item 3.1.1-004, and GALL-SLR AMR Item IV.A2.R-70) in SLRA Table 3.1.2-1 for managing cumulative fatigue damage corrosion in the support skirts under exposure to the uncontrolled indoor air environment and the referenced plant-specific Note J–based AMR item in SLRA Table 3.1.2-1 for managing loss of material in the support skirts under exposure to this environment (as evaluated above). Thus, for the plant-specific “None-None” item for the RPV support skirts, the staff determined the need for additional information, which resulted in the issuance of RAI 3.1.2-1, Part 2. The applicant’s response is documented in its letter dated May 27, 2022 (ADAMS Accession No. ML22147A001).

The staff evaluated the NDT type fracture toughness analysis of the RPV support skirts (as referenced in Note 1 of SLRA Table 3.1.2-1) in SE Section 3.5.2.2.2.6. The staff noted that, consistent with the applicant’s response to RAI 3.1.2-1, Part 2, and plant-specific Note 1 in SLRA Table 3.1.2-1, the applicant identifies that its NDT (RT_{NDT}) analysis for the RPV support skirts demonstrates that the support skirts are not susceptible to an aging effect and mechanism combination of LOFT-IE. The staff also observed that, in its response to RAI 3.1.2-1, Part 2, the applicant amended the “*Aging Effect*” column entry of the original Note J “None-None” AMR subitem of the RPV support skirts to state an aging effect of “loss of fracture toughness” instead of listing it as “None.”

Based on the staff’s observations summarized in the items below, the staff found the applicant’s response to RAI 3.1.2-1, Part 2, and the amendment of the referenced Note J AMR subitem for the RPV support skirts to be acceptable because:

(1) In SLRA Table 3.1.2-1, the applicant clearly identifies that the RPV support skirts are potentially susceptible to two other aging effects (i.e,. loss of material and cumulative fatigue damage) that require aging management during the subsequent period of extended operation in accordance with 10 CFR 54.21(a)(3):

(a) loss of material, which will be managed by the AMP in SLRA Section B2.1.30, “ASME Section XI, Subsection IWF,” and (b) cumulative fatigue damage, which will be managed by the applicant’s TLAA on Class 1 metal fatigue of the RPV, as summarized and evaluated in SLRA Section 4.3.2.1.

(2) The applicant’s amended version of the referenced plant-specific Note J item for the RPV support skirts clarifies that the support skirts do not need to be subject to the aging management provisions of 10 CFR 54.21(a)(3) only in terms of considering whether:

(1) a drop in the fracture toughness property of the steel materials used to fabricate the supports skirts may occur as a function of elapsed time, and (2) if so, whether a potential drop in the fracture toughness properties of support skirts would need to be age managed during the subsequent period of extended operation. For this consideration, the staff determined that the applicant is applying its NDT analysis of the RPV support skirts as its basis for concluding that the support skirts (1) do not screen in for loss of fracture toughness due to neutron irradiation embrittlement during a cumulative 80-year licensed operating term, and (2) do not need to be subject to any aging management activities for this specific aging effect and mechanism combination during the subsequent period of extended operation.

The staff's evaluation of the NDT analysis for the RPV support skirts is provided and documented in SE Section 3.5.2.2.2.6. Based on the conclusions stated above, the matter in RAI 3.1.2-1, Part 2, is resolved.

3.1.2.3.3 Reactor Vessel, Reactor Internals, and Reactor Coolant System - Steam Generators - Aging Management Evaluation

Nickel-Alloy Auxiliary Feedwater Nozzle Thermal Sleeves and Main Feedwater Nozzle Spray Plates Exposed Externally to Secondary Feedwater.

SLRA Table 3.1.2-4 states that loss of material for nickel-alloy auxiliary feedwater nozzle thermal sleeves and the main feedwater nozzle spray plates exposed externally to secondary feedwater will be managed by the Water Chemistry and the One-Time Inspection programs. The AMR items cite generic Note F. The staff reviewed the associated items in the SLRA and considered whether the aging effects proposed by the applicant constitute all of the applicable aging effects for this component, material, and environment description. In addition to loss of material, the staff noted that the applicant addressed cracking and cumulative fatigue damage for these component, material, and environment combinations in other AMR items. Based on its review of "Expanded Material Degradation Assessment" (NUREG CR-7153, Vol. 2), which states that degradation concerns for nickel alloy consist of SCC, fatigue, pitting corrosion, and wear, the staff finds that the applicant has identified all applicable aging effects for this component, material, and environment combination. The staff finds the applicant's proposal to manage the effects of aging acceptable because the Water Chemistry program uses periodic monitoring of the treated water in order to minimize loss of material. Additionally, the use of the One-Time Inspection program can detect loss of material if it is occurring and verify the system-wide effectiveness of the Water Chemistry program that is designed to prevent or minimize aging to the extent that it will not cause the loss of intended function during the subsequent period of extended operation.

Stainless Steel Auxiliary Feedwater Nozzle Flanges Plates Exposed Internally to Treated Water.

SLRA Table 3.1.2-4 states that cracking for SS auxiliary feedwater nozzle flanges exposed internally to treated water will be managed by the Water Chemistry and the One-Time Inspection programs. The AMR items cite generic Note F. The staff reviewed the associated items in the SLRA and considered whether the aging effects proposed by the applicant constitute all of the applicable aging effects for this component, material, and environment description. In addition to cracking, the staff noted that the applicant addressed loss of material and cumulative fatigue damage for these component, material, and environment combinations in other AMR items. Based on its review of the GALL-SLR, Table IX.C, which states that SS is susceptible to a variety of aging effects and mechanisms, including loss of material and cracking, the staff finds that the applicant has identified all applicable aging effects for this component, material, and environment combination. The staff finds the applicant's proposal to manage the effects of aging acceptable because the Water Chemistry program uses periodic monitoring of the treated water in order to minimize cracking. Additionally, the use of the One-Time Inspection program can detect cracking if it is occurring and verifies the system-wide effectiveness of the Water Chemistry program that is designed to prevent or minimize aging to the extent that it will not cause the loss of intended function during the subsequent period of extended operation.

3.2 Aging Management of Engineered Safety Features

3.2.1 Summary of Technical Information in the Application

SLRA Section 3.2 provides AMR results for those components that the applicant identified in SLRA Section 2.3.2, "Engineered Safety Features," as being subject to an AMR. SLRA Table 3.2.1, "Summary of Aging Management Programs for Engineered Safety Features Evaluated in Chapter V of the GALL-SLR Report," is a summary comparison of the applicant's AMR results with those provided in the GALL-SLR Report for the engineered safety features (ESF) components.

3.2.2 Staff Evaluation

Table 3.2-1 below summarizes the staff's evaluation of the component groups listed in SLRA Section 3.2 and addressed in the GALL-SLR Report.

Table 3.2-1 Staff Evaluation for Engineered Safety Features Components Evaluated in the GALL-SLR Report

Component Group (SRP-SLR Item No.)	Staff Evaluation
3.2.1-001	Consistent with the GALL-SLR Report (see SE Section 3.2.2.2.1)
3.2.1-002	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.2.1-003	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.2.1-004	Consistent with the GALL-SLR Report (see SE Section 3.2.2.2.2)
3.2.1-005	Consistent with the GALL-SLR Report
3.2.1-006	Not applicable to PWRs (see SE Section 3.2.2.2.3)
3.2.1-007	Consistent with the GALL-SLR Report (see SE Section 3.2.2.2.4)
3.2.1-008	Not applicable to Oconee
3.2.1-009	Consistent with the GALL-SLR Report
3.2.1-010	Consistent with the GALL-SLR Report
3.2.1-011	Not applicable to Oconee
3.2.1-012	Not applicable to Oconee
3.2.1-013	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.2.1-014	Consistent with the GALL-SLR Report
3.2.1-015	Consistent with the GALL-SLR Report
3.2.1-016	Not applicable to Oconee
3.2.1-017	Not applicable to Oconee
3.2.1-018	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.2.1-019	Consistent with the GALL-SLR Report
3.2.1-020	Consistent with the GALL-SLR Report
3.2.1-021	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.2.1-022	Consistent with the GALL-SLR Report
3.2.1-023	Consistent with the GALL-SLR Report
3.2.1-024	Not applicable to Oconee
3.2.1-025	Consistent with the GALL-SLR Report
3.2.1-026	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.2.1-027	Consistent with the GALL-SLR Report

Component Group (SRP-SLR Item No.)	Staff Evaluation
3.2.1-028	Not applicable to Oconee
3.2.1-029	Not applicable to Oconee
3.2.1-030	Consistent with the GALL-SLR Report
3.2.1-031	Not applicable to Oconee
3.2.1-032	Not applicable to Oconee
3.2.1-033	Not applicable to Oconee
3.2.1-034	Not applicable to Oconee
3.2.1-035	Not applicable to Oconee
3.2.1-036	Not applicable to Oconee
3.2.1-037	Not applicable to Oconee
3.2.1-038	Not applicable to Oconee
3.2.1-039	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.2.1-040	Consistent with the GALL-SLR Report
3.2.1-041	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.2.1-042	Not applicable to Oconee (see SE Section 3.2.2.2.10)
3.2.1-043	Not applicable to Oconee
3.2.1-044	Not applicable to Oconee
3.2.1-045	Not applicable to Oconee
3.2.1-046	Not applicable to Oconee
3.2.1-047	Not applicable to Oconee
3.2.1-048	Consistent with the GALL-SLR Report (see SE Section 3.2.2.2.2)
3.2.1-049	Consistent with the GALL-SLR Report
3.2.1-050	Consistent with the GALL-SLR Report
3.2.1-051	Not applicable to Oconee
3.2.1-052	Not applicable to Oconee
3.2.1-053	Not applicable to Oconee
3.2.1-054	Not applicable to PWRs
3.2.1-055	Not applicable to Oconee (see SE Section 3.2.2.2.9)
3.2.1-056	Not applicable to Oconee (see SE Section 3.2.2.2.10)
3.2.1-057	Not applicable to Oconee
3.2.1-058	Consistent with the GALL-SLR Report
3.2.1-059	Not applicable to Oconee
3.2.1-060	Consistent with the GALL-SLR Report
3.2.1-061	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.2.1-062	Not applicable to Oconee
3.2.1-063	Consistent with the GALL-SLR Report
3.2.1-064	Not applicable to Oconee
3.2.1-065	Consistent with the GALL-SLR Report (see SE Section 3.2.2.1.2)
3.2.1-066	Not applicable to Oconee (see SE Section 3.2.2.2.7)
3.2.1-067	Not applicable to Oconee
3.2.1-068	Consistent with the GALL-SLR Report
3.2.1-069	Not applicable to Oconee
3.2.1-070	Not applicable to Oconee
3.2.1-071	Not applicable to Oconee
3.2.1-072	Consistent with the GALL-SLR Report

Component Group (SRP-SLR Item No.)	Staff Evaluation
3.2.1-073	Consistent with the GALL-SLR Report
3.2.1-074	Not applicable to Oconee
3.2.1-075	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.2.1-076	Not applicable to Oconee
3.2.1-077	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.2.1-078	Not applicable to Oconee. Addressed by 3.2.1-068
3.2.1-079	Consistent with the GALL-SLR Report
3.2.1-080	Not applicable to Oconee (see SE Section 3.2.2.2.4)
3.2.1-081	Not applicable to Oconee
3.2.1-082	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.2.1-083	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.2.1-084	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.2.1-085	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.2.1-086	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.2.1-087	Consistent with the GALL-SLR Report
3.2.1-088	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.2.1-089	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.2.1-090	Consistent with the GALL-SLR Report
3.2.1-091	Not applicable to Oconee (see SE Section 3.2.2.2.9)
3.2.1-092	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.2.1-093	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.2.1-094	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.2.1-095	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.2.1-096	Not applicable to Oconee
3.2.1-097	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.2.1-098	Not applicable to Oconee
3.2.1-099	Consistent with the GALL-SLR Report (see SE Section 3.2.2.2.2)
3.2.1-100	Not applicable to Oconee (see SE Section 3.2.2.2.8)
3.2.1-101	Not applicable to Oconee (see SE Section 3.2.2.2.8)
3.2.1-102	Not applicable to Oconee (see SE Section 3.2.2.2.8)
3.2.1-103	Not applicable to Oconee (see SE Section 3.2.2.2.4)
3.2.1-104	Not applicable to Oconee
3.2.1-105	Not applicable to Oconee (see SE Section 3.2.2.2.10)
3.2.1-106	Not applicable to Oconee (see SE Section 3.2.2.2.2)
3.2.1-107	Consistent with the GALL-SLR Report (see SE Section 3.2.2.2.2)
3.2.1-108	Consistent with the GALL-SLR Report (see SE Section 3.2.2.2.4)
3.2.1-109	Not applicable to Oconee (see SE Section 3.2.2.2.8)
3.2.1-110	Not applicable to Oconee (see SE Section 3.2.2.2.8)
3.2.1-111	Not applicable to Oconee (see SE Section 3.2.2.2.10)
3.2.1-112	Not applicable to Oconee (see SE Section 3.2.2.2.2)
3.2.1-113	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.2.1-114	Not applicable to Oconee
3.2.1-115	Not applicable to Oconee
3.2.1-116	Not applicable to Oconee
3.2.1-117	Not applicable to Oconee

Component Group (SRP-SLR Item No.)	Staff Evaluation
3.2.1-118	Not applicable to Oconee
3.2.1-119	Not applicable to Oconee (see SE Section 3.2.2.2.10)
3.2.1-120	Not applicable to Oconee
3.2.1-121	Not applicable to Oconee (see SE Section 3.2.2.2.10)
3.2.1-122	Not applicable to Oconee
3.2.1-123	Not applicable to Oconee
3.2.1-124	Not applicable to Oconee
3.2.1-125	Not applicable to Oconee
3.2.1-126	Not applicable to Oconee
3.2.1-127	Not applicable to Oconee
3.2.1-128	Not applicable to Oconee
3.2.1-129	Not applicable to Oconee
3.2.1-130	Not applicable to Oconee
3.2.1-131	Not applicable to Oconee
3.2.1-132	Not applicable to Oconee
3.2.1-133	Not applicable to Oconee
3.2.1-134	Not applicable to Oconee

The staff's review of component groups, as described in SE Section 3.0.2.2, is summarized in the following three sections:

(3) SE Section 3.2.2.1 discusses AMR results for components that the applicant states are either not applicable to Oconee or are consistent with the GALL-SLR Report. Section 3.2.2.1.1 summarizes the staff's review of items that are not applicable or not used and documents any RAIs issued and the staff's conclusions. The remaining subsections in SE Section 3.2.2.1 document the review of components that required additional information or otherwise require explanation.

(4) SE Section 3.2.2.2 discusses AMR results for which the GALL-SLR Report and SRPSLR recommend further evaluation.

(5) SE Section 3.2.2.3 discusses AMR results for components that the applicant states are not consistent with, or not addressed in, the GALL-SLR Report. These AMR results typically are identified by generic Notes F through J and plant-specific notes in the SLRA.

3.2.2.1 Aging Management Review Results Consistent with the GALL-SLR Report

The following subsections document the staff's review of AMR results listed in SLRA Tables 3.2.2-1 through 3.2.2-4 that the applicant determined to be consistent with the GALL-SLR Report. The staff audited and reviewed the information in the SLRA. The staff did not repeat its review of the matters described in the GALL-SLR Report. The staff verified that the material presented in the SLRA was applicable and that the applicant identified the appropriate GALL-SLR Report AMRs. For those AMR items that the staff found to be consistent with the GALL-SLR Report, and for which no additional evaluation or RAI applies, the staff's review and conclusions as documented in the GALL-SLR Report are considered to be the basis for acceptability of the AMR items. The staff's conclusion of "Consistent with the GALL-SLR Report" is documented in SE Table 3.2-1, and no separate writeup is required or provided. For the AMR items that required additional evaluation (such as responses to RAIs), the staff's evaluation is documented in Section 3.2.2.1.2 below.

SE Section 3.2.2.1.1 documents the staff's review of AMR items the applicant determined to be not applicable or not used.

3.2.2.1.1 Aging Management Review Results Identified as Not Applicable or Not Used

For SLRA Table 3.2.1, Items 3.2.1 008, 3.2.1-011, 3.2.1-012, 3.2.1-016, 3.2.1-017, 3.2.1-024, 3.2.1-028, 3.2.1-029, 3.2.1-031, 3.2.1-032, 3.2.1-033, 3.2.1-034, 3.2.1-035, 3.2.1-036, 3.2.1-037, 3.2.1-038, 3.2.1-042, 3.2.1-043, 3.2.1-044, 3.2.1-045, 3.2.1-046, 3.2.1-047, 3.2.1-051, 3.2.1-052, 3.2.1-053, 3.2.1-055, 3.2.1-056, 3.2.1-057, 3.2.1-059, 3.2.1-062, 3.2.1-064, 3.2.1-066, 3.2.1 067, 3.2.1-069, 3.2.1-070, 3.2.1-071, 3.2.1-074, 3.2.1-076, 3.2.1-078, 3.2.1-080, 3.2.1-081, 3.2.1-091, 3.2.1-096, 3.2.1-098, 3.2.1-100, 3.2.1-101, 3.2.1-102, , 3.2.1-103, 3.2.1-104, 3.2.1-105, 3.2.1-106, 3.2.1-109, 3.2.1-110, 3.2.1-111, 3.2.1-112, 3.2.1-114, 3.2.1-115, 3.2.1-116, 3.2.1-117, 3.2.1-118, 3.2.1-119, 3.2.1-120, 3.2.1-121, 3.2.1-122, 3.2.1-123, 3.2.1-124, 3.2.1-125, 3.2.1-126, 3.2.1-127, 3.2.1-128, 3.2.1-129, 3.2.1-130, 3.2.1-131, 3.2.1-132, 3.2.1-133, and 3.2.1-134, the applicant claims that the corresponding AMR items in the GALL-SLR Report are not applicable to ONS. The staff reviewed the SLRA and UFSAR and confirmed that the applicant's SLRA does not have any AMR results that are applicable for these items.

For SLRA Table 3.2.1, Items 3.2.1-006 and 3.2.1-054, the applicant claims that the corresponding AMR items in the GALL-SLR Report are not applicable because the associated items are only applicable to BWRs. The staff reviewed the SRP-SLR, confirmed that these items only apply to BWRs, and finds that these items are not applicable to ONS because it is a PWR.

For the following SLRA Table 3.4-1 item, the applicant claimed that the corresponding item in the GALL-SLR Report is not applicable and it is addressed by another SLRA Table 1, AMR item: 3.2.1-078 (addressed by 3.2.1-068). The staff reviewed the SLRA and confirmed that the aging effects for this item will be addressed by other SLRA Table 1 AMR items. Therefore, the staff finds the applicant's proposal to use alternate items acceptable.

3.2.2.1.2 Loss of Material Due to Erosion

SLRA Table 3.3-1, Item 3.2.1-065, addresses wall thinning due to erosion for metallic piping and piping components exposed to treated borated water. As amended by letter dated February 14, 2022 (ADAMS Accession No. ML22045A021), for the AMR item that cites generic Note E, the SLRA credits the ASME Section XI, "Inservice Inspection," Subsections IWB, IWC, and IWD program to manage wall thinning due to erosion for SS piping and piping components exposed to treated borated water. Based on its review of components associated with Item 3.2.1-065, for which the applicant cited generic Note E, the staff finds the applicant's proposal to manage wall thinning due to erosion using the above-cited program acceptable because ONS' ASME Section XI, "Inservice Inspection," Subsections IWB, IWC, and IWD program specifically addresses erosion mechanisms and includes volumetric inspections that are capable of monitoring wall thicknesses.

3.2.2.2 Aging Management Review Results for Which Further Evaluation Is Recommended by the GALL-SLR Report

In SLRA Section 3.2.2.2, the applicant further evaluates aging management for certain ESF components, as recommended by the GALL-SLR Report, and provides information concerning how it will manage the applicable aging effects. The staff reviewed the applicant's evaluation of these component groups against the criteria contained in SRP-SLR Section 3.2.2.2. The following subsections document the staff's review.

3.2.2.2.1 Cumulative Fatigue Damage

SLRA Section 3.2.2.2.1, associated with SLRA Table 3.2.1, Item 3.2.1-001, states that the TLAA on cumulative fatigue damage in the components of ESF is evaluated in accordance with 10 CFR 54.21(c)(1) and addressed in SLRA Section 4.3.3. This is consistent with SRP-SLR Section 3.2.2.2.1 and is therefore acceptable. The staff's evaluation of the TLAA for the components of ESF is documented in SE Section 4.3.3.

3.2.2.2.2 Loss of Material Due to Pitting and Crevice Corrosion in Stainless Steel and Nickel Alloys

SLRA Section 3.2.2.2.2, associated with SLRA Table 3.2.1, AMR Items 3.2.1-004, 3.2.1-048, 3.2.1-099, and 3.2.1-107, addresses loss of material due to pitting and crevice corrosion for SS and nickel-alloy piping, piping components, tanks, and insulated SS piping, piping components, and tanks exposed to air or condensation, which will be managed by the One-Time Inspection program. The staff reviewed the applicant's proposal against the criteria in SRP-SLR Section 3.2.2.2.2.

In its review of components associated with AMR Items 3.2.1-004, 3.2.1-048, 3.2.1-099, and 3.2.1-107, the staff finds that the applicant has met the further evaluation criteria, and the applicant's proposal to manage the effects of aging using the One-Time Inspection program acceptable because the plant-specific OE does not reveal a history of loss of material for these components, and the proposed one-time inspections are capable of detecting whether loss of material is occurring.

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-SLR Section 3.2.2.2.2 criteria. For those AMR items associated with SLRA Section 3.2.2.2.2, the staff concludes that the SLRA is consistent with the GALL-SLR Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions(s) will be maintained consistent with the CLB during the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3).

SLRA Section 3.2.2.2.2, associated with Table 3.2.1, AMR Items 3.2.1-106 and 3.2.1-112, addresses loss of material due to pitting and crevice corrosion for SS and nickel-alloy tanks, within the scope of GALL-SLR AMP XI.M29, that are exposed to air or condensation, and for underground SS piping, piping components, and tanks. The applicant stated that these items are not applicable. The staff evaluated the applicant's claim against the criteria in SRP-SLR Section 3.3.2.2.2 and finds it acceptable because, based on a review of the UFSAR and SLRA, there are no SS or nickel-alloy tanks within the scope of GALL-SLR AMP XI.M29 that are exposed to air or condensation, or underground SS piping, piping components, or tanks in the ESF systems.

3.2.2.2.3 Loss of Material Due to General Corrosion and Flow Blockage Due to Fouling

In SLRA Section 3.2.2.2.3, associated with SLRA Table 3.2.1, Item 3.2-1-006, addresses loss of material and flow blockage in metallic flow orifices and spray nozzles exposed to uncontrolled indoor air and condensation. The applicant stated that this item is not applicable because ONS Units 1, 2, and 3 are PWRs, and the components are for BWR plants. The staff evaluated the applicant's claim against the criteria in SRP-SLR Section 3.2.2.2.3 and finds it acceptable because, as stated in the SRP-SLR, the metallic flow orifices and spray nozzles are located in the drywell and suppression chamber spray system, which can be found only in a BWR plant.

3.2.2.2.4 Cracking Due to Stress Corrosion Cracking in SS Alloys

SLRA Section 3.2.2.2.4, associated with SLRA Table 3.2.1, AMR Items 3.2.1-007 and 3.2.1-108, addresses cracking due to SCC for SS piping, piping components, and tanks and insulated SS piping, piping components, and tanks exposed to air or condensation, which will be managed by the One-Time Inspection program. The staff reviewed the applicant's proposal against the criteria in SRP-SLR Section 3.2.2.2.4.

In its review of components associated with AMR Items 3.2.1-007 and 3.2.1-108, the staff finds that the applicant has met the further evaluation criteria, and the applicant's proposal to manage the effects of aging using the One-Time Inspection program acceptable because the plant-specific OE does not reveal a history of cracking for these components, and the proposed OTIs are capable of detecting whether cracking is occurring.

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-SLR Section 3.2.2.2.4 criteria. For those AMR items associated with SLRA Section 3.2.2.2.4, the staff concludes that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3).

SLRA Section 3.2.2.2.4, associated with Table 3.2.1, AMR items 3.2.1-080 and 3.2.1-103, addresses cracking due to SCC for SS underground piping, piping components, and tanks, and for SS tanks within the scope of GALL-SLR AMP XI.M29 exposed to air or condensation. The applicant stated that these items are not applicable. The staff evaluated the applicant's claim against the criteria in SRP-SLR Section 3.3.2.2.4 and finds it acceptable because, based on a review of the UFSAR and SLRA, there are no SS underground piping, piping components, or tanks, or SS tanks within the scope of GALL-SLR AMP XI.M29 exposed to air or condensation, in the ESF systems.

3.2.2.2.5 Quality Assurance for Aging Management of Nonsafety-Related Components

SE Section 3.0.4 documents the staff's evaluation of the applicant's QA Program.

3.2.2.2.6 Ongoing Review of OE

SE Section 3.0.5 documents the staff's evaluation of the applicant's ongoing review of OE.

3.2.2.2.7 Loss of Material Due to Recurring Internal Corrosion

SLRA Section 3.2.2.2.7 is associated with SLRA Table 3.2.1, Item 3.2.1-066, for loss of material due to recurring internal corrosion in metallic piping components exposed to several water environments. The applicant stated that its review of OE confirmed that loss of material due to recurring internal corrosion is not an AERM for the ESF systems. The staff evaluated the applicant's claim against the criteria in SRP-SLR Section 3.2.2.2.7 and finds it is acceptable because the staff also did not identify any instances of recurring internal corrosion in ESF systems during its review of the OE documentation provided as part of the audit.

3.2.2.2.8 Cracking Due to SCC in Aluminum Alloys

SLRA Section 3.2.2.2.8, associated with SLRA Table 3.2.1, AMR Items 3.2.1-100, 3.2.1-101, 3.2.1-102, 3.2.1-109, and 3.2.1-110, addresses cracking due to SCC for aluminum components. The applicant stated that these items are not applicable. The staff evaluated the applicant's claim against the criteria in SRP-SLR Section 3.2.2.2.8 and finds it acceptable because, based on a review of the UFSAR and SLRA, there are no in-scope aluminum components in the ESF systems.

3.2.2.2.9 Loss of Material Due to General, Crevice, or Pitting Corrosion and Cracking Due to SCC

SLRA Section 3.2.2.2.9, associated with SLRA Table 3.2.1, Items 3.2.1-055 and 3.2.1-091, addresses (a) loss of material due to general, crevice, or pitting corrosion for steel piping and piping components exposed to concrete (Item 3.2.1-055); and (b) loss of material due to crevice or pitting corrosion and cracking due to SCC for SS piping and piping components exposed to concrete (Item 3.2.1-091). The applicant stated that these items are not applicable because there are no ESF systems with SS or steel piping or piping components within the scope of SLR that are exposed to concrete. The staff evaluated the applicant's claim against the criteria in SRP-SLR Section 3.2.2.2.9 and finds it acceptable because, based on a review of the UFSAR, there are no steel or SS piping or piping components exposed to concrete in the ESF systems.

For those AMR items associated with SLRA Section 3.2.2.2.9, the staff concludes that the SLRA is consistent with the GALL-SLR Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.2.10 Loss of Material Due to Pitting and Crevice Corrosion in Aluminum Alloys

SLRA Section 3.2.2.2.10, associated with SLRA Table 3.2.1, AMR Items 3.2.1-042, 3.2.1-056, 3.2.1-105, 3.2.1-111, 3.2.1-119, and 3.2.1-121, addresses loss of material due to pitting and crevice corrosion for aluminum components. The applicant stated that these items are not applicable. The staff evaluated the applicant's claim against the criteria in SRP-SLR Section 3.2.2.2.10 and finds it acceptable because, based on a review of the UFSAR and SLRA, there are no in-scope aluminum components in the ESF systems.

3.2.2.3 Aging Management Review Results Not Consistent with or Not Addressed in the GALL-SLR Report

The SLRA did not identify any AMR results in SLRA Tables 3.2.2-1 through 3.2.2-4 that are not consistent with, or not addressed in, the GALL-SLR Report.

3.3 Aging Management of Auxiliary Systems

3.3.1 Summary of Technical Information in the Application

SLRA Section 3.3 provides AMR results for those components that the applicant identified in SLRA Section 2.3.3, "Auxiliary Systems," as being subject to an AMR. SLRA Table 3.3.1, "Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report," is a summary comparison of the applicant's AMR results with those provided in the GALL-SLR Report for the auxiliary systems components.

3.3.2 Staff Evaluation

Table 3.3-1 below summarizes the staff's evaluation of the component groups listed in SLRA Section 3.3 and addressed in the GALL-SLR Report.

Table 3.3-1 Staff Evaluation for Auxiliary Systems Components Evaluated in the GALL-SLR Report

Component Group (SRP-SLR Item No.)	Staff Evaluation
3.3.1-001	Consistent with the GALL-SLR Report (see SE Section 3.3.2.2.1, item 1)
3.3.1-002	Consistent with the GALL-SLR Report (see SE Section 3.3.2.2.1, item 2)
3.3.1-003	Not applicable to Oconee (see SE Section 3.3.2.2.2)
3.3.1-003a	Not applicable to Oconee (see SE Section 3.3.2.2.2)
3.3.1-004	Consistent with the GALL-SLR Report (see SE Section 3.3.2.2.3)
3.3.1-005	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-006	Consistent with the GALL-SLR Report (see SE Section 3.3.2.2.4)
3.3.1-007	Consistent with the GALL-SLR Report
3.3.1-008	Consistent with the GALL-SLR Report
3.3.1-009	Consistent with the GALL-SLR Report
3.3.1-010	Not applicable to Oconee
3.3.1-011	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-012	Consistent with the GALL-SLR Report (See SE Section 3.3.2.1.6)
3.3.1-013	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-014	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-015	Consistent with the GALL-SLR Report
3.3.1-016	Not applicable to PWRs
3.3.1-017	Consistent with the GALL-SLR Report
3.3.1-018	Not applicable to Oconee
3.3.1-019	Not applicable to PWRs
3.3.1-020	Consistent with the GALL-SLR Report
3.3.1-021	Not applicable to PWRs
3.3.1-022	Not applicable to PWRs
3.3.1-023	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-024	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-025	Consistent with the GALL-SLR Report
3.3.1-026	Not applicable to PWRs
3.3.1-027	Not applicable to PWRs

Component Group (SRP-SLR Item No.)	Staff Evaluation
3.3.1-028	Consistent with the GALL-SLR Report
3.3.1-029	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-030	Not applicable to Oconee
3.3.1-030a	Not applicable to Oconee
3.3.1-031	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-032	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-032a	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-033	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-034	Consistent with the GALL-SLR Report
3.3.1-035	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-036	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-037	Consistent with the GALL-SLR Report
3.3.1-038	Consistent with the GALL-SLR Report
3.3.1-039	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-040	Consistent with the GALL-SLR Report
3.3.1-041	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-042	Consistent with the GALL-SLR Report
3.3.1-043	Consistent with the GALL-SLR Report
3.3.1-044	Consistent with the GALL-SLR Report
3.3.1-045	Consistent with the GALL-SLR Report
3.3.1-046	Consistent with the GALL-SLR Report
3.3.1-047	Not applicable to PWRs
3.3.1-048	Not applicable to Oconee
3.3.1-049	Consistent with the GALL-SLR Report
3.3.1-050	Consistent with the GALL-SLR Report
3.3.1-051	Not applicable to Oconee
3.3.1-052	Consistent with the GALL-SLR Report
3.3.1-053	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-054	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-055	Consistent with the GALL-SLR Report
3.3.1-056	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-057	Consistent with the GALL-SLR Report
3.3.1-058	Consistent with the GALL-SLR Report
3.3.1-059	Consistent with the GALL-SLR Report
3.3.1-060	Consistent with the GALL-SLR Report (See SE Section 3.3.2.1.9)
3.3.1-061	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-062	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-063	Consistent with the GALL-SLR Report
3.3.1-064	Consistent with the GALL-SLR Report
3.3.1-065	Not applicable to Oconee
3.3.1-066	Consistent with the GALL-SLR Report
3.3.1-067	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-068	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-069	Not applicable to Oconee
3.3.1-070	Consistent with the GALL-SLR Report (See SE Section 3.3.2.1.2)

Component Group (SRP-SLR Item No.)	Staff Evaluation
3.3.1-071	Consistent with the GALL-SLR Report (See SE Section 3.3.2.1.3)
3.3.1-072	Consistent with the GALL-SLR Report
3.3.1-073	Not applicable to Oconee
3.3.1-074	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-075	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-076	Consistent with the GALL-SLR Report
3.3.1-077	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-078	Consistent with the GALL-SLR Report
3.3.1-079	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-080	Consistent with the GALL-SLR Report
3.3.1-081	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-082	Consistent with the GALL-SLR Report
3.3.1-083	Consistent with the GALL-SLR Report
3.3.1-084	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-085	Consistent with the GALL-SLR Report
3.3.1-086	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-087	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-088	Consistent with the GALL-SLR Report
3.3.1-089	Consistent with the GALL-SLR Report
3.3.1-090	Consistent with the GALL-SLR Report
3.3.1-091	Consistent with the GALL-SLR Report
3.3.1-092	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-093	Consistent with the GALL-SLR Report
3.3.1-094	Consistent with the GALL-SLR Report (see SE Section 3.3.2.2.4)
3.3.1-094a	Consistent with the GALL-SLR Report (see SE Section 3.3.2.2.3)
3.3.1-095	Consistent with the GALL-SLR Report
3.3.1-096	Consistent with the GALL-SLR Report
3.3.1-096a	Consistent with the GALL-SLR Report
3.3.1-096b	Consistent with the GALL-SLR Report
3.3.1-097	Consistent with the GALL-SLR Report
3.3.1-098	Consistent with the GALL-SLR Report
3.3.1-099	Consistent with the GALL-SLR Report
3.3.1-100	Consistent with the GALL-SLR Report
3.3.1-101	Not applicable to Oconee
3.3.1-102	Not applicable to Oconee
3.3.1-103	Not applicable to Oconee
3.3.1-104	Not applicable to Oconee
3.3.1-105	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-106	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-107	Consistent with the GALL-SLR Report
3.3.1-108	Consistent with the GALL-SLR Report
3.3.1-109	Consistent with the GALL-SLR Report
3.3.1-109a	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-110	Not applicable to PWRs
3.3.1-111	Not applicable to Oconee (see SE Section 3.3.2.1.1)

Component Group (SRP-SLR Item No.)	Staff Evaluation
3.3.1-112	Consistent with the GALL-SLR Report (see SE Section 3.3.2.2.9)
3.3.1-113	Consistent with the GALL-SLR Report
3.3.1-114	Consistent with the GALL-SLR Report
3.3.1-115	Consistent with the GALL-SLR Report
3.3.1-116	Consistent with the GALL-SLR Report
3.3.1-117	Consistent with the GALL-SLR Report
3.3.1-118	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-119	Consistent with the GALL-SLR Report
3.3.1-120	Consistent with the GALL-SLR Report
3.3.1-121	Consistent with the GALL-SLR Report
3.3.1-122	Not applicable to Oconee
3.3.1-123	Not applicable to Oconee
3.3.1-124	Consistent with the GALL-SLR Report
3.3.1-125	Consistent with the GALL-SLR Report
3.3.1-126	Consistent with the GALL-SLR Report (See SE Section 3.3.2.1 and 3.3.2.1.4)
3.3.1-127	Consistent with the GALL-SLR Report (see SE Section 3.3.2.2.7)
3.3.1-128	Not applicable to Oconee
3.3.1-129	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-130	Consistent with the GALL-SLR Report
3.3.1-131	Not applicable to Oconee
3.3.1-132	Consistent with the GALL-SLR Report (see SE Section 3.3.2.1.7)
3.3.1-133	Not applicable to Oconee
3.3.1-134	Consistent with the GALL-SLR Report (See SE Section 3.3.2.1.11)
3.3.1-135	Not applicable to Oconee
3.3.1-136	Consistent with the GALL-SLR Report
3.3.1-137	Not applicable to Oconee
3.3.1-138	Consistent with the GALL-SLR Report (see SE Section 3.3.2.1.5)
3.3.1-139	Consistent with the GALL-SLR Report (see SE Section 3.3.2.1.5)
3.3.1-140	Consistent with the GALL-SLR Report
3.3.1-141	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-142	Consistent with the GALL-SLR Report
3.3.1-143	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-144	Consistent with the GALL-SLR Report
3.3.1-145	Consistent with the GALL-SLR Report
3.3.1-146	Consistent with the GALL-SLR Report (see SE Section 3.3.2.2.3)
3.3.1-147	Not applicable to Oconee
3.3.1-148	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-149	Not applicable to Oconee
3.3.1-150	Not applicable to Oconee
3.3.1-151	Consistent with the GALL-SLR Report
3.3.1-152	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-153	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-154	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-155	Consistent with the GALL-SLR Report
3.3.1-156	This item number is not used in the SRP-SLR or the GALL-SLR Report

Component Group (SRP-SLR Item No.)	Staff Evaluation
3.3.1-157	Consistent with the GALL-SLR Report
3.3.1-158	Not applicable to Oconee
3.3.1-159	Not applicable to Oconee
3.3.1-160	Consistent with the GALL-SLR Report
3.3.1-161	Consistent with the GALL-SLR Report
3.3.1-162	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-163	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-164	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-165	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-166	Consistent with the GALL-SLR Report
3.3.1-167	Consistent with the GALL-SLR Report
3.3.1-168	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-169	Not applicable to Oconee
3.3.1-170	Not applicable to Oconee. Addressed by 3.3.1-125
3.3.1-171	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-172	Not applicable to Oconee
3.3.1-173	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-174	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-175	Not applicable to Oconee
3.3.1-176	Not applicable to Oconee
3.3.1-177	Not applicable to Oconee
3.3.1-178	Not applicable to Oconee
3.3.1-179	Consistent with the GALL-SLR Report
3.3.1-180	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-181	Not applicable to Oconee
3.3.1-182	Consistent with the GALL-SLR Report
3.3.1-183	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-184	Consistent with the GALL-SLR Report
3.3.1-185	Not applicable to Oconee
3.3.1-186	Not applicable to Oconee (see SE Section 3.3.2.2.8)
3.3.1-187	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-188	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-189	Consistent with the GALL-SLR Report (see SE Section 3.3.2.2.8)
3.3.1-190	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-191	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-192	Not applicable to Oconee (see SE Section 3.3.2.2.8)
3.3.1-193	Consistent with the GALL-SLR Report
3.3.1-194	Not applicable to Oconee
3.3.1-195	Not applicable to Oconee
3.3.1-196	Not applicable to Oconee
3.3.1-197	Consistent with the GALL-SLR Report
3.3.1-198	Not Used.
3.3.1-199	Consistent with the GALL-SLR Report
3.3.1-200	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-201	This item number is not used in the SRP-SLR or the GALL-SLR Report

Component Group (SRP-SLR Item No.)	Staff Evaluation
3.3.1-202	Consistent with the GALL-SLR Report (see SE Section 3.3.2.2.9)
3.3.1-203	Not applicable to PWRs
3.3.1-204	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-205	Consistent with the GALL-SLR Report (see SE Section 3.3.2.2.3)
3.3.1-206	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-207	Consistent with the GALL-SLR Report
3.3.1-208	Not applicable to Oconee
3.3.1-209	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-210	Not applicable to Oconee (See SE Section 3.3.2.1.12)
3.3.1-211	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-212	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-213	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-214	Not applicable to Oconee
3.3.1-215	Not applicable to Oconee
3.3.1-216	Not applicable to Oconee
3.3.1-217	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-218	Not applicable to Oconee
3.3.1-219	Not applicable to Oconee. Addressed by 3.3.1-028
3.3.1-220	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-221	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-222	Consistent with the GALL-SLR Report (see SE Section 3.3.2.2.4)
3.3.1-223	Not applicable to Oconee (see SE Section 3.3.2.2.10)
3.3.1-224	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-225	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-226	Not applicable to Oconee
3.3.1-227	Not applicable to Oconee (see SE Section 3.3.2.2.10)
3.3.1-228	Not applicable to Oconee (see SE Section 3.3.2.2.4)
3.3.1-229	Not applicable to Oconee
3.3.1-230	Not applicable to Oconee
3.3.1-231	Not applicable to Oconee (see SE Section 3.3.2.2.3)
3.3.1-232	Consistent with the GALL-SLR Report (see SE Section 3.3.2.2.4)
3.3.1-233	Not applicable to Oconee (see SE Section 3.3.2.2.8)
3.3.1-234	Consistent with the GALL-SLR Report (see SE Section 3.3.2.2.10)
3.3.1-235	Consistent with the GALL-SLR Report
3.3.1-236	Not applicable to Oconee
3.3.1-237	Not applicable to Oconee
3.3.1-238	Not applicable to Oconee
3.3.1-239	Not applicable to Oconee
3.3.1-240	Not applicable to Oconee (see SE Section 3.3.2.2.10)
3.3.1-241	Consistent with the GALL-SLR Report (see SE Section 3.3.2.2.4)
3.3.1-242	Consistent with the GALL-SLR Report (see SE Section 3.3.2.2.10)
3.3.1-243	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-244	Not applicable to PWRs
3.3.1-245	Consistent with the GALL-SLR Report (see SE Section 3.3.2.2.10)
3.3.1-246	Consistent with the GALL-SLR Report (see SE Section 3.3.2.2.4)

Component Group (SRP-SLR Item No.)	Staff Evaluation
3.3.1-247	Consistent with the GALL-SLR Report (see SE Section 3.3.2.2.10)
3.3.1-248	Consistent with the GALL-SLR Report
3.3.1-249	Consistent with the GALL-SLR Report
3.3.1-250	Consistent with the GALL-SLR Report (See SE Section 3.3.2.1.10)
3.3.1-251	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-252	Not applicable to Oconee
3.3.1-253	Consistent with the GALL-SLR Report
3.3.1-254	Consistent with the GALL-SLR Report (see SE Section 3.3.2.2.8)
3.3.1-255	Consistent with the GALL-SLR Report
3.3.1-256	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-257	Consistent with the GALL-SLR Report
3.3.1-258	Not applicable to Oconee. Addressed 3.3.1-091 and 3.3.1-095
3.3.1-259	Not applicable to Oconee
3.3.1-260	Consistent with the GALL-SLR Report
3.3.1-261	Not applicable to Oconee
3.3.1-262	Not applicable to Oconee
3.3.1-263	Consistent with the GALL-SLR Report (see SE Section 3.3.2.1.8)
3.3.1-264	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-265	Not applicable to Oconee
3.3.1-266	Not applicable to Oconee
3.3.1-267	Consistent with the GALL-SLR Report (see SE Section 3.3.2.1)
3.3.1-268	Consistent with the GALL-SLR Report (see SE Section 3.3.2.1)
3.3.1-269	Consistent with the GALL-SLR Report

The staff's review of component groups, as described in SE Section 3.0.2.2, is summarized in the following three sections:

(6) SE Section 3.3.2.1 discusses AMR results for components that the applicant states are either not applicable to Oconee or are consistent with the GALL-SLR Report. Section 3.3.2.1.1 summarizes the staff's review of items that are not applicable and documents any RAIs issued and the staff's conclusions. The remaining subsections in SE Section 3.3.2.1 document the review of components that required additional information or otherwise require explanation.

(7) SE Section 3.3.2.2 discusses AMR results for which the GALL-SLR Report and SRPSLR recommend further evaluation.

(8) SE Section 3.3.2.3 discusses AMR results for components that the applicant states are not consistent with, or not addressed in, the GALL-SLR Report. These AMR results typically are identified by generic Notes F through J and plant-specific notes in the SLRA.

3.3.2.1 Aging Management Review Results Consistent with the GALL-SLR Report

The following subsections document the staff's review of AMR results listed in SLRA Tables 3.3.2-1 through 3.3.2-59 that the applicant determined to be consistent with the

GALL-SLR Report. The staff audited and reviewed the information in the SLRA. The staff did not repeat its review of the matters described in the GALL-SLR Report. The staff verified that the material presented in the SLRA was applicable and that the applicant identified the appropriate GALL-SLR Report AMRs. For those AMR items the staff found to be consistent with the GALL-SLR Report, and for which no additional evaluation or RAI applies, the staff's review and conclusions, as documented in the GALL-SLR Report, are considered to be the basis for acceptability of the AMR items. The staff's conclusion of "Consistent with the GALL-SLR Report" is documented in SE Table 3.3-1, and no separate writeup is required or provided. For AMR items that required additional evaluation (such as responses to RAIs), the staff's evaluation is documented in Sections 3.3.2.1.2 through 3.3.2.1.11 below.

The staff notes that the applicant changed the designation for Table 3.3.1, AMR item 3.3.1-126 in the original submittal from:

> "Not applicable. Wall thinning due to erosion has not been identified as an applicable aging effect in ONS metallic piping, piping components exposed to treated water, treated borated water, or raw water in the scope of SLR in auxiliary systems. The associated NUREG-2191 aging items are not used"

to:

> "Consistent with NUREG-2191, except that a different program is credited. The Open-Cycle Cooling Water System (B2.1.11) program is credited for managing wall thinning for piping and piping components in the Condenser Circulating Water and Low-Pressure Service Water systems"

as part of Supplement 1 dated October 28, 2021 (ADAMS Accession No. ML21302A208), and response to RAI Set 2, dated February 14, 2022 (ADAMS Accession No. ML22045A021). The staff finds this change acceptable. See SE Section 3.3.2.1.4 below.

The staff notes that the applicant changed the designation for Table 3.3.1, AMR Items 3.3.1-267 and 3.3.1-268 from "Not applicable" in the original submission to "Consistent with NUREG-2191" as part of Supplement 2 dated November 11, 2021 (ADAMS Accession No. ML21315A012). The staff finds these changes acceptable.

SE Section 3.3.2.1.1 documents the staff's review of AMR items the applicant determined to be not applicable or not used.

3.3.2.1.1 Aging Management Review Results Identified as Not Applicable or Not Used

For SLRA Table 3.3.1, Items 3.3.1-003, 3.3.1-003a, 3.3.1-010, 3.3.1-018, 3.3.1-030, 3.3.1-030a, 3.3.1-048, 3.3.1-051, 3.3.1-065, 3.3.1-069, 3.3.1-073, 3.3.1-101, 3.3.1-102, 3.3.1-103, 3.3.1-104, 3.3.1-111, 3.3.1-122, 3.3.1-123, 3.3.1-126, 3.3.1-128, 3.3.1-131, 3.3.1-133, 3.3.1-135, 3.3.1-137, 3.3.1-147, 3.3.1-149, 3.3.1-150, 3.3.1-158, 3.3.1-159, 3.3.1-169, 3.3.1 170, 3.3.1-172, 3.3.1-175, 3.3.1-176, 3.3.1-177, 3.3.1-178, 3.3.1-181, 3.3.1-185, 3.3.1-186, 3.3.1-192, 3.3.1-194, 3.3.1-195, 3.3.1-196, 3.3.1-198, 3.3.1-208, 3.3.1-210, 3.3.1-214, 3.3.1-215, 3.3.1-216, 3.3.1-218, 3.3.1-219, 3.3.1-223, 3.3.1-226, 3.3.1-227, 3.3.1-228, 3.3.1-229, 3.3.1-230, 3.3.1-231, 3.3.1-236, 3.3.1-237, 3.3.1-238, 3.3.1-239, 3.3.1-240, 3.3.1-252, 3.3.1-258, 3.3.1-259, 3.3.1-261, 3.3.1-262, 3.3.1-265, and 3.3.1-266, the applicant claims that the corresponding AMR items in the GALL-SLR Report are not applicable to ONS. The staff reviewed the SLRA and UFSAR and confirmed that the applicant's SLRA does not have any AMR results that are applicable for these items.

For SLRA Table 3.3-1, Items 3.3.1-016, 3.3.1-019, 3.3.1-021, 3.3.1-022, 3.3.1-026, 3.3.1-027, 3.3.1-047, 3.3.1-110, 3.3.1-203, and 3.3.1-244, the applicant claims that the corresponding AMR items in the GALL-SLR Report are not applicable because the associated items are only applicable to BWRs. The staff reviewed the SRP-SLR, confirmed that these items only apply to BWRs and finds that these items are not applicable to ONS because it is a PWR.

For the following SLRA Table 3.4-1 items, the applicant claimed that the corresponding items in the GALL-SLR Report are not applicable and are addressed by other SLRA Table 1, AMR items: 3.3.1-170 (addressed by 3.3.1-125), 3.3.1-219 (addressed by 3.3.1-028), and 3.3.1-258 (addressed by 3.3.1-091 and 3.3.1-095). The staff reviewed the SLRA and confirmed that the aging effects for each of these items will be addressed by other SLRA Table 1 AMR items. Therefore, the staff finds the applicant's proposal to use alternate items acceptable.

SLRA Table 3.3.1, AMR item 3.3.1-111, as amended by Supplement 3 dated December 15, 2021, addresses loss of material due to general, pitting, crevice corrosion for structural steel in new fuel storage racks exposed to an uncontrolled indoor-air environment. The applicant stated that this item is not applicable. As stated in UFSAR Section 9.1, new fuel is normally stored in the SFP and may also be stored in the fuel transfer canal or the shipping containers. It is noted, per SLRA Section 2.4.1 and UFSAR Section 9.1.2.1.2, that the spent fuel storage racks at ONS are made from SS material, not carbon steel. The staff evaluated the applicant's claim and finds it acceptable because the component, material, and environment combination associated with this AMR item is not applicable to ONS.

3.3.2.1.2 Loss of material due to general, pitting, crevice corrosion, and MIC

SLRA Table 3.3.1, AMR item 3.3.1-070 addresses loss of material due to general, pitting, crevice corrosion, and microbiologically induced corrosion (MIC) for steel piping, piping components, and tanks exposed to fuel oil. For the SLRA Table 2 AMR item that cites generic Note E, the SLRA credits the Fuel Oil Chemistry program for managing the aging effect for steel piping, piping components, and tanks. The AMR item cites plant-specific Note 4, which states that the fuel oil supply to the auxiliary boiler is not routinely analyzed for water or corrosion product contamination; therefore, this component is managed by the Inspection of the Internal Surfaces in Miscellaneous Piping and Ducting Components program instead of the Fuel Oil Chemistry program.

Based on its review of components associated with AMR Item 3.3.1-070 for which the applicant cited generic Note E, the staff finds the applicant's proposal to manage the effects of aging using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program acceptable because the program relies on internal inspections performed during the periodic system and component surveillances or during the performance of maintenance activities when the surfaces are made accessible for visual inspection. The program includes visual inspections and, when appropriate, surface examinations.

3.3.2.1.3 Loss of material due to pitting, crevice corrosion, and MIC

SLRA Table 3.3.1, AMR Item 3.3.1-071, addresses loss of material due to pitting and crevice corrosion and MIC for steel piping, piping components, and tanks exposed to fuel oil. For the SLRA Table 2 AMR item that cites generic Note E, the SLRA credits the Fuel Oil Chemistry program to manage the aging effect for steel piping, piping components, and tanks. The AMR item cites plant-specific Note 4, which states that the fuel oil supply to the auxiliary boiler is not routinely analyzed for water or corrosion product contamination; therefore, this component is managed by the Inspection of the Internal Surfaces in Miscellaneous Piping and Ducting Components program instead of the Fuel Oil Chemistry program.

Based on its review of components associated with AMR Item 3.3.1-071 for which the applicant cited generic Note E, the staff finds the applicant's proposal to manage the effects of aging using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program acceptable because the program relies on internal inspections performed during periodic system and component surveillances or during the performance of maintenance activities when the surfaces are made accessible for visual inspection. The program includes visual inspections and, when appropriate, surface examinations.

3.3.2.1.4 Loss of Material Due to Erosion

SLRA Table 3.3-1, Item 3.3.1-126 addresses wall thinning due to erosion for metallic piping and piping components exposed to treated water, treated borated water, and raw water. As amended by letter dated February 14, 2022 (ADAMS Accession No. ML22045A021), for the AMR item that cites generic Note E, the SLRA credits the Open-Cycle Cooling Water System program to manage wall thinning due to erosion for steel piping and piping components exposed to raw water in the CCW and low-pressure service water systems. Based on its review of components associated with Item 3.3.1-126, for which the applicant cited generic Note E, the staff finds the applicant's proposal to manage wall thinning due to erosion using the above-cited program acceptable because ONS' Open-Cycle Cooling Water System program implements the recommendations of NRC Generic Letter 89-13, which provides for routine inspections and maintenance to ensure that aging mechanisms, including erosion, cannot degrade the performance of the open-cycle cooling water system.

3.3.2.1.5 Loss of Coating or Lining Integrity Due to Blistering, Cracking, Flaking, Peeling, Delamination, Rusting, or Physical Damage; Loss of Material or Cracking for Cementitious Coatings/Linings; Loss of Material Due to General, Pitting, or Crevice Corrosion or MIC

As amended by Supplement 4 dated June 7, 2022 (ADAMS Accession No. ML22158A028), SLRA Table 3.3.1, AMR Items 3.3.1-138 and 3.3.1-139 address (a) loss of coating or lining integrity due to blistering, cracking, flaking, peeling, delamination, rusting, or physical damage (AMR Item 3.3.1-138); (b) loss of material or cracking for cementitious coatings/linings (AMR Item 3.3.1-138); and (c) loss of material due to general, pitting, or crevice corrosion or MIC (AMR Item 3.3.1-139) for any material piping, piping components, heat exchangers, and tanks with internal coatings/linings exposed to closed-cycle cooling water, raw water, raw water (potable), treated water, treated borated water, fuel oil, lubricating oil, and waste water.

For the SLRA Table 2 AMR items that cite generic Note E and the AMR Items referenced in the paragraph above, the SLRA credits the following AMPs: (a) the Fire Water System program for the EWST in the high-pressure service water system; (b) the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program for the drain pans in the ventilation systems, the package steam fired water heater tank in the plant drinking water system, and the feedwater pump turbine oil and main turbine oil tanks in the lube oil system; and (c) the Open-Cycle Cooling Water System program for the main turbine oil tank oil cooler heat exchanger head in the lube oil system. The staff's evaluation of these three AMPs to manage components associated with AMR Items 3.3.1-138 and 3.3.1-139 follows.

Fire Water System. During its review, the staff noted that GALL-SLR Report AMP XI.M42 states the following:

> The aging effects associated with fire water tank internal coatings/linings are managed by Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report aging management program (AMP) XI.M27, "Fire Water System," instead of this AMP. However, where the fire water storage tank internals are coated, the Fire Water System Program and Final Safety Analysis Report (FSAR) Summary Description of the Program should be enhanced to include the recommendations associated with training and qualification of personnel and the "corrective actions" program element. The Fire Water System Program should also be enhanced to include the recommendations from the "acceptance criteria" program element.

Based on its review of components associated with AMR Items 3.3.1-138 and 3.3.1-139 for which the applicant cited generic Note E, the staff finds the applicant's proposal to manage the effects of aging using the Fire Water System program acceptable based on the following reasons: (a) as described in SE Section 3.0.3.2.11, Enhancement 10 to the Fire Water System program (see Section 3.0.3.2.11), acceptance criteria and corrective actions for internal inspections of the EWST will be in accordance with GALL-SLR Report AMP XI.M42 recommendations, and (b) as amended by Supplement 1 dated October 28, 2021 (ADAMS Accession No. ML21302A208), Enhancement 11 was added to the Fire Water System program to reflect that personnel involved with inspection of the internal coatings of the EWST and evaluation of degraded conditions will be trained and qualified in accordance with GALL-SLR Report AMP XI.M42 recommendations.

Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components. During its review, the staff determined the need for additional information, which resulted in the issuance of an RAI. RAI B2.1.27-1 and the applicant's response are documented in ADAMS Accession Nos. ML21271A590 and ML21295A035, respectively.

In its response, the applicant stated the following with respect to the drain pans in the ventilation systems: (a) the drain pans are not located upstream of any equipment that performs 10 CFR Part 54.21(a)(1) or (a)(3) intended functions; (b) the only intended function of the drain pans is leakage boundary (spatial interaction); (c) the internal environment for the drain pans is condensation from the air-handling units; (d) the condensation does not contain chemical compounds that could cause accelerated corrosion; (e) the internal environment for the drain pans is condensation from the air-handling units, which does not promote MIC; (f) the coatings are applied to the galvanized-steel surfaces of the drain pan such that a potential failure of the coating will not create a galvanic couple; and (g) the coating is applied as a repair and is not credited in the original design.

In addition, the applicant stated the following with respect to the package steam-fired water heater tank in the plant drinking water system: (a) the water heater is not located upstream of any equipment that performs 10 CFR Part 54.21(a)(1) or (a)(3) intended functions; (b) the only intended function of the tank is leakage boundary (spatial interaction); (c) the internal environment of the water heater tank is normally plant drinking water, which does not contain chemical compounds that could cause accelerated corrosion; (d) the water heater tank is supplied by the plant drinking water system, which is connected to the City of Seneca public water system, which does not promote MIC; (e) the water heater tank is steel, the steam supply piping is steel, and the water distribution piping is steel and copper; (f) galvanic corrosion is not a concern as the steel tank presents a large anode to the 2.5-inch copper piping; and (g) the coating is not credited in the design.

Furthermore, the applicant stated the following with respect to the feedwater pump turbine oil and main turbine oil tanks in the lube oil system: (a) if any coating debris were present in the oil, it would be removed by the filters and detected through monitoring of filter differential pressure; (b) the only intended function of the oil tanks is leakage boundary (spatial interaction); (c) the internal environment of the tanks is lubricating oil, which does not contain chemical compounds that could cause accelerated corrosion; (d) the internal environment of the tanks is lubricating oil, which does not promote MIC; (e) the oil tank and the connecting piping are steel; therefore, a galvanic couple does not exist; and (f) the coating is not credited in the design.

During its evaluation of the applicant's response to RAI B2.1.27-1, the staff noted that GALL-SLR Report AMP XI.M42 states that GALL-SLR Report AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," is an acceptable alternative to the inspections recommended in GALL-SLR Report AMP XI.M42 when: (a) loss of coating or lining integrity cannot result in downstream effects for in-scope components; (b) the component's only CLB intended function is leakage boundary or structural integrity; (c) the internal environment does not contain chemical compounds that could cause accelerated corrosion of the base material; (d) the coated/lined components are not located in the vicinity of uncoated components that could cause a galvanic couple to exist; (e) the design for the component did not credit the coating/lining; and (f) the internal environment would not promote MIC of the base metal. Based on its review of components associated with AMR items 3.3.1-138 and 3.3.1-139 for which the applicant cited generic Note E, the staff finds the applicant's proposal to manage the effects of aging using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program acceptable for the following reasons: (a) loss of coating integrity would not result in downstream effects of in-scope components (based on configuration or monitoring of filter differential pressure for the feedwater pump turbine oil and main turbine oil tanks); (b) the intended function of these components is leakage boundary; (c) the internal environments of condensation, potable water, and lubricating oil would not promote MIC and do not contain chemical compounds that could cause accelerated corrosion; (d) these components are either not subject to galvanic corrosion or not subject to a configuration where accelerated corrosion due to galvanic effects would occur; and (e) these components do not credit the internal coating in the design.

Open-Cycle Cooling Water. During its review, the staff determined the need for additional information, which resulted in the issuance of an RAI. RAI B2.1.27-1 and the applicant's response are documented in ADAMS Accession Nos. ML21271A590 and ML21295A035, respectively.

In its response, the applicant stated the following with respect to the main turbine oil tank oil cooler heat exchanger head in the lube oil system: (a) the main turbine oil tank coolers are not located upstream of any equipment that performs 10 CFR Part 54.21(a)(1) or (a)(3) intended functions; (b) the only intended function of the cooler is leakage boundary (spatial interaction); (c) the internal environment for the cooler is raw water from Lake Keowee; (d) water from Lake Keowee is non-aggressive and does not contain chemical compounds that could cause accelerated corrosion; (e) a total of five piping segments in raw water systems have experienced leaks at ONS over the past 10 years where MIC was identified as a contributing cause or potential contributing cause, and they are all stagnant or intermittent flow lines; (f) the coatings are applied to the gray cast-iron surfaces of the oil tank cooler head such that a potential failure of the coating will not create a galvanic couple; and (g) the coatings are applied as a repair and were not credited in the original design.

In addition, in its response to RAI B2.1.27-1, the applicant amended SLRA Table 3.3.2-48, "Auxiliary Systems - Condenser Circulating Water - Aging Management Evaluation," to reflect that internally lined steel main condenser discharge piping exposed to raw water will be managed for loss of coating integrity (Item 3.3.1-138) and loss of material (Item 3.3.1-139) using the Open-Cycle Cooling Water program (both items cited generic Note E). Furthermore, the applicant stated the following with respect to the internally lined steel main condenser discharge piping in the CCW system: (a) this piping is not located upstream of any equipment that performs 10 CFR Part 54.21(a)(1) or (a)(3) intended functions; (b) the only intended function of the piping is leakage boundary (spatial interaction); (c) the internal environment is raw water from Lake Keowee, which is non-aggressive and does not contain chemical compounds that could cause accelerated corrosion; (d) the condenser shell, waterboxes, tubesheets, and discharge piping are steel; (f) the main condenser tubes are SS; (e) galvanic corrosion is not a concern as the steel tubesheets present a large anode to the 0.875-inch SS tubes; and (f) the coatings are not credited in the design.

During its evaluation of the applicant's responses to RAI B2.1.27-1, the staff noted that GALL-SLR Report AMP XI.M42 states that GALL-SLR Report AMP XI.M20, "Open-Cycle Cooling Water System," is an acceptable alternative to the inspections recommended in GALL-SLR Report AMP XI.M42 when: (a) loss of coating or lining integrity cannot result in downstream effects for in-scope components; (b) the component's only CLB intended function is leakage boundary or structural integrity; (c) the internal environment does not contain chemical compounds that could cause accelerated corrosion of the base material; (d) the coated/lined components are not located in the vicinity of uncoated components that could cause a galvanic couple to exist; (e) the design for the component did not credit the coating/lining; and (f) the internal environment would not promote MIC of the base metal. Based on its review of components associated with AMR Items 3.3.1-138 and 3.3.1-139 for which the applicant cited generic Note E, the staff finds the applicant's proposal to manage the effects of aging using the Open-Cycle Cooling Water System program acceptable (in part) for the following reasons: (a) loss of coating integrity would not result in downstream effects of in-scope components; (b) the intended function of these components is leakage boundary; (c) the internal environments of these components do not contain chemical compounds that could cause accelerated corrosion; (d) these components are not subject to galvanic corrosion; and (e) these components do not credit the internal coating in the design. However, the staff determined the need for additional information regarding how the raw water environment at ONS would not promote MIC of the base metal for internally coated components within the scope of the Open-Cycle Cooling Water System program, which resulted in the issuance of an RAI. RAI B2.1.27-1a and the applicant's response are documented in ADAMS Accession Nos. ML21327A277 and ML22010A129, respectively.

In its response, the applicant stated, in part, the following:

> the Open-Cycle Cooling Water System program will manage the following internally-coated components exposed to raw water:…main turbine oil tank oil cooler heat exchanger head…main condenser outlet waterbox and outlet waterbox tubesheet…main condenser discharge piping.

> [t]he main turbine oil tank cooler, which is supplied by the Low Pressure Service Water System, is subject to continuous flow conditions and has not experienced leakage due to MIC. In addition, none of the identified leaks occurred in the Condenser Circulating Water System which supplies the main condenser. The main condenser outlet waterbox, outlet waterbox tubesheet, and discharge piping are subject to continuous flow conditions.
>
> [t]he main turbine oil tank cooler is subject to a continuous flow of 3,000 gallons per minute (gpm) with a fluid velocity of greater than 6 feet per second. The main condenser outlet waterboxes, outlet waterbox tubesheet, and discharge piping are subject to a flow of 113,000 gpm with a fluid velocity of greater than 6 feet per second.

During its evaluation of the applicant's response to RAI B2.1.27-1a, the staff noted that NRC Information Notice No. 85-30, "Microbiologically Induced Corrosion of Containment Service Water System," states that "it has been observed that relatively rapid fluid flow tends to prevent attachment of organisms whereas low flow rates or stagnant conditions favor biofouling and concentration cell corrosion." In addition, based on its review of *Albright's Chemical Engineering Handbook* (specifically Chapter 21.3.4, "Microbiologically Influenced Corrosion"), the staff noted that MIC may occur in seawater at velocities up to 5 feet per second. The staff finds the applicant's basis (regarding why the raw water environment at ONS would not promote MIC of the base metal for internally coated components within the scope of the Open-Cycle Cooling Water System program) to be reasonable based on the following reasons: (a) the components are subject to a continuous fluid velocity of greater than 5 feet per second, which, based on the references cited above, would not promote MIC of the base metal; and (b) plant-specific OE involving leaks (where MIC was identified as a contributing cause or potential contributing cause) did not occur in components subject to continuous flow.

3.3.2.1.6 Loss of Material Due to General, Pitting, and Crevice Corrosion

As amended by Supplement 2 dated November 11, 2021 (ADAMS Accession No. ML21315A012), SLRA Table 3.3.1, AMR Item 3.3.1-012, addresses loss of material due to general, pitting, and crevice corrosion for SS closure bolting exposed to air. For the SLRA Table 2 AMR item that cites generic Note E, the SLRA credits the Fire Protection program with managing loss of material of the SS fire barriers and penetration seals exposed externally to air. In addition, this AMR item cites plant-specific Note 6, which states, "Steel and stainless steel fasteners used to secure fiber blankets and fiberboards in place are evaluated as fire barriers - penetration seals component type." The staff notes that Section 6.1 of EPRI 3002013084, "Long-Term Operations: Subsequent License Renewal Aging Effects for Structures and Structural Components (Structural Tools)," November 2018, states, in part, "wire and other appurtenances used to secure fire wrap to the item being protected – is considered to be part of the fire wrap itself." Based on its review of the component associated with Item 3.3.1-012 for which the applicant cited generic Note E, the staff finds the applicant's proposal to manage the effects of aging using the Fire Protection program acceptable because the SS fasteners are being managed by the same program as the fiber blankets and fiberboards that they secure in place, and the periodic visual inspections required by this program are capable of detecting loss of material.

3.3.2.1.7 Cracking Due to Stress Corrosion Cracking

SLRA Table 3.3.1, AMR item 3.3.1-132, as modified by Supplement 4 dated June 7, 2022 (ML22158A028), addresses cracking due to SCC for copper-alloy (greater than 15 percent zinc) piping exposed to uncontrolled indoor air (external). For the associated SLRA Table 2 AMR item that cites generic Note E, the SLRA credits the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components AMP to manage the aging effect for heat exchanger (generator air cooler) tubes. The AMR item cites plant-specific Note 4, which states, “The external surface of the generator air cooler tubes is internal to the generator units.”

The staff notes that although the cited item is for insulated piping, the same material, environment, aging effect, and program combination is used for SRP-SLR, Item 3.4.1-106 for piping without insulation. Because the same material, environment, aging effect, and program combination is used for items 3.4.1-106 and 3.3.1-132 in NUREG-2192, the use of the insulated piping item in this situation is acceptable. Based on its review of components associated with AMR Item 3.3.1-132 for which the applicant cited generic Note E, the staff finds the applicant’s proposal to manage the effects of aging using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components AMP acceptable because the specified program includes inspections of copper-alloy (greater than 15 percent zinc) components and uses inspection methods capable of detecting cracking.

For SLRA AMR item 3.3.1-144, the applicant provided a supplement (ADAMS Accession No. ML21302A208) that revised the application to reflect that the valve bodies in the high pressure service water system were inadvertently included in the application (i.e., there are no buried SS valves at ONS) and that cracking due to SCC will be managed for the subject piping. These revisions addressed the staff’s concern regarding why cracking due to SCC is not an AERM for the following SS components: (a) valve bodies in the high-pressure service water system, and (b) piping in the CCW and siphon seal water systems.

As amended by Supplement 2 dated November 11, 2021 (ADAMS Accession No. ML21315A012), SLRA Table 3.3.1, AMR Item 3.3.1-145, addresses cracking due to SCC for SS closure bolting exposed to air. For the SLRA Table 2 AMR item that cites generic Note E, the SLRA credits the Fire Protection program with managing cracking of the SS fire barriers and penetration seals exposed externally to air. In addition, this AMR item cites plant-specific Note 6, which states, “Steel and stainless steel fasteners used to secure fiber blankets and fiberboards in place are evaluated as fire barriers - penetration seals component type.” The staff notes that Section 6.1 of EPRI 3002013084, “Long-Term Operations: Subsequent License Renewal Aging Effects for Structures and Structural Components (Structural Tools),” November 2018, states, in part, “wire and other appurtenances used to secure fire wrap to the item being protected – is considered to be part of the fire wrap itself.” Based on its review of the component associated with Item 3.3.1-145, for which the applicant cited generic Note E, the staff finds the applicant’s proposal to manage the effects of aging using the Fire Protection program acceptable because the SS fasteners are being managed by the same program as the fiber blankets and fiberboards that they secure in place, and the periodic visual inspections required by this program are capable of detecting cracking.

3.3.2.1.8 Hardening or Loss of Strength Due to Polymeric Degradation; Loss of Material Due to Peeling, Delamination, or Wear; Cracking or Blistering Due to Exposure to Ultraviolet Light, Ozone, Radiation or Chemical Attack

SLRA Table 3.3.1, AMR Item 3.3.1-263, as amended by Supplement 4 dated June 7, 2022, addresses hardening or loss of strength, loss of material, and cracking or blistering for polymeric plexiglass covers exposed to air (external). For the SLRA Table 3.5.2-1 AMR item that cites generic Note E, the SLRA credits the SLRA Structures Monitoring AMP to manage the aging effects for polymeric plexiglass covers exposed to air (external) installed over certain doors of the Auxiliary Building with a structural function to direct airflow in the building. The AMR item cites plant-specific Note 4, which states: “In accordance with GALL-SLR Table IX.C, page IX C-6 flow blockage due to fouling need not be managed for polymeric materials exposed to air (external) and hardening need not be managed for rigid polymeric materials.”

Based on its review of components associated with AMR Item 3.3.1-263 for which the applicant cited generic Note E, the staff finds the applicant’s proposal to manage the applicable effects of aging using the SLRA Structures Monitoring AMP acceptable because (a) the AMP credited is appropriate because plexiglass covers are used for the structural function of directing air flow and do not perform a mechanical function; (b) the “parameters monitored or inspected,” “detection of aging effects,” and “acceptance criteria” program elements will be enhanced and expanded to monitor polymeric materials (i.e., plexiglass covers) for cracking or blistering, loss of material, and loss of strength, and establish corresponding acceptance criteria; (c) the enhanced program will be adequate to monitor and manage indications of the applicable aging effects for the polymeric plexiglass covers through periodic visual examinations at an interval not to exceed 5 years, with a provision for more frequent inspections based on evaluation of observed degradation, and will ensure that corrective action can be taken prior to loss of structural intended function of directing air flow; and (d) consistent with guidance for “polymeric” material in Table IX.C of GALL-SLR, the aging effects of flow blockage due to fouling and hardening do not require aging management for the plexiglass covers since being exposed to air (external) and are rigid. Therefore, the applicant has identified all applicable aging effects for the component. The staff evaluation of the SLRA B2.1.33 AMP “Structures Monitoring,” which is characterized as an existing program, with exception and enhancements that will be consistent with GALL-SLR AMP XI.S6, is documented in SE Section 3.0.3.2.22.

3.3.2.1.9 Cracking Due to Chemical Reaction, Weathering, Settlement, or Corrosion of Reinforcement and Loss of Material due to Delamination, Exfoliation, Spalling, Pop-out, or Scaling

As amended by Supplement 2 dated November 11, 2021 (ADAMS Accession No. ML21315A012), SLRA Table 3.3.1, AMR Item 3.3.1-060, addresses cracking and loss of material for reinforced concrete structural fire barrier walls, ceilings, and floors exposed to air. For the SLRA Table 2 AMR item that cites generic Note E, the SLRA credits the ASME Section XI, Subsection IWL program and the Fire Protection program to manage cracking and loss of material for reinforced concrete exposed to air. Based on its review of components associated with AMR item 3.3.1-060 for which the applicant cited generic Note E, the staff finds the applicant’s proposal to manage the effects of aging using the ASME Section XI, Subsection IWL program and the Fire Protection program acceptable because periodic visual examinations, in accordance with ASME Section XI, Subsection IWL, can identify cracking and loss of material before a loss of intended function, and the use of the Fire Protection program to manage cracking and loss of material is consistent with the GALL-SLR Report.

3.3.2.1.10 Loss of Material Due to Pitting and Crevice Corrosion

SLRA Table 3.3.1, AMR Item 3.3.1-250, addresses loss of material due to general, pitting, and crevice corrosion for steel tanks, piping, and piping components exposed internally to lubricating oil (waste oil). For the SLRA Table 2 AMR items that cite generic Note E, the SLRA credits the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program to manage the aging effect for the components listed above. The AMR item cites plant-specific Note 1, which states, "This portion of the system potentially contains waste oil, contaminated oil, and solvents; therefore, a periodic inspection program is used in lieu of a one-time inspection for conservatism." Based on its review of components associated with AMR Item 3.3.1-250 for which the applicant cited generic Note E, the staff finds the applicant's proposal to manage the effects of aging using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program acceptable because the program relies on internal inspections performed during the periodic system and component surveillances or during the performance of maintenance activities when the surfaces are made accessible for visual inspection. The program includes visual inspections and, when appropriate, surface examinations.

3.3.2.1.11 Flow Blockage Due to Fouling

For SLRA AMR Item 3.3.1-134, the applicant submitted a supplemental response (ADAMS Accession No. ML21302A208) that revised the application to reflect that flow blockage due to fouling will be managed for the SS piping (with an intended function of pressure boundary) exposed to raw water in the essential siphon vacuum system. These revisions addressed the staff's concern regarding why flow blockage due to fouling is not an AERM for SS piping (with an intended function of pressure boundary) exposed to raw water in the essential siphon vacuum system.

3.3.2.1.12 Cracking, Blistering; Flow Blockage Due to Fouling

For SLRA AMR Item 3.3.1-210, the applicant submitted a supplemental response (ADAMS Accession No. ML21302A208) that revised the application to reflect that aging effects and mechanisms associated with polymeric materials will be cited for the polymeric chlorine tank exposed to raw water in the Keowee service water system. These revisions addressed the staff's concern regarding why aging effects and mechanisms associated with high-density polyethylene (HDPE) are being cited for the polymeric chlorine tank exposed to raw water in the Keowee service water system.

3.3.2.2 Aging Management Review Results for Which Further Evaluation Is Recommended by the GALL-SLR Report

In SLRA Section 3.3.2.2, the applicant further evaluates aging management for certain auxiliary systems components, as recommended by the GALL-SLR Report, and provides information concerning how it will manage the applicable aging effects. The staff reviewed the applicant's evaluation of these component groups against the criteria contained in SRP-SLR Section 3.3.2.2. The following subsections document the staff's review.

3.3.2.2.1 Cumulative Fatigue Damage

<u>Item 1</u>. SLRA Section 3.3.2.2.1, associated with SLRA Table 3.3.1 AMR Item 3.3.1-001, addresses cumulative fatigue damage due to fatigue of structural members of steel cranes. The SLRA notes that this is evaluated as a TLAA in accordance with 10 CFR 54.21(c)(1) and is

addressed in SLRA Section 4.7, “Other Plant-Specific Time Limited Aging Analyses,” specifically Section 4.7.5, “Crane Load Cycle Limit.” This is consistent with SRP-SLR Section 3.3.2.2.1, “Cumulative Fatigue Damage,” and is therefore acceptable. The staff’s evaluation regarding the TLAA for load cycle limits of the plant cranes is documented in SE Section 4.7.5.

Item 2. SLRA Section 3.3.2.2.1, associated with SLRA Table 3.3.1, Item 3.3.1-002, states that the TLAA on cumulative fatigue damage in the components of auxiliary systems is evaluated as a TLAA in accordance with 10 CFR 54.21(c)(1) and addressed in SLRA Section 4.3.3. SLRA Section 3.3.2.2.1 also states that the load cycles of plant cranes, associated with SLRA Table 3.3.1, Item 3.3.1-001, are evaluated as a TLAA in SLRA Section 4.7.5.

The applicant’s evaluation of the TLAAs is consistent with SRP-SLR Section 3.3.2.2.1 and is therefore acceptable. The staff’s evaluation of the TLAA for the components of auxiliary systems and steam and power conversion systems is documented in SE Section 4.3.3. In addition, the staff’s evaluation of the TLAA for the cranes is documented in SE Section 4.7.5.

3.3.2.2.2 Cracking Due to Stress Corrosion Cracking and Cyclic Loading

The staff reviewed SLRA Section 3.3.2.2.2, Item 1, against the criteria in SRP-SLR Section 3.3.2.2.2. SLRA Section 3.3.2.2.2, Item 1, is associated with SLRA Table 3.3.1, Items 3.3.1-003 and 3.3.1-003a, which address cracking due to SCC and cyclic loading, respectively. The applicant amended this SLRA section by Supplement 1 dated October 28, 2021 (ADAMS Accession No. ML21302A208) and stated that the letdown cooler tubes are in-scope of SLR. The applicant also stated that because the letdown cooler assemblies are replaced on a specified frequency, they are not subject to AMR in accordance with 10 CFR 54.21(a)(1)(ii). Accordingly, the applicant removed AMR line items related to the head and the shell of the letdown coolers, from SLRA Tables 2.3.2-3 and 3.2.2-3. Additionally, the applicant revised SLRA Section 3.3.2.2.2 and stated that letdown coolers are replaced on a specified time period and are short-lived components; therefore, they are not subject to AMR. By letter dated February 14, 2022, the applicant provided additional details related to the periodic replacement of the letdown coolers. The staff reviewed the applicant’s justification for the periodic replacement of the letdown coolers and found the periodic replacement adequate. The staff’s review of the letdown coolers is documented in SE Section 3.0.3.2.1.

The staff finds the applicant’s claim acceptable because the applicant has demonstrated that the effects of aging will be adequately managed by periodic replacement and therefore are not subject to AMR in accordance with 10 CFR 54.21(a)(1)(ii).

3.3.2.2.3 Cracking Due to Stress Corrosion Cracking in Stainless Steel Alloys

SLRA Section 3.3.2.2.3, associated with SLRA Table 3.3.1, AMR Items 3.3.1-004, 3.3.1-094a, 3.3.1-146, and 3.3.1-205, addresses cracking due to SCC for SS piping, piping components, tanks, ducting and ducting components exposed to air or condensation, and SS underground piping, piping components, and tanks, which will be managed by the One-Time Inspection program. The staff reviewed the applicant’s proposal against the criteria in SRP-SLR Section 3.3.2.2.3.

In its review of components associated with AMR Items 3.3.1-004, 3.3.1-094a, 3.3.1-146, and 3.3.1-205, the staff finds that the applicant has met the further evaluation criteria and the applicant’s proposal to manage the effects of aging using the One-Time Inspection program acceptable because the plant-specific OE does not reveal a history of cracking for these components, and the proposed one-time inspections are capable of detecting whether cracking is occurring.

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-SLR Section 3.3.2.2.3 criteria. For those AMR items associated with SLRA Section 3.3.2.2.3, the staff concludes that the SLRA is consistent with the GALL-SLR Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the subsequent period of extended operation as required by 10 CFR 54.21(a)(3).

SLRA Section 3.3.2.2.3, associated with Table 3.3.1, AMR Item 3.3.1-231, addresses cracking due to SCC for SS tanks exposed to air or condensation within the scope of GALL-SLR Report AMP XI.M29. The applicant stated that this item is not applicable because there are no SS tanks in auxiliary systems in the scope of AMP XI.M29 and in the scope of SLR. The staff evaluated the applicant's claim again the criteria in SRP-SLR Section 3.3.2.2.3 and finds it acceptable because, based on a review of the UFSAR and SLRA, there are no in-scope SS tanks in auxiliary systems in the scope of GALL-SLR Report AMP XI.M29.

3.3.2.2.4 Loss of Material Due to Pitting and Crevice Corrosion in SS and Nickel Alloys

SLRA Section 3.3.2.2.4, associated with SLRA Table 3.3.1, AMR Items 3.3.1-006, 3.3.1-094, 3.3.1-222, 3.3.1-232, 3.3.1-241, and 3.3.1-246, addresses loss of material due to pitting and crevice corrosion for SS and nickel-alloy piping, piping components, tanks, ducting, ducting components, and heat exchanger components exposed to air or condensation; insulated SS and nickel-alloy piping, piping components, and tanks exposed to air or condensation; and underground SS or nickel-alloy piping, piping components, and tanks, which will be managed by the One-Time Inspection program. The staff reviewed the applicant's proposal against the criteria in SRP-SLR Section 3.3.2.2.4.

In its review of components associated with AMR Items 3.3.1-006, 3.3.1-094, 3.3.1-222, 3.3.1-232, 3.3.1-241, and 3.3.1-246, the staff finds that the applicant has met the further evaluation criteria, and the applicant's proposal to manage the effects of aging using the One-Time Inspection program is acceptable because the plant-specific OE does not reveal a history of loss of material due to pitting and crevice corrosion for these components, and the proposed OTIs are capable of detecting whether loss of material is occurring.

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-SLR Section 3.3.2.2.4 criteria. For those AMR items associated with SLRA Section 3.3.2.2.4, the staff concludes that the SLRA is consistent with the GALL-SLR Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3).

SLRA Section 3.3.2.2.4, associated with Table 3.3.1, AMR Item 3.3.1-228, addresses loss of material due to pitting or crevice corrosion for SS and nickel-alloy tanks exposed to air or condensation within the scope of GALL-SLR Report AMP XI.M29. The applicant stated that this item is not applicable because there are no SS or nickel-alloy tanks in auxiliary systems in the scope of AMP XI.M29 and in the scope of SLR. The staff evaluated the applicant's claim against the criteria in SRP-SLR Section 3.3.2.2.4 and finds it acceptable because, based on a review of the UFSAR and SLRA, there are no SS or nickel alloy tanks in auxiliary systems in the scope of GALL-SLR Report AMP XI.M29.

3.3.2.2.5 Quality Assurance for Aging Management of Nonsafety-Related Components

SE Section 3.0.4 documents the staff's evaluation of the applicant's QA Program.

3.3.2.2.6 Ongoing Review of OE

SE Section 3.0.5 documents the staff's evaluation of the applicant's ongoing review of OE.

3.3.2.2.7 Loss of Material Due to Recurring Internal Corrosion

SLRA Section 3.3.2.2.7 is associated with SLRA Table 3.3.1, Item 3.3.1-127, for loss of material due to recurring internal corrosion in metallic piping components exposed to several water environments. The applicant states that its review of plant-specific OE identified recurring internal corrosion in carbon steel components exposed to raw water systems from Lake Keowee. Systems susceptible to recurring internal corrosion include the CCW, high-pressure service water, Keowee fire protection/detection, Keowee main turbine, Keowee service water, Keowee turbine generator cooling water, low-pressure service water, protected service water, and vacuum systems. The applicant proposed to use the Open-Cycle Cooling Water System program to manage recurring internal corrosion in these systems and addressed the further evaluation attributes (a) through (e) prescribed in SRP-SLR Section 3.3.2.2.7.

The SLRA states that the Open-Cycle Cooling Water System program (see staff evaluation in SE Section 3.0.3.2.6) will be enhanced to require a minimum of 20 inspections for recurring internal corrosion every 24 months. The inspections will be performed at representative sample locations in both open-cycle cooling water and water-based fire suppression systems. In addition, inspection results will be extrapolated to similar locations throughout all the raw water systems and used to assess the general condition, including components that are not easily accessed (i.e., buried). To ensure conservatism for calculating the expected remaining service life, the program applies a safety factor of 1.5 or 2.0 to the measured corrosion rate, depending on whether multiple data sets or a single data set is used, respectively. Additionally, the program will require no fewer than five additional inspections for each inspection that does not meet acceptance criteria.

The staff reviewed the applicant's approach against the criteria in SRP-SLR Section 3.3.2.2.7 for the components associated with Item 3.3.1-127 and determined that the further evaluation criteria have been met. Based on the information provided in the application (as discussed above), the staff finds that the applicant's approach to manage recurring internal corrosion using the Open-Cycle Cooling Water System program is acceptable because the program will perform inspections, evaluate the remaining service life, and take corrective actions until the occurrence rate of recurring internal corrosion no longer meets the associated criteria in SRP-SLR Section 3.3.2.2.7.

3.3.2.2.8 Cracking Due to Stress Corrosion Cracking in Aluminum Alloys

SLRA Section 3.3.2.2.8, associated with SLRA Table 3.3.1, AMR Items 3.3.1-189 and 3.3.1-254, addresses cracking due to SCC for aluminum piping, piping components, and tanks exposed to air; condensation, raw water, raw water (potable), or waste water; and heat exchanger components exposed to air or condensation, which will be managed by the

One-Time Inspection program. The staff reviewed the applicant's proposal against the criteria in SRP-SLR Section 3.3.2.2.8.

In its review of components associated with AMR Items 3.3.1-189, and 3.3.1-254, the staff finds that the applicant has met the further evaluation criteria, and the applicant's proposal to manage the effects of aging using the One-Time Inspection program is acceptable because the plant-specific OE does not reveal a history of cracking for these components, and the proposed one-time inspections are capable of detecting whether cracking is occurring.

Based on the program identified, the staff concludes that the applicant's program meets SRP-SLR Section 3.3.2.2.8 criteria. For those AMR items associated with SLRA Section 3.3.2.2.8, the staff concludes that the SLRA is consistent with the GALL-SLR Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3).

SLRA Section 3.3.2.2.8, associated with SLRA Table 3.3.1, AMR Items 3.3.1-186 and 3.3.1-192, addresses cracking due to SCC for aluminum tanks (within the scope of GALL-SLR AMP XI.M29) exposed to air, condensation, soil, concrete, raw water, or waste water; and underground piping, piping components, and tanks. The applicant stated that these items are not applicable. The staff evaluated the applicant's claim against the criteria in SRP-SLR Section 3.3.2.2.8 and finds it acceptable because, based on a review of the UFSAR and SLRA, there are no aluminum tanks within the scope of GALL-SLR AMP XI.M29 or underground aluminum piping, piping components, or tanks in the auxiliary systems.

SLRA Section 3.3.2.2.8, associated with SLRA Table 3.3.1, AMR Item 3.3.1-233, addresses cracking due to SCC for insulated aluminum piping, piping components, and tanks exposed to air or condensation. In SLRA Supplement 4 (ML22158A028), the applicant revised SLRA Section 3.3.2.2.8 to state that the boric acid tanks in the chemical addition system and coolant storage system are constructed of an aluminum alloy (Alloy 5052) not susceptible to SCC because the alloy contains less than 3.5 percent magnesium. The applicant also added a statement in SLRA Section 3.3.2.2.8 that cracking due to SCC for insulated aluminum piping, piping components, and tanks exposed to air or condensation is not a concern for ONS and deleted the statement that the One-Time Inspection program would be used for this item. The applicant revised Table 3.3.1 to state that Item 3.3.1-233 is not applicable. The applicant also revised Tables 3.3.2-12 and 3.3.2-13 to change the aging effect and AMPs to "None" for the aluminum boric acid tanks that used Item 3.3.1-233. In both cases, the applicant added Note I and an existing footnote stating that the material is not susceptible to SCC. The staff evaluated the applicant's proposed changes against the criteria in SRP-SLR Section 3.3.2.2.8 and finds them acceptable because the SRP-SLR identifies 5xxx series aluminum alloys as susceptible to SCC only if they have a magnesium content of 3.5 wt % or greater. For ONS, the components addressed by AMR Item 3.3.1-233 are constructed of Alloy 5052, which has a magnesium content of 2.2–2.8 wt %.

3.3.2.2.9 Loss of Material Due to General, Crevice, or Pitting Corrosion and Cracking Due to Stress Corrosion Cracking

SLRA Section 3.3.2.2.9, associated with SLRA Table 3.3.1, Item 3.3.1-112, addresses loss of material due to general, crevice, or pitting corrosion for steel piping and piping components exposed to concrete. Specifically, SLRA Section 3.3.2.2.9 states the following:

> Loss of material of steel piping components or structural steel with an external environment of concrete that do not exit the concrete into soil is not an applicable aging effect requiring management. Steel components that do not exit the concrete into soil are not potentially exposed to groundwater. Structural steel embedded in reinforced concrete within building walls are not potentially exposed to groundwater. The concrete in areas containing these components conforms to ACI 349 or ACI 318. Review of ONS OE did not identify degradation of concrete around embedded components that could lead to penetration of water.
>
> Loss of material can occur for steel piping components with an external environment of concrete that are potentially exposed to groundwater. Embedded piping that exits concrete into soil is potentially exposed to groundwater. Loss of material for steel components with an external environment of concrete that exit the concrete into soil is managed by the Buried and Underground Piping and Tanks (B2.1.26) program, as identified in Item [3.3.1-109].

The staff reviewed the applicant's proposal against the criteria in SRP-SLR Section 3.3.2.2.9. For steel components with an external environment of concrete that do not exit the concrete into soil, the staff finds that the applicant has met the further evaluation criteria, and the applicant's proposal that there are no aging effects requiring management is acceptable for the following reasons: (a) the components are encased in concrete that conforms to ACI 349 or ACI 318, (b) plant-specific OE did not reveal any instances of degradation of concrete around embedded components that could lead to penetration of water, and (c) the components are not potentially exposed to groundwater. For steel piping components with an external environment of concrete that are potentially exposed to groundwater, the staff finds the applicant's proposal to manage the effects of aging using the Buried and Underground Piping and Tanks program acceptable because periodic visual inspections are capable of detecting loss of material in steel piping.

SLRA Section 3.3.2.2.9, associated with SLRA Table 3.3.1, Item 3.3.1-202, addresses loss of material due to crevice or pitting corrosion and cracking due to SCC for SS piping and piping components exposed to concrete. Specifically, SLRA Section 3.3.2.2.9 states the following:

> Loss of material and cracking of stainless steel components exposed to concrete is not an aging effect for components that are not potentially exposed to groundwater. Stainless steel piping components exposed to concrete within interior concrete structures are not potentially exposed to groundwater…
>
> Loss of material and cracking could occur for stainless steel piping components with an external environment of concrete that are potentially exposed to groundwater. Embedded piping that exits concrete into soil is potentially exposed to groundwater. ONS has no in-scope embedded stainless steel piping that exits concrete directly into the soil. Loss of material and cracking for stainless steel components with an external environment of soil is managed by the Buried and Underground Piping and Tanks (B2.1.26) program, as identified in Item [3.3.1-107] and [3.3.1-144].

The staff reviewed the applicant's proposal against the criteria in SRP-SLR Section 3.3.2.2.9. For SS piping components exposed to concrete within interior concrete structures, the staff finds the applicant's proposal that there are no aging effects requiring management acceptable because, consistent with the further evaluation criteria, the components are not potentially exposed to groundwater. For SS piping components with an external environment of soil, the staff finds the applicant's proposal to manage the effects of aging using the Buried and Underground Piping and Tanks program acceptable because periodic visual inspections are capable of detecting loss of material and cracking in SS piping.

Based on the program identified, the staff concludes that the applicant's program meets SRP-SLR Section 3.3.2.2.9 criteria. For those AMR items associated with SLRA Section 3.3.2.2.9, the staff concludes that the SLRA is consistent with the GALL-SLR Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.2.10 Loss of Material Due to Pitting and Crevice Corrosion in Aluminum Alloys

SLRA Section 3.3.2.2.10, associated with SLRA Table 3.3.1, AMR Items 3.3.1-234, 3.3.1-242, 3.3.1-245, and 3.3.1-247, addresses loss of material due to pitting and crevice corrosion for aluminum piping, piping components, and tanks exposed to air, condensation, raw water or waste water; aluminum heat exchanger components exposed to air or condensation; and insulated aluminum piping, piping components, and tanks exposed to air or condensation, which will be managed by the One-Time Inspection program. The staff reviewed the applicant's proposal against the criteria in SRP-SLR Section 3.3.2.2.10.

In its review of components associated with AMR Items 3.3.1-234, 3.3.1-242, 3.3.1-245, and 3.3.1-247, the staff finds that the applicant has met the further evaluation criteria, and the applicant's proposal to manage the effects of aging using the One-Time Inspection program is acceptable because the plant-specific OE does not reveal a history of loss of material due to pitting and crevice corrosion for these components, and the proposed one-time inspections are capable of detecting whether loss of material is occurring.

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-SLR Section 3.3.2.2.10 criteria. For those AMR items associated with SLRA Section 3.3.2.2.10, the staff concludes that the SLRA is consistent with the GALL-SLR Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3).

SLRA Section 3.3.2.2.10, associated with SLRA Table 3.3.1, AMR Items 3.3.1-223, 3.3.1-227, and 3.3.1-240, addresses loss of material due to pitting or crevice corrosion for aluminum underground piping, piping components, and tanks; tanks within the scope of GALL-SLR AMP XI.M29; and heat exchanger components exposed to waste water. The applicant stated that these items are not applicable. The staff evaluated the applicant's claim against the criteria in SRP-SLR Section 3.3.2.2.10 and finds it acceptable because, based on a review of the UFSAR and SLRA, there are no in-scope aluminum alloy components with the above component and environment combinations in the auxiliary systems.

3.3.2.3 Aging Management Review Results Not Consistent with or Not Addressed in the GALL-SLR Report (F-J)

The following subsections document the staff's review of AMR results listed in SLRA Tables 3.3.2-1 through 3.3.2-59 that are either not consistent with or not addressed in the GALL-SLR Report and are usually denoted with generic notes F through J. To efficiently capture and identify multiple applicable AMR items in each subsection, and because these AMR items often are not associated with a Table 1 item, the subsections are organized by applicable AMR section and then by material and environment combinations.

For component type, material, and environment combinations not evaluated in the GALL-SLR Report, the staff reviewed the applicant's evaluation to determine whether the applicant has demonstrated that it will adequately manage the effects of aging in a way that maintains the intended function(s) consistent with the CLB for the subsequent period of extended operation. The following sections document the staff's evaluation.

3.3.2.3.1 Auxiliary Systems - Auxiliary Instrument Air System - Aging Management Evaluation

Malleable Iron Piping Exposed to Raw Water, Raw Water (Potable) Closed-Cycle Cooling Water, Waste Water, and Treated Water. As amended by letter dated January 7, 2022, SLRA Tables 3.3.2-1, 3.3.2-4, 3.3.2-6, 3.3.2-8, 3.3.2-10, 3.3.2-18, 3.3.2-20, 3.3.2-21, 3.3.2-22, 3.3.2-23, 3.3.2-24, 3.3.2-25, 3.3.2-26, 3.3.2-36, 3.3.2-41, 3.3.2-48, 3.3.2-49, 3.3.2-59, 3.4.2-1, 3.4.2-2, 3.4.2-3, 3.4.2-7, and 3.4.2-10 state that selective leaching for malleable iron piping exposed to raw water, raw water (potable), closed-cycle cooling water, waste water, and treated water will be managed by the Selective Leaching program. The AMR items cite generic Note H, for which the applicant has identified selective leaching as an additional aging effect. The staff's evaluation of the applicant's proposal to manage selective leaching for malleable iron piping using the Selective Leaching program is documented in SE Section 3.0.3.2.14.

3.3.2.3.2 Auxiliary Systems – Recirculating Cooling Water System - Aging Management Evaluation

Copper Alloy (Greater Than 15 Percent Zinc) Piping and Piping Components Exposed to Closed-Cycle Cooling Water.

As amended by Supplement 2 dated November 11, 2021, and by letter dated February 14, 2022 (ADAMS Accession Nos. ML21315A012 and ML22045A021, respectively), SLRA Table 3.3.2-21 states that wall thinning for copper-alloy (greater than 15 percent zinc) piping and piping components exposed to closed-cycle cooling water in the recirculating cooling water system will be managed by the Open-Cycle Cooling Water System program. The AMR item cites generic Note H, for which the applicant has identified wall thinning as an additional aging effect. The AMR item also cites plant-specific Notes 3 and 4, stating that, based on site-specific OE, the outer surfaces of the system's heat exchanger tubes are susceptible to wall thinning from erosion and that the Open-Cycle Cooling Water System program will manage wall thinning on the outside (closed-cycle cooling water side) of the tubes by means of ECT performed on the inside (raw water side) of the tubes.

While the applicant cited generic Note H, the staff notes that GALL-SLR Report, Table IX.D, "Use of Terms for Environments," explains that closed-cycle cooling water is a subset of the treated water environment, which is an applicable environment of AMR Item 3.3.1-126 that addresses wall thinning due to erosion for copper-alloy (greater than 15 percent zinc) piping and piping components exposed to treated water by the Flow-Accelerated Corrosion program. The staff finds the applicant's proposal to manage wall thinning due to erosion for copper-alloy (greater than 15 percent zinc) piping and piping components exposed to closed-cycle cooling water in the recirculating cooling water system by the Open-Cycle Cooling Water System program acceptable because management of this additional aging effect is based on plant-specific OE, consistent with AMR Item 3.3.1-126, and the ONS Open-Cycle Cooling Water

System program implements ECT for managing wall thinning of the associated heat exchanger tubes.

3.3.2.3.3 Auxiliary Systems - Chilled Water (Vital Loads) System - Aging Management Evaluation

Polymeric Piping Exposed to Closed-Cycle Cooling Water. SLRA Table 3.3.2-23 states that hardening or loss of strength, loss of material, and cracking or blistering for polymeric piping exposed to closed-cycle cooling water will be managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program. The AMR items cite generic Note G.

The staff reviewed the associated items in the SLRA and considered whether the aging effects proposed by the applicant constitute all of the applicable aging effects for this component, material, and environment description. During its review, the staff noted the following based on its review of the GALL-SLR Report: (a) polymeric piping exposed to raw water is managed for hardening or loss of strength, loss of material, cracking or blistering, and flow blockage due to fouling using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program; and (b) flow blockage due to fouling is not an applicable aging effect for a closed-cycle cooling water environment. Based on its review of the GALL-SLR Report, the staff finds that the applicant has identified all applicable aging effects for this component, material, and environment combination. In addition, the staff finds the applicant’s proposal to manage the effects of aging using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program acceptable because raw water is more aggressive than a closed-cycle cooling water environment; therefore, the applicant’s proposal is consistent with the GALL-SLR Report recommendations.

Polyvinyl Chloride (PVC) Valve Bodies Exposed to Closed-Cycle Cooling Water. As amended by Supplement 4 dated June 7, 2022 (ADAMS Accession No. ML22158A028), SLRA Table 3.3.2-23 states that aging effects for PVC valve bodies exposed to closed-cycle cooling water are not applicable, and no AMP is proposed. The AMR item cites generic Note G. During its review, the staff noted that the GALL-SLR Report cites no aging effects for PVC exposed to potable raw water (i.e., a more aggressive environment when compared to closed-cycle cooling water). The staff finds the applicant’s proposal to cite no aging effects acceptable because it is consistent with the GALL-SLR Report recommendations.

3.3.2.3.4 Auxiliary Systems - Plant Drinking Water System - Aging Management Evaluation

SS Piping and Piping Components Exposed to Raw Water (Potable) Greater Than 60 °C. SLRA Table 3.3.2-36 states that cracking for SS piping and piping components exposed to raw water (potable) greater than 60 °C will be managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program. The AMR items cite generic Note H.

The staff reviewed the associated items in the SLRA and considered whether the aging effects proposed by the applicant constitute all of the applicable aging effects for this component, material, and environment description. The staff noted that the applicant addressed loss of material for this component, material, and environment combination in other AMR items. Based on its review of GALL-SLR Report, which states that SS piping exposed to raw water (potable) is susceptible to loss of material, the staff finds that the applicant has identified all applicable aging effects for this component, material, and environment combination.

During its review, the staff noted that the GALL-SLR Report recommends using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program to manage cracking for SS piping and piping components exposed to waste water greater than 60 °C. The staff finds the applicant's proposal to manage the effects of aging using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program acceptable because raw water (potable) and waste water are similar environments; therefore, the applicant's proposal is consistent with the GALL-SLR Report recommendations.

3.3.2.3.5 Auxiliary Systems - Fuel Oil System - Aging Management Evaluation

SS Pulsation Dampener and Sight Glass Exposed to Lubricating Oil (Waste Oil). SLRA Table 3.3.2-43 states that loss of material for the SS pulsation dampener and sight glass exposed to lubricating oil (waste oil) will be managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program. The AMR items cite generic Note G. During its review, the staff noted that the GALL-SLR Report recommends using the One-Time Inspection program (i.e., less frequent inspections when compared to the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program) to manage loss of material for steel components (i.e., a less corrosion-resistant material when compared to SS) exposed to lubricating oil (waste oil). The staff finds the applicant's proposal to manage the effects of aging using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program acceptable because it is consistent with the GALL-SLR Report recommendations.

3.3.2.3.6 Auxiliary Systems – Fuel Oil System – Aging Management Evaluation

Polyvinylidene Fluoride Piping Exposed to Fuel Oil. SLRA Table 3.3.2-43 states that polymeric piping (identified as polyvinylidene fluoride material) exposed to fuel oil (internally) has no aging effects requiring management and does not include a program for managing the effects of aging for these components. The SLRA item cites generic Note H with a plant-specific note stating that this material and environment combination (polymeric/fuel oil) is not in the GALL-SLR Report. The note also states that in accordance with EPRI Tools Section C.2.1.6 (EPRI 1010639 Non-Class 1 Mechanical Implementation Guideline and Mechanical Tools, Revision 4), polymerics in this environment have no aging effects.

During its evaluation of the applicant's above proposal, the staff identified prior staff evaluations of this material that noted that polyvinylidene fluoride is characterized by superior resistance to multiple environments including oil and chemical solvents. In the prior evaluation, the staff also determined that there were no aging effects requiring management in environments including raw water, treated water, and sodium hypochlorite (Reference SEs: Safety Evaluation Report Related to the License Renewal of Byron Station, Units 1 and 2, and Braidwood Station, Units 1 and 2 [ADAMS Accession No. ML15182A051], and Safety Evaluation Report Related to the License Renewal of River Bend Station, Unit 1 [ADAMS Accession No. ML18212A151]). The staff finds the applicant's proposal (that there are no aging effects requiring management and no required AMPs) acceptable because sufficient technical bases and prior precedents exist to conclude that polyvinylidene fluoride will have no aging effects in a fuel oil environment. The staff notes that the effects of aging for the outside surface of the components made with this material are being appropriately managed through Item 3.3.1-263.

3.4 Aging Management of Steam and Power Conversion Systems

3.4.1 Summary of Technical Information in the Application

SLRA Section 3.4 provides AMR results for those components that the applicant identified in SLRA Section 2.3.4, "Steam and Power Conversion Systems," as being subject to an AMR. SLRA Table 3.4.1, "Summary of Aging Management Programs for Steam and Power Conversion System Evaluated in Chapter VIII of the GALL-SLR Report," is a summary comparison of the applicant's AMR results with those provided in the GALL-SLR Report for the steam and power conversion systems components.

3.4.2 Staff Evaluation

Table 3.4-1 below summarizes the staff's evaluation of the component groups listed in SLRA Section 3.4 and addressed in the GALL-SLR Report.

Table 3.4-1 Staff Evaluation for Steam and Power Conversion System Components in the GALL-SLR Report

Component Group (SRP-SLR Item No.)	Staff Evaluation
3.4.1-001	Consistent with the GALL-SLR Report (see SE Section 3.4.2.2.1)
3.4.1-002	Not applicable to Oconee (see SE Section 3.4.2.2.2)
3.4.1-003	Not applicable to Oconee (see SE Section 3.4.2.2.3)
3.4.1-004	Consistent with the GALL-SLR Report
3.4.1-005	Consistent with the GALL-SLR Report
3.4.1-006	Consistent with the GALL-SLR Report
3.4.1-007	Consistent with the GALL-SLR Report
3.4.1-008	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.4.1-009	Consistent with the GALL-SLR Report
3.4.1-010	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.4.1-011	Consistent with the GALL-SLR Report
3.4.1-012	Consistent with the GALL-SLR Report
3.4.1-013	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.4.1-014	Consistent with the GALL-SLR Report
3.4.1-015	Consistent with the GALL-SLR Report
3.4.1-016	Consistent with the GALL-SLR Report
3.4.1-017	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.4.1-018	Consistent with the GALL-SLR Report
3.4.1-019	Consistent with the GALL-SLR Report
3.4.1-020	Not applicable to Oconee
3.4.1-021	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.4.1-022	Consistent with the GALL-SLR Report
3.4.1-023	Consistent with the GALL-SLR Report
3.4.1-024	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.4.1-025	Consistent with the GALL-SLR Report
3.4.1-026	Consistent with the GALL-SLR Report
3.4.1-027	Consistent with the GALL-SLR Report

Component Group (SRP-SLR Item No.)	Staff Evaluation
3.4.1-028	Not applicable to Oconee
3.4.1-029	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.4.1-030	Not applicable to Oconee
3.4.1-031	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.4.1-032	Not applicable to Oconee
3.4.1-033	Consistent with the GALL-SLR Report
3.4.1-034	Consistent with the GALL-SLR Report
3.4.1-035	Not applicable to Oconee (see SE Section 3.4.2.2.9)
3.4.1-036	Not applicable to Oconee
3.4.1-037	Consistent with the GALL-SLR Report
3.4.1-038	Not applicable to Oconee
3.4.1-039	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.4.1-040	Consistent with the GALL-SLR Report
3.4.1-041	Not applicable to Oconee
3.4.1-042	Not applicable to Oconee
3.4.1-043	Consistent with the GALL-SLR Report
3.4.1-044	Not applicable to Oconee
3.4.1-045	Not applicable to Oconee
3.4.1-046	Not applicable to Oconee
3.4.1-047	Not applicable to Oconee
3.4.1-048	Not applicable to Oconee
3.4.1-049	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.4.1-050	Not applicable to Oconee
3.4.1-051	Consistent with the GALL-SLR Report (see SE Section 3.4.2.2.8)
3.4.1-052	Not applicable to Oconee
3.4.1-053	Not applicable to Oconee
3.4.1-054	Consistent with the GALL-SLR Report
3.4.1-055	Consistent with the GALL-SLR Report
3.4.1-056	Not applicable to Oconee
3.4.1-057	Not applicable to Oconee
3.4.1-058	Not applicable to Oconee
3.4.1-059	Not applicable to Oconee
3.4.1-060	Consistent with the GALL-SLR Report (see SE Section 3.4.2.1.2)
3.4.1-061	Not applicable to Oconee (see SE Section 3.4.2.2.6)
3.4.1-062	Not applicable to Oconee
3.4.1-063	Not applicable to Oconee. Addressed by 3.4-1, 034)
3.4.1-064	Not applicable to Oconee
3.4.1-065	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.4.1-066	Consistent with the GALL-SLR Report (see SE Section 3.4.2.1.3)
3.4.1-067	Consistent with the GALL-SLR Report (see SE Section 3.4.2.1.3)
3.4.1-068	Not applicable to Oconee
3.4.1-069	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.4.1-070	Not applicable to Oconee
3.4.1-071	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.4.1-072	Not applicable to Oconee

Component Group (SRP-SLR Item No.)	Staff Evaluation
3.4.1-073	Consistent with the GALL-SLR Report
3.4.1-074	Not applicable to Oconee (see SE Section 3.4.2.2.2)
3.4.1-075	Not applicable to Oconee
3.4.1-076	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.4.1-077	Not applicable to Oconee
3.4.1-078	Not applicable to Oconee
3.4.1-079	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.4.1-080	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.4.1-081	Consistent with the GALL-SLR Report
3.4.1-082	Not applicable to Oconee (see SE Section 3.4.2.2.8)
3.4.1-083	Consistent with the GALL-SLR Report
3.4.1-084	Not applicable to Oconee. Addressed by 3.4.1-085
3.4.1-085	Consistent with the GALL-SLR Report
3.4.1-086	Not applicable to Oconee
3.4.1-087	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.4.1-088	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.4.1-089	Not applicable to Oconee
3.4.1-090	Not applicable to Oconee
3.4.1-091	Not applicable to Oconee. Addressed by 3.3.1-088
3.4.1-092	Not applicable to Oconee
3.4.1-093	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.4.1-094	Not applicable to Oconee (see SE Section 3.4.2.2.9)
3.4.1-095	Not applicable to Oconee (see SE Section 3.4.2.2.3)
3.4.1-096	Not applicable to Oconee
3.4.1-097	Not applicable to Oconee (see SE Section 3.4.2.2.9)
3.4.1-098	Not applicable to Oconee (see SE Section 3.4.2.2.3)
3.4.1-099	Not applicable to Oconee
3.4.1-100	Not applicable to Oconee (see SE Section 3.4.2.2.2)
3.4.1-101	Not applicable to Oconee
3.4.1-102	Not applicable to Oconee (see SE Section 3.4.2.2.7)
3.4.1-103	Consistent with the GALL-SLR Report (see SE Section 3.4.2.2.3)
3.4.1-104	Consistent with the GALL-SLR Report (see SE Section 3.4.2.2.2)
3.4.1-105	Not applicable to Oconee (see SE Section 3.4.2.2.7)
3.4.1-106	Consistent with the GALL-SLR Report
3.4.1-107	Not applicable to Oconee
3.4.1-108	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.4.1-109	Not applicable to Oconee (see SE Section 3.4.2.2.7)
3.4.1-110	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.4.1-111	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.4.1-112	Not applicable to Oconee (see SE Section 3.4.2.2.7)
3.4.1-113	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.4.1-114	Not applicable to Oconee
3.4.1-115	Not applicable to Oconee
3.4.1-116	Not applicable to Oconee
3.4.1-117	Not applicable to Oconee

Component Group (SRP-SLR Item No.)	Staff Evaluation
3.4.1-118	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.4.1-119	Not applicable to Oconee (see SE Section 3.4.2.2.9)
3.4.1-120	Not applicable to Oconee (see SE Section 3.4.2.2.9)
3.4.1-121	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.4.1-122	Not applicable to Oconee
3.4.1-123	Not applicable to Oconee
3.4.1-124	Not applicable to Oconee
3.4.1-125	Not applicable to Oconee
3.4.1-126	Not applicable to Oconee
3.4.1-127	Not applicable to Oconee
3.4.1-128	Not applicable to Oconee
3.4.1-129	Not applicable to Oconee
3.4.1-130	Not applicable to Oconee
3.4.1-131	Not applicable to Oconee
3.4.1-132	Consistent with the GALL-SLR Report
3.4.1-133	Not applicable to Oconee
3.4.1-134	Not applicable to Oconee
3.4.1-135	Consistent with the GALL-SLR Report
3.4.1-136	This item number is not used in the SRP-SLR or the GALL-SLR Report

The staff's review of component groups, as described in SE Section 3.0.2.2, is summarized in the following three sections:

(1) SE Section 3.4.2.1 discusses AMR results for components that the applicant states are either not applicable to Oconee or are consistent with the GALL-SLR Report. Section 3.4.2.1.1 summarizes the staff's review of items that are not applicable and documents any RAIs issued and the conclusions. The remaining subsections in SE Section 3.4.2.1 document the review of components that required additional information or otherwise require explanation.

(2) SE Section 3.4.2.2 discusses AMR results for which the GALL-SLR Report and SRP-SLR recommend further evaluation.

(3) SE Section 3.4.2.3 discusses AMR results for components that the applicant states are not consistent with, or not addressed in, the GALL-SLR Report. These AMR results typically are identified by generic Notes F through J and plant-specific notes in the SLRA.

3.4.2.1 Aging Management Review Results Consistent with the GALL-SLR Report

The following subsections document the staff's review of AMR results listed in SLRA Tables 3.4.2-1 through 3.4.2-12 that the applicant determined to be consistent with the GALL-SLR Report. The staff audited and reviewed the information in the SLRA. The staff did not repeat its review of the matters described in the GALL-SLR Report; however, the staff did verify that the material presented in the SLRA was applicable and that the applicant identified the appropriate GALL-SLR Report AMRs. For those AMR items the staff found to be consistent with the GALL-SLR Report, and for which no additional evaluation or RAI applies, the staff's review and conclusions as documented in the GALL-SLR Report are considered to be the basis for acceptability of the AMR items. The staff's conclusion of "Consistent with the GALL-SLR Report" is documented in SE Table 3.4-1, and no separate writeup is provided.

SE Section 3.4.2.1.1 documents the staff's review of AMR items the applicant determined to be not applicable or not used.

3.4.2.1.1 Aging Management Review Results Identified as Not Applicable or Not Used

For SLRA Table 3.4-1, Items 3.4.1-002, 3.4.1-003, 3.4.1-020, 3.4.1-028, 3.4.1-030, 3.4.1-032, 3.4.1-035, 3.4.1-036, 3.4.1 038, 3.4.1-041, 3.4.1-042, 3.4.1 044, 3.4.1-045, 3.4.1-046, 3.4.1-047, 3.4.1-048, 3.4.1-050, 3.4.1-052, 3.4.1-053, 3.4.1-056, 3.4.1-057, 3.4.1-058, 3.4.1-059, 3.4.1-061, 3.4.1-062, 3.4.1-063, 3.4.1-064, 3.4.1-068, 3.4.1-070, 3.4.1-072, 3.4.1-074, 3.4.1-075, 3.4.1-077, 3.4.1-078, 3.4.1-082, 3.4.1-084, 3.4.1-086, 3.4.1-089, 3.4.1-090, 3.4.1-091, 3.4.1-092, 3.4.1-094, 3.4.1-095, 3.4.1-096, 3.4.1-097, 3.4.1-098, 3.4.1-099, 3.4.1-100, 3.4.1-101, 3.4.1-102, 3.4.1-105, 3.4.1-107, 3.4.1-109, 3.4.1-112, 3.4.1-114, 3.4.1-115, 3.4.1-116, 3.4.1-117, 3.4.1-119, 3.4.1-120, 3.4.1 122, 3.4.1-123, 3.4.1-124, 3.4.1-125, 3.4.1-126, 3.4.1-127, 3.4.1-128, 3.4.1-129, 3.4.1-130, 3.4.1-131, 3.4.1-133, and 3.4.1-134, the applicant claims that the corresponding AMR items in the GALL-SLR Report are not applicable to ONS. The staff reviewed the SLRA and UFSAR and confirmed that the applicant's SLRA does not have any AMR results that are applicable for these items.

For the following SLRA Table 3.4-1 items, the applicant claimed that the corresponding item in the GALL-SLR Report is not applicable and it is addressed by other SLRA Table 1, AMR items: 3.4.1-063 (addressed by 3.4.1-034), 3.4.1-084 (addressed by 3.4.1-085), and 3.4.1-091 (addressed by 3.3.1-088). The staff reviewed the SLRA and confirmed that the aging effects for each of these items will be addressed by other SLRA Table 1 AMR items. Therefore, the staff finds the applicant's proposal to use alternate items acceptable.

3.4.2.1.2 Loss of Material Due to Erosion

SLRA Table 3.4-1, Item 3.4.1-060 addresses wall thinning due to erosion for metallic piping and piping components exposed to treated water. As amended by letter dated April 22, 2022 (ADAMS Accession No. ML22112A016), for the AMR item that cites generic Note E, the SLRA credits the Open-Cycle Cooling Water System Program to manage wall thinning due to erosion for SS main condenser tubes exposed to treated water in the condensate system. The AMR item cites plant-specific Note 6, stating that the Open-Cycle Cooling Water System program performs ECT from the interior of the main condenser tubes to identify wall thinning on the exterior side of the tubes. Based on its review of components associated with Item 3.4.1-060, for which the applicant cited generic Note E, the staff finds the applicant's proposal to manage wall thinning due to erosion using the above cited program acceptable because performing ECT of the main condenser tubes as part of ONS' Open-Cycle Cooling Water System program is capable of identifying loss of material on the exterior side of heat exchanger tubes.

3.4.2.1.3 Loss of Coating or Lining Integrity due to Blistering, Cracking, Flaking, Peeling, Delamination, Rusting, or Physical Damage; Loss of Material due to General, Pitting, Crevice Corrosion or MIC

SLRA Table 3.4.1, AMR Items 3.4.1-066 and 3.4.1-067, address (a) loss of coating or lining integrity due to blistering, cracking, flaking, peeling, delamination, rusting, or physical damage (AMR Item 3.4.1-66); (b) loss of material or cracking for cementitious coatings/linings (AMR Item 3.4.1-66); and (c) loss of material due to general, pitting, or crevice corrosion or

MIC (AMR Item 3.4.1-67) for any material piping, piping components, heat exchangers, and tanks with internal coatings/linings exposed to closed-cycle cooling water, raw water, treated water, and lubricating oil. For the SLRA Table 2 AMR items that cite generic Note E, the SLRA credits the following AMPs: (a) the Open-Cycle Cooling Water System program for the main condenser outlet waterboxes and tubesheets in the condensate system; and (b) the Water Chemistry and One-Time Inspection programs for the Powdex and slurry tanks in the condensate system. The staff's evaluation of these two AMPs to manage components associated with AMR Items 3.4.1-66 and 3.4.1-67 follows.

Open-Cycle Cooling Water. During its review, the staff determined the need for additional information, which resulted in the issuance of an RAI. RAI B2.1.27-1 and the applicant's response are documented in ADAMS Accession Nos. ML21271A590 and ML21295A035.

In its response, the applicant stated the following with respect to the main condenser outlet waterboxes and tubesheets in the condensate system: (a) these components are not located upstream of any equipment that performs (a)(1) or (a)(3) intended functions; (b) the only intended function of these components is leakage boundary (spatial interaction); (c) the internal environment for these components is raw water from Lake Keowee; (d) water from Lake Keowee is non-aggressive and does not contain chemical compounds that could cause accelerated corrosion; (e) a total of five piping segments in raw water systems have experienced leaks at Oconee over the past 10 years where MIC was identified as a contributing cause or potential contributing cause, and they are all stagnant or intermittent flow lines; (f) the waterboxes and tubesheets are steel; (g) the main condenser tubes are SS; (h) galvanic corrosion is not a concern as the steel tubesheets present a large anode to the 0.875-inch SS tubes; and (i) the coatings are not credited in the design.

During its evaluation of the applicant's response to RAI B2.1.27-1, the staff noted that GALL-SLR Report AMP XI.M42 states that GALL-SLR Report AMP XI.M20, "Open-Cycle Cooling Water System," is an acceptable alternative to the inspections recommended in GALL-SLR Report AMP XI.M42 when: (a) loss of coating or lining integrity cannot result in downstream effects for in-scope components; (b) the component's only CLB intended function is leakage boundary or structural integrity; (c) the internal environment does not contain chemical compounds that could cause accelerated corrosion of the base material; (d) the coated/lined components are not located in the vicinity of uncoated components that could cause a galvanic couple to exist; (e) the design for the component did not credit the coating/lining; and (f) the internal environment would not promote MIC of the base metal. Based on its review of components associated with AMR Items 3.4.1-066 and 3.4.1-067 for which the applicant cited generic Note E, the staff finds the applicant's proposal to manage the effects of aging using the Open-Cycle Cooling Water System program acceptable (in part) for the following reasons: (a) the loss of coating integrity would not result in downstream effects of in-scope components; (b) the intended function of these components is leakage boundary; (c) the internal environments of these components do not contain chemical compounds that could cause accelerated corrosion; (d) these components are either not subject to galvanic corrosion or not subject to a configuration where accelerated corrosion due to galvanic effects would occur; and (e) these components do not credit the internal coating in the design. However, the staff determined the need for additional information regarding how the raw water environment at Oconee would not promote MIC of the base metal for internally coated components within the scope of the Open-Cycle Cooling Water System program, which resulted in the issuance of an RAI. RAI B2.1.27-1a and the applicant's response are documented in ADAMS Accession Nos. ML21327A277 and ML22010A129. The staff's evaluation of this RAI is documented in SE Section 3.3.2.1.7.

Water Chemistry and One-Time Inspection. During its review, the staff determined the need for additional information, which resulted in the issuance of an RAI. RAI B2.1.27-1 and the applicant's response are documented in ADAMS Accession Nos. ML21271A590 and ML21295A035.

In its response, the applicant stated "[t]he application [SLRA] is being amended to credit the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program for aging management in place of the combination of the Water Chemistry and One-Time Inspection programs." In addition, the applicant amended SLRA Table 3.4.2-1, "Steam and Power Conversion Systems - Condensate System - Aging Management Evaluation," to reflect that internally lined Powdex and slurry tanks exposed to treated water will be managed for loss of coating integrity (Item 3.4.1-066) and loss of material (Item 3.4.1-067) using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program (both items cited generic Note E). Furthermore, the applicant stated the following with respect to the internally lined Powdex and slurry tanks in the condensate system: (a) if any coating debris were present in the slurry, it would be removed by the demineralizer; therefore, failure of the coating will not result in any downstream effects; (b) the only intended function of the tanks is leakage boundary (spatial interaction); (c) the internal environment of the tanks is condensate or demineralized quality water, which does not contain chemical compounds that could cause accelerated corrosion and would not promote MIC; (d) the tanks and the connecting piping are steel; therefore a galvanic couple does not exist; and (e) the coating is not credited in the tank design.

During its evaluation of the applicant's response to RAI B2.1.27-1, the staff noted that GALL-SLR Report AMP XI.M42 states that GALL-SLR Report AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," is an acceptable alternative to the inspections recommended in GALL-SLR Report AMP XI.M42 when: (a) loss of coating or lining integrity cannot result in downstream effects for in-scope components; (b) the component's only CLB intended function is leakage boundary or structural integrity; (c) the internal environment does not contain chemical compounds that could cause accelerated corrosion of the base material; (d) the coated/lined components are not located in the vicinity of uncoated components that could cause a galvanic couple to exist; (e) the design for the component did not credit the coating/lining; and (f) the internal environment would not promote MIC of the base metal. Based on its review of components associated with AMR Items 3.4.1-066 and 3.4.1-067 for which the applicant cited generic Note E, the staff finds the applicant's proposal to manage the effects of aging using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program acceptable for the following reasons: (a) loss of coating integrity would not result in downstream effects of in-scope components (based on coating debris, if present, being removed by the demineralizer); (b) the intended function of these tanks is leakage boundary; (c) the internal environment of treated water would not promote MIC and does not contain chemical compounds that could cause accelerated corrosion; (d) these tanks are not subject to galvanic corrosion; and (e) these tanks do not credit the internal coating in the design.

3.4.2.2 Aging Management Review Results for Which Further Evaluation Is Recommended by the GALL-SLR Report

In SLRA Section 3.4.2.2, the applicant further evaluates aging management for certain steam and power conversion systems components, as recommended by the GALL-SLR Report, and provides information concerning how it will manage the applicable aging effects. The staff reviewed the applicant's evaluation of these component groups against the criteria contained in SRP-SLR Section 3.4.2.2. The following subsections document the staff's review.

3.4.2.2.1 Cumulative Fatigue Damage Due to Fatigue

SLRA Section 3.4.2.2.1, associated with SLRA Table 3.4.1, Item 3.4.1-001, states that the TLAA on cumulative fatigue damage in the components of steam and power conversion systems is evaluated in accordance with 10 CFR 54.21(c)(1) and addressed in SLRA Section 4.3.3. This is consistent with SRP-SLR Section 3.4.2.2.1 and is therefore acceptable. The staff's evaluation of the TLAA for the components of steam and power conversion systems is documented in SE Section 4.3.3.

3.4.2.2.2 Cracking Due to Stress Corrosion Cracking in Stainless Steel Alloys

SLRA Section 3.4.2.2.2, associated with SLRA Table 3.4.1, AMR Item 3.4.1-104, addresses cracking due to SCC for insulated SS piping, piping components, and tanks exposed to air or condensation, which will be managed by the One-Time Inspection program. The staff reviewed the applicant's proposal against the criteria in SRP-SLR Section 3.4.2.2.2.

In its review of components associated with AMR Item 3.4.1-104, the staff finds that the applicant has met the evaluation criteria and the applicant's proposal to manage the effects of aging for AMR Item 3.4.1-104 using the One-Time Inspection program is acceptable because the plant-specific OE does not reveal a history of cracking for these components, and the proposed one-time inspections are capable of detecting whether cracking is occurring.

SLRA Section 3.4.2.2.2, associated with SLRA Table 3.4.1, AMR Item 3.4.1-002, addresses cracking due to SCC for SS piping, piping components, and tanks exposed to air or condensation. The applicant stated that this item is not applicable because there are no uninsulated in-scope SS piping, piping components, or tanks exposed to air or condensation in the steam and power conversion systems. The applicant stated that system components are insulated and aligned to AMR Item 3.4.1-104. As stated in the preceding paragraph, the staff finds the applicant's proposal to manage the effects of aging for AMR Item 3.4.1-104 acceptable.

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-SLR Section 3.4.2.2.2 criteria. For those AMR items associated with SLRA Section 3.4.2.2.2, the staff concludes that the SLRA is consistent with the GALL-SLR Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the subsequent period of extended operation as required by 10 CFR 54.21(a)(3).

SLRA Section 3.4.2.2.2, associated with SLRA Table 3.4.1, AMR Item 3.4.1-074, addresses cracking for underground SS piping, piping components, and tanks. The applicant stated that this item is not applicable because there are no in-scope underground SS piping, piping components, or tanks. The staff evaluated the applicant's claim against the criteria in SRP-SLR Section 3.4.2.2.2 and finds it acceptable because, based on a review of the UFSAR and SLRA, there are no underground SS piping, piping components, or tanks in the steam and power conversion systems.

SLRA Section 3.4.2.2.2, associated with SLRA Table 3.4.1, AMR Item 3.4.1-100, addresses cracking for SS tanks within the scope of GALL-SLR Report XI.M29 exposed to air or condensation. The applicant stated that this item is not applicable because there are no in-scope SS tanks in the steam and power conversion systems in the scope of GALL-SLR Report XI.M29. The staff evaluated the applicant's claim against the criteria in SRP-SLR

Section 3.4.2.2.2 and finds it acceptable because, based on a review of the UFSAR and SLRA, there are no in-scope SS tanks within the scope of GALL-SLR Report AMP XI.M29 exposed to air or condensation in the steam and power conversion systems.

3.4.2.2.3 Loss of Material Due to Pitting and Crevice Corrosion in SS and Nickel Alloys

SLRA Section 3.4.2.2.3, associated with SLRA Table 3.4.1, AMR Items 3.4.1-003 and 3.4.1-103, addresses loss of material due to pitting and crevice corrosion for, respectively, uninsulated and insulated SS and nickel-alloy piping, piping components, and tanks exposed to air or condensation, which will be managed by the One-Time Inspection program. The staff reviewed the applicant's proposal against the criteria in SRP-SLR Section 3.4.2.2.3.

In its review of components associated with AMR Item 3.4.1-103, the staff finds that the applicant has met the evaluation criteria and the applicant's proposal to manage the effects of aging for AMR Item 3.4.1-103 using the One-Time Inspection program is acceptable because the plant-specific OE does not reveal a history of loss of material due to pitting and crevice corrosion for these components, and the proposed one-time inspections are capable of detecting whether loss of material is occurring.

For SLRA Section 3.4.2.2.3 Item 3.4.1-003, the staff determined the need for additional information, which resulted in the issuance of an RAI. RAI B.2.3.2-1 and the applicant's response are documented in ADAMS Accession No. ML22045A021. The additional information was needed because the applicant stated in SLRA Table 3.4.1 that aging management for Item 3.4.1-003 is consistent with the GALL-SLR report, while stating in SLRA Table 3.4.1 that the corresponding Item 3.4.1-002 for cracking due to SCC is not applicable because there are no SS or nickel-alloy piping, piping components, or tanks exposed to air or condensation in the steam and power conversion systems.

In its response to RAI B.2.3.2-1, the applicant stated that there are no uninsulated SS or nickel-alloy components in the steam and power conversion systems externally exposed to air or condensation. The applicant stated that these components are insulated and aligned to AMR Item 3.4.1-103 for managing loss of material due to pitting or crevice corrosion for the insulated components. The applicant also noted in the response that one insulated component, a nickel-alloy low-pressure turbine extraction system expansion joint, had been incorrectly aligned to Item 3.4.1-003 instead of Item 3.4.1-103 in SLRA Table 3.4.2-6. As part of its response, the applicant proposed the following changes to the SLRA:

- SLRA Table 3.4.1 (page 3-1082) is revised to state that Item 3.4.1-003 is not applicable because ONS has no uninsulated SS or nickel-alloy piping, piping components, or tanks exposed to air or condensation in steam and power conversion systems and that the insulated components are aligned to Item 3.4.1-103 for aging management.
- SLRA Section 3.4.2.2.3 is revised to state that ONS has no uninsulated SS or nickel-alloy piping, piping components, or tanks exposed to air or condensation in steam and power conversion systems and that the insulated components are aligned to Item 3.4.1-103.
- SLRA Table 3.4.2-6 (page 3-1199) is revised to use Item 3.4.1-103 instead of Item 3.4.1-003 for managing loss of material of the nickel-alloy expansion joint exposed externally to indoor uncontrolled air.
- SLRA Section 3.4.2.2.3 is revised to add "and nickel alloy" to the description for Item 3.4.1-103 based on applying this item to the nickel-alloy expansion joints.

As stated above in this section of this SE, the staff finds the applicant's proposal to manage the effects of aging for AMR Item 3.4.1-103 acceptable. The staff finds the proposed changes to the SLRA Table 3.4.1, Table 3.4.2-6, and Section 3.4.2.2.3 acceptable because they are consistent with the GALL-SLR report and the applicant's RAI response with respect to aging management for the uninsulated SS piping, piping components, or tanks exposed to air or condensation in the steam and power conversion systems.

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-SLR Section 3.4.2.2.3 criteria. For those AMR items associated with SLRA Section 3.4.2.2.3, the staff concludes that the SLRA is consistent with the GALL-SLR Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3).

SLRA Section 3.4.2.2.3, associated with SLRA Table 3.4.1, AMR Item 3.4.1-095, addresses loss of material due to pitting or crevice corrosion for underground SS and nickel-alloy piping, piping components, and tanks. The applicant stated that this item is not applicable because there are no in-scope underground SS or nickel-alloy piping, piping components, or tanks in the steam and power conversion systems. The staff evaluated the applicant's claim against the criteria in SRP-SLR Section 3.4.2.2.3 and finds it acceptable because, based on a review of the UFSAR and SLRA, there are no in-scope underground SS or nickel-alloy piping, piping components, or tanks in the steam and power conversion systems.

SLRA Section 3.4.2.2.3, associated with SLRA Table 3.4.1, AMR Item 3.4.1-098, addresses loss of material due to pitting or crevice corrosion for SS or nickel-alloy tanks within the scope of GALL-SLR AMP XI.M29 exposed to air or condensation. The applicant stated that this item is not applicable because there are no in-scope SS or nickel-alloy tanks in the steam and power conversion systems in the scope of GALL-SLR Report XI.M29. The staff evaluated the applicant's claim against the criteria in SRP-SLR Section 3.4.2.2.3 and finds it acceptable because, based on a review of the UFSAR and SLRA, there are no in-scope SS or nickel-alloy tanks within the scope of GALL-SLR Report AMP XI.M29 exposed to air or condensation in the steam and power conversion systems.

3.4.2.2.4 Quality Assurance for Aging Management of Nonsafety-Related Components

SE Section 3.0.4 documents the staff's evaluation of the applicant's QA Program.

3.4.2.2.5 Ongoing Review of Operating Experience

SE Section 3.0.5 documents the staff's evaluation of the applicant's ongoing review of OE.

3.4.2.2.6 Loss of Material Due to Recurring Internal Corrosion

SLRA Section 3.4.2.2.6 is associated with SLRA Table 3.4.1, Item 3.4.1-061, for loss of material due to recurring internal corrosion in metallic components exposed to several water environments. The applicant stated that the further evaluation associated with this item is not applicable because its OE review did not identify recurring internal corrosion for components exposed to raw water or wastewater in the steam and power conversion systems. The staff evaluated the applicant's claim against the criteria in SRP-SLR Section 3.4.2.2.6 and finds it acceptable because the staff also did not identify any instances of recurring internal corrosion in steam and power conversion systems during its review of the OE documentation provided as part of the audit.

3.4.2.2.7 Cracking Due to Stress Corrosion Cracking in Aluminum Alloys

SLRA Section 3.4.2.2.7, associated with SLRA Table 3.4.1, AMR Items 3.4.1-102, 3.4.1-105, 3.4.1-109, and 3.4.1-112, addresses cracking due to SCC for aluminum components. The applicant stated that these items are not applicable. The staff evaluated the applicant's claim against the criteria in SRP-SLR Section 3.4.2.2.7 and finds it acceptable because, based on a review of the UFSAR and SLRA, there are no in-scope aluminum components in the steam and power conversion systems.

3.4.2.2.8 Loss of Material Due to General, Crevice, or Pitting Corrosion and Cracking Due to Stress Corrosion Cracking

SLRA Section 3.4.2.2.8, associated with SLRA Table 3.4.1, Item 3.4.1-051, addresses loss of material due to general, crevice, or pitting corrosion for steel piping and piping components exposed to concrete. Specifically, SLRA Section 3.4.2.2.8 states the following:

> The steel components aligned to this item are condensate piping and the main condenser shell. Loss of material of is not considered to be an applicable aging effect for these components based on the following consideration: (a) the concrete in areas containing these components conforms to ACI 349 or ACI 318; (b) review of ONS operating experience did not identify degradation of concrete around embedded components that could lead to penetration of water; and (c) these components are not exposed to a soil environment. Steel components that do not exit the concrete into soil are not potentially exposed to groundwater.

The staff reviewed the applicant's proposal against the criteria in SRP-SLR Section 3.4.2.2.8. For the condensate piping and the main condenser shell associated with Item 3.4.1-051, the staff finds the applicant's proposal that there are no aging effects requiring management acceptable because, consistent with the evaluation criteria, (a) the attributes of the concrete are consistent with ACI 349 or ACI 318, (b) plant-specific OE did not reveal any instances of degradation of concrete around embedded components that could lead to penetration of water, and (c) the components are not potentially exposed to groundwater. In addition, based on its review of the UFSAR, the staff noted that there are no other steel piping or piping components exposed to concrete in the steam and power conversion systems.

SLRA Section 3.4.2.2.8, associated with SLRA Table 3.4.1, Item 3.4.1-082, addresses loss of material due to crevice or pitting corrosion and cracking due to SCC for SS piping and piping components exposed to concrete. The applicant stated that there are no SS piping components exposed to concrete in the scope of SLR in steam and power conversion systems. The staff evaluated the applicant's claim against the criteria in SRP-SLR Section 3.4.2.2.8 and finds it acceptable because, based on a review of the UFSAR, there are no SS components exposed to concrete in the steam and power conversion systems.

For those AMR items associated with SLRA Section 3.4.2.2.8, the staff concludes that the SLRA is consistent with the GALL-SLR Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the subsequent period of extended operation as required by 10 CFR 54.21(a)(3).

3.4.2.2.9 Loss of Material Due to Pitting and Crevice Corrosion in Aluminum Alloys

SLRA Section 3.4.2.2.9, associated with SLRA Table 3.4.1, AMR Items 3.4.1-035, 3.4.1-094, 3.4.1-097, 3.4.1-119, and 3.4.1-120, addresses loss of material due to pitting and crevice corrosion for aluminum components. The applicant stated that these items are not applicable. The staff evaluated the applicant's claim against the criteria in SRP-SLR Section 3.4.2.2.9 and finds it acceptable because, based on a review of the UFSAR and SLRA, there are no in-scope aluminum components in the steam and power conversion systems.

3.4.2.3 Aging Management Review Results Not Consistent with or Not Addressed in the GALL-SLR Report

The SLRA did not identify any AMR results in SLRA Tables 3.4.2-1 through 3.4.2-12 that are not consistent with, or not addressed in, the GALL-SLR Report.

3.5 Aging Management of Containments, Structures, and Component Supports

3.5.1 Summary of Technical Information in the Application

SLRA Section 3.5 provides AMR results for those components the applicant identified in SLRA Section 2.4, "Scoping and Screening Results: Containments, Structures, and Component Supports" as being subject to an AMR. SLRA Table 3.5.1, "Summary of Aging Management Programs for Containments, Structures and Component Supports Evaluated in Chapter II and III of the GALL-SLR Report," is a summary comparison of the applicant's AMR results with those provided in the GALL-SLR Report for the containments, structures, and component supports components.

3.5.2 Staff Evaluation

Table 3.5-1, below, summarizes the staff's evaluation of the component groups listed in SLRA Section 3.5 and addressed in the GALL-SLR Report.

Table 3.5-1 Staff Evaluation for Containments, Structures, and Component Supports Components in the GALL-SLR Report

Component Group (SRP-SLR Item No.)	Staff Evaluation
3.5.1-001	Consistent with the GALL-SLR Report (see SE Section 3.5.2.2.1.1)
3.5.1-002	Consistent with the GALL-SLR Report (see SE Section 3.5.2.2.1.1)
3.5.1-003	Not applicable to Oconee (see SE Section 3.5.2.2.1.2)
3.5.1-004	Not applicable to PWRs (see SE Section 3.5.2.2.1.3, item 1)
3.5.1-005	Consistent with the GALL-SLR Report (see SE Section 3.5.2.2.1.3, item 1)
3.5.1-006	Not applicable to PWRs (see SE Section 3.5.2.2.1.3, item 2)
3.5.1-007	Not applicable to PWRs (see SE Section 3.5.2.2.1.3, item 3)
3.5.1-008	Consistent with the GALL-SLR Report (see SE Sections 3.5.2.2.1.4 & 3.5.2.1.2)
3.5.1-009	Consistent with the GALL-SLR Report (see SE Section 3.5.2.2.1.5)
3.5.1-010	Consistent with the GALL-SLR Report (see SE Section 3.5.2.2.1.6)
3.5.1-011	Consistent with the GALL-SLR Report (see SE Section 3.5.2.2.1.7)
3.5.1-012	Consistent with the GALL-SLR Report (see SE Section 3.5.2.2.1.8)
3.5.1-013	This item number is not used in the SRP-SLR or the GALL-SLR Report

Component Group (SRP-SLR Item No.)	Staff Evaluation
3.5.1-014	Consistent with the GALL-SLR Report (see SE Section 3.5.2.2.1.9)
3.5.1-015	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.5.1-016	Consistent with the GALL-SLR Report
3.5.1-017	This item number is not used in the SRP-SLR nor the GALL-SLR Report
3.5.1-018	Consistent with the GALL-SLR Report
3.5.1-019	Consistent with the GALL-SLR Report
3.5.1-020	Consistent with the GALL-SLR Report
3.5.1-021	Consistent with the GALL-SLR Report
3.5.1-022	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.5.1-023	Consistent with the GALL-SLR Report
3.5.1-024	Consistent with the GALL-SLR Report
3.5.1-025	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.5.1-026	Consistent with the GALL-SLR Report
3.5.1-027	Not applicable to Oconee (see SE Section 3.5.2.2.1.5)
3.5.1-028	Consistent with the GALL-SLR Report
3.5.1-029	Consistent with the GALL-SLR Report
3.5.1-030	Consistent with the GALL-SLR Report
3.5.1-031	Consistent with the GALL-SLR Report
3.5.1-032	Consistent with the GALL-SLR Report (see SE Section 3.5.2.1.3)
3.5.1-033	Consistent with the GALL-SLR Report
3.5.1-034	Consistent with the GALL-SLR Report
3.5.1-035	Consistent with the GALL-SLR Report (see SE Section 3.5.2.2.1.3, item 1)
3.5.1-036	Not Applicable to PWRs
3.5.1-037	Not Applicable to PWRs
3.5.1-038	Not applicable to PWRs (see SE Section 3.5.2.2.1.6)
3.5.1-039	Not applicable to PWRs (see SE Section 3.5.2.2.1.6)
3.5.1-040	Not applicable to PWRs (see SE Section 3.5.2.2.1.5)
3.5.1-041	Not Applicable to PWRs
3.5.1-042	Consistent with the GALL-SLR Report (see SE Section 3.5.2.2.2.1, item 1)
3.5.1-043	Consistent with the GALL-SLR Report (see SE Section 3.5.2.2.2.1, item 2)
3.5.1-044	Consistent with the GALL-SLR Report (see SE Section 3.5.2.2.2.1, item 3)
3.5.1-045	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.5.1-046	Consistent with the GALL-SLR Report (see SE Section 3.5.2.2.2.1, item 3)
3.5.1-047	Consistent with the GALL-SLR Report (see SE Section 3.5.2.2.2.1, item 4)
3.5.1-048	Consistent with the GALL-SLR Report (see SE Section 3.5.2.2.2.2)
3.5.1-049	Consistent with the GALL-SLR Report (see SE Section 3.5.2.2.2.3, item 1)
3.5.1-050	Consistent with the GALL-SLR Report (see SE Section 3.5.2.2.2.3, item 2)
3.5.1-051	Consistent with the GALL-SLR Report (see SE Section 3.5.2.2.2.3, item 3)
3.5.1-052	Not applicable to Oconee (see SE Section 3.5.2.2.2.4)
3.5.1-053	Consistent with the GALL-SLR Report (see SE Section 3.5.2.2.2.5)
3.5.1-054	Consistent with the GALL-SLR Report (see SE Section 3.5.2.1.4)
3.5.1-055	Consistent with the GALL-SLR Report
3.5.1-056	Consistent with the GALL-SLR Report
3.5.1-057	Consistent with the GALL-SLR Report
3.5.1-058	Consistent with the GALL-SLR Report

Component Group (SRP-SLR Item No.)	Staff Evaluation
3.5.1-059	Consistent with the GALL-SLR Report
3.5.1-060	Consistent with the GALL-SLR Report
3.5.1-061	Consistent with the GALL-SLR Report
3.5.1-062	Not Applicable to Oconee
3.5.1-063	Consistent with the GALL-SLR Report (see SE Section 3.5.2.1.5)
3.5.1-064	Consistent with the GALL-SLR Report
3.5.1-065	Consistent with the GALL-SLR Report (see SE Section 3.5.2.1.6)
3.5.1-066	Consistent with the GALL-SLR Report
3.5.1-067	Consistent with the GALL-SLR Report (see SE Section 3.5.2.1.7)
3.5.1-068	Consistent with the GALL-SLR Report
3.5.1-069	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.5.1-070	Consistent with the GALL-SLR Report
3.5.1-071	Consistent with the GALL-SLR Report
3.5.1-072	Consistent with the GALL-SLR Report
3.5.1-073	Consistent with the GALL-SLR Report
3.5.1-074	Not applicable to Oconee
3.5.1-075	Consistent with the GALL-SLR Report
3.5.1-076	Not applicable PWRs
3.5.1-077	Consistent with the GALL-SLR Report
3.5.1-078	Consistent with the GALL-SLR Report
3.5.1-079	Consistent with the GALL-SLR Report
3.5.1-080	Consistent with the GALL-SLR Report
3.5.1-081	Consistent with the GALL-SLR Report
3.5.1-082	Consistent with the GALL-SLR Report
3.5.1-083	Consistent with the GALL-SLR Report
3.5.1-084	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.5.1-085	Consistent with the GALL-SLR Report
3.5.1-086	Not used - addressed by 3.5.1-081 (see SE Section 3.5.2.1.1)
3.5.1-087	Consistent with the GALL-SLR Report
3.5.1-088	Consistent with the GALL-SLR Report (see SE Section 3.5.2.1.8)
3.5.1-089	Consistent with the GALL-SLR Report
3.5.1-090	Consistent with the GALL-SLR Report
3.5.1-091	Consistent with the GALL-SLR Report
3.5.1-092	Consistent with the GALL-SLR Report (see SE Section 3.5.2.1.9)
3.5.1-093	Not used. Addressed by 3.5.1-092 (see SE Section 3.5.2.1.1)
3.5.1-094	Consistent with the GALL-SLR Report
3.5.1-095	Not used. Addressed by 3.5.1-092 (see SE Section 3.5.2.1.1)
3.5.1-096	Consistent with the GALL-SLR Report (see SE Section 3.5.2.1.10)
3.5.1-097	Not applicable to Oconee (see SE Section 3.5.2.2.2.6)
3.5.1-098	Consistent with the GALL-SLR Report
3.5.1-099	Consistent with the GALL-SLR Report (see SE Section 3.2.2.2.4)
3.5.1-100	Consistent with the GALL-SLR Report (see SE Section 3.2.2.2.4)

The staff’s review of component groups, as described in SE Section 3.0.2.2, is summarized in the following three sections:

(1) SE Section 3.5.2.1 discusses AMR results for components that the applicant states are either not applicable to Oconee or are consistent with the GALL-SLR Report. Section 3.5.2.1.1 summarizes the staff's review of items that are not applicable or not used and documents any RAIs issued and the staff's conclusions. The remaining subsections in SE Section 3.5.2.1 document the review of components that required additional information or otherwise require explanation.

(2) SE Section 3.5.2.2 discusses AMR results for which the GALL-SLR Report and SRP-SLR recommend further evaluation.

(3) SE Section 3.5.2.3 discusses AMR results for components that the applicant states are not consistent with, or not addressed in, the GALL-SLR Report. These AMR results typically are identified by generic Notes F through J and plant-specific notes in the SLRA.

3.5.2.1 Aging Management Review Results Consistent with the GALL-SLR Report

The following subsections document the staff's review of AMR results listed in SLRA Tables 3.5.2-1 through 3.5.2-23 that the applicant determined to be consistent with the GALL-SLR Report. The staff audited and reviewed the information in the SLRA. The staff did not repeat its review of the matters described in the GALL-SLR Report; however, the staff did verify that the material presented in the SLRA was applicable and that the applicant identified the appropriate GALL-SLR Report AMRs. For those AMR items that the staff found to be consistent with the GALL-SLR Report, and for which no additional evaluation or request for additional information applies, the staff's review and conclusions as documented in the GALL-SLR Report are considered to be the basis for acceptability of the AMR items. The staff's conclusion of "Consistent with the GALL-SLR Report" is documented in SE Table 3.5-1, and no separate writeup is required or provided. For AMR items that required additional evaluation (such as responses to RAIs), the staff's evaluation is documented in Sections 3.5.2.1.2 through 3.5.2.1.10 below.

SE Section 3.5.2.1.1 documents the staff's review of AMR items that the applicant determined to be not applicable or not used.

3.5.2.1.1 Aging Management Review Results Identified as Not Applicable

For SLRA Table 3.5-1, Items 3.5.1-003, 3.5.1-027, 3.5.1-052, 3.5.1-062, 3.5.1-074, and 3.5.1-097, the applicant claims that the corresponding AMR items in the GALL-SLR Report are not applicable to Oconee. The staff reviewed the SLRA and UFSAR and confirmed that the applicant's SLRA does not have any AMR results that are applicable for these items.

For SLRA Table 3.5-1, Items 3.5.1-004, 3.5.1-006, 3.5.1-007, 3.5.1-036, 3.5.1-037, 3.5.1-038, 3.5.1-039, 3.5.1-040, 3.5.1-041, and 3.5.1-076, the applicant claims that the corresponding AMR items in the GALL-SLR Report are not applicable because the associated items are only applicable to BWRs. The staff reviewed the SRP-SLR, confirmed that these items only apply to BWRs, and finds that these items are not applicable to ONS because it is a PWR.

For SLRA Table 3.5.1, Item 3.5.1-086, the applicant claimed that the corresponding items in the GALL-SLR Report are not used. The staff reviewed the SLRA and confirmed that the aging effects will be addressed by another SLRA Table 1 AMR item (3.5.1-081). The staff noted that the applicant addressed the galvanized steel structural bolting addressed by Item 3.5.1-086 using GALL-SLR items for steel structural bolting. Therefore, the staff finds the applicant's proposal to use an alternate item acceptable.

SLRA Table 3.5.1, Item 3.5.1-093, addresses loss of material due to pitting and crevice corrosion for galvanized steel support members, welds, bolted connections, and support anchorage exposed to an air--outdoor environment. SLRA Table 3.5.1, AMR Item 3.5.1-095, also addresses the same components by stating that there are no aging effects requiring management when exposed to an air-indoor (uncontrolled) environment. The applicant stated that these AMR items are not applicable. However, the staff determined the need for additional information, which resulted in the issuance of an RAI. RAI 3.5.1-093-1 and the applicant's response are documented in ADAMS Accession No. ML22045A021.

In its response, the applicant stated that the material and environment combination for the components associated to AMR Items 3.5.1-093 and 3.5.1-095 were evaluated under AMR Item 3.5.1-092. The applicant revised SLRA Table 3.5.1 to clarify that these AMR line items were not used because they were evaluated under SLRA Table 3.5.1, AMR Item 3.5.1-092.

During its evaluation of the applicant's response to RAI 3.5.1-093-1, the staff noted that the applicant revised the SLRA to address the issue identified in the RAI. The staff finds the applicant's response and changes to the SLRA Table 3.5.1, Items 3.5.1-093 and 3.5.1-095, acceptable because they clarify that SLRA AMR Item 3.5.1-092 was used as an alternate AMR item to evaluate these components.

3.5.2.1.2 Loss of Prestress

SLRA Table 3.5.1, AMR Item 3.5.1-008, addresses loss of prestress due to relaxation, shrinkage, creep, or elevated temperature for steel tendon wires in a prestressing system. For the SLRA Table 2 AMR items that cite generic Note E, the SLRA credits the plant-specific Secondary Shield Wall Tendon Surveillance program to manage the aging effect for prestressing steel tendon wire of the SSW. The staff noted that the associated line item from the GALL-SLR Report evaluates these aging effects by assuming that a CLB analysis and associated TLAA exist for this component. Because ONS does not have an analysis in its CLB that estimates the loss of prestress of the SSW tendons, the applicant credited the plant-specific AMP instead of a TLAA. Additional information on this can be found in SE Section 3.5.2.2.1.4.

Based on its review of components associated with AMR Item 3.5.1-008, for which the applicant cited generic Note E, the staff finds the applicant's proposal to manage the effects of aging using the Secondary Shield Wall Tendon Surveillance program acceptable because the program uses similar physical testing as the GALL Report–recommended Concrete Containment Unbonded Tendon Prestress program to monitor prestress. Additionally, the Secondary Shield Wall Tendon Surveillance program conducts testing every other outage (approximately every 3 years), which is more frequent than the GALL Report's recommended frequency. Similar to the GALL Report program, this testing is conducted on randomly selected tendons during each inspection interval. The adequacy of the sample size and selection is discussed in the staff's review of the Secondary Shield Wall Tendon Surveillance program, which is documented in SE Section 3.0.3.3.1.

3.5.2.1.3 Loss of Material Due to Corrosion

SLRA Table 3.5.1, AMR Item 3.5.1-032, addresses loss of material due to corrosion for steel tendon wire and anchorages of a prestressing system exposed to air-indoor uncontrolled or air-outdoor environments. For the SLRA Table 2 AMR items that cite generic Note E, the SLRA credits the plant-specific Secondary Shield Wall Tendon Surveillance program to manage the aging effect for prestressing steel tendon wire and anchorages of the SSW.

Based on its review of components associated with AMR Item 3.5.1-032, for which the applicant cited generic Note E, the staff finds the applicant's proposal to manage the effects of aging using the Secondary Shield Wall Tendon Surveillance program acceptable because the program uses similar visual inspections as the GALL Report–recommended ASME Section XI, Subsection IWL program to inspect for indications of corrosion. Additionally, the Secondary Shield Wall Tendon Surveillance program conducts inspections every other refueling outage (approximately every 4 years), which is more frequent than the GALL Report–recommended frequency of once every 5 years. This inspection is conducted on five randomly selected tendons during each inspection interval. The adequacy of the sample size and selection is discussed in the staff's review of the Secondary Shield Wall Tendon Surveillance program, which is documented in SE Section 3.0.3.3.1.

3.5.2.1.4 Cracking Due to Expansion from Reaction with Aggregates

SLRA Table 3.5.2-4, as amended by Attachment 13 of Supplement 3 dated December 15, 2021, includes an AMR item corresponding to SLRA Table 3.5.1, Item 3.5.1-054, which addresses cracking due to expansion from reaction with aggregates for concrete elements in accessible areas of Keowee Hydro Station exposed to a water-flowing (external) environment. For the SLRA Table 2 AMR item, as amended by Supplement 3 dated December 15, 2021, that cites generic Note E, the SLRA credits the Federal Energy Regulatory Commission (FERC) Inspections of the Keowee Hydro Station Program to manage the aging effect for accessible concrete elements of the Keowee Hydro Station exposed to a water-flowing (external) environment. In addition, the AMR item cites plant-specific Notes 1 and 8, which state that concrete elements include beams, columns, walls, slabs, curbs, sumps, foundations, and pads, and the underwater inspection associated with FERC Inspections of the Keowee Hydro Station Program is credited for the material, environment, and aging effect combination.

During its audit, the staff reviewed the scope of water-control structures and confirmed that the applicant performs the inspections of the concrete elements in accessible areas of Keowee Hydro Station exposed to a water-flowing (external) environment required by CFR Title 18, "Conservation of Power and Water Resources," Part 12, "Safety of Water Power Projects and Project Works," Subpart D under the regulatory jurisdiction of the FERC.

Based on its review of components associated with AMR Item 3.5.1-054, for which the applicant cited generic Note E, the staff finds the applicant's proposal to manage the effects of aging using the FERC Inspections of the Keowee Hydro Station Program acceptable because continued compliance with FERC requirements for the aging management of these water-control structures during the subsequent period of extended operation, by virtue of that agency's authority and responsibility for ensuring that its regulated projects are operated and maintained to protect public health and safety as well as the environment, provides reasonable assurance of constituting an acceptable AMP for the purposes of SLR when a plant-specific AMP is not necessary. Oconee stated that it will continue to comply with these FERC requirements during the subsequent period of extended operation.

3.5.2.1.5 Increase in Porosity and Permeability, and Loss of Strength Due to Leaching of Calcium Hydroxide and Carbonation

SLRA Table 3.5.2-4, as amended by Attachment 13 of Supplement 3 dated December 15, 2021, includes AMR items corresponding to SLRA Table 3.5.1, Item 3.5.1-063, which addresses increases in porosity and permeability, loss of strength due to leaching of calcium hydroxide, and carbonation for concrete elements in accessible areas of Keowee Hydro Station exposed to a water-flowing (external) environment. For the SLRA Table 2 AMR item, as amended by Supplement 3 dated December 15, 2021, that cites generic Note E, the SLRA credits the FERC Inspections of the Keowee Hydro Station Program to manage the aging effects for accessible concrete elements of the Keowee Hydro Station exposed to a water-flowing (external) environment. In addition, the AMR item cites plant-specific Notes 1 and 8, which state that concrete elements include beams, columns, walls, slabs, curbs, sumps, foundations, and pads, and that the underwater inspection associated with FERC Inspections of the Keowee Hydro Station Program is credited for the material, environment, and aging effect combination.

During its audit, the staff reviewed the scope of water-control structures and confirmed that the applicant performs inspections of the concrete elements in accessible areas of the Keowee Hydro Station exposed to water-flowing (external) environment as required by CFR Title 18, “Conservation of Power and Water Resources,” Part 12, “Safety of Water Power Projects and Project Works,” Subpart D under the regulatory jurisdiction of the FERC. Based on its review of components associated with AMR Item 3.5.1-063, for which the applicant cited generic Note E, the staff finds the applicant’s proposal to manage the effects of aging using the FERC Inspections of the Keowee Hydro Station Program acceptable because continued compliance with FERC requirements for the aging management of these water-control structures during the subsequent period of extended operation, by virtue of that agency’s authority and responsibility for ensuring that its regulated projects are operated and maintained to protect public health and safety as well as the environment, provides reasonable assurance of constituting an acceptable AMP for the purposes of SLR. Oconee stated that it will continue to comply with these FERC requirements during the subsequent period of extended operation.

3.5.2.1.6 Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling) Due to Corrosion of Embedded Steel

SLRA Table 3.5.1, AMR Item 3.5.1-065, addresses cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel for inaccessible areas of concrete elements of Groups 1–9 structures exposed to a groundwater/soil (external) environment. For the SLRA Table 2 AMR items that cite generic Note E, the SLRA credits the FERC Inspections of the Keowee Hydro Station Program to manage the aging effects for inaccessible concrete elements of the Keowee Hydro Station penstock, power tunnels, and intake and spillway structures exposed to a groundwater/soil (external) environment. In addition, the AMR item cites plant-specific Note 6, which states, in part:

> *The FERC Inspections of the Keowee Hydro Station (Dam) are the aging management program credited for the Powerhouse, Penstock, Power Tunnels, Spillway and Intake portions of the Keowee Hydro Station (Dam). Keowee is licensed by the Federal Energy Regulatory Commission (FERC). ONS will continue to comply with these FERC requirements during the second period of extended operation. See Section B2.1.34 for description of FERC inspection activities.*

During its audit, the staff reviewed the scope of water-control structures and confirmed that the applicant performs inspections of the inaccessible concrete elements of the Keowee Hydro Station penstock, power tunnels, and intake and spillway structures exposed to a groundwater/soil (external) environment are performed in accordance as required by CFR Title 18, "Conservation of Power and Water Resources," Part 12, "Safety of Water Power Projects and Project Works," Subpart D under the regulatory jurisdiction of the FERC.

Based on its review of components associated with AMR Item 3.5.1-065, for which the applicant cited generic Note E, the staff finds the applicant's proposal to manage the effects of aging using the FERC Inspections of the Keowee Hydro Station Program acceptable because continued compliance with FERC requirements for the aging management of these water-control structures during the subsequent period of extended operation, by virtue of that agency's authority and responsibility for ensuring that its regulated projects are operated and maintained to protect public health and safety as well as the environment, provides reasonable assurance of constituting an acceptable AMP for the purposes of SLR. Oconee stated that it will continue to comply with these FERC requirements during the subsequent period of extended operation.

3.5.2.1.7 Increase in porosity and permeability, cracking, and loss of material (spalling, scaling) due to aggressive chemical attack

SLRA Table 3.5.1, AMR Item 3.5.1-067, addresses increases in porosity and permeability, cracking, and loss of material (spalling, scaling) due to aggressive chemical attack for concrete elements in interior, above-grade exterior, and inaccessible areas of structures of all groups exposed to air-indoor uncontrolled, air-outdoor, and groundwater/soil (external) environments. For the SLRA Table 2 AMR item that cites generic Note E, the SLRA credits the FERC Inspections of the Keowee Hydro Station Program to manage the aging effect for inaccessible concrete elements of Keowee Hydro Station penstock, power tunnels, and intake and spillway structures exposed to a groundwater/soil (external) environment. In addition, the AMR item cites plant-specific Note 6, which states, in part:

> *The FERC Inspections of the Keowee Hydro Station (Dam) are the aging management program credited for the Powerhouse, Penstock, Power Tunnels, Spillway and Intake portions of the Keowee Hydro Station (Dam). Keowee is licensed by the Federal Energy Regulatory Commission (FERC). ONS will continue to comply with these FERC requirements during the second period of extended operation. See Section B2.1.34 for description of FERC inspection activities.*

During its audit, the staff reviewed the scope of water-control structures and confirmed that the applicant performs inspections of the inaccessible concrete elements of the Keowee Hydro Station penstock, power tunnels, and intake and spillway structures exposed to a groundwater/soil (external) environment required by CFR Title 18, "Conservation of Power and Water Resources," Part 12, "Safety of Water Power Projects and Project Works," Subpart D under the regulatory jurisdiction of the FERC. Based on its review of components associated with AMR Item 3.5.1-067, for which the applicant cited generic Note E, the staff finds the applicant's proposal to manage the effects of aging using the FERC Inspections of the Keowee Hydro Station Program acceptable because continued compliance with FERC requirements for the aging management of these water-control structures during the subsequent period of extended operation, by virtue of that agency's authority and responsibility for ensuring that its regulated projects are operated and maintained to protect public health and safety as well as the environment, provides reasonable assurance of constituting an acceptable AMP for the purposes of SLR. Oconee stated that it will continue to comply with these FERC requirements during the subsequent period of extended operation.

3.5.2.1.8 Loss of Preload Due to Self-Loosening

SLRA Table 3.5.1, AMR Item 3.5.1-088, addresses loss of preload due to self-loosening for steel and SS structural bolting exposed to any environment.

For the SLRA Table 2 AMR items that cite generic Note E, the SLRA credits the Inspection of Water-Control Structures Associated with Nuclear Power Plants program to manage the aging effects for the structural bolting of the trash rack filter at the CCW intake structure exposed to an air-outdoor or water-flowing (external) environment. The AMR item cites plant-specific Note 3, which states that the trash rack filter includes the structural members and the structural bolting.

For the SLRA Table 2 AMR items that cite generic Note E, the SLRA credits the FERC Inspections of the Keowee Hydro Station Program to manage the aging effects for the structural bolting at Keowee Hydro Station penstock, power tunnels, and intake and spillway structures exposed to an air-outdoor (external) environment. In addition, the AMR item cites plant-specific Note 6, which states, in part:

> *The FERC Inspections of the Keowee Hydro Station (Dam) are the aging management program credited for the Powerhouse, Penstock, Power Tunnels, Spillway and Intake portions of the Keowee Hydro Station (Dam). Keowee is licensed by the Federal Energy Regulatory Commission (FERC). ONS will continue to comply with these FERC requirements during the second period of extended operation. See Section B2.1.34 for description of FERC inspection activities.*

For the SLRA Table 2 AMR items that cite generic Note E, the SLRA credits the FERC Inspections of the Keowee Hydro Station Program to manage the aging effects for the structural bolting at Keowee Hydro Station penstock, power tunnels, and intake and spillway structures exposed to a water-flowing (external) environment, and the AMR item cites plant-specific Note 7, which states that the Underwater Inspection and Penstock Inspection Program and ongoing aging management activities associated with the FERC Inspections of the Keowee Hydro Station and performed under the Inspection of Water-Control Structures Associated with Nuclear Power Plants Program are credited for the material, environment, and aging effect combination. These inspection activities manage Keowee Dam SCs that are under water or are normally submerged and inaccessible for inspection during the Title 18, Part 12D inspection.

For the SLRA Table 2 AMR items that cite generic Note E, the SLRA credits the FERC Inspections of the Keowee Hydro Station Program to manage the aging effects for the structural bolting at Keowee Hydro Station penstock, power tunnels, and intake and spillway structures exposed to an air-outdoor (external) environment. In addition, the AMR items cite plant-specific Note 4, which states that the trash rack filter includes the structural members, structural bolting, and spillway sluice gate. The AMR items also cite plant-specific Note 8, which states that the underwater inspections associated with the FERC Inspections of the Keowee Hydro Station Program are credited for the material, environment, and aging effect combination.

During its audit, the staff reviewed the scope of water-control structures and confirmed that the applicant performs inspections of the structural bolting of the trash rack filter at the CCW intake structure exposed to an air-outdoor or water-flowing (external) environment and the Keowee Hydro Station penstock, power tunnels, and intake and spillway structures exposed to an air-outdoor (external) environment required by CFR Title 18, “Conservation of Power and Water Resources,” Part 12, “Safety of Water Power Projects and Project Works,” Subpart D under the regulatory jurisdiction of the FERC.

Based on its review of components associated with AMR Item 3.5.1-088, for which the applicant cited generic Note E, the staff finds the applicant’s proposal to manage the effects of aging for the structural bolting of the trash rack filter at the CCW intake structure using the Inspection of Water-Control Structures Associated with Nuclear Power Plants program acceptable because the alternate program implements similar visual inspection techniques and inspection frequencies as the program recommended by the GALL-SLR Report. The staff also finds the applicant’s proposal to manage the effects of aging for the structural bolting at Keowee Hydro Station penstock, power tunnels, and intake and spillway structures using the FERC Inspections of the Keowee Hydro Station Program acceptable because continued compliance with FERC requirements for the aging management of these water-control structures during the subsequent period of extended operation, by virtue of that agency’s authority and responsibility for ensuring that its regulated projects are operated and maintained to protect public health and safety as well as the environment, provides reasonable assurance of constituting an acceptable AMP for the purposes of SLR. Oconee will continue to comply with these FERC requirements during the subsequent period of extended operation.

3.5.2.1.9 Loss of Material due to General, Pitting Corrosion

SLRA Table 3.5.1, AMR Item 3.5.1-092 addresses loss of material due to general, pitting corrosion for support members, welds, bolted connections, and support anchorage to building structures exposed to an air-indoor uncontrolled or air-outdoor (external) environment. For the SLRA Table 2 AMR items, as amended by Supplement 3 dated by December 15, 2021, that cite generic Note E, the SLRA credits the Inspection of Water-Control Structures Associated with Nuclear Power Plants program to manage the aging effects for the steel support members of the trash rack filter at the CCW intake structure exposed to an air-outdoor (external) environment. In addition, the Table 2 AMR item cites plant-specific Note 3, which states that the trash rack filter includes the structural members and the structural bolting.

For the SLRA Table 2 AMR items, as amended by Supplement 3 dated December 15, 2021, that cite generic Note E, the SLRA credits the FERC Inspections of the Keowee Hydro Station Program to manage the aging effects for the SS and steel support members of the trash rack filter at the Keowee Hydro Station exposed to an air-outdoor (external) environment, and the AMR item cites plant-specific Notes 4 and 8, which state that the trash rack filter includes the structural members, structural bolting, and the spillway sluice gate, and the underwater inspections associated with the FERC Inspections of the Keowee Hydro Station Program are credited for the material, environment, and aging effect combination.

During its audit, the staff reviewed the scope of water-control structures and confirmed that the applicant performs inspections of the SS and steel support members of the trash rack filter at the Keowee Hydro Station exposed to an air-outdoor (external) environment as required by CFR Title 18, “Conservation of Power and Water Resources,” Part 12, “Safety of Water Power Projects and Project Works,” Subpart D under the regulatory jurisdiction of the FERC. Based on its review of components associated with AMR Item 3.5.1-092, for which the applicant cited generic Note E, the staff finds the applicant’s proposal to manage the effects of aging of the trash rack filter at condenser circulating intake using the Inspection of Water-Control Structures

Associated with Nuclear Power Plants program acceptable because the alternate program implements similar visual inspection techniques and inspection frequencies as the program recommended by the GALL-SLR Report. The staff also finds the applicant's proposal to manage the effects of aging of the trash rack filter at the Keowee Hydro Station intake using the FERC Inspections of the Keowee Hydro Station Program acceptable because continued compliance with requirements of FERC for the aging management of these water-control structures during the subsequent period of extended operation, by virtue of that agency's authority and responsibility for ensuring that its regulated projects are operated and maintained to protect public health and safety as well as the environment, provides reasonable assurance of constituting an acceptable AMP for the purposes of SLR. Oconee stated it will continue to comply with these FERC requirements during the subsequent period of extended operation.

3.5.2.1.10 Cracking Due to Expansion from Reaction with Aggregates

SLRA Table 3.5.1, AMR Item 3.5.1-096, addresses cracking due to expansion from reaction with aggregates for concrete elements in accessible areas of Group 6 structures exposed to air-outdoor or water-flowing (external) environments. For the SLRA Table 2 AMR items, as amended by Supplement 3 dated by December 15, 2021, that cite generic Note E, the SLRA credits the FERC Inspections of the Keowee Hydro Station Program to manage the aging effect for accessible concrete elements of Keowee Hydro Station penstock, power tunnels, spillway, and intake structures exposed to an air-outdoor (external) environment. In addition, the AMR items cite plant-specific Note 6, which states in part that the FERC Inspections of the Keowee Hydro Station (Dam) Program is the AMP credited for the powerhouse, penstock, power tunnels, spillway and intake portions of the Keowee Hydro Station (Dam). The Keowee Hydro Station is licensed by the FERC. ONS will continue to comply with these FERC requirements during the subsequent period of extended operation.

For the SLRA Table 2 AMR items, as amended by Supplement 3 dated by December 15, 2021, that cite generic Note A, which is an error and should be generic Note E, because the SLRA credits the FERC Inspections of the Keowee Hydro Station Program instead of the Inspection of Water-Control Structures Associated with Nuclear Power Plants program specified in the GALL-SLR Report to manage the aging effects for accessible concrete elements of Keowee Hydro Station penstock, power tunnels, spillway, and intake structures exposed to a water flowing (external) environment. In addition, the AMR items cite plant-specific Note 7, which states that the underwater inspection and penstock inspection are ongoing aging management activities associated with the FERC Inspection of the Keowee Hydro Station Program and are credited for the material, environment, and aging effect combination. These inspection activities manage Keowee Dam SCs that are under water or are normally submerged and inaccessible for inspection during the Title 18, Part 12D inspection.

During its audit, the staff reviewed the scope of water-control structures and confirmed that the applicant performs inspections of the accessible concrete elements of Keowee Hydro Station penstock, power tunnels, spillway, and intake structures exposed to an air-outdoor or water-flowing (external) environment as required by CFR Title 18, "Conservation of Power and Water Resources," Part 12, "Safety of Water Power Projects and Project Works," Subpart D under the regulatory jurisdiction of the FERC. Based on its review of components associated with AMR Item 3.5.1-096, for which the applicant cited generic Note E, the staff finds the applicant's proposal to manage the effects of aging using the FERC Inspections of the Keowee Hydro Station Program acceptable because continued compliance with FERC requirements for the aging management of these water-control structures during the subsequent period of extended operation, by virtue of that agency's authority and responsibility for ensuring that its regulated projects are operated and maintained to protect public health and safety as well as the environment, provides reasonable assurance of constituting an acceptable AMP for the purposes of SLR when a plant-specific AMP is not necessary. Oconee stated that it will continue to comply with these FERC requirements during the subsequent period of extended operation.

3.5.2.2 Aging Management Review Results for Which Further Evaluation Is Recommended by the GALL-SLR Report

In SLRA Section 3.5.2.2, the applicant further evaluates aging management for certain containment, structures, and component supports components as recommended by the GALL-SLR Report and provides information concerning how it will manage the applicable aging effects. The staff reviewed the applicant's evaluation of these component groups against the criteria contained in SRP-SLR Section 3.5.2.2. The following subsections document the staff's review.

3.5.2.2.1 Pressurized Water Reactor and Boiling Water Reactor Containments

3.5.2.2.1.1 Cracking and Distortion Due to Increased Stress Levels from Settlement, Reduction of Foundation Strength, and Cracking Due to Differential Settlement and Erosion of Porous Concrete Subfoundations

SLRA Section 3.5.2.2.1.1, associated with SLRA Table 3.5.1, AMR Items 3.5.1-001 and 3.5.1-002, addresses cracking and distortion due to increased stress levels from settlement and the reduction of foundation strength and cracking due to differential settlement and erosion of porous concrete subfoundations for containment concrete elements exposed to soil and flowing water environments, respectively. The SLRA notes that the aging effects associated with settlement (AMR Item 3.5.1-001) will be managed by the Structures Monitoring program, while the aging effects associated with erosion of porous concrete subfoundations (AMR Item 3.5.1-002) are not applicable; however, the reactor building will be monitored for cracking due to reduction in foundation strength and settlement by the Structures Monitoring program. The staff reviewed the applicant's proposal against the criteria in SRP-SLR Section 3.5.2.2.1.1.

In its review of components associated with AMR Item 3.5.1-001, the staff finds that the applicant has met the further evaluation criteria, and the applicant's proposal to manage the effects of aging using the Structures Monitoring program is acceptable because the accessible concrete components are monitored by the GALL-SLR Report–recommended program to confirm the absence of any visible effects due to settlement, and a dewatering system is not credited to manage settlement.

In its review of components associated with AMR Item 3.5.1-002, the staff reviewed Section 3.8.1 of the ONS UFSAR and noted that the reactor buildings do not rest on porous concrete subfoundations. The staff also noted that although porous concrete was not used in the subfoundations, the aging effects associated with AMR Item 3.5.1-002 are monitored for the reactor building by the Structures Monitoring program. Therefore, the staff finds the applicant's not applicable claim acceptable because the containment foundations do not sit on porous concrete subfoundations, and the Structures Monitoring program will continue to inspect the reactor building for indications of settlement.

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-SLR Section 3.5.2.2.1.1 criteria. For those AMR items associated with SLRA Section

3.5.2.2.1.1, the staff concludes that the SLRA is consistent with the GALL-SLR Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the subsequent period of extended operation as required by 10 CFR 54.21(a)(3).

3.5.2.2.1.2 Reduction of Strength and Modulus Due to Elevated Temperature

SLRA Section 3.5.2.2.1.2, associated with SLRA Table 3.5.1, Item 3.5.1-003, addresses reduction of strength and modulus of elasticity due to elevated temperatures in concrete components (e.g., dome, wall, basemat, ring girders, buttresses, containment, and concrete fill-in annulus) of containment structures exposed to an air-indoor uncontrolled or air-outdoor environment. The applicant stated that this item is not applicable.

During its review, the staff noted that a review of ONS OE, as stated in the SLRA Section B2.1.29, reflects that the maximum inner surface of the concrete around the piping at the Unit 1 main steam penetration was 227 °F. The staff also noted that the applicant performed volumetric non-destructive concrete testing at Unit 1 to address the exposure to elevated temperatures concern at the main steam penetrations. The staff further noted in the SLRA that the main steam penetrations are designed with cooling fans and stacks.

For SLRA Section 3.5.2.2.1.2, the staff determined the need for additional information, which resulted in the issuance of an RAI. RAI 3.5.2.2.1.2-1 and the applicant's responses are documented in ADAMS Accession No. ML22045A021.

In its response, the applicant stated that the main steam penetration fans are not within the scope of SLR, and their function is to maintain the temperature of concrete within limits during normal operation.

During its evaluation of the applicant's response to RAI 3.5.2.2.1.2-1, the staff noted that the fans are required to be operating when the main steam lines are above 150 °F, and each main steam penetration is supplied with two cooling fans. When cooling is required, one fan is normally operating while the second fan is a backup. The status of the main steam penetration fans is monitored in the Control Room, where corrective actions are initiated to repair the inoperable fan. Therefore, the localized concrete temperature at the main steam penetration is adequately maintained through operating procedures. The staff further noted that there is no OE at Units 2 and 3 that found signs of degradation at the penetration. The staff finds the applicant's response acceptable because (1) based on the staff's scoping review in accordance with the criteria of 10 CFR 54.4 (a), the main steam penetration fans are not within the scope of SLR; (2) the fans are capable of maintaining the localized concrete temperature at the main steam penetrations through operating procedures; and (3) the conclusions of the volumetric non-destructive concrete testing at the Unit 1 main steam penetrations can be extrapolated reasonably and conservatively to the Units 2 and 3 main steam penetrations because (1) the configuration and conditions of outside main steam penetrations and plant-specific specifications for concrete in the reactor building are the same for three units, (2) Unit 1 has been operating the longest, and (3) the Unit 1 main steam penetration concrete has received the most thermal exposure.

The staff evaluated the applicant's claim against the criteria in SRP-SLR Section 3.5.2.2.1.2 and finds it acceptable because, based on its review of the SLRA, the applicant's response to RAI 3.5.2.2.1.2-1 and the volumetric non-destructive concrete testing results, most open areas in the reactor building have a maximum temperature of 140 °F, which is below the SRP-SLR guidance recommended threshold limit of 150 °F for general areas and 200 °F for local areas, and plant OE has not identified signs of degradation at the main steam penetrations. Only the localized concrete temperatures at the main steam penetrations have marginally exceeded 200 °F at areas around the penetrations due to limitations of air movement. The applicant's volumetric non-destructive concrete testing results at the main steam penetrations demonstrated that there was no adverse impact to the concrete strength due to the marginally higher temperatures in these areas. Therefore, concrete containment components are not exposed to the temperatures required for this aging effect to occur.

3.5.2.2.1.3 Loss of Material Due to General, Pitting, and Crevice Corrosion

Item 1. SLRA Section 3.5.2.2.1.3, Item 1, as amended by Supplement 3 dated December 15, 2021 (ADAMS Accession No. ML21349A005), associated with SLRA Table 3.5-1, Items 3.5.1-004, 3.5.1-005 and 3.5.1-035, addresses loss of material due to general, pitting, and crevice corrosion for inaccessible and accessible areas of drywell shell, drywell head, and containment liners (including liner anchors and integral attachments) of steel material exposed to an air-indoor uncontrolled environment. The applicant stated that Item 3.5.1-004 is not applicable as it applies to BWR containments only. For components associated with Items 3.5.1-005 and 3.5.1035, the applicant stated that the aging effects will be managed by the ASME Section XI, Subsection IWE, and 10 CFR Part 50, Appendix J AMPs. The staff reviewed the applicant's proposal against the criteria in SRP-SLR Section 3.5.2.2.1.3, Item 1.

The staff evaluated the applicant's non-applicability claim for SLRA Table 3.5.1, AMR Item 3.5.1-004, and finds it acceptable because the AMR item only applies to BWR containment drywell shells, and the ONS containments are PWR designs that do not incorporate drywell shells.

In its review of components associated with AMR Items 3.5.1-005 and 3.5.1-035, the staff finds that the applicant has met the further evaluation criteria, and the applicant's proposal to manage the effects of aging using the ASME Section XI, Subsection IWE, and 10 CFR Part 50, Appendix J AMPs is acceptable because (1) plant-specific OE with regard to corrosion associated with the containment liner in accessible and inaccessible areas have been identified, evaluated, and appropriately corrected by repair; (2) the design and construction of containment concrete has been in accordance with applicable ACI and ASTM standards to produce a dense, low-permeability concrete to protect against corrosion; (3) the ASME Section XI, Subsection IWE AMP inspects the moisture barrier at the location where the steel liner becomes embedded in concrete, (4) the ASME Section XI, Subsection IWE AMP identifies and manages cracks in the containment concrete that could provide a pathway for water to reach inaccessible portions of the steel containment liner; (5) the Oconee Boric Acid Corrosion AMP monitors the borated water leakage at locations where potential leakage could occur, and (6) the continued monitoring using the proposed AMPs provides reasonable assurance that any occurrence of corrosion of the containment liner and its integral attachments will be identified and corrected prior to loss of intended function.

Based on the program identified, the staff concludes that applicant's programs meet SRP-SLR Section 3.5.2.2.2.1, Item 1 criteria. For those AMR items associated with SLRA Section 3.5.2.2.2.1, Item 1, the staff concludes that the SLRA is consistent with the GALL-SLR Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3).

Item 2. SLRA Section 3.5.2.2.1.3, Item 2, associated with SLRA Table 3.5.1, AMR Item 3.5.1-006, addresses loss of material for steel torus shells exposed to air-indoor uncontrolled or treated-water environments. The applicant stated that this item is not applicable as it applies to BWR containments only. The staff evaluated the applicant's claim against the criteria in SRP-SLR Section 3.5.2.2.1.3, Item 2, and finds it acceptable because ONS containments are PWR designs that do not incorporate torus shells.

Item 3. SLRA Section 3.5.2.2.1.3, Item 3, associated with SLRA Table 3.5.1, AMR Item 3.5.1-007, addresses loss of material for steel suppression chamber shells, steel torus ring girders, and steel downcomers exposed to air-indoor uncontrolled or treated-water environments. The applicant stated that this item is not applicable as it applies to BWR containments only. The staff evaluated the applicant's claim against the criteria in SRP-SLR Section 3.5.2.2.1.3, Item 3, and finds it acceptable because ONS containments are PWR designs that do not incorporate torus ring girders and downcomers.

3.5.2.2.1.4 Loss of Prestress Due to Relaxation, Shrinkage, Creep, and Elevated Temperature

SLRA Section 3.5.2.2.1.4 states that TLAAs are evaluated in accordance with 10 CFR 54.21(c)(1) and that the evaluation of this TLAA associated with the containment tendon system is addressed in Section 4.5. This is consistent with SRP-SLR Section 3.5.2.2.1.4 and is therefore acceptable. The staff's evaluation regarding the TLAA for the containment tendon prestressing system is documented in SE Section 4.5.

SLRA Section 3.5.2.2.1.4 also notes that the loss of prestress of the SSW tendons is managed by the plant-specific Secondary Shield Wall Tendon Surveillance program. During its review, the staff noted that no analysis exists in the applicant's CLB that estimates the loss of prestress of the SSW. Therefore, it is not a TLAA as defined by 10 CFR 54.3, which notes that TLAAs are calculations or analyses that are contained or incorporated in the CLB. Because this evaluation is not associated with a TLAA, the guidance in SRP-SLR Section 3.5.2.2.1.4 is not applicable. Instead, the applicant proposed to manage aging of the SSW tendons with a plant-specific AMP. The staff's evaluation of that plant-specific AMP follows the guidance in SRP-SLR Appendix A, Section A.1, and is documented in SE Section 3.0.3.3.1.

3.5.2.2.1.5 Cumulative Fatigue Damage

SLRA Section 3.5.2.2.1.5, as amended by responses to RAI 3.5.2.2.1.5-1 and RAI 4.6.1-1 by letter dated February 14, 2022 (ADAMS Accession No. ML22045A021), associated with SLRA Table 3.5.1, AMR Items 3.5.1-009 and 3.5.1-027, states that TLAAs are evaluated in accordance with 10 CFR 54.21(c)(1) and that the evaluation of this TLAA for fatigue damage of the containment liner plate and penetrations—including mechanical, electrical, equipment, and personnel-related penetrations of steel and SS material—is addressed in SLRA Section 4.6. This is consistent with SRP-SLR Section 3.5.2.2.1.5 (as modified by SLR-ISG-2021-03-STRUCTURES [ADAMS Accession No. ML20181A381]) and is therefore acceptable. The staff's evaluation regarding the TLAA for containment liner plate and containment penetrations (both hot and cold) is documented in SE Section 4.6.

For SLRA Section 3.5.2.2.1.5, the staff determined the need for additional information with regard to non-applicability of Table 3.5.1, Item 3.5.1-027, which resulted in the issuance of an RAI. RAI 3.5.2.2.1.5-1 and the applicant's response are documented in ADAMS Accession No. ML22045A021.

In its response, the applicant made changes to the SLRA and clarified that a fatigue analysis exists for ONS Units 1, 2, and 3 containment liner plate and penetrations—including mechanical, electrical, equipment, and personnel-related penetrations of steel and SS material, which are evaluated as fatigue TLAAs in SLRA Section 4.6.1 (for containment liner plate and cold penetrations) and 4.6.3 (for hot penetrations), as amended by responses to RAI 4.6.1-1. The applicant further stated that the above-mentioned penetrations include associated penetration sleeves, but ONS does not have penetration bellows as part of the containment pressure boundary; therefore, SRP-SLR Item 3.5-1, 027 (with corresponding GALL-SLR AMR Item II.A3.CP-37), which applies to metal liner and penetrations, including penetration sleeves and bellows, is not applicable to ONS.

The staff finds the applicant's response and changes to SLRA Section 3.5.2.2.1.5 and SLRA Table 3.5.2-2 acceptable because the staff verified that, during the evaluation of SLRA Section 4.6, as amended, documented in SE Section 4.6, applicable ONS containment pressure-retaining boundary components covered by SRP-SLR Item 3.5-1, 027 (identified in the paragraph above) have CLB fatigue analyses, and the staff verified from a review of UFSAR Section 3.8.1.5.4 that ONS does not have penetration bellows; therefore, the non-applicability of SLRA AMR Item 3.5.1-027 to ONS is justified.

3.5.2.2.1.6 Cracking Due to Stress Corrosion Cracking

SLRA Section 3.5.2.2.1.6, associated with SLRA Table 3.5-1, Items 3.5.1-010, 3.5.1-038, and 3.5.1-039, addresses cracking due to SCC for penetration sleeves, penetration bellows, suppression chamber shell, and vent line bellows made of SS or carbon steel with dissimilar metal welds exposed to an air-indoor uncontrolled environment. The applicant stated that Items 3.5.1-038 and 3.5.1-039 are not applicable as they apply to BWR containments only. For components associated with Item 3.5.1-010, the applicant stated that the aging effects will be managed by the ASME Section XI, Subsection IWE, and 10 CFR Part 50, Appendix J AMPs. The staff reviewed the applicant's proposal against the criteria in SRP-SLR Section 3.5.2.2.1.6.

The staff evaluated the applicant's non-applicability claim for AMR items 3.5.1-038 and 3.5.1-039 and finds it acceptable because these items correspond to SRP-SLR Table 3.5-1 Items 3.5.1-038 and 3.5.1-039, which only apply to BWR containment suppression chamber shells and BWR vent line bellows, respectively. The ONS containments are PWR designs that do not incorporate these components.

For SLRA Section 3.5.2.2.1.6, the staff determined the need for additional information, which resulted in the issuance of an RAI. RAI 3.5.2.2.1.6-1 and the applicant's response are documented in ADAMS Accession No. ML22045A021.

In its response, the applicant stated that the Oconee containment pressure boundary has SS components and dissimilar metal welds, and SS pipes that penetrate the containment are connected to SS split rings and welded to a carbon dish head with dissimilar metal welds. The applicant stated that for Units 1, 2, and 3, there are dissimilar metal welds related to the containment liner and penetrations for a total of four ½-inch nominal pipe size (NPS) sample lines. In addition, the applicant stated that for SCC of SS to be an issue requires that the material be exposed to an adverse environment in the presence of a stressor such as high temperature. For these dissimilar metal welds, an adverse environment would be a concentration of chloride or sulfate contaminates, as well as high stress levels and high temperatures.

During its evaluation of the applicant’s response to RAI 3.5.2.2.1.6-1, the staff noted that the area of containment where these welds are located does not have either of the adverse environments or conditions that could lead to SCC. The staff finds the applicant’s response and changes to SLRA Section 3.5.2.2.1.6 and Table 3.5.1, Item 3.5.1-010, acceptable because the penetrations that contain SS and dissimilar metal welds are not subject to environments that would contribute to SCC, and the plant-specific OE has not identified SCC associated with these dissimilar metal welds. Therefore, supplemental surface or enhanced examinations are not required.

In its review of components associated with AMR Item 3.5.1-010, the staff finds that the applicant has met the further evaluation criteria, and the applicant’s proposal to manage the effects of aging using the ASME Section XI, Subsection IWE and the 10 CFR Part 50, Appendix J AMPs is acceptable because (1) the plant-specific OE has not identified SCC associated with these dissimilar metal welds, (2) there are no adverse environments conducive to SCC (i.e., the penetrations are exposed to temperatures less than 140 °F and the environment is dry and free of contaminants that facilitate SCC), and (3) the proposed programs are consistent with the GALL-SLR Report recommendations to adequately manage this aging effect during the subsequent period of extended operation.

Based on the programs identified, the staff concludes that the applicant’s programs meet SRP-SLR Section 3.5.2.2.1.6 criteria. For those AMR items associated with SLRA Section 3.5.2.2.1.6, as amended by the RAI 3.5.2.2.1.6-1 response, the staff concludes that the SLRA is consistent with the GALL-SLR Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.2.1.7 Loss of Material (Scaling, Spalling) and Cracking Due to Freeze-Thaw

SLRA Section 3.5.2.2.1.7, associated with SLRA Table 3.5-1, AMR Item 3.5.1-011, addresses loss of material (spalling, scaling) and cracking due to freeze-thaw of inaccessible areas of containment concrete components exposed to air-outdoor or groundwater/soil environments. These aging effects will be managed by the ASME Section XI, Subsection IWL and Structures Monitoring programs. The staff reviewed the applicant’s proposal against the criteria in SRP-SLR Section 3.5.2.2.1.7.

During its review, the staff noted that the specific air-entrainment value was not provided; however, the containment concrete was designed and constructed in accordance with ACI 318 63 and ACI 301, which ensure a dense, low-permeability concrete. In addition, a review of inspection results indicated that no significant concrete degradation has been attributed to freeze-thaw in accessible areas, and the Structures Monitoring and ASME Section XI, Subsection IWL programs will continue to inspect for signs of this aging effect. Finally, the Structures Monitoring program will opportunistically confirm the absence of aging effects whenever normally inaccessible concrete is made accessible.

In its review of components associated with AMR Item 3.5.1-011, the staff finds that the applicant’s proposal to manage the effects of aging using the ASME Section XI, Subsection IWL and Structures Monitoring programs is acceptable because the concrete was designed in accordance with ACI 318-63, which ensures a dense, low-permeability concrete with air-entrainment between 4 and 8 percent, which falls within the SRP-SLR recommendation, and plant OE has not identified any significant aging effects related to freeze-thaw in accessible areas. Additionally, the Structures Monitoring program will opportunistically confirm the absence of aging effects by examining normally inaccessible structural components when scheduled maintenance work and planned plant modifications permit access. Therefore, a plant-specific AMP or enhancement is not required.

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-SLR Section 3.5.2.2.1.7 criteria. For those AMR items associated with SLRA Section 3.5.2.2.1.7, the staff concludes that the SLRA is consistent with the GALL-SLR Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.2.1.8 Cracking Due to Expansion from Reaction with Aggregates

SLRA Section 3.5.2.2.1.8, associated with SLRA Table 3.5.1, AMR Item 3.5.1-012, addresses cracking due to expansion from reaction with aggregates in inaccessible areas of containment concrete components exposed to any environment, which will be managed by the ASME Section XI, Subsection IWL program. The staff reviewed the applicant's proposal against the criteria in SRP-SLR Section 3.5.2.2.1.8.

During its review, the staff noted that the applicant's ASME Section XI, Subsection IWL program includes guidance for visual inspections to detect indications of degradation due to reactive aggregates, including patterned cracking, darkened crack edges, water ingress, or misalignment of components. The staff also noted that plant OE has not identified indications of ASR in containment concrete.

In its review of components associated with AMR Item 3.5.1-012, the staff finds that the applicant has met the further evaluation criteria, and the applicant's proposal to manage the effects of aging using the ASME Section XI, Subsection IWL program is acceptable. A plant-specific AMP is not needed because plant OE has not identified visual indications of ASR in accessible areas and the ASME Section XI, Subsection IWL program includes inspections to detect indications of ASR.

Based on the program identified, the staff concludes that the applicant's program meets SRP-SLR Section 3.5.2.2.1.8 criteria. For those AMR items associated with SLRA Section 3.5.2.2.1.8, the staff concludes that the SLRA is consistent with the GALL-SLR Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.2.1.9 Increase in Porosity and Permeability Due to Leaching of Calcium Hydroxide and Carbonation

SLRA Section 3.5.2.2.1.9, associated with SLRA Table 3.5.1, AMR Item 3.5.1-014, addresses increase in porosity and permeability and loss of strength due to leaching of calcium hydroxide and carbonation in inaccessible areas of containment concrete components exposed to flowing-water environments. These aging effects will be managed by the ASME Section XI, Subsection IWL program. The staff reviewed the applicant's proposal against the criteria in SRP-SLR Section 3.5.2.2.1.9.

During its review, the staff noted that the ASME Section XI, Subsection IWL program inspects accessible areas for leaching of calcium hydroxide and carbonation, and plant OE has not identified evidence of this aging effect. In addition, the ASME Section XI, Subsection IWL program will continue to inspect for this aging effect in accessible areas.

In its review of components associated with AMR Item 3.5.1-014, the staff finds that the applicant has met the further evaluation criteria, and the applicant's proposal to manage the effects of aging using the ASME Section XI, Subsection IWL program is acceptable. A plant-specific program or enhancement is not necessary because plant OE has not shown degradation due to leaching of calcium hydroxide, and the ASME Section XI, Subsection IWL program inspects for evidence of the aging effect in accessible areas.

Based on the program identified, the staff concludes that the applicant's programs meet SRP-SLR Section 3.5.2.2.1.9 criteria. For those AMR items associated with SLRA Section 3.5.2.2.1.9, the staff concludes that the SLRA is consistent with the GALL-SLR Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.2.2 Safety-Related and Other Structures and Component Supports

In SLRA Section 3.5.2.2, the applicant further evaluates aging management, as recommended in the GALL-SLR Report, for the containment, structures, and component supports components and provides information concerning how it will manage the applicable aging effects. The staff reviewed the applicant's evaluation of component groups for which the GALL-SLR Report recommends further evaluation against the criteria contained in SRP-SLR Section 3.5.2.2. The following subsections document the staff's review.

3.5.2.2.2.1 Aging Management of Inaccessible Areas

Item 1. SLRA Section 3.5.2.2.2.1, Item 1, associated with SLRA Table 3.5-1, Item 3.5.1-042, as amended by Supplement 2 dated November 11, 2021 (ADAMS Accession No. ML21315A012), addresses loss of material (spalling, scaling) and cracking due to freeze-thaw in below-grade inaccessible concrete areas of Groups 1–3, 5, and 7–9 structures exposed to an air-outdoor or groundwater/soil environment. ONS is located in a moderate weathering region, as defined in ASTM C-33. The applicant used the Structures Monitoring program to manage loss of material (spalling, scaling) and cracking due to freeze-thaw for concrete elements in below-grade inaccessible areas of Groups 1–3, 5, and 7–9 structures. The applicant stated that a plant-specific AMP or plant-specific enhancements to the Structures Monitoring program for inaccessible areas are not required to manage loss of material and cracking due to freeze-thaw. The staff reviewed the applicant's proposal against the criteria in SRP-SLR Section 3.5.2.2.2.1, Item 1.

In its review of components associated with AMR Item 3.5.1-042, the staff finds that the applicant has met further evaluation criteria, and the applicant's proposal to manage the effects of aging using the Structures Monitoring program is acceptable because (1) the concrete mix designs contain an air-entraining admixture capable of entraining 3–8 percent air in accordance with ASTM standards; (2) plant OE identified instances of aging effects related to freeze-thaw in accessible areas; however, the structural integrity of the components was not impacted, and the conditions will be monitored during subsequent inspections; therefore a plant-specific AMP is not needed; and (3) the Structures Monitoring program will opportunistically confirm the absence of aging effects by examining normally inaccessible structural components when scheduled maintenance work and planned plant modifications permit access and will evaluate observed aging effects in accessible areas that could indicate degradation in inaccessible areas.

Based on the program identified, the staff concludes that applicant's program meets SRP-SLR Section 3.5.2.2.2.1, Item 1 criteria. For those AMR items associated with SLRA Section 3.5.2.2.2.1, Item 1, the staff concludes that the SLRA is consistent with the GALL-SLR Report and that applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3).

Item 2. SLRA Section 3.5.2.2.2.1, Item 2, associated with SLRA Table 3.5-1, Item 3.5.1-043, addresses cracking due to expansion from reaction with aggregates in inaccessible areas of Groups 1–3, 5, and 7–9 structures exposed to any environment, which will be managed by the Structures Monitoring program. The staff reviewed the applicant's proposal against the criteria in SRP-SLR Section 3.5.2.2.2.1, Item 2.

For SLRA Section 3.5.2.2.2.1, Item 2, the staff determined the need for additional information, which resulted in the issuance of an RAI. RAI 3.5.2.2.2.1-1 and the applicant's responses are documented in ADAMS Accession No. ML22052A002.

In its response, the applicant stated that an enhancement to the Structures Monitoring program includes the inspection of cracking with darkened edges, and SLRA Section 3.5.2.2.1, Item 3.5.1-043 will be revised to include acceptability of inaccessible areas when conditions exist in accessible areas that could indicate the presence of, or result in, degradation to such inaccessible areas.

During its evaluation of the applicant's response to RAI 3.5.2.2.1.2-1, the staff noted that the applicant does have an enhancement to incorporate the visual inspections for ASR (i.e., patterned cracking with darkened edges) into the Structures Monitoring program, and the applicant has not identified evidence of patterned cracking with darkened edges that would imply ASR degradation in Groups 1–3, 5, and 7–9 structures. The staff also noted in the response to RAI B2.1.33-3 (ADAMS Accession No. ML22045A021) that an enhancement to the Structures Monitoring program is added to include consideration of the acceptability of inaccessible areas when conditions exist in accessible areas that could indicate the presence of, or result in, degradation to such inaccessible areas. The staff finds the applicant's response and changes to the SLRA Section 3.5.2.2.1, Item 3.5.2-043, acceptable because, when the enhancement is implemented, it will update the program's guidance to align with the GALL-SLR Report AMP for visual inspections related to ASR degradation acceptability of inaccessible areas when conditions exist in accessible areas that could indicate the presence of, or result in, degradation to such inaccessible areas.

In its review of components associated with Item 3.5.1-043, the staff finds that applicant has met the further evaluation criteria, and the applicant's proposal to manage the effects of aging using the Structures Monitoring program is acceptable because (1) plant OE has not identified any indications of ASR in below-grade inaccessible concrete areas of ONS Groups 1–3, 5, and 7–9 structures; therefore, a plant-specific AMP is not needed; (2) the visual inspections for ASR performed every 5 years under the Structures Monitoring program can identify conditions that could indicate ASR in accessible areas; (3) the Structures Monitoring program inspects for evidence of the aging effect in accessible areas and requires that evaluation of inspection results includes consideration of the acceptability of inaccessible areas when conditions exist in accessible areas that could indicate the presence of, or result in, degradation to inaccessible areas; and (4) the Structures Monitoring program will perform opportunistic inspections of normally inaccessible areas when areas are made accessible by excavation or by other means.

Based on the program identified, the staff concludes that applicant's program meets SRP-SLR Section 3.5.2.2.2.1, Item 2 criteria. For those AMR items associated with SLRA Section 3.5.2.2.2.1, Item 2, the staff concludes that the SLRA is consistent with the GALL-SLR Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3).

Item 3. SLRA Section 3.5.2.2.2.1, Item 3, associated with SLRA Table 3.5-1, Item 3.5.1-044, as amended by Supplement 3 dated December 15, 2021 (ADAMS Accession No. ML21349A005), addresses cracking and distortion due to increased stress levels from settlement in inaccessible areas of structures for all groups exposed to a soil environment, which will be managed by the Structures Monitoring program or the FERC Inspections of the Keowee Hydro Station program. The staff reviewed the applicant's proposal against the criteria in SRP-SLR Section 3.5.2.2.2.1, Item 3.

For the SLRA Table 2 AMR items that cite generic Note E, the SLRA credits the FERC Inspections of the Keowee Hydro Station program to manage the aging effect for concrete elements of Keowee Hydro Station penstock, power tunnels, and intake and spillway structures exposed to a soil (external) environment. In addition, the AMR items cite plant-specific Note 6, which states in part:

> The FERC Inspections of the Keowee Hydro Station (Dam) are the aging management program credited for the Powerhouse, Penstock, Power Tunnels, Spillway and Intake portions of the Keowee Hydro Station (Dam). Keowee is licensed by the Federal Energy Regulatory Commission (FERC). ONS will continue to comply with these FERC requirements during the second period of extended operation.

During its audit, the staff reviewed the scope of water-control structures and confirmed that the applicant performs inspections of the concrete elements of the Keowee Hydro Station penstock, power tunnels, and intake and spillway structures exposed to a soil (external) environment as required by CFR Title 18, "Conservation of Power and Water Resources," Part 12, "Safety of Water Power Projects and Project Works," Subpart D under the regulatory jurisdiction of the FERC. Based on its review of components associated with AMR Item 3.5.1-044, for which the applicant cited generic Note E, the staff finds the applicant's proposal to manage the effects of aging using the FERC Inspections of the Keowee Hydro Station program acceptable because continued compliance with FERC requirements for the aging management of these water-control structures during the subsequent period of extended operation, by virtue of that agency's authority and responsibility for ensuring that its regulated projects are operated and maintained to protect public health and safety as well as the environment, provides reasonable assurance of constituting an acceptable AMP for the purposes of SLR. Oconee stated that it will continue to comply with these FERC requirements during the subsequent period of extended operation.

SLRA Section 3.5.2.2.2.1, Item 3, associated with SLRA Table 3.5-1, Item 3.5.1-046, as amended by Supplement 3 dated December 15, 2021 (ADAMS Accession No. ML21349A005), addresses reduction in foundation strength and cracking due to differential settlement and erosion of porous concrete subfoundations in below-grade inaccessible concrete areas of Groups 1–3 and 5–9 structures exposed to a water-flowing environment, which will be managed by the Structures Monitoring program or the Inspection of Water-Control Structures Associated with Nuclear Power Plants program. The staff reviewed the applicant's proposal against the criteria in SRP-SLR Section 3.5.2.2.2.1, Item 3.

For the SLRA Table 2 AMR items that cite generic Note E, the SLRA credits the Inspection of Water-Control Structures Associated with Nuclear Power Plants program to manage the aging effect for concrete elements of Keowee Hydro Station exposed to a water-flowing (external) environment. In addition, the AMR items cite plant-specific Notes 1 and 8, which state that concrete elements include beams, columns, walls, slabs, curbs, sumps, foundations, and pads, and the underwater inspection performed under the Inspection of Water-Control Structures Associated with Nuclear Power Plants program is credited for the material, environment, and aging effect combination. The staff finds the applicant's proposal to manage the effects of aging using the Inspection of Water-Control Structures Associated with Nuclear Power Plants program acceptable because it uses inspection procedures and inspection intervals similar to the Structures Monitoring program.

In its review of components associated with Items 3.5.1-044 and 3.5.1-046, the staff finds that the applicant has met the further evaluation criteria, and the applicant's proposal to manage the effects of aging using the Structures Monitoring program or the Inspection of Water-Control Structures Associated with Nuclear Power Plants program is acceptable because the applicant does not credit a dewatering system in its CLB for controlling settlement at ONS.

Based on the program identified, the staff concludes that applicant's program meets SRP-SLR Section 3.5.2.2.2.1, Item 3 criteria. For those AMR items associated with SLRA Section 3.5.2.2.2.1, Item 3, the staff concludes that the SLRA is consistent with the GALL-SLR Report and that applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3).

Item 4. SLRA Section 3.5.2.2.2.1, Item 4, associated with SLRA Table 3.5-1, Item 3.5.1-047, as amended by Supplement 2 dated November 11, 2021 (ADAMS Accession No. ML21315A012), addresses increases in porosity and permeability and loss of strength due to leaching of calcium hydroxide and carbonation in inaccessible areas of concrete components for Groups 1-3, 5, and 7–9 structures exposed to a water-flowing environment, which will be managed by the Structures Monitoring program. The applicant stated that a plant-specific AMP or plant-specific enhancements to the Structures Monitoring program are not required to manage this aging effect in inaccessible areas. The staff reviewed the applicant's proposal against the criteria in SRP-SLR Section 3.5.2.2.2.1, Item 4.

For SLRA Section 3.5.2.2.2.1, Item 4, the staff determined the need for additional information, which resulted in the issuance of an RAI. RAI 3.5.2.2.2.1-2 and the applicant's responses are documented in ADAMS Accession No. ML22052A002.

In its response, the applicant stated that OE related to leaching of calcium hydroxide and carbonation was found in several locations and evaluated for increases in porosity and permeability and loss of strength due to leaching of calcium hydroxide and carbonation, and a new enhancement to the Structures Monitoring program was added to include consideration of the acceptability of inaccessible areas when conditions exist in accessible areas that could indicate the presence of, or result in, degradation to such inaccessible areas.

During its evaluation of the applicant's response to RAI 3.5.2.2.1.2-2, the staff noted that the applicant provided the evaluation to address the issue identified in the RAI, and the applicant's evaluation determined that the observed leaching did not meet the criteria necessary to adversely impact the structural integrity and therefore would not result in a loss of intended function of the associated concrete structure. The staff also noted in the response to RAI B2.1.33-3 (ADAMS Accession No. ML22045A021) that an enhancement to the Structures Monitoring program is added in the SLRA to include consideration of the acceptability of inaccessible areas when conditions exist in accessible areas that could indicate the presence of, or result in, degradation to such inaccessible areas. The staff finds the applicant's response and changes to the SLRA Section 3.5.2.2.1, Item 3.5.1-047, acceptable because (1) the applicant provided the evaluation to demonstrate that the observed leaching of calcium hydroxide and carbonation in accessible areas has no impact on the intended function of the concrete structure, and (2) when new enhancement is implemented, it will update the program's guidance to align with the GALL-SLR Report AMP for visual inspections related to acceptability of inaccessible areas when conditions exist in accessible areas that could indicate the presence of, or result in, degradation to such inaccessible areas.

In its review of components associated with Item 3.5.1-047, the staff finds that applicant has met the further evaluation criteria, and the applicant's proposal to manage the effects of aging using the Structures Monitoring program is acceptable because (1) review of plant OE identified instances of aging effects related to increases in porosity and permeability, and loss of strength due to leaching of calcium hydroxide and carbonation in accessible areas; however, the applicant's evaluation determined that the structural integrity of the components was not impacted, i.e., the observed leaching of calcium hydroxide and carbonation in accessible areas has no impact on the intended function; therefore, a plant-specific AMP is not needed for inaccessible areas; (2) the Structures Monitoring program inspects for evidence of the aging effect in accessible areas and requires that evaluation of inspection results includes consideration of the acceptability of inaccessible areas when conditions exist in accessible areas that could indicate the presence of, or result in, degradation to inaccessible areas; and (3) the Structures Monitoring program will perform opportunistic inspections of normally inaccessible areas when areas are made accessible by excavation or by other means.

Based on the program identified, the staff determined that applicant's program meets SRP-SLR Section 3.5.2.2.2.1, Item 4 criteria. For those items associated with SLRA Section 3.5.2.2.2.1, Item 4, the staff concludes that the SLRA is consistent with the GALL-SLR Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.2.2.2 Reduction of Strength and Modulus Due to Elevated Temperatures

SLRA Section 3.5.2.2.2.2, associated with SLRA Table 3.5.1 AMR Item 3.5.1-048, addresses reduction of strength and modulus of elasticity due to elevated temperatures in Groups 1–5 concrete structures exposed to an air-indoor uncontrolled environment. The applicant stated that this item is not applicable. The staff evaluated the applicant's claim against the criteria in SRP-SLR Section 3.5.2.2.2.2.

For SLRA Section 3.5.2.2.2.2, the staff determined the need for additional information, which resulted in the issuance of RAIs. RAIs 3.5.2.2.2.2-1 and 3.5.2.2.2.2-3 and the applicant's responses are documented in ADAMS Accession Nos. ML22052A002 and ML22045A021, respectively.

In its response to RAI 3.5.2.2.2.2-1, the applicant stated that the spent fuel temperature under normal operation is maintained less than 150 °F and clarified that the SFP temperatures (greater than 150 °F) may occur either for short durations, which are managed by operating procedures, or infrequently during accident conditions (i.e., loss of SFP cooling and abnormal heat load situations as defined in UFSAR 9.1.3.1), which are addressed in the design.

During its evaluation of the applicant's response to RAI 3.5.2.2.2.2-1, the staff noted that the applicant revised the SLRA and provided clarification to demonstrate that the spent fuel pool concrete is maintained below 150 °F during normal operations. The staff finds the applicant's response and changes to the SLRA Section 3.5.2.2.2.2 acceptable because (1) the SFP concrete is maintained below 150 °F under normal operation, which does not exceed the specified temperature limit (a general area temperature of 150 °F) in the SRP-SLR Section 3.5.2.2.2.2; and (2) the elevated temperatures for short durations or in abnormal cases have no normal, long-term aging effects on the concrete structures.

In its response to RAI 3.5.2.2.2.2-3, the applicant stated that two analyses were performed to calculate primary shield wall concrete temperature to demonstrate that the maximum concrete temperature of the primary shield wall will not exceed 200 °F in local areas.

During its evaluation of the applicant's response to RAI 3.5.2.2.2.2-3, the staff reviewed analytical methodologies for the Oconee reactor cavity concrete temperature and the concrete temperature near the hot-leg nozzle and the calculated concrete temperature results. The staff finds the applicant's response acceptable because the calculations are provided to demonstrate that the calculated concrete temperature at penetrations in the primary shield wall does not exceed the specified temperature limit (local area temperature 200 °F) in SRP-SLR Section 3.5.2.2.2.2.

Based on the program identified, the staff determined that the applicant's program meets SRP-SLR Section 3.5.2.2.2.2. For those items associated with SLRA Section 3.5.2.2.2.2, the staff concludes that the SLRA is consistent with the GALL-SLR Report, and that applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.2.2.3 Aging Management of Inaccessible Areas for Group 6 Structures

Item 1. SLRA Section 3.5.2.2.2.3, Item 1, associated with SLRA Table 3.5-1, Item 3.5.1-049, as amended by Supplement 2 dated November 11, 2021 (ADAMS Accession No. ML21315A012), addresses loss of material (spalling, scaling) and cracking due to freeze-thaw in below-grade inaccessible concrete areas of Group 6 structures exposed to an air-outdoor or groundwater/soil environment, which will be managed by the Structures Monitoring program or the FERC Inspections of the Keowee Hydro Station Program. ONS is located in a moderate weathering region, as defined in ASTM C-33. The applicant stated that a plant-specific AMP or plant-specific enhancements to the Structures Monitoring program for inaccessible areas to manage the aging effects of loss of material (scaling, spalling) and cracking due to freeze-thaw are not required. The staff reviewed the applicant's proposal against the criteria in SRP-SLR Section-3.5.2.2.2.3, Item-1.

For the SLRA Table-2 AMR items that cite generic Note E, the SLRA credits the FERC Inspections of the Keowee Hydro Station Program to manage the aging effect for inaccessible concrete elements of Keowee Hydro Station penstock, power tunnels, and intake and spillway structures exposed to a groundwater/soil (external) environment. In addition, the AMR items cite plant-specific Note 6, which states, in part:

> The FERC Inspections of the Keowee Hydro Station (Dam) are the aging management program credited for the Powerhouse, Penstock, Power Tunnels, Spillway and Intake portions of the Keowee Hydro Station (Dam). Keowee is licensed by the Federal Energy Regulatory Commission (FERC). ONS will continue to comply with these FERC requirements during the second period of extended operation.

During its audit, the staff reviewed the scope of water-control structures, and confirmed that the applicant performs inspections of the inaccessible concrete elements of the Keowee Hydro Station penstock, power tunnels, and intake and spillway structures exposed to a water-flowing (external) environment as required by CFR Title 18, "Conservation of Power and Water Resources," Part 12, "Safety of Water Power Projects and Project Works," Subpart D, under the regulatory jurisdiction of the FERC. Based on its review of components associated with AMR Item 3.5.1-049, for which the applicant cited generic Note E, the staff finds the applicant's proposal to manage the effects of aging using the FERC Inspections of the Keowee Hydro Station Program acceptable because continued compliance with requirements of FERC for the aging management of these water-control structures during the subsequent period of extended operation, by virtue of that agency's authority and responsibility for ensuring that its regulated projects are operated and maintained to protect public health and safety as well as the environment, provides reasonable assurance of constituting an acceptable AMP for the purposes of SLR. Oconee stated that it will continue to comply with these FERC requirements during the subsequent period of extended operation.

In its review of components associated with AMR Item 3.5.1-049, the staff finds that the applicant has met the further evaluation criteria, and the applicant's proposal to manage the effects of aging using the Structures Monitoring program is acceptable because (1) the concrete mix designs contain an air-entraining admixture capable of entraining 3–8 percent air in accordance with ASTM standards; (2) plant OE identified instances of aging effects related to freeze-thaw in accessible areas; however, the structural integrity of the components was not impacted and the conditions will be monitored during subsequent inspections; therefore, a plant-specific AMP is not needed; and (3) the Structures Monitoring program will opportunistically confirm the absence of aging effects by examining normally inaccessible structural components when scheduled maintenance work and planned plant modifications permit access and will evaluate observed aging effects in accessible areas that could be indicate degradation in inaccessible areas.

Based on the program identified, the staff concludes that applicant's Structures Monitoring Program meets SRP-SLR Section 3.5.2.2.2.3, Item 1 criteria. For those AMR items associated with SLRA Section 3.5.2.2.2.3, Item 1, and managed by the Structures Monitoring program, the staff concludes that the SLRA is consistent with the GALL-SLR Report and that applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3).

Item 2. SLRA Section 3.5.2.2.2.3, Item 2, associated with SLRA Table 3.5-1, Item 3.5.1-050, as amended by Supplement 3 dated December 15, 2021 (ADAMS Accession No. ML21349A005), addresses cracking due to expansion from reaction with aggregates in inaccessible areas of Group 6 structures exposed to any environment, which will be managed by the Structures Monitoring program or the FERC Inspections of the Keowee Hydro Station Program. The staff reviewed the applicant's proposal against the criteria in SRP-SLR Section 3.5.2.2.2.3, Item 2.

For the SLRA Table 2 AMR items that cite generic Note E, the SLRA credits the FERC Inspections of the Keowee Hydro Station Program to manage the aging effect for inaccessible concrete elements of Keowee Hydro Station penstock, power tunnels, spillway, and intake structures exposed to a water-flowing or groundwater/soil (external) environment. In addition, the AMR item cites plant-specific Note 6, which states, in part:

> The FERC Inspections of the Keowee Hydro Station (Dam) are the aging management program credited for the Powerhouse, Penstock, Power Tunnels, Spillway and Intake portions of the Keowee Hydro Station (Dam). Keowee is licensed by the Federal Energy Regulatory Commission (FERC). ONS will continue to comply with these FERC requirements during the second period of extended operation.

During its audit, the staff reviewed the scope of water-control structures and confirmed that the applicant performs inspections of the inaccessible concrete elements of Keowee Hydro Station penstock, power tunnels, spillway, and intake structures exposed to a groundwater/soil or water-flowing (external) environment as required by CFR Title 18, "Conservation of Power and Water Resources," Part 12, "Safety of Water Power Projects and Project Works," Subpart D under the regulatory jurisdiction of the FERC. In addition, the staff noted that plant OE has not identified any indications of ASR for the concrete structures at ONS, except for at the Keowee Dam spillway. The expansion from reaction with aggregates caused gate binding problems at spillway gates 4 and 1. The applicant evaluated the conditions by drilling, sampling, borehole imaging, compression testing, petrographic testing, in-situ stress testing, biaxial modulus testing, and stress calculation, and the applicant's investigation found that no significant deterioration of the spillway concrete had occurred. In addition, the applicant took the corrective actions and resolved the gate binding problems by recessing the guide plates into the piers to increase the clearances. Using the FERC Inspections of the Keowee Hydro Station Program, the applicant will continue to monitor and adjust the gates as needed to maintain sufficient operating clearance.

Based on its review of components associated with AMR Item 3.5.1-050, for which the applicant cited generic Note E, the staff finds the applicant's proposal to manage the effects of aging using the FERC Inspections of the Keowee Hydro Station Program acceptable because continued compliance with requirements of FERC for the aging management of these water-control structures during the subsequent period of extended operation, by virtue of that agency's authority and responsibility for ensuring that its regulated projects are operated and maintained to protect public health and safety as well as the environment, provides reasonable assurance of constituting an acceptable AMP for the purposes of SLR renewal when a plant-specific AMP is not necessary. Oconee stated that it will continue to comply with these FERC requirements during the subsequent period of extended operation.

For SLRA Section 3.5.2.2.2.3, Item 2, the staff determined the need for additional information, which resulted in the issuance of an RAI. RAI 3.5.2.2.2.1-1 and the applicant's responses are documented in ADAMS Accession No. ML22052A002.

In its response, the applicant stated that the enhancement to the Structural Monitoring program includes the inspection of cracking with darkened edges, as stated in SLRA Section B2.1.33 and Appendix A2.33, and SLRA Section 3.5.2.2.1, Item 3.5.1-050, will be revised to include acceptability of inaccessible areas when conditions exist in accessible areas that could indicate the presence of, or result in, degradation to such inaccessible areas.

During its evaluation of the applicant's response to RAI 3.5.2.2.2.1-1, the staff noted that the applicant does have an enhancement to incorporate the visual inspections for ASR (i.e., patterned cracking with darkened edges) into the Structures Monitoring program in the enhancements, and plant OE has not identified any indications of ASR for the concrete structures at ONS, except for at the Keowee Dam spillway. The staff also noted in the response to RAI B2.1.33-3 (ADAMS Accession No. ML22045A021) that a new enhancement to the Structures Monitoring program is added in the SLRA to include consideration of the acceptability of inaccessible areas when conditions exist in accessible areas that could indicate the presence of, or result in, degradation to such inaccessible areas. The staff finds the applicant's response and changes to SLRA Section 3.5.2.2.3, Item 3.5.2-050, acceptable because, when the enhancement is implemented, it will update the program's guidance to align with the GALL-SLR Report AMP for visual inspections related to ASR degradation (i.e., patterned cracking with darkened edges) and acceptability of inaccessible areas when conditions exist in accessible areas that could indicate the presence of, or result in, degradation to such inaccessible areas.

In its review of components associated with Item 3.5.1-050, the staff finds that applicant has met the further evaluation criteria, and the applicant's proposal to manage the effects of aging using the Structures Monitoring program is acceptable because (1) plant OE has not identified any indications of ASR in below-grade inaccessible concrete areas of Group 6 structures, except at the Keowee Dam spillway; therefore, a plant-specific AMP is not needed; (2) the visual inspections for ASR performed every 5 years under the Structures Monitoring program will be able to identify conditions that could indicate ASR in accessible areas; (3) the Structures Monitoring program inspects for evidence of the aging effect in accessible areas and requires that evaluation of inspection results includes consideration of the acceptability of inaccessible areas when conditions exist in accessible areas that could indicate the presence of, or result in, degradation to inaccessible areas; and (4) the Structures Monitoring program will perform opportunistic inspections of normally inaccessible areas when areas are made accessible by excavation or by other means.

Based on the program identified, the staff concludes that applicant's program meets SRP-SLR Section 3.5.2.2.2.3, Item 2 criteria. For those AMR items associated with SLRA Section 3.5.2.2.2.3, Item 2, and managed by the Structures Monitoring Program, the staff concludes that the SLRA is consistent with the GALL-SLR Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3).

Item 3. SLRA Section 3.5.2.2.2.3, Item 3, associated with SLRA Table 3.5-1, Item 3.5.1-051, as amended by Supplement 2 dated November 11, 2021 (ADAMS Accession No. ML21315A012), addresses increases in porosity and permeability and loss of strength due to leaching of calcium hydroxide and carbonation in inaccessible areas of concrete components for Group 6 structures exposed to a water-flowing environment, which will be managed by the Structures Monitoring program or the FERC Inspections of the Keowee Hydro Station Program. The applicant stated that a plant-specific AMP or plant-specific enhancements to the Structures Monitoring program are not required to manage this aging effect in inaccessible areas. The staff reviewed the applicant's proposal against the criteria in SRP-SLR Section 3.5.2.2.2.3, Item 3.

For the SLRA Table 2 AMR items that cite generic Note E, the SLRA credits the FERC Inspections of the Keowee Hydro Station Program to manage the aging effect for inaccessible concrete elements of Keowee Hydro Station penstock, power tunnels, and intake and spillway structures exposed to a water-flowing (external) environment. In addition, the AMR items cite plant-specific Note 6, which states, in part:

> The FERC Inspections of the Keowee Hydro Station (Dam) are the aging management program credited for the Powerhouse, Penstock, Power Tunnels, Spillway and Intake portions of the Keowee Hydro Station (Dam). Keowee is licensed by the Federal Energy Regulatory Commission (FERC). ONS will continue to comply with these FERC requirements during the second period of extended operation.

During its audit, the staff reviewed the scope of water-control structures and confirmed that the applicant performs inspections of the inaccessible concrete elements of the Keowee Hydro Station penstock, power tunnels, and intake and spillway structures exposed to a water-flowing (external) environment as required by CFR Title 18, "Conservation of Power and Water Resources," Part 12, "Safety of Water Power Projects and Project Works," Subpart D under the regulatory jurisdiction of the FERC. Based on its review of components associated with AMR Item 3.5.1-051, for which the applicant cited generic Note E, the staff finds the applicant's proposal to manage the effects of aging using the FERC Inspections of the Keowee Hydro Station Program acceptable because continued compliance with requirements of FERC for the aging management of these water-control structures during the subsequent period of extended operation, by virtue of that agency's authority and responsibility for ensuring that its regulated projects are operated and maintained to protect public health and safety as well as the environment, provides reasonable assurance of constituting an acceptable AMP for the purposes of SLR. Oconee stated it will continue to comply with these FERC requirements during the subsequent period of extended operation.

For SLRA Section 3.5.2.2.2.3, Item 3, the staff determined the need for additional information, which resulted in the issuance of an RAI. RAI 3.5.2.2.2.1-2, and the applicant's response is documented in ADAMS Accession No. ML22052A002.

In its response, the applicant stated that OE related to leaching of calcium hydroxide and carbonation was found in several locations and evaluated for increases in porosity and permeability and loss of strength, and a new enhancement to the Structures Monitoring program was added to include consideration of the acceptability of inaccessible areas when conditions exist in accessible areas that could indicate the presence of, or result in, degradation to such inaccessible areas.

During its evaluation of the applicant's response to RAI 3.5.2.2.1.2-2, the staff noted that the applicant provided the evaluation to address the issue identified in the RAI, and the applicant's evaluation determined that the observed leaching did not meet the criteria necessary to adversely impact the structural integrity and therefore would not result in a loss of intended function of the associated concrete structure. The staff also noted in the response to RAI B2.1.33-3 (ADAMS Accession No. ML22045A021) that an enhancement to the Structures Monitoring program is added in the SLRA to include consideration of the acceptability of inaccessible areas when conditions exist in accessible areas that could indicate the presence of, or result in, degradation to such inaccessible areas. The staff finds the applicant's response and changes to the SLRA Section 3.5.2.2.2.3, Item 3.5.1-051 acceptable because (1) the applicant provided the evaluation to demonstrate that the observed leaching of calcium hydroxide and carbonation in accessible areas has no impact on the intended function of the concrete structure, and (2) when the new enhancement is implemented, it will update the program's guidance to align with the GALL-SLR Report AMP for visual inspections related to acceptability of inaccessible areas when conditions exist in accessible areas that could indicate the presence of, or result in, degradation to such inaccessible areas.

In its review of components associated with Item 3.5.1-051, the staff finds that applicant has met the further evaluation criteria, and the applicant's proposal to manage the effects of aging using the Structures Monitoring program is acceptable because (1) review of plant OE identified instances of aging effects related to increases in porosity and permeability and loss of strength due to leaching of calcium hydroxide and carbonation in accessible areas; however, the applicant's evaluation determined that the structural integrity of the components was not impacted, i.e., the observed leaching of calcium hydroxide and carbonation in accessible areas has no impact on the intended function; therefore, a plant-specific AMP is not needed for inaccessible areas; (2) the Structures Monitoring program inspects for evidence of the aging effect in accessible areas and requires that evaluation of inspection results includes consideration of the acceptability of inaccessible areas when conditions exist in accessible areas that could indicate the presence of, or result in, degradation to inaccessible areas; and (3) the Structures Monitoring program will perform opportunistic inspections of normally inaccessible areas when areas are made accessible by excavation or by other means.

Based on the program identified, the staff determined that applicant's program meets SRP-SLR Section 3.5.2.2.2.3, Item 3 criteria. For those items associated with SLRA Section 3.5.2.2.2.3, Item 3, the staff concludes that the SLRA is consistent with the GALL-SLR Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.2.2.4 Cracking Due to Stress Corrosion Cracking and Loss of Material Due to Pitting and Crevice Corrosion

SLRA Section 3.5.2.2.2.4, as amended by Supplement 3 dated December 15, 2021 (ADAMS Accession No. ML21349A005), associated with SLRA Table 3.5.1 AMR Items 3.5.1-052, 3.5.1-099, and 3.5.1-100, addresses cracking due to SCC and loss of material due to pitting and crevice corrosion for SS tank liners exposed to standing water and aluminum and SS support members, welds, bolted connections, and support anchorage to building structures exposed to air or condensation, which will be managed by the ASME Section XI, Subsection IWF program, the Structures Monitoring program, the Inspection of Water-Control Structures Associated with Nuclear Power Plants program, or the FERC Inspections of the Keowee Earthen Embankments Program. The staff reviewed the applicant's proposal against the criteria in SRP-SLR Section 3.5.2.2.2.4. The staff noted that the OE review did not identify pitting or crevice corrosion or cracking for aluminum and SS structural components exposed to air or condensation.

For SLRA AMR Item 3.5.1-052, the applicant stated that the corresponding item in the GALL-SLR Report is not applicable because there are no SS tank liners within the scope of SLR. The staff evaluated the applicant's claim against the criteria in SRP-SLR Section 3.5.2.2.2.4 and finds it acceptable because a search of applicant's SLRA and UFSAR confirmed that there are no SS tank liners exposed to standing water in the scope of SLR.

The applicant also stated that for AMR Item 3.5.1-099, the applicability is limited to SS support components exposed to air because there are no aluminum ASME Class 1, 2, 3 or MC support components. The staff noted that a search of the applicant's SLRA and UFSAR confirmed that no in-scope aluminum support components exposed to air or condensation are present in the ASME Class 1, 2, 3 or MC piping support systems, except for those SS components listed in SLRA Table 3.5.2-22 as associated with AMR Item 3.5.1-099.

In its review of components associated with AMR Item 3.5.1-099, the staff finds that the applicant has met the further evaluation criteria, and the applicant's proposal to manage the effects of aging for the applicable SS components using the ASME Section XI, Subsection IWF Program is acceptable because the use of periodic visual inspections to detect cracking and loss of material in SS structural support components will allow for degradations to be detected and corrective action to be taken prior to a loss of intended function.

The staff noted that the components associated with AMR Item 3.5.1-100 addresses the portion of the aluminum and SS supports for non-ASME code piping and components exposed to air or condensation. For the SLRA Table 2 AMR items associated with AMR Item 3.5.1-100 that cites generic Note E, the SLRA credits the Inspection of Water-Control Structures Associated with Nuclear Power Plants program to manage these aging effects for the SS trash rack filter at the CCW intake structure exposed to external air and the FERC Inspections of the Keowee Hydro Station Program to manage these aging effects for the SS trash rack filter at Keowee Hydro Station exposed to external air. The AMR item in SLRA Table 3.5.2-9 associated with AMR Item 3.5.1-100 cites plant-specific Note 3, which states that the trash rack filter of the intake structure includes the structural members and the structural bolting.

Based on its review of components associated with AMR Item 3.5.1-100 for which the applicant cited generic Note E, the staff finds that the applicant has met the further evaluation criteria, and the applicant's proposal to manage the effects of aging using the Inspection of Water-Control Structures Associated with Nuclear Power Plants program or the FERC Inspections of the Keowee Hydro Station Program is acceptable because the use of periodic visual inspections at a frequency of every 5 years for the SS trash rack filter under either program is consistent with the recommended AMPs by the GALL-SLR Report to ensure that the aging effects of cracking and loss of material can be detected and corrective action be taken prior to a loss of intended function.

In its review of components associated with AMR Item 3.5.1-100 for which the applicant cited generic Notes B or D, the staff noted that the SLRA credits the Structures Monitoring program to manage the aging effect for associated aluminum and SS components. Based on its review of the components, the staff finds that the applicant has met the further evaluation criteria, and the applicant's proposal to manage the effects of aging using the Structures Monitoring Program for the applicable non-ASME code aluminum and SS structural components is acceptable because the use of periodic visual inspections to detect cracking and loss of material in aluminum and SS structural support components will allow for degradations to be detected and corrective action to be taken prior to a loss of intended function.

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-SLR Section 3.5.2.2.2.4 criteria. For those AMR items associated with SLRA Section 3.5.2.2.2.4, the staff concludes that the SLRA is consistent with the GALL-SLR Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.2.2.5 Cumulative Fatigue Damage

SLRA Section 3.5.2.2.2.5, associated with SLRA Table 3.5.1, Item 3.5.1-053, indicates that the evaluation of fatigue for component support members, anchor bolts, and welds for Groups B1.1, B1.2, and B1.3 component supports are TLAAs as defined in 10 CFR 54.3 and are addressed in SLRA Section 4.3, "Metal Fatigue." The specific component support groups are the following: (1) Group B1.1, supports for ASME Code Class 1 piping and components; (2) Group B1.2, supports for ASME Code Class 2 and 3 piping and components; and (3) Group B1.3, supports for ASME Code Class MC components.

In its response dated January 7, 2022, to RAI 3.5.2.2.2.5-1, the applicant provided additional information regarding the metal fatigue in the component supports (ADAMS Accession Nos. ML21327A279 and ML22010A129). Specifically, the applicant clarified that the Group B1.1 component supports subject to a fatigue TLAA are the following supports: (1) reactor vessel support skirt, (2) steam generator base support, and (3) pressurizer support plate assemblies. The applicant also explained that these component supports are evaluated in SLRA Section 4.3.2, which addresses the fatigue TLAA for ASME Code Class 1 components.

SLRA Section 4.3.2 states that the effects of fatigue on the intended functions will be adequately managed by the Fatigue Monitoring Program for the subsequent period of extended operation. The staff's evaluations of SLRA Sections 4.3.2 (fatigue TLAA of ASME Code Class 1 components) and B3.1 (Fatigue Monitoring Program) are documented in Sections 4.3.2 and 3.0.3.2.28 of this SE, respectively. The staff finds that the use of the Fatigue Monitoring Program is acceptable to manage the effect of fatigue on the reactor vessel support skirt, steam generator base support, and pressurizer support plate assemblies because the Fatigue Monitoring Program will monitor the actual transient cycles to ensure that the CUF values do not exceed the design limit of 1.0 by performing corrective action as needed (e.g., repair/replacement of components and refinement of fatigue analysis).

In its response dated January 7, 2022, to RAI 3.5.2.2.2.5-1, the applicant also stated that the ONS CLB does not contain a fatigue analysis for Group B1.2 or B1.3 component supports, and therefore a TLAA is not required to be evaluated in accordance with 10 CFR 54.21(c) for these component supports (i.e., the supports for ASME Code Class 2 and 3 piping and components and the supports for ASME Code Class MC components).

In order to check if a CLB fatigue analysis exists for Groups B1.2 and B1.3 supports, the staff reviewed the following sections of the ONS UFSAR: (1) Section 3.0, "Design of Structures, Components, Equipment, and Systems"; (2) Section 4.0, "Reactor"; (3) Section 5.0, "Reactor Coolant System and Connected Systems"; (4) Section 6.0, "Engineered Safeguards"; (5) Section 9.0, "Auxiliary Systems"; and (6) Section 10.0, "Steam and Power Conversion System." In its review, the staff did not identify a CLB fatigue analysis for Groups B1.2 or B1.3 supports.

The staff also noted that each unit of ONS has a concrete containment with metal liner, as stated in SLRA Section 4.6.2, and therefore a fatigue analysis for supports of an MC (Group B1.3 supports) is not applicable to ONS. The staff further noted that a fatigue analysis for the metal liner of the concrete containment is separately addressed in SLRA Section 4.6.1. Accordingly, the staff's evaluation of the fatigue TLAA on the metal liner of the concrete containment is documented in Section 4.6.1 of this SE.

As discussed above, the staff finds the applicant's evaluation of cumulative fatigue damage for the component supports, including the response to RAI 3.5.2.2.2.5-1, acceptable in accordance with the guidance with SRP-SLR Section 3.5.2.2.2.5 because (1) the fatigue TLAA for Group B1.1 supports is evaluated in SLRA Section 4.3.2, which addresses the metal fatigue for ASME Code Class 1 components, (2) the use of the Fatigue Monitoring Program to manage cumulative fatigue damage for Group B1.1 supports is consistent with the guidance in SRP-SLR Section 4.3.2.1.1.3, and (3) there is no CLB fatigue analysis involving a time-dependent assumption for Group B1.2 or B1.3 supports.

3.5.2.2.2.6 Reduction of Strength and Mechanical Properties of Concrete Due to Irradiation

SLRA Section 3.5.2.2.2.6, associated with SLRA Table 3.5.1, AMR item 3.5.1-097, and allied SLRA Sections 3.5.2.2.2.2, 3.5.2.2.2.5, 4.3.2.1, B2.1.4, B2.1.30, and B3.1, as amended by ONS Supplements 2 and 3 and responses to staff's RAIs, summarizes the ONS Units 1, 2, and 3 further evaluation (FE) for the reduction in strength and mechanical properties of the RPV primary shield wall (PSW) and pedestal concretes, and for the integrity of the RV steel support skirt assembly (SSSA). The staff reviewed the applicant's proposal against the criteria in SRP-SLR Section 3.5.2.2.2.6, including gamma heating effects.

The SLRA states that the ONS PSW concrete surrounds the RV and extends upward from the reactor building floor to form the walls of the fuel transfer canal. The PSW concrete is 5 feet thick up to the height of the RV flange and 4.5 feet thereafter. The RV SSSA further described in SLRA Sections 2.3.1.1, 2.4.8.1, and 4.2 consists of the RV steel skirt and its weldments, bearing plates, and other SSSA components. The skirt and its flanges were fabricated separately and attached to each RV prior to site installation and anchorage to a reactor cavity concrete pedestal. Anchorage and support for the concrete pedestal include a grouted sole plate, a vertical bearing plate, plate anchoring nelson studs, shear pins, anchor bolts, washers, and hex nuts. These concrete and steel components are exposed to irradiation and its effects (neutron and gamma radiation and radiation-induced heating) in an air-indoor uncontrolled environment, which this FE addresses.

The applicant determined that for the described steel and concrete components, a plant-specific AMP is not required to manage the effects of aging due to fluence and gamma dose irradiation projected to 72 EFPY, determined to be equivalent to 80 years of plant operation or to the end of the subsequent period of extended operation. In its determination, the applicant used, and the staff audited (ADAMS Accession No. ML22045A053), plant-specific studies, historical B&W topical reports, and two SLRA-specific reports. The first, Framatome Topical Report ANP 3898 P/NP, Revision 0, "Framatome Reactor Vessel TLAA and Aging Management Review Input to the ONS SLRA," dated May 2021, was submitted as proprietary Enclosure 5 and non-proprietary Enclosure 4, Attachment 1, to the SLRA (ADAMS Accession Nos. ML21158A201 and ML21158A200 for proprietary and non-proprietary versions, respectively). The second audited proprietary report, "Oconee SLR Fluence and Gamma Heating Analyses Summary," dated July 2019, summarizes the neutron fluence and gamma dose calculations for the ONS concrete bio-shield or PSW, the RV support skirt welds, and the embedment in pedestal concrete.

The staff's review below addresses the level of exposure of PSW and RV pedestal concretes and RV SSSAs of ONS Units 1, 2, and 3 to fluence and gamma heating. It includes assessments, primarily of the effects of irradiation, of the structural integrity of the RV concrete and steel support system comprising the RV PSW and RV pedestal concretes and RV SSSA.

Fluence Evaluation on PSW - RV Pedestal Concretes and RV SSSAs

During the regulatory audit, the staff verified that the applicant used an acceptable calculational model for fluence and gamma dose analyses summarized in the "Analytical Methodology" subsection of SLRA FE 3.5.2.2.2.6. The staff noted that the model is consistent with the NRC-approved fluence analysis methodology documented in the generic topical report BAW-2241P-A using a discrete ordinate transport (DORT) 2-D methodology (ADAMS Package Accession No. ML18204A008) and follows the guidance presented in RG 1.190. The deterministic DORT 2-D methodology was used to estimate the exposure in the reactor air cavity above the RV skirt support to define the bounding fluence value for the PSW. Although the primary intended application for this method is to determine fluence for a typical RV beltline, i.e., the reactor pressure vessel surfaces where the neutron fluence greater than 1 mega-electron volt (E > 1 MeV) exceeds 1E+17 neutrons per square centimeter (n/cm2), the DORT 2-D transport methodology is valid for estimating both fluence and displacements per atom (dpa) in areas outside the reactor vessel, and also vertically near the center of the core midplane.

Appendix E to BAW-2241 provides an analysis of the database that Framatome, the methodology's vendor, used to qualify the methodology and estimate the uncertainties involved. This database includes ex-vessel dosimetry from other B&W plants as well. The inclusion of this type of dosimetry demonstrates that the fluence estimates for the PSW, with an estimated uncertainty consistent with Appendix E to BAW-2241P-A, are valid and hence acceptable.

It should be noted, however, that the RV SSSA is located below the active fuel region of the core. In this location, certain transport phenomena, such as cavity streaming effects, take on greater importance in the overall fluence determination and for conservatisms used in the analysis. For example, the dpa to the steel RV supports was determined by extrapolating the results from the bottom of the BAW-2241P-A model to the RV skirt transition forging weld (approximately 17.49 inches below the bottom of the model) using a curve fit to the dpa rate and neutron flux profiles at the outer RV surface in the air cavity region. The dpa at the RV skirt weld was assumed to be applicable to all of the steel support assembly and steel embedment materials. Furthermore, the calculated dpa to the steel support assembly and embedment materials was compared to the estimated dpa from Figure 3-1 of NUREG-1509 for each material using the irradiation-induced shift in the nil-ductility temperature (ΔNDTT), as estimated using the methodology described in Section 4.3.4.2 of NUREG-1509. The nil-ductility adjusted reference temperature (ART) at the end-of-life used in the calculation of ΔNDTT was conservatively assumed to be equal to the minimum calculated lowest service temperature (LST) of 139.05 °F (59.5 °C) for the RV support assembly and embedment.

Similarly, the fluence and gamma dose to the reactor vessel pedestal concrete and support embedment components and appurtenances were calculated through the extrapolation of the BAW-2241P-A fluence and gamma dose results to the RV skirt and skirt weld(s) using a curve fit to the neutron flux and gamma heating profiles at the outer RV surface in the air cavity region. The calculated neutronic results at the skirt weld(s) were conservatively assumed to be applicable to the concrete pedestal and support embedment components and appurtenances as well because there is no specific regulatory guidance to estimate the fluence and gamma dose and associated aging effects for these locations.

Section 9.4.4.1 of ANP-3898P/NP, Revision 0, "Framatome Reactor Vessel and RCP TLAA and Aging Management Review Input to the ONS SLRA," (Enclosure 5 to the SLRA for the proprietary version and Enclosure 4, Attachment 1, to the SLRA for the non-proprietary version) states that "[n]eutron fluence and gamma dose at 80-years (72 EFPY) are calculated using source terms that bound all three ONS units to provide bounding estimates for RPV support and the biological shield wall."

Because the degree of conservatism in the fluence estimates remained unclear, the staff requested that the applicant further explain its approach through RAI 3.5.2.2.2.6-4 so that it can reasonably conclude that the resulting downstream aging effects (e.g., loss of fracture toughness) were analyzed based on valid estimates of radiation exposure. In its response to RAI 3.5.2.2.2.6-4 by letter dated February 14, 2022 (ADAMS Accession Nos. ML22045A021 and ML22045A020 for non-proprietary and proprietary versions, respectively), the applicant provided comparative data between the source properties of peripheral fuel assemblies used in the fluence analysis to those observed from recent fuel cycles. The data demonstrated that the source properties assumed in the calculations for the peripheral assemblies would lead to a significantly stronger core leakage flux (both for neutron and gamma) than was reflected in recent cycle designs. In addition, the applicant stated that all three ONS units use low-leakage core designs to limit neutronic exposure to the RV, which provided assurance that similar trends would continue to occur throughout the subsequent period of extended operation. The applicant determined that the assumptions used for the core neutron source calculations would produce conservative fluence results approximately 2–3 times higher than the actual ONS core power distributions. The staff finds the applicant's justification of flux estimates acceptable because it used a core design that is conservative relative to the current low-leakage core design to estimate projected fluence to the end of the subsequent period of extended operation.

In RAI 3.5.2.2.2.6-5, the staff requested clarification on the conservatism in the assumption that the 5.53E-04 dpa value at the RV skirt to transition forging weld is applicable to all of the support assembly and embedment materials. In its response to RAI 3.5.2.2.2.6-5 (ADAMS Accession Nos. ML22045A021 and ML22045A020 for non-proprietary and proprietary versions, respectively), the applicant stated that it used measurement data from a series of 41-foot-long SS chains irradiated at different locations in the RV cavity region at Davis-Besse Nuclear Power Station to estimate the degree of conservatism in the ONS dpa valuation. The applicant used the measured activity of the chains as a function of location in order to estimate the expected reduction in neutron flux, and thus in the dpa, which was found to be decreased approximately by a factor of 2 from the skirt weld(s) to the embedment. Therefore, the assumption that the skirt weld(s) dpa is applicable to the steel support assembly and steel embedment materials results in estimates that are conservative by approximately a factor of 2. Similarly, the neutron fluence and gamma dose to the skirt weld(s) is assumed to be applicable to the pedestal concrete, so it can be expected that this degree of conservatism is present in the pedestal concrete results as well. The staff finds this methodology for estimating the dpa to be reasonable and conservative because it is based on actual measurements at Davis-Besse Nuclear Power Station, which is a B&W plant, as ONS is, and is therefore acceptable. The staff also finds the assumption that the neutron fluence and gamma dose at the skirt weld(s) to be equally applicable to the pedestal and conservative because the location of the pedestal is further away from the active fuel region where neutron and gamma fluxes are at maximum.

Additionally, the staff issued RCI 3.5.2.2.2.6-L regarding the concrete fluence and gamma heating on April 20, 2022 (ADAMS Accession Nos. ML22112A006 and ML22112A013 for non-proprietary and proprietary versions, respectively). In its response to RCI 3.5.2.2.2.6-L by letter dated May 11, 2022 (ADAMS Accession No. ML22131A023), the applicant confirmed that the gamma heating of the concrete was determined using the gamma dose calculated with BAW-2241P-A methods and the bounding core source term that is described above and in the response to RAI 3.5.2.2.2.6-4. The response to RCI 3.5.2.2.2.6-L also confirms that the gamma heating profile at the inside surface of the PSW concrete was applied without attenuation in the concrete heat transfer models, which is conservative because the amount of gamma irradiation and gamma heating would decrease as a function of concrete depth. The staff finds these modelling assumptions to be conservative and therefore acceptable.

The applicant demonstrated that the neutron fluence, gamma dose, and gamma heating analyses were based on conservative modeling assumptions that would produce results higher than reflected in actual plant operation. Therefore, the staff determined that the applicant established that adequate conservatism was incorporated into the fluence, gamma dose, and gamma heating analyses such that the staff could reasonably conclude that the downstream aging effects for the RV steel support assembly, steel embedment materials, pedestal concrete, and PSW concrete would be based on acceptable estimates of radiation exposure.

For energy levels E > 0.1 MeV at the inside surface of the reactor cavity concrete (or PSW concrete surface), the staff finds the SLRA 72 EFPY (or to the end of the subsequent period of extended operation) calculated maximal values for fluence and gamma dose of 9.36E18 n/cm^2 and 5.87E9 radiation absorbed doses (rads), respectively, acceptable, because (a) the reported values are less than the corresponding SRP-SLR limits of 1E19 n/cm^2 and 1E10 rads, and (b) they are based on NRC-approved fluence analysis methodology documented in the generic topical report BAW-2241P-A using the DORT-2 model and the conservatism discussed above. Similarly, the staff finds that at 72 EFPY, reported in ANP-3898 P/NP, Revision 0, the estimates for fluence and gamma dose of 1.63E18 n/cm^2 and 1.75E9 rads, respectively, at the concrete pedestal embedment are acceptable, because (a) these are less than the corresponding SRP-SLR limits of 1E19 n/cm^2 and 1E10 rads as well, and (b) they are estimated based on curve fitting extrapolates of neutron flux and gamma dose profiles from the outer RV surface in the air cavity region to a location that is conservative with regard to the fluence and gamma dose relative to the concrete pedestal embedment.

Integrity of RV PSW (Bioshield) and RV Pedestal Concretes Including Heating Effects

Concerned with the state of the PSW concrete, both currently and to the end of the subsequent period of extended operation, the staff sought, through several RCIs (ADAMS Accession No. ML21336A001), clarifications for its intended function, condition, integrity, and mix used for its construction as well as that for the construction of the RV concrete pedestal.
In RCI 3.5.2.2.2.6-E, the applicant confirmed that at ONS "[t]he reactor cavity concrete serves as a biological shield wall [BSW] (aka PSW)" and that "[t]here is no other material within the reactor cavity air gap that would be considered as part of the" BSW. In RCI 3.5.2.2.2.2.6-B, the applicant confirmed that all three ONS Units' PSWs and RV pedestals are constructed with 5,000 psi compressive strength concrete having crushed marble as coarse aggregate. In RCI 3.5.2.2.2.6-C, the applicant confirmed that the PSW concrete has a corrugated metal liner anchored to it and shows no signs of degradation. The staff notes that, to date, the sustained attachment of the steel liner to the PSW concrete exhibiting no deformation, bulging, or degradation indicates that the encapsulated PSW concrete continues to meet its intended function of shelter and protection.

The staff also noted that the SLRA states that the reactor cavity (or PSW) concrete does not provide a support function for the reactor coolant system and that the function of the RV pedestal is structural support upon which the RV SSSA transfers loads through a grout pad. In RCI 3.5.2.2.2.2.6-A, the applicant confirmed that the grout at the RV pedestal was in the scope of SLR and revised its SLRA Table 3.5.1 Item 3.5.1-055 to include, in addition to "Structures Monitoring" (SLRA Section B2.1.33, reviewed and evaluated in SE Section 3.0.3.2.22), the ASME Code Section XI, Subsection IWF AMP (SLRA Section B2.1.30, reviewed and evaluated in SE Section 3.0.3.2.20) to manage the effects of aging for the grout AMR item in SLRA Table 3.5.2-23.

From the review of the SLRA and during its regulatory audit, the staff noted that, to date, the applicant has not identified any plant-specific OE for reduction of strength and of mechanical properties of the PSW and RV pedestal concretes including embedment, the latter further reviewed and evaluated in "*Fracture Analysis via the Transition Temperature Approach*" below, due to radiation exposure.

With regard to thermal effects on concrete associated with the RV SSSA, the staff noted that SLRA Section 3.5.2.2.2.2 states that an analysis was performed to determine that the maximum concrete temperature of the PSW would not exceed 200 °F for local thermal loads. The staff noted that the SRP-SLR limits concrete temperature to 150 °F, including that used in BSW, such as the PSW, except for local areas allowed to have temperatures of up to 200 °F. However, as noted in EPRI Report 3002011710 (which assumes a generic RV air cavity temperature of 150 °F as the threshold temperature for further analyses for the effects of gamma heating on concrete) and outlined by Bruck et al. in "Structural Assessment of Radiation Damage in Light Water Power Reactor Concrete Biological Shield Walls," concrete exposed to radiation could undergo a temperature increase due to gamma dose thermal loading. In such instances, incident gamma rays and gamma production in the concrete by neutron capture could locally elevate the concrete temperature beyond the SRP-SLR established limit of 200 °F, at which point concrete's strength and modulus of elasticity will begin to reduce.

To this end, the staff audited the SLRA FE Section 3.5.2.2.2.2 referenced analysis, "Oconee Reactor Vessel Cavity Concrete," and concluded that for the reactor cavity temperature to remain within the SRP-SLR acceptable limits to the end of the subsequent period of extended operation, the applicant needed to credit the RV thermal insulation and include a relevant AMR line item in the SLRA. As a result of the regulatory audit, the applicant, by Supplement 2 dated November 11, 2021 (ADAMS Accession No. ML21315A012), revised SLRA Table 2.3.1-1, "Reactor Vessel," and SLRA Table 3.1.2-1, "Reactor Vessel, Reactor Internals, and Reactor Coolant System – Reactor Vessel – Aging Management Evaluation," to include the RV thermal insulation in the scope of the SLRA and added an AMR item (3.1.1-107) to the material/environment combination (addressed in SE Section 3.0.3.1.9). The staff finds the applicant's approach acceptable because the now in-scope RV thermal insulation helps reduce the effects of RV-originating elevated temperatures on the air cavity concrete, including that at the RV pedestal.

The staff, however, noted that Section 3.8.3.5 of the ONS UFSAR states that the "allowable concrete temperature at penetrations in the Primary Shield Wall" are limited to 400 °F. Noting that local areas of the RV air cavity concrete may still experience temperatures exacerbated by gamma heating far in excess of the SRP-SLR set limit of 200 °F, the staff requested that the applicant, through RAI 3.5.2.2.2.6-4, to clarify the conservatism of the bounding gamma dose source term estimate and, through RAIs 3.5.2.2.2.6-3 and 3.5.2.2.2.6-3A, to provide a summary of the concrete thermal analysis (and its conservatisms) referenced in SLRA

Section 3.5.2.2.2.2, leading to the determination that the air cavity concrete temperatures at PSW concrete penetrations remain within the 200 °F SRP-SLR set limit.

In its response to RAI 3.5.2.2.2.6-4, reviewed and evaluated in "*Fluence Evaluation on Concrete Walls and RV Steel Support Assembly"* above, and to RAIs 3.5.2.2.2.6-3 (identified by the applicant as 3.5.2.2.2.2-3) (ADAMS Accession Nos. ML22045A021 and ML22045A020 for non-proprietary and proprietary versions, respectively) and 3.5.2.2.2.6-3A (ADAMS Accession No. ML22206A005), by letters dated February 14, 2022, and July 25, 2022, respectively, the applicant discussed the various analyses performed and the conservatisms used in its assumptions to estimate the RV air cavity concrete temperature(s). In its review of applicant's response to RAI 3.5.2.2.2.6-3, the staff noted that the applicant performed heat transfer calculations on the most thermally stressed areas of concrete in the RV air cavity (i.e., in proximity to the RV hot leg and at the RV pedestal) to verify that they remain below the SRP-SLR set limits of 200 °F and to confirm that there are no adverse temperature effects exacerbated by gamma heating on the concrete strength and its modulus. The staff finds the temperature estimate at the PSW concrete surrounding the RV hot leg of less than the SRP-SLR set limit of 200 °F based on a 1-D model adequate because the analysis considered the salient features of the area geometry, materials, air flow, and prevalent cavity heating, including that from gamma exposure, which is noted above to be conservative and therefore acceptable.

In its review of the localized RV pedestal concrete temperatures described by the applicant in its response to RAI 3.5.2.2.2.6-3, the staff noted that **[[**[redacted]**]]** heat transfer analyses were performed using an "anchor bolts location" model and a "shear pin location" model. The "anchor bolts location" model calculations estimated localized temperature at the concrete pedestal to be less than the SRP-SLR limit of 200 °F. However, the "shear pin location" model calculated that the localized concrete pedestal temperature exceeded the SRP-SLR set limit of 200 °F by **[[**[redacted]**]]**. In its review of the applicant's response to RAI 3.5.2.2.2.6-3A, the staff noted the conservatism in modeling and in assumptions used in the **[[**[redacted]**]]** thermal analyses to help bound the localized concrete pedestal temperature estimates. These included area geometry, minimal cavity air flows, gamma heating rates at 80 years, zero gamma heating attenuation in concrete, and the average of measured ambient bulk air summer temperatures of the area. The staff finds the calculated upper and lower bound estimates of temperature at the RV concrete pedestal adequate because the applicant used an analytical methodology with conservative assumptions that considered the salient features of area geometry, position of the pedestal with respect to radiation exposure, constant radiation effects through the bulk of concrete, temperature differentials, high ambient temperatures, materials of construction, and accounting for uncertainties that typically result in calculated temperature estimates to be elevated. For these reasons, the risk that actual temperatures at the pedestal would exceed the SRP-SLR set limits is minimal, and hence the concrete pedestal strength and its modulus is expected to remain consistent with the CLB during the subsequent period of extended operation and is therefore acceptable.

The staff, therefore, finds that thermal effects on concrete at the pedestal and at the PSW hot-leg area warrant no further examination as there is reasonable assurance that the concrete in these areas will continue to fulfill its intended function without any potential reduction in its strength and mechanical properties due to the effects of radiation through the subsequent period of extended operation.

Based on its review of SLRA Section 3.5.2.2.2.6 as amended by Supplement 2 and the applicant's responses to the staff's concerns addressed in RCIs 3.5.2.2.2.6-A, 3.5.2.2.2.6-B, 3.5.2.2.2.6-C, 3.5.2.2.2.6-E, 3.5.2.2.2.6-F, and 3.5.2.2.2.6-L and RAIs 3.5.2.2.2.6-3, 3.5.2.2.2.6-3A, and 3.5.2.2.2.6-4, the staff finds that:

(a) The applicant met the intent of the SRP-SLR further evaluation criteria consistent with the GALL-SLR Report principles regarding the structural integrity of concrete for the PSW and RV pedestals for ONS Units 1, 2, and 3.

(b) The applicant met the SRP-SLR acceptance limits for estimated fluence and gamma dose values at the PSW and RV pedestal concrete surfaces based on a conservatively applied NRC-approved methodology.

(c) To date, the applicant has not identified plant-specific OE for reduction of strength and mechanical properties of concrete due to irradiation aging effects.

(d) The applicant manages the effects of aging—loss of material, deterioration, distress, cracking, and loss of bond for the air cavity structural concrete commodities—with the "Structures Monitoring" AMP which, in the case of pedestal grout, is further supplemented by the ASME Section XI, Subsection IWF AMP.

(e) The applicant has adequately addressed the staff's concerns related to all potential aging effects consistent with SRP-SLR and GALL-SLR Report principles regarding deterioration of PSW and RV pedestal concretes.

Therefore, based on the above, the staff finds acceptable the applicant's determination that a plant-specific program is not required to manage the aging effects of irradiation for the RV air cavity concretes (that of PSW and RV pedestal).

Conclusion. For the air cavity concrete that includes the PSW and the RV pedestal concretes associated with the evaluation in SLRA Section 3.5.2.2.2.6, as amended by SLRA Supplement 2, the staff concludes that a plant-specific AMP is not required to manage the effects of aging due to irradiation and, as such, the applicant's evaluation for PSW and RV pedestal concretes meets the SRP-SLR Section 3.5.2.2.2.6 criteria and its SLRA is consistent with the GALL-SLR Report. Further, the applicant has in place an AMP (Structures Monitoring Program) to manage the effects of aging, such as loss of material, deterioration, distress, cracking, and loss of bond, so that the intended function(s) of ONS Units 1, 2, and 3 PSW and RV pedestal concretes will be maintained consistent with the CLB during the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3).

Structural Integrity of RV SSSA (Skirt, Flanges, Plates, Connections, Embedment)

With regard to the integrity of the RV ASME Class 1 support (skirt) and its components and embedment, there are two aspects that need to be addressed, the structural evaluation aspect and the fracture analysis aspect, to conclude that there is reasonable assurance that the RV SSSA as a whole will continue to maintain its intended function and integrity consistent with the CLB during the subsequent period of extended operation.

3.A Structural Evaluation

With regard to the structural integrity of the RV SSSA and its components, the staff noted that several sections of the SLRA describe the integrated construction of the supports with the RVs while Supplement 3, dated December 15, 2021 (ADAMS Accession No. ML21349A005), addresses management of inaccessible component aging effects. SLRA Section 2.3.1.1 outlines the ONS B&W lower loop RV construction and states that it consists of a cylindrical steel shell with a removable reactor closure head bolted to its ring flange and of a spherical dished bottom head attached (welded) through a transition forging (i.e., dutchman) to a cylindrical support skirt. Table 2.3.1-1 of the SLRA identifies the function of the ASME Class 1 steel support skirt to be that of a structural support. Section 2.4.8.1 of the SLRA states that the support skirt is bolted to the concrete pedestal by means of an integral base plate and subject to aging management reviews.

ANP-3898P/NP, Revision 0, submitted as previously noted as Enclosures 5 and 4 to the SLRA, provides an evaluation of the RV steel support skirt and its weldments. Accordingly, SLRA Section 3.5.2.2.2.6 determines that the RV skirt "support assembly … is not susceptible to irradiation embrittlement based on … NDT evaluation … [and that the RV] support intended function will be maintained consistent with the CLB during the subsequent period of extended operation when considering damage due to irradiation."

As initially stated, the staff audited pertinent documents and examined relevant UFSAR sections and docketed information to evaluate the applicant's determination of the structural adequacy of the RV SSSA and ensure that the applicant manages the effects of aging for the ASME Class 1 RV SSSA consistent with 10 CFR 54.21(a)(3) sufficiently so that it will continue to meet its intended function for the subsequent period of extended operation. In its review, the staff noted that, historically, the applicant experienced difficulties and identified the impracticality of inspecting the skirt to the RV dutchman weldments. To this end, the applicant requested a relief from the ISI requirements of ASME Section XI 1974 Code Edition (with addenda through Summer 1975), Table IWB-2600, Item B1.12, "Volumetric Examination for the Reactor Vessel Support Skirt." The relief was granted (ADAMS Accession Nos. ML15238A569 and ML15238A620) with the stipulation that surface examination was to be performed from either the inner or the outer surface of the skirt to ensure the integrity of the support skirt structural weldments.

The applicant followed up with a second relief request from the ASME Section XI 1980 Code Edition (with addenda through Winter 1980) IWF VT-3 ISI examination requirements for the RV support skirt welds in 1986 (ADAMS Accession No. ML15244A153). The last relief request on record was for the fourth 10-year ISI interval (RR 15-ON-004), dated July 15, 2015 (ADAMS Accession No. ML15201A573). The request was made for limited ISI IWF VT-3 examinations of each Unit's RV support skirt from the ASME Section XI 1998 Code Edition with 2000 addenda requirements. It specifically addressed exclusion of RCS RV SSSA welds 1-RPV-WR36, 2-RPV-WR36, and 3-RPV-WR36 inspections from IWF-2500, Table IWF-2500-1, Examination Category F-A, F1.40 IWF VT-3 ISI requirements. For applicable examination boundaries, the relief referenced ASME Code Section XI Figure IWF-1300-1(c) and proposed a skirt surface visual examination coverage of 66.5 percent, which the staff found acceptable in the relief request SE (ADAMS Accession No. ML16004A262).

During the regulatory audit, the staff reviewed RR 15-ON-004 and the corresponding NRC SE and further examined the results of the fourth 10-year interval ASME Section XI, Subsection IWF ISI for the RV SSSA. The staff noted that although the ISIs for all three ONS Units' RV support skirts addressed the same inspections areas in similar environments, the results for the IWF VT-3 examinations differed. Noting the disparity of the results for the three NDE ONS Units' RV SSSAs, the staff audited the applicant's NDE-91, "NDE Procedures Manual, Volume 1, Reporting Coverage During PreService and InService Inspection." The staff noted, and subsequently the applicant confirmed through RCI 3.5.2.2.2.6-D (ADAMS Accession No. ML21336A001), that the differences in the inspection results were due to changes made to its inspection procedure "NDE-91" acceptance criteria over the course of its fourth 10-year ISI interval.

As noted in BAW-2251, "Demonstration of the Management of Aging Effects for the Reactor Vessel" (ADAMS Accession No. ML20115B833), the most susceptible locations for flaw initiation and growth in a welded structure are its joints that exhibit varied mechanical properties across base and weld metals (weldments). While an increase in strength weld metal yielding occurs outside the welded joint, a lower toughness could result in weld metal cracking and hence in a reduced ability for the structure, and in this case for the RV SSSA, to support loads. With regard to the inability of the applicant to perform the required ASME Code Section XI IWF ISIs of ONS Units 1, 2, and 3 WR36 skirt to dutchman welds to date to the fullest, the staff requested, through RAI 3.5.2.2.2.6-1, that the applicant describe measures taken and to be taken to ensure the structural integrity of weldments and whether the effects of aging will be adequately managed to the end of the subsequent period of extended operation.

In its response to RAI 3.5.2.2.2.6-1 (ADAMS Accession Nos. ML22045A021 and ML22045A020 for non-proprietary and proprietary versions, respectively), the applicant stated that each welded RV SSSA was fabricated in accordance with ASME Code Section III (1965 Edition, through Summer 1967 addenda) and B&W specifications. The applicant stated that the WR36 welds underwent rigorous volumetric and surface examinations and inspections to identify potential inclusions and to repair potential defects. It also stated that to minimize effects of [[redacted]]. In addition, the applicant stated that ONS QA packages include results of a preservice volumetric examination of the WR36 welds that shows the absence of recordable indications or reportable defects.

The applicant stated that its NRC-authorized relief RR 15-ON-004 from ASME Section XI Subsection IWF-2500, Examination Category F-A, Item F1.40, was requested even though the WR36 welds were inspectable in part and continue to be so. The partial inspection, the applicant stated, serves as an indicator of potential aging effects for all WR36 weldments. The applicant then stated that degradations spotted on 66.5 percent of the required IWF-2500 surface examination area, which includes a small portion of the WR36 welds augmented with additional inspections of visible sections and accessible areas of RV SSSA, in the absence of a "bounding degradation," would bound the degradation that may develop. Furthermore, the applicant stated that any observable deficiencies would be addressed through its corrective actions program of ASME Section XI, Subsection IWF, and Boric Acid Corrosion AMPs (SLRA Sections B2.1.30 and B2.1.4 respectively, reviewed and evaluated in SE Sections 3.0.3.2.20 and 3.0.3.1.2) and for cumulative fatigue damage as a TLAA through the Fatigue Monitoring AMP (SLRA Section B3.1, reviewed and evaluated in SE Section 3.0.3.2.28).

Because of the existence of several audited action reports (ARs) reviewed during the regulatory audit (ADAMS Accession No. ML22045A053), the staff further scrutinized the term "bounding degradation" stated by the applicant in its response to RAI 3.5.2.2.2.6-1. Due to a lack of clarity on whether the term may indicate a numerical value considered as a starting point for managing the effects of aging for loss of material due to leakage or of airborne boric acid, through the follow-up RAI 3.5.2.2.6-1A, the staff requested further clarifications to assess steps that are being taken or are to be taken so that the RV SSSA structural integrity, and in particular that of the WR36 welds, remains intact.

In its response to RAI 3.5.2.2.6-1A (ADAMS Accession No. ML22206A005), the applicant stated that the acceptance criteria for VT-3 examinations performed in accordance with IWF-2520, Table IF-2500-1, Item F1.40, do not include a specific numerical value. The applicant also stated that "bounding degradation" is a "qualitative judgement" term it used in the response to RAI 3.5.2.2.2.6-1 to help describe the potential loss of material in inspectable regions of the highest susceptibility bounding those of difficult or impossible to access or inspect areas of the RV SSSA and its anchorage and embedment. Relevant inspections of inspectable areas, the applicant stated, include sections of the WR36 welds after the removal of portions the RV reflective metal insulation. Furthermore, the applicant noted that its Supplement 3 enhanced its ASME Section XI, Subsection IWF AMP for periodic evaluations of inaccessible areas of supports that are encased in concrete, grout, or covered by insulation by considering prevalent conditions in accessible areas. For boric acid examinations, the applicant stated that it includes visual inspections to identify boric acid residues and corrective actions taken for their removal as well as further examination of surrounding areas of pathways where leakages are detected.

With regard to "bounding degradation" associated with the RV SSSA baseline condition for the additional aging effect of cumulative fatigue damage, the staff expressed a similar concern and noted that the SLRA AMP B3.1 has no discussion to bound cyclic loading in fatigue analyses or the fatigue waiver evaluations for the RV SSSA, including its WR-36 welds. The staff was also unclear about whether such a fatigue analysis (or fatigue waiver evaluation) for the skirt and welds considered the effects of the boric acid corrosion, if any, in the definition of "bounding degradation."

In its response to RAI 3.5.2.2.6-1B (ADAMS Accession No. ML22206A005), the applicant stated that the fatigue life of RV SSSA, including its skirt, was determined in accordance with the requirements of the 1965 Edition of ASME Boiler and Pressure Vessel (B&PV) Code, Section III, with addenda through Summer 1967. The applicant then restated that "bounding degradation" refers to areas of highest susceptibility for loss of material bounding those of lower susceptibility and that design cycles and thermal conditions set by a component's design specification defines its ability to withstand cyclic loading without failure expressed in terms of fatigue usage factors further discussed in part in SLRA Section 4.3.2.1 (reviewed and evaluated by the staff in SE Section 4.3.2.1). For the case of the RV SSSA, the applicant stated that the Fatigue Monitoring AMP monitors its cyclic loading and hence its cumulative usage or the fatigue damage aging effect. The applicant then concluded that implementation of the Fatigue Monitoring AMP, in concert with the ASME Section XI, Subsection IWF, Boric Acid Corrosion AMPs, will "utilize the corrective action program to address conditions adverse to quality, thus providing reasonable assurance that identified aging effects will be adequately managed so that the intended function of the RV skirt assembly will be maintained consistent with the CLB during the subsequent period of extended operation."

The staff finds the response to RAIs 3.5.2.2.2.6-1, 3.5.2.2.6-1A, and 3.5.2.2.6-1B acceptable to ensure that the RV SSSA and its WR36 welds continue to fulfill their intended functions to the end of the subsequent period of extended operation for the following reasons: (a) the applicant had taken adequate measures during fabrication of the RV with its welded skirt to rule out potential future performance issues that could have occurred to this Class 1 support; (b) to date, there is no OE for loss of material due to boric acid corrosion or for any of the unacceptable conditions identified in ASME Section XI IWF-3410 requirements during past ISI examinations that would indicate compromised performance for the RV SSSA Class 1 support or its fatigue damage; (c) the "indirect symptomatic evidence" presented by the applicant and discussed in BAW-2251 of partial ASME Code Section XI IWF ISI examinations of the RV SSSA for managing the effects of aging and degradation due to potential loss of material and cyclic loading is reasonably adequate and therefore acceptable.

With regard to AMR for the RV SSSA "Support Skirt" component in SLRA Table 3.1.2-1, the staff noted that for the loss of material aging effect in an air-indoor uncontrolled environment, the table, as submitted, aligned its ASME Code Section XI ISIs with those of ASME Subsections

IWB, IWC, and IWD or with SLRA AMP B2.1.1. The staff also noted that the AMR alignment was consistent with aspects of the first ONS ASME Code Section XI relief request discussed above, but not with the current ASME Code Section XI IWF ISI requirements addressed in part in RR 15-ON-004. Accordingly, the staff, through RAI 3.5.2.2.2.6-2, requested a clarification as to why the SLRA Table 3.1.2-1 AMR indicated that, for ASME Class 1 RV SSSA, "[n]either the component nor the material and environment combination is evaluated in NUREG-2191" while noting the needed compliance with ASME Code Section XI Subsection IWF. In its response to RAI 3.5.2.2.2.6-2, the applicant revised the SLRA table, which the staff finds acceptable because it aligns its inspection and management of aging effects for the RV SSSA loss of material "in an air indoor uncontrolled (external)" environment consistent with the GALL-SLR XI.S3 guidance that also incorporates the requirements of ASME Code Section XI Subsection IWF.

With regard to the RV SSSA anchorage to the concrete pedestal, the staff notes the applicant's response to RAI B2.1.30-1 (ADAMS Accession No. ML22045A021), dated February 14, 2022, stating that, to date, no ASTM A490 RV anchorage bolts/rods had shown signs of cracking and that ONS, consistent with the GALL-SLR XI.S3 guidance, is committed to performing volumetric inspections for a sample of bolts/rods as indicative of conditions existing for those at RV anchorage during the subsequent period of extended operation. The staff's review and acceptability of the RAI B2.1.30-1 and review and evaluation of the relevant AMP B2.1.30, ASME Section XI, Subsection IWF are in SE Section 3.0.3.2.20.

The staff therefore finds that there is reasonable assurance that the structural integrity of the RV SSSA will be maintained and that such components as the RV skirt, flanges, plates, connections, and embedment will continue to fulfil their intended functions without any potential reduction in their loadcarrying ability, consistent with the CLB as required by 10 CFR 54.32(a)(3) to the end of the subsequent period of extended operation.

With regard to the AMR for the RV SSSA "Support Skirt" component in SLRA Table 3.1.2-1, the staff noted that the table also showed that, for this component, there was no aging effect in an air-indoor uncontrolled environment. Hence, no AMP was assigned to the component because it "is not susceptible to irradiation embrittlement based on the NDT evaluation," as noted in the SLRA. In its review of the AMR, the staff noted that the applicant identified that the nil-ductility temperature (NDT [RTNDT]) analysis for the RV support skirts demonstrated that these "are not susceptible to an aging effect and mechanism combination of loss of fracture toughness due to neutron irradiation embrittlement." The staff's review for this AMR item is in SE Section 3.1.2.3.2. The staff's review and evaluation for the fracture toughness of RV SSSA is below.

3B. Fracture Analysis via the Transition Temperature Approach

In the subsection titled "Reactor Vessel Support Steel Evaluation" of SLRA Section 3.5.2.2.2.6, the applicant addressed its further evaluation related to the effects of reduction of fracture toughness due to neutron irradiation embrittlement of ONS Units 1, 2, and 3 RV SSSAs and embedment. The various components comprising the RV SSSAs and embedment include the RV support skirt, the RV support flange, and embedment, including the anchor bolts (including nuts and washers), sole plate, vertical bearing plate, and nelson studs.

The SLRA states that the RV support skirt, RV support flange, and anchor bolts (including nuts and washers) were determined to support the RV intended function of providing structural support for the RV and that these structural steel components were subject to evaluation for susceptibility to irradiation embrittlement using the transition temperature approach in

NUREG-1509. By letter dated February 14, 2022, the applicant, in its response to RAI 3.5.2.2.2.6-7 Request 1 (ADAMS Accession Nos. ML22045A021 and ML22045A020 for non-proprietary and proprietary versions, respectively), included the sole plate, vertical bearing plate, and associated nelson studs in its RV SSSA list of components providing structural support to the RV and noted the need for these components to be evaluated for susceptibility to reduction of fracture toughness due to irradiation embrittlement.

<u>Transition temperature evaluation</u>

SLRA Section 3.5.2.2.2.6 references report ANP-3898P/NP, Revision 0, for the evaluation of the RV SSSAs (including welds) and anchor bolts (including nuts and washers) for susceptibility to reduction of fracture toughness by irradiation embrittlement. The report describes the shear pins as part of the RV support flange and includes these shear pins in the evaluation for susceptibility to reduction of fracture toughness by irradiation embrittlement.

Section 9.0 of ANP-3898P/NP, Revision 0, implements the transition temperature approach methodology of NUREG-1509 for the evaluation of the RV SSSAs, anchor bolts, and shear pins for susceptibility to reduction of fracture toughness by irradiation embrittlement. The applicant included the susceptibility evaluation of the sole plate, vertical bearing plate, and associated nelson studs in its response to RAI 3.5.2.2.2.6-7 Request 2 in the letter dated February 14, 2022. The main concept in the transition temperature approach is to demonstrate that the NDT at 72 EFPY of a component, with an additional margin to account for uncertainties in initial temperature estimation and in radiation exposure, would be less than the LST for the component, thereby demonstrating that a component is not susceptible to reduction of fracture toughness by irradiation embrittlement. The applicant implemented the transition temperature approach by calculating the value of the shift in NDT (ΔNDTT) needed to reach the LST and estimating from this value the corresponding radiation-induced damage value expressed in dpa for the components and embedment of the RV SSSAs that would be compared to the projected dpa values for the component.

The results of the applicant's transition temperature evaluation for the RV SSSAs, anchor bolts, and shear pins are provided in Tables 9-6 and 9-7 of ANP-3898P/NP, Revision 0, which show the estimated dpa values corresponding to the ΔNDTT needed to reach the "minimum" LST compared to the corresponding projected 72 EFPY dpa values. The results of the applicant's transition temperature evaluation for the sole plate, vertical bearing plate, and associated nelson studs are included in the response to RAI 3.5.2.2.2.6-7 Request 2. In Section 9.4.4.3 of ANP-3898P/NP, Revision 0, and in the response to RAI 3.5.2.2.2.6-7 Request 2, the applicant stated that the projected 72 EFPY dpa values for the RV support flange and nelson studs for all three ONS Units, and the RV support flange welds for ONS Units 1 and 2, are greater than the estimated dpa value corresponding to the ΔNDTT needed to reach the "minimum" LST for these components. The applicant stated that, per the results of the transition temperature evaluation, the RV support flange and nelson studs of ONS Units 1, 2, and 3 and the RV support flange welds of ONS Units 1 and 2 are potentially susceptible to reduction of fracture toughness by irradiation embrittlement at 72 EFPY of operation. The applicant also stated that all remaining components of the RV SSSAs and steel components of the RV embedment that perform the RV support intended function were determined not to be susceptible to reduction of fracture toughness by irradiation embrittlement.

The staff reviewed the applicant's transition temperature evaluation as described in SLRA Section 3.5.2.2.2.6, ANP-3898P/NP, Revision 0, and the responses to RAI 3.5.2.2.2.6-7. Specifically, the staff reviewed the applicant's determination of the following four parameters for the RV SSSAs and embedment: (1) initial NDT values with associated margin, (2) “minimum” LST value, (3) estimated dpa values corresponding to the ΔNDTT needed to reach the “minimum” LST, and (4) dpa value projected to 72 EFPY.

In Section 9.4.4.3 of ANP-3898P/NP, Revision 0, the applicant included initial NDT values with the associated margin of the RV SSSAs, anchor bolts, and shear pins. In the response to RAI 3.5.2.2.2.6-7 Request 2, the applicant also included initial NDT values with associated margin of the sole plate, vertical bearing plate, and nelson studs. However, based on the regulatory audit, the staff noted that the initial NDT values with associated margins were not plant-specific values. In RCIs 3.5.2.2.2.6-H and 3.5.2.2.2.6-I, included in the letter dated December 2, 2021 (ADAMS Accession No. ML21336A001), the applicant confirmed that there were no plant-specific measured values of initial NDT of the evaluated steel components, and that the initial NDT values and corresponding margins originated from NUREG-1509 and BAW-10046A, “Methods of Compliance with Fracture Toughness and Operational Requirements of 10 CFR 50, Appendix-G,” Revision 2 (ADAMS Accession No. ML20207G642). In its response to RAI 3.5.2.2.2.6-10, by letter dated July 25, 2022 (ADAMS Accession Nos. ML22206A005), the applicant restated that the components of the RV SSSAs of the ONS Units were fabricated in accordance with the design specifications of ASME Code Section III, 1965 Edition (through Summer 1967 addenda) and that the components complied with the specifications. The applicant explained that because of the significant differences between the current and 1965 editions of the ASME Code Section III, especially with regard to fracture toughness testing requirements, it is not possible to derive initial NDT values of the RV SSSA components with the data collected based on the ASME Code Section III, 1965 Edition. The applicant, therefore, obtained values of initial NDT from NUREG-1509 and BAW-10046A, Revision 2, and used these as the initial NDT values of the RV SSSA components for all three ONS Units. The staff reviewed the initial NDT values from NUREG-1509 and BAW-10046A, Revision 2, and finds the applicant’s use of these values acceptable because they are conservative and are for the material type that corresponds to the material of the RV SSSA components of the ONS Units.

In Section 9.4.3 of ANP-3898P/NP, Revision 0, the applicant determined the “minimum” LST for the RV SSSAs, including their anchor bolts/rods and shear pins. In its response to RAI 3.5.2.2.2.6-7 Request 2, the applicant included the “minimum” LST values for the sole plate, vertical bearing plate, and nelson studs. Based on the audit, the staff noted that potential air circulation through the 9.25-inch ventilation holes in the RV support skirt, although useful for inspections as noted earlier, could affect the “minimum” LST value determined in Section 9.4.3 of ANP-3898P/NP, Revision 0, especially in the region of the RV support skirt below the ventilation holes. In RCI 3.5.2.2.2.6-K, included in the letter dated December 2, 2021 (ADAMS Accession No. ML21336A001), the applicant confirmed that air circulation through the 9.25-inch ventilation holes in the RV support skirt was considered in determining the “minimum” LST and that the air circulation does not affect its value. In ANP-3898P/NP, Revision 0, the applicant explained that temperature contours of the reactor RV SSSAs of the ONS Units were developed using finite element analysis (FEA) models, **[[** [redacted] **]]**, to determine the “minimum” LST value. Furthermore, in its response to RAI 3.5.2.2.2.6-9 included in the letter dated July 25, 2022 (ADAMS Accession Nos. ML22206A005), the applicant described the conservatisms used in the analyses for determining the minimum LST value. In its response to RAI 3.5.2.2.2.6-7A, the applicant clarified that the LST value determined in the response to RAI 3.5.2.2.2.6-7 Request 2 for the nelson studs was based on the temperature contour from the most conservative model for thermal calculations performed. The staff finds the “minimum” calculated LST value described in Section 9.4.3 of ANP-3898P/NP, Revision 0, and in responses to

RAIs 3.5.2.2.2.6-7 Request 2, 3.5.2.2.2.6-7A, and 3.5.2.2.2.6-9 acceptable because air circulation through the 9.25-inch ventilation holes in the RV support skirt was considered in determining the LST, as well as other conservatisms, e.g., gamma heating was neglected and maximum cavity ventilation airflow was assumed. The staff concludes that these assumptions would ensure a "minimum" LST, and therefore its value is acceptable.

In Section 9.4.4.3 of ANP-3898P/NP, Revision 0, the applicant estimated the dpa values corresponding to the ΔNDTT needed to reach the "minimum" LST. These dpa values are reported in Tables 9-6 and 9-7 of ANP-3898P/NP, Revision 0, for the RV SSSAs, anchor bolts/rods, and shear pins and those reported for the sole plate, vertical bearing plate, and nelson studs in its response to RAI 3.5.2.2.2.6-7 Request 2. Using the initial NDT values (and associated margins) and "minimum" LST values discussed above, the staff verified the applicant's estimated dpa values corresponding to the ΔNDTT needed to reach the "minimum" LST and determined them to be acceptable because they are based on the upper bound curve in Figure 3-1 of NUREG-1509, which shows ΔNDTT as a function of dpa.

Section 9.4.4.1 of ANP-3898P/NP, Revision 0, discusses the projected 72 EFPY dpa value of 5.53E-04 for the RV SSSAs' components and embedment. In RCI 3.5.2.2.2.6-G, included in the letter dated December 2, 2021 (ADAMS Accession No. ML21336A001), the applicant clarified that the location of the projected 72 EFPY dpa value of 5.53E-04 is approximately 1.75 inches above the top of the WR36 weld that connects the transition forging to the RV support skirt, and in RCI 3.5.2.2.2.6-J (ADAMS Accession No. ML21336A001), the applicant confirmed that the transition forging-to-skirt weld (WR36) falls under the examination requirements for RV supports in Division 1 ASME Code Section XI, Subsection IWF (illustrated in Figure 3.5.2.2.2.6-1-1 in its response to RAI 3.5.2.2.2.6-1, reviewed and dispositioned in "*Structural Integrity of RV SSSA (Skirt, Flanges, Plates, Connections, Embedment / Structural Evaluation)*" above. These RCIs clarify that the WR36 transition forging-to-skirt weld is the upper boundary of the RV SSSAs. Therefore, the evaluated RV SSSAs' components and embedment in their entirety are below the location of the projected 72 EFPY dpa value of 5.53E-04. Hence, all of the RV SSSAs and embedment are expected to have exposure damage levels lower than that of 5.53E-04 dpa noted for the WR36 because these components and embedment are farther away from the reactor core. Furthermore, as discussed in "*Fluence Evaluation on Concrete Walls and RV Steel Support Assembly*" above, the applicant estimated that the exposure level of 5.53E-04 dpa is conservative by a factor of 2 with respect to the exposure level at the RV embedment locations. Based on this discussion, the staff finds the projected 72 EFPY dpa value of 5.53E-04 for the RV SSSAs and embedment conservative and therefore acceptable.

Based on the review above, the staff determined that the applicant's use and implementation of the transition temperature methodology, as described in NUREG-1509, is acceptable. Based on comparisons of the estimated dpa values corresponding to the ΔNDTT needed to reach the "minimum" LST with the projected 72 EFPY dpa value, the staff verified the applicant's determination that the RV support flanges and nelson studs for all three ONS Units and the RV support flange welds of ONS Units 1 and 2 need further evaluation. These components were shown to be potentially susceptible to reduction of fracture toughness by irradiation embrittlement, and as such, their further evaluation is discussed in the sections below. Additionally, the staff finds acceptable the applicant's similar dpa comparisons, as above, for the determination that all remaining steel components of the RV SSSA components and embedment that perform the RV support intended functions are not susceptible to reduction of fracture toughness by irradiation embrittlement because the 72 EFPY dpa value of 5.53E-04 is less than the estimated dpa values corresponding to the ΔNDTT needed to reach the "minimum" LST.

Further evaluation of the RV support flanges and RV support flange welds

Section 9.4.5 of ANP-3898P/NP, Revision 0, evaluates the RV support flanges for all ONS Units and the RV support flange welds for ONS Units 1 and 2. These components were determined to be potentially susceptible to reduction of fracture toughness by irradiation embrittlement at 72 EFPY of operation. In Section 9.4.5 of ANP-3898P/NP, Revision 0, the applicant stated that the RV support flange is anchored to the concrete with 48 bolts/rods equally spaced around the outside of the flange, and with 48 bolts/rods equally spaced around the inside part of the flange. The applicant also stated that the faulted load reduction considering the leak-before-break (LBB) of the primary RCS piping is approximately one-quarter of the original design loads. The applicant stated that this approach would significantly reduce the faulted stress intensities in the RV support skirt and RV support flange. Additionally, the applicant stated in Section 9.4.5 of ANP-3898P/NP, Revision 0, that the RV support skirt (not the RV support flange and its associated welds) is the most stressed item in terms of design stresses.

In Section 9.4.2 of ANP-3898P/NP, Revision 0, the applicant compared the proprietary design stress values with the corresponding allowable stress values. The applicant's responses to RAI 3.5.2.2.2.6-7 Request 3 and RAI 3.5.2.2.2.6-8, included in the letter dated February 14, 2022, clarified that the design stresses that were evaluated in Section 9.4.2 of ANP-3898P/NP, Revision 0, were limited to RV support skirt steel members and their locations. The aforementioned RAIs augmented the components for evaluation to include the sole plate, vertical plate, and nelson studs and explained the critically stressed locations due to asymmetric loads resulting from postulated loss-of-coolant accident (LOCA) of primary piping line breaks determined in BAW-1621 (Reference 4.7-9 of the SLRA, ADAMS Accession No. ML19320B058) and BAW-1621, Supplement 1 (Reference 4.7-10 of the SLRA, ADAMS Accession No. ML20009B628), which are part of the CLB for the ONS Units. In a 1983 NRC SE (ADAMS Accession No. ML15238A804), the staff determined the critically stressed locations due to asymmetric LOCA loads determined in BAW-1621 and BAW-1621 Supplement 1 to be acceptable.

The staff reviewed the applicant's acceptability evaluation of the RV support flanges of the ONS units and the RV support flange welds of ONS Units 1 and 2 as described in the last paragraph of SLRA Section 3.5.2.2.2.6 and Section 9.4.5 of ANP-3898P/NP, Revision 0. With regard to the configuration of the RV support skirt/flange assembly, the staff determined that the RV support flanges (and associated welds) would remain intact and secure should they crack as a result of irradiation embrittlement because the 96 anchor bolts/rods provide ample anchorage to the concrete pedestal.

With regard to the RV support skirt being the most vulnerable part of the fracture-critical member, the staff confirmed, through a review of BAW-1621, BAW-1621 Supplement 1, and the 1983 NRC safety evaluation of these documents, that (1) the postulated LOCA loads in BAW-1621 and BAW-1621 Supplement 1 are from guillotine breaks of the hot-leg and cold-leg piping, i.e., the main RCS piping; and (2) the evaluation in these two documents does not invalidate the determination that the RV support skirt will continue to be the critical component of the RV SSSA.

With regard to reduction of loads due to consideration of LBB of the RCS piping, the staff confirmed that the applicant has evaluated the main RCS piping at the ONS Units for LBB, as documented by the applicant in BAW-1847, Revision 1 (Reference 4.7-29 of the SLRA, ADAMS Accession No. ML20138R230). The staff's safety evaluation of BAW-1847, Revision 1 is found in ADAMS Accession No. ML20138M389. In SLRA Section 4.7.4, "Leak Before Break Analysis for Reactor Coolant System Piping," as amended by its response to RAI 4.7.4-1 included in the letter dated February 21, 2022 (ADAMS Accession No. ML22052A002), the applicant clarified that the LBB analysis in BAW-1847, Revision 1, has been projected to the end of the subsequent period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii). The staff's evaluation of SLRA Section 4.7.4 is in SE Section 4.7.4. The staff finds this consideration acceptable because the LBB approach for the main RCS piping and LOCAs from guillotine breaks of piping smaller than the main RCS piping would significantly reduce the loads, and hence the resulting stresses, in the RV SSSAs and embedment, including the support flange components.

Furthermore, the conservatisms in the determination of the LST value as discussed in the supplemental response to RAI-3.5.2.2.2.6-9, included in the letter dated July 25, 2022, and the projected 72 EFPY dpa value of 5.53E-04, which is conservative by a factor of 2 as evaluated by the staff in "Fluence Evaluation on Concrete Walls and RV Steel Support Assembly" above, provide an additional margin against reduction of fracture toughness of the RV support flanges and the RV support flange welds.

Based on the discussion above, the staff finds that the applicant's further evaluation of the RV support flanges (all three ONS Units) and the RV support flange welds (ONS Units 1 and 2) for potential susceptibility to reduction of fracture toughness by irradiation embrittlement is acceptable because (1) there is a reasonable assurance that the RV SSSA welded support flanges are amply secured by 96 anchor bolts/rods to the concrete pedestal; (2) the stresses in the RV support flanges and RV support flange welds are not limiting and would be reduced following reconsideration of the LBB analysis of the main RCS piping as noted above, which has been projected to the end of the subsequent period of extended operation; and (3) the conservatisms in LST values and the projected 72 EFPY dpa value of 5.53E-04 provide an additional margin against reduction of fracture toughness of the RV support flanges and the RV support flange welds.

Further evaluation of the nelson studs

In its response to RAI 3.5.2.2.2.6-7 Request 2, the applicant evaluated the nelson studs for reduction of fracture toughness by irradiation embrittlement at 72 EFPY of operation. Specifically, the applicant described a hypothetical scenario that could create stress in the nelson studs but concluded that with LBB of the primary piping, the loads (and therefore the stress) on the nelson studs for this scenario are expected to be insignificant and have no impact on the RV support intended function.

The staff reviewed the applicant's further evaluation of the nelson studs as described in the response to RAI 3.5.2.2.2.6-7 Request 2. The staff finds that the hypothetical scenario that the applicant described that could create insignificant stress in the nelson studs is acceptable for these reasons: (1) consideration of LBB of the main RCS piping would reduce the loads on the nelson studs because LOCAs from guillotine breaks of piping smaller than the main RCS piping would reduce the loads in the RV steel support components that include the nelson studs, and (2) the conservatisms in LST values and the projected 72 EFPY dpa value of 5.53E-04 provide an additional margin against reduction of fracture toughness of the nelson studs, as summarized in responses to RAIs 3.5.2.2.2.6-7A and 3.5.2.2.2.6-9. Based on these two considerations, the staff finds acceptable the applicant's further evaluation of the nelson studs of all three ONS Units for potential susceptibility to reduction of fracture toughness by irradiation embrittlement.

Overall conclusion on the RV SSSA structural integrity

Based on the staff's review of SLRA Section 3.5.2.2.2.6, its enclosures, and amendments by:

- Supplement 3
- Responses to:
  - RCIs 3.5.2.2.2.6-D, 3.5.2.2.2.6-F, 3.5.2.2.2.6-G, 3.5.2.2.2.6-H, 3.5.2.2.2.6-I, 3.5.2.2.2.6-J, and 3.5.2.2.2.6-K; and
  - RAIs 3.5.2.2.2.6-1, 3.5.2.2.2.6-1A, 3.5.2.2.2.6-1B, 3.5.2.2.2.6-2, 3.5.2.2.2.6-3, 3.5.2.2.2.6-3A, 3.5.2.2.2.6-4, 3.5.2.2.2.6-5, 3.5.2.2.2.6-6, 3.5.2.2.2.6-7, 3.5.2.2.2.6-7A, 3.5.2.2.2.6-8, 3.5.2.2.2.6-9, and 3.5.2.2.2.6-10

addressing structural evaluation, transition temperature evaluation, and portions review of specific AMPs addressing management for the effects of aging of the RV SSSAs, as applicable, the staff finds acceptable the applicant's determination that a plant-specific program is not required to manage aging effects of irradiation for the RV SSSA for the subsequent period of extended operation. The staff based this conclusion on the following:

(a) The applicant satisfied the SRP-SLR further evaluation criteria consistent with GALL-SLR Report principles regarding the structural integrity of ONS Units 1, 2, and 3 RV SSSAs and ability to meet their intended function.

(b) The applicant has taken appropriate steps during manufacture of the RV SSSAs for their continued safe operation as ASME Class 1 supports.

(c) The applicant's transition temperature approach and fluence evaluations provided reasonable assurance that the effects of aging for loss or reduction of fracture toughness due to irradiation will not occur during the subsequent period of extended operation.

(d) The applicant, to date, has not identified plant-specific OE of RV SSSA indicating degradation due to embrittlement or other synergistic aging effects.

(e) The applicant's proposal to continue to manage the potential effects of aging, such as loss of material using the ASME Section XI Subsection IWF and the Boric Acid Corrosion AMPs (as applicable) and for cyclic loading and cumulative fatigue damage using the Fatigue Monitoring AMP, provides reasonable assurance that the integrity and performance of the RV SSSA will be monitored and managed adequately such that its intended function will be maintained consistent with the CLB during the subsequent period of extended operation when also considering potential damage due to irradiation.

(f) The applicant has adequately addressed the staff's issues related to all potential aging effects consistent with SRP-SLR and GALL-SLR Report principles.

Conclusion: Based on the AMPs identified to manage loss of material and cyclic loading and cumulative fatigue damage for the RV SSSA, the staff finds that ONS's AMPs and AMRs in the SLRA, as amended by SLRA Supplement 3, are acceptable. Further, the staff finds that the applicant adequately assessed, through fracture mechanics evaluations, that a plant-specific program is not needed to manage the effects of aging due to radiation (loss of fracture toughness, loss of function due to irradiation embrittlement) for ONS Units 1, 2, and 3 RV SSSAs. Therefore, the applicant's evaluation of the RV SSSAs meets the intent of SRP-SLR further evaluation criteria, consistent with GALL-SLR Report principles. As such, the staff concludes that the applicant has demonstrated that the effects of aging for the RV SSSAs will be adequately managed so that their intended function(s) will be maintained, consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.2.3 Quality Assurance for Aging Management of Nonsafety-Related Components

SE Section 3.0.4 documents the staff's evaluation of the applicant's QA Program.

3.5.2.2.4 Ongoing Review of Operating Experience

SE Section 3.0.5 documents the staff's evaluation of the applicant's ongoing review of OE.

3.5.2.3 Aging Management Review Results Not Consistent with or Not Addressed in the GALL-SLR Report

The following subsections document the staff's review of AMR results listed in SLRA Tables 3.5.2-1 through 3.5.2-23 that are either not consistent with or not addressed in the GALL-SLR Report and that are usually denoted with generic Notes F through J. To efficiently capture and identify multiple applicable AMR items in each subsection, and because these AMR items often are not associated with a Table 1 item, the subsections are organized by applicable AMR section and then by material and environment combinations.

For component type, material, and environment combinations not evaluated in the GALL-SLR Report, the staff reviewed the applicant's evaluation to determine whether the applicant has demonstrated that it will adequately manage the effects of aging in a way that maintains the intended function(s) consistent with the CLB for the subsequent period of extended operation. The following sections document the staff's evaluation.

3.5.2.3.1 Containments, Structures, and Component Supports – Auxiliary Building – Aging Management Evaluation – SLRA Table 3.5.2-1

<u>Fiber Reinforced Polymer Exposed to Air-outdoor.</u>

SLRA Table 3.5.2-1, as revised by letter dated February 14, 2022, states that hardening, loss of strength, loss of material, cracking, blistering, and loss of adhesion for FRP exposed to an air-outdoor environment will be managed by the Structures Monitoring program. The AMR item cites generic Note J.

The staff reviewed the associated items in the SLRA and considered whether the aging effects proposed by the applicant constitute all of the applicable aging effects for this component, material, and environment description. The staff noted that SLRA Section B2.1.33 stated that the installation of the FRP was approved through a license change approved by the staff on June 27, 2011 (ADAMS Accession No. ML11164A257). Per Commitment No. 4 of the license change, the visual inspections also include the monitoring for changes in color, debonding, peeling, blistering, cracking, crazing, deflections, and other anomalies. Based on its review of GALL-SLR Report Tables IX.E and IX.F, which state the different aging effects and mechanisms (e.g., hardening and loss of strength due to thermal aging, cracking, changes in material properties, etc.) that have been associated with polymer materials, the staff finds that the applicant has identified all applicable aging effects for this component, material, and environment combination.

The SLRA also states that OE from previous inspections has not identified degradations for the FRP. The staff noted that per Commitment No. 4 of the license change, inspections also include testing for tension adhesion of cored samples taken from designated test walls using methods specified in ASTM D7234 and the visual inspections of mortar joints located along the bottom edge of FRP-strengthened masonry walls. The review of the Structures Monitoring program and the proposed inspection frequency for the FRP is documented in SE Section 3.0.3.2.22. The staff finds the applicant's proposal to manage the effects of aging using the Structures Monitoring program acceptable because the proposed aging effects are consistent with the aging effects identified in the GALL-SLR report for polymer materials, and no degradations have been identified during previous inspections that would require modifying the current inspection parameters.

3.5.2.3.2 Containments, Structures, and Component Supports – Component Supports – Aging Management Evaluation – SLRA Table 3.5.2-22

Steel Wear Plates Exposed to Air-Indoor Uncontrolled and Stainless-Steel Wear Plates Exposed to Air-outdoor (External)

SLRA Table 3.5.2-22, as revised by letter dated December 14, 2021, states that loss of material for steel wear plates exposed to air-indoor uncontrolled and SS wear plates exposed to an air-outdoor (external) environment will be managed by the Structures Monitoring program. These AMR items cite generic Note H, for which the applicant has identified loss of material as an additional aging effect. The AMR items cite plant-specific Note 6, which also states that loss of material will be managed for wear plates.

The staff reviewed the associated items in the SLRA and noted that the applicant addressed loss of material for these component, material, and environment combinations in other AMR items (i.e., AMR Items 3.5.1-092 and 3.5.1-100). Therefore, the staff determined the need for additional information, which resulted in the issuance of an RAI. RAI 3.5.1-092-1 and the applicant's response is documented in ADAMS Accession No. ML22045A021.

In its response, the applicant revised SLRA Table 3.5.2-22 to remove the AMR line items citing generic Note H. The applicant stated that the AMR line items that cited generic Note H were deleted, as the other AMR line items that cited generic Note D (i.e., AMR line Items 3.5.1-092 and 3.5.1-100) already evaluated the wear plates and demonstrated that the associated aging effect(s) will be adequately managed by the program. The applicant also revised SLRA Sections A2.33 and B2.1.33 and Table A6.0-1 to further clarify that the Structures Monitoring program will monitor the aging effects of cracking due to SCC and loss of material due to pitting and crevice corrosion for SS components (i.e., including the wear plates) and to establish its acceptance criteria.

During its evaluation of the applicant's response to RAI 3.5.1-092-1, the staff noted that the applicant revised the SLRA to correct the discrepancies identified in the RAI and to ensure that the Structures Monitoring program will manage the aging effects of cracking due to SCC and loss of material for SS components. The staff also noted that the revised enhancement also establishes the acceptance criteria as no significant loss of material or cracking to ensure that the observed degradation will not result in a loss of intended function. The staff finds the applicant's response and changes to the SLRA Sections A2.33 and B2.1.33, Table A6.0 1, and Table 3.5.2-22 acceptable because they demonstrate that the aging effects of loss of material and cracking for wear plates will be managed by the Structures Monitoring program in a manner consistent with the GALL-SLR Report recommendations for the different material and environment combinations, so that the intended function(s) will be maintained consistent with the CLB for the subsequent period of extended operation.

3.6 Aging Management of Electrical and Instrumentation and Controls

3.6.1 Summary of Technical Information in the Application

SLRA Section 3.6 provides AMR results for those components the applicant identified in SLRA Section 2.5.1, “Electrical and Instrumentation and Control Component Commodity Groups,” as being subject to an AMR. SLRA Table 3.6.1, “Summary of Aging Management Programs for the Electrical Components Evaluated in Chapter VI of the GALL-SLR Report,” is a summary comparison of the applicant’s AMR results with those provided in the GALL-SLR Report for electrical components.

3.6.2 Staff Evaluation

Table 3.6.1 below summarizes the staff’s evaluation of the component groups listed in SLRA Section 3.6 and addressed in the GALL-SLR Report.

Table 3.6-1 Staff Evaluation for Electrical Components Evaluated in the GALL-SLR Report

Component Group (SRP-SLR Item No.)	Staff Evaluation
3.6.1-001	Consistent with the GALL-SLR Report (see SE Section 3.6.2.2.1)
3.6.1-002	Not applicable to Oconee (see SE Section 3.6.2.3.2)
3.6.1-003	Not applicable to Oconee (see SE Section 3.6.2.3.2)
3.6.1-004	Not applicable to Oconee (see SE Section 3.6.2.2.3 and 3.6.2.3.1)
3.6.1-005	Not applicable to Oconee (see SE Sections 3.6.2.2.3 and 3.6.2.3.1)
3.6.1-006	Not applicable to Oconee (see SE Sections 3.6.2.2.3 and 3.6.2.3.1)
3.6.1-007	Not applicable to Oconee (see SE Sections 3.6.2.2.3 and 3.6.2.3.1)
3.6.1-008	Consistent with the GALL-SLR Report
3.6.1-009	Consistent with the GALL-SLR Report
3.6.1-010	Consistent with the GALL-SLR Report
3.6.1-011	Consistent with the GALL-SLR Report
3.6.1-012	Consistent with the GALL-SLR Report
3.6.1-013	Consistent with the GALL-SLR Report
3.6.1-014	Consistent with the GALL-SLR Report
3.6.1-015	Consistent with the GALL-SLR Report
3.6.1-016	Consistent with the GALL-SLR Report
3.6.1-017	Consistent with the GALL-SLR Report
3.6.1-018	Consistent with the GALL-SLR Report
3.6.1-019	Consistent with the GALL-SLR Report
3.6.1-020	Consistent with the GALL-SLR Report
3.6.1-021	Consistent with the GALL-SLR Report
3.6.1-022	Consistent with the GALL-SLR Report
3.6.1-023	Consistent with the GALL-SLR Report
3.6.1-024	Consistent with the GALL-SLR Report
3.6.1-025	This item number is not used in the SRP-SLR nor in the GALL-SLR Report
3.6.1-026	This item number is not used in the SRP-SLR nor in the GALL-SLR Report
3.6.1-027	Not applicable to Oconee (see SE Section 3.6.2.2.2)

Component Group (SRP-SLR Item No.)	Staff Evaluation
3.6.1-028	This item number is not used in the SRP-SLR nor in the GALL-SLR Report
3.6.1-029	Not applicable to Oconee (see SE Section 3.6.2.2.2)
3.6.1-030	Not applicable to Oconee (see SE Section 3.6.2.2.2)
3.6.1-031	Not applicable to Oconee (see SE Section 3.6.2.2.2)
3.6.1-032	Not applicable to Oconee (see SE Section 3.6.2.2.2)

The staff's review of component groups, as described in SE Section 3.0.2.2, is summarized in the following three sections:

(1) SE Section 3.6.2.1 discusses AMR results for components that the applicant states are either not applicable to ONS or are consistent with the GALL-SLR Report. Section 3.6.2.1.1 summarizes the staff's review of items that are not applicable.

(2) SE Section 3.6.2.2 discusses AMR results for which the GALL-SLR Report and SRP-SLR recommend further evaluation.

(3) SE Section 3.6.2.3 discusses AMR results for components that the applicant states are not consistent with, or not addressed in, the GALL-SLR Report. These AMR results typically are identified by generic Notes F through J and plant-specific notes in the SLRA.

3.6.2.1 Aging Management Review Results Consistent with the GALL-SLR Report

The following subsections document the staff's review of AMR results listed in SLRA Tables 3.6.1 and 3.6.2-1 that the applicant determined to be consistent with the GALL-SLR Report. The staff audited and reviewed the information in the SLRA. The staff did not repeat its review of the matters described in the GALL-SLR Report. The staff verified that the material presented in the SLRA was applicable and that the applicant identified the appropriate GALL-SLR Report AMRs. For those AMR items the staff found to be consistent with the GALL-SLR Report, and for which no additional evaluation or request for additional information applies, the staff's review and conclusions, as documented in the GALL-SLR Report, are considered to be the basis for acceptability of the AMR items. The staff's conclusion of "Consistent with the GALL-SLR Report" is documented in SE Table 3.6.1, and no separate writeup is required or provided. The staff did not identify any AMR items that required additional review with an associated writeup.

SE Section 3.6.2.1.1 documents the staff's review of AMR items that the applicant determined to be not applicable.

3.6.2.1.1 Aging Management Review Results Identified as Not Applicable

For SLRA Table 3.6.1, Items 3.6.1-002, 3.6.1-003, 3.6.1-004, 3.6.1-005, 3.6.1-006, 3.6.1-007, 3.6.1-027, 3.6.1-029, 3.6.1-030, 3.6.1-031, and 3.61-032, the applicant claims that the corresponding AMR items in the GALL-SLR Report are not applicable to ONS. The staff reviewed the SLRA and UFSAR and confirmed that the applicant's SLRA does not have any AMR results that are applicable for these items.

3.6.2.2 Aging Management Review Results for Which Further Evaluation Is Recommended by the GALL-SLR Report

In SLRA Section 3.6.2.2, the applicant further evaluates aging management for certain electrical and instrumentation and controls system components, as recommended by the GALL-SLR Report, and provides information concerning how it will manage the applicable aging effects. The staff reviewed the applicant's evaluation of these component groups against the criteria contained in SRP-SLR Section 3.6.2.2. The following subsections document the staff's review.

3.6.2.2.1 Electrical Equipment Subject to Environmental Qualification.

SLRA Section 3.6.2.2.1, associated with SLRA Table 3.6.1, Item 3.6.1-001, notes that TLAAs are defined in 10 CFR 54.3 and are evaluated in accordance with 10 CFR 54.21(c). The applicant's evaluation of these TLAAs is addressed in SLRA Section 4.4. This is consistent with SRP-SLR Section 3.6.2.2.1, which states that TLAAs, as defined in 10 CFR 54.3, are evaluated in accordance with 10 CFR 54.21(c)(1) and are, therefore, acceptable. The staff's evaluation of the TLAA for EQ of electrical equipment is documented in SE Section 4.4.

3.6.2.2.2 Reduced Insulation Resistance Due to Age Degradation of Cable Bus Arrangements Caused by Intrusion of Moisture, Dust, Industrial Pollution, Rain, Ice, Photolysis, Ohmic Heating, and Loss of Strength of Support Structures and Louvers of Cable Bus Arrangements Due to General Corrosion and Exposure to Air-outdoor.

SLRA Section 3.6.2.2.2 is associated with SLRA Table 3.6.1, Items 3.6.1-027, 3.6.1-029, 3.6.1-030, 3.6.1-031, and 3.6.1-032. This section addresses reduced insulation resistance due to age degradation of cable bus arrangements caused by external pollutants and general corrosion and exposure to an air-outdoor environment.

The applicant stated that UFSAR Section 8.3.1.4 describes a cable bus that is installed in the 13.8 kV power feeder of protected service water system (PSWS). Specifically, the applicant stated, in part, in reference to the Keowee power feeder switchgear line side cable bus:

> . . . Power cable bus is a manufacturer-designed engineered system that consists of single-conductor cables installed in a metallic enclosure with conductor spacing devices that are integral to the cable bus. These conductor spacing devices physically separate and electrically isolate each cable using insulated support blocks. The Keowee power feeder switchgear line side cable bus is not a true power cable bus, but rather an enclosed cable tray design with three phase conductors braced together by cleats in a triangular configuration. The safety-function of the cleats is to eliminate the hazard of cable whip during a fault downstream of the transition junction boxes. These cable cleats are constructed of stainless steel, with a Low-smoke/Low-fume cushioning pad used to protect the cables prior to closing the cable cleat locking tang. This Low-smoke/Low-fume pad has no electrical function, and failure of the Low-smoke /Low-fume pad after installation will not prevent the cable cleat from bracing the cable. The cleat to tray hardware and cleat locking tang are secured with stainless steel hardware using good bolting practices that include locking nuts. There is therefore no aging management required for the cable cleat.

The applicant further stated that aging management of the cables is implemented under the Electrical Insulation for Electrical Cables and Connections Not Subject to 10 CFR 50.49

Environmental Qualification Requirements aging management program (B2.1.36), whereas aging management of the cable tray and associated hardware is accomplished using the Structures Monitoring program (B2.1.33).

The staff reviewed the aging effects on the 13.8-kV power feeder cable bus for the PSWS. As described by the applicant, the cable bus at ONS consists of single-conductor cables installed in a metallic enclosure and is uniquely designed for the specific application at ONS. SRP-SLR Section 3.6.2.2.2 provides guidance on evaluating site-specific age degradation of cable buses. The applicant has stated that the aging effects of insulation material of these cables are managed by AMP B2.1.36, and that no additional site-specific programs are needed. The staff evaluation of these AMPs is discussed in Section 3.0.3.2.24 of this safety evaluation and found to be acceptable. The staff concludes that there is reasonable assurance that the aging effects of the PSWS cable bus are adequately managed, and no additional plant-specific program is required.

3.6.2.2.3 Loss of Material Due to Wind-Induced Abrasion, Loss of Conductor Strength Due to Corrosion, and Increased Resistance of Connection Due to Oxidation or Loss of Preload for Transmission Conductors, Switchyard Buses, and Connections

SLRA Section 3.6.2.2.3, “Loss of Material Due to Wind-Induced Abrasion, Loss of Conductor Strength Due to Corrosion, and Increased Resistance of Connection Due to Oxidation or Loss of Preload for Transmission Conductors, Switchyard Buses, and Connections,” as amended by Supplement 2 dated November 11, 2021 (ADAMS Accession No. ML21315A012), and SLRA Table 3.6.2-1, are associated with SLRA Table 3.6.1 Items 3.6.1-004, 3.6.1-005, 3.6.1-006, and 3.6.1-007. These items address loss of conductor strength due to corrosion, increased resistance of connection due to oxidation or loss of preload, and loss of material due to wind-induced abrasion in transmission conductors and transmission connections as well as switchyard buses and connections. The criteria in SRP-SLR Section 3.6.2.2.3 state that the GALL-SLR Report recommends further evaluation of a plant-specific AMP to ensure that the aging effects are adequately managed. A discussion of each of these AMR items follows.

Transmission Conductors Composed of Aluminum and Steel Exposed to an Air-outdoor Environment.

SLRA Section 3.6.2.2.3, Item 3.6.1-004, “Corrosion – Transmission Conductors,” addressed the aging effect of loss of conductor strength due to corrosion in transmission conductors composed of aluminum and steel exposed to air-outdoor environments. SLRA Section 3.6.2.2.3 stated that:

> All transmission conductors under the scope of 10 CFR 54.4 at ONS are aluminum conductor steel reinforced, or all aluminum conductors. The aluminum conductor steel reinforced conductor size ranges from 4/0 to 2156 MCM, and the aluminum conductor size is 2000 MCM. The most prevalent mechanism contributing to loss of conductor strength of an aluminum conductor steel reinforced transmission conductor is corrosion, which includes corrosion of the steel core and aluminum strand pitting. For aluminum conductor steel reinforced conductors, degradation begins as a loss of zinc from the galvanized steel core wires. Corrosion rates depend largely on air quality, which includes suspended particles chemistry, SO_2 concentration in air, precipitation, fog chemistry and meteorological conditions.

In SLRA Section 3.6.2.2.3, the applicant cited an industry-accepted Ontario Hydroelectric study of transmission conductor loss of composite strength. The study showed the loss of conductor strength for similar conductors in 80 years of operation exposed to an air-outdoor environment to be limited to 30 percent. The relatively short length of the in-scope transmission conductors (4/0 ACSR) used at ONS have adequate strength margin for loss of conductor strength due to corrosion thorough the subsequent period of extended operation. The staff conducted a virtual audit to verify the extent of the in-scope transmission conductors and to discuss the lack of OE with any unique aging effects at ONS. The staff also noted that the referenced Ontario Hydroelectric study has already been cited in previous license renewal SE reports and found to be acceptable by the staff. Based on industry experience, the staff finds the applicant's proposal acceptable because the in-scope transmission conductors at ONS will have adequate strength maintained during the subsequent period of extended operation.

<u>Transmission Connectors Composed of Aluminum and Steel Exposed to an Air-outdoor Environment.</u>

SLRA Section 3.6.2.2.3 Item 3.6.1-005 addresses the aging effect of increased resistance of bolted connections due to oxidation or loss of preload in transmission connectors exposed to air-outdoor environment. The applicant stated: Transmission connectors employ good bolting practices. The connections are treated with corrosion inhibitors to avoid connection oxidation and torqued at the time of installation to avoid loss of preload. The transmission connectors are designed and installed using stainless steel lock washers that provide vibration absorption and prevent loss of preload. Therefore, based on ONS design and OE, oxidation and loss of preload are not applicable aging mechanisms for ONS transmission connectors.

The staff reviewed the associated item in the SLRA and noted that the bolted transmission connectors at ONS have antioxidant material that minimizes corrosion of the contact surfaces. In addition, the transmission connectors are designed and installed using SS lock washers and torqued at the time of installation to avoid loss of preload. Based on the applicant's statement that operating experience at ONS indicates that transmission connectors have not exhibited significant aging effects coupled with the maintenance activities associated with bolted connections, the staff finds the applicant's evaluation to be acceptable.

<u>Switchyard Buses and Connections Composed of Aluminum, Copper, Bronze, SS, and Galvanized Steel Exposed to an Air-outdoor Environment.</u>

SLRA Section 3.6.2.2.3, Item 3.6.1-006, addresses the aging effects of loss of material due to wind-induced abrasion, increased resistance of connection due to oxidation, or loss of preload in switchyard buses and connections exposed to an air-outdoor environment. In SLRA Table 3.6.2-1, the applicant stated that loss of material and increased resistance of connection are not applicable for aging effects on ONS switchyard buses and connections. The applicant has provided the following details to support this conclusion:

> Switchyard buses are connected to flexible conductors that do not normally vibrate and are supported by insulators and ultimately by static, structural components, such as concrete footings and structural steel. Switchyard bus is rigidly mounted and is therefore not subject to abrasion induced by wind loading. Therefore, based on ONS design and confirmed by operating experience, wind-induced abrasion and fatigue are not applicable aging mechanisms for ONS switchyard bus.
>
> Switchyard bus is used to provide an electrically common connection point for disconnect switches and flexible conductors. Since the connections to

disconnect switches are maintained as part of the switch, switchyard bus connections to disconnect switches are considered part of the disconnect switch. Bolted flexible connections to the switchyard bus are part of the transmission connectors [3.6.1-005]. All rigid switchyard bus connections are welded connections. Therefore, based on ONS design and confirmed by operating experience, oxidation and loss of preload are not applicable aging mechanisms for ONS switchyard bus connections.

The staff reviewed the associated items in SLRA Section 3.6.2.2.3, Item 3.6.1-006, and noted that the relatively short lengths of in-scope switchyard bus flexible connectors are rigidly mounted and are supported by static, structural components. Therefore, wind-induced abrasion and fatigue are not applicable aging effects. All switchyard bus connections are welded connections. Therefore, oxidation and loss of preload are not an aging effect that require management. The staff finds the applicant's evaluation acceptable because operating experience also demonstrated that increased connection resistance due to corrosion, oxidation, or loss of preload for the flexible connectors associated with switchyard buses is not an area of concern from an aging management perspective at ONS.

Transmission Conductors Composed of Aluminum Steel Exposed to an Air-outdoor Environment.

SLRA Section 3.6.2.2.3, Item 3.6.1-007, "Wind-Induced Abrasion and Fatigue – Transmission Conductors," addresses the aging effects of loss of material due to wind-induced abrasion in transmission conductors composed of aluminum and steel exposed to an air-outdoor environment. In SLRA Section 3.6.2.2.3, the applicant stated that transmission conductor vibration or sway could be caused by wind loading. Industry experience has shown that the transmission conductors do not normally swing significantly, and when they do swing due to a substantial wind, they do not continue to swing for very long once the wind has subsided. For most ONS transmission conductors, the applicant noted that wind loading that can cause a transmission line to vibrate or sway is adequately addressed in design and installation, such that abrasion/fatigue that could result from wind-induced transmission conductor vibration or sway is not applicable and would not cause a loss of intended function for transmission conductors for the subsequent period of extended operation.

In Supplement 2 dated November 11, 2021 (ADAMS Accession No. ML21315A012), the applicant provided details on overhead conductor failures associated with startup transformers CT2 and CT3. ONS has three startup transformers (CT1, CT2, and CT3) each with a short overhead conductor connection. The applicant stated:

ONS operating experience includes the partial and complete severance failure of aluminum conductor steel reinforced transformer drop line conductors/terminations to startup transformers CT2 and CT3, respectively. A 2002 CT2 partial drop line severance failure occurred after approximately 30 years of operation and a 2015 CT3 complete drop line severance failure occurred after approximately 40 years of operation. The ONS startup transformer drop lines consist of 4/0 aluminum conductor steel reinforced cable with a 0.556 inch diameter, which is substantially smaller than the cable size typical of today's standards for 230 kV operation. While this smaller cable is capable of carrying the required ampacity of the startup transformer, the causal evaluation for this the CT3 failure determined wind-induced (aeolian) vibrations of these smaller conductors can produce damage that will negatively impact the reliability of these lines. The causal evaluation further determined that vulnerability to this aging mechanism at ONS is limited to the overhead transmission conductors and drop lines to startup transformers

CT1, CT2, and CT3. The corrective action arising from this failure resulted in a preventive maintenance activity to replace the aluminum conductor steel reinforced transmission conductors and drop lines to all three startup transformers on a 10 year frequency.

During replacement intervals, inspections for drop line degradation are performed on a daily, monthly, and biennial basis. Equipment has been installed on CT1, CT2, and CT3 to actively monitor for drop line open phase conditions. The 10-year replacement frequency combined with daily, monthly, and biennial inspections for degraded drop line conductors provides conservative margin to preclude future conductor failures. If future inspections detect unexpected degradation between drop line replacements, this internal OE will be used to adjust the replacement frequency or make other changes as necessary. Given that these conductors are now replaced on a specified frequency, they are considered short-lived, such that no further aging management is required.

The staff reviewed the associated items in the SLRA, as supplemented by Supplement 2 dated November 11, 2021. The staff agrees with the applicant's assertion that industry experience has shown that the "transmission conductors do not normally swing significantly, and when they do swing due to a substantial wind, they do not continue to swing for very long once the wind has subsided." Industry OE shows that fatigue failures from wind-induced transmission conductor vibrations or sway is not very common for overhead aluminum conductors with steel reinforcement. The staff finds that there is reasonable assurance that a loss of intended safety function will not occur as a consequence of transmission conductor failure, and aging management is not required.

For the CT1, CT2, and CT3 drop lines, due to the smaller conductor size and specific configuration of the drop lines that has resulted in two failures, the applicant has implemented a 10-year replacement period for these specific conductors. The applicant has indicated that the first failure (2002) occurred after 30 years of operation and the second failure (2015) occurred after 40 years of operation. Based on the operating experience, the staff finds the 10-year replacement period for the drop lines to be acceptable. In addition, the staff finds it acceptable for the applicant to monitor the condition of the conductors and adjust the replacement frequency based on the results of maintenance activities.

Conclusion. Based on its audit and review of the SLRA, the staff concludes that the applicant has met the SRP-SLR Section 3.6.2.2.3 criteria. For those items that apply to SLRA Section 3.6.2.2.3, the staff finds that the SLRA is consistent with the GALL-SLR Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3).

3.6.2.2.4 Quality Assurance for Aging Management of Nonsafety-Related Components

SE Section 3.0.4 documents the staff's evaluation of the applicant's QA Program.

3.6.2.2.5 Ongoing Review of OE

SE Section 3.0.5 documents the staff's evaluation of the applicant's ongoing review of OE.

3.6.2.3 Aging Management Review Results Not Consistent with or Not Addressed in the GALL-SLR Report

The following subsections document the staff's review of AMR results listed in SLRA Table 3.6.2-1 that are either not consistent with or not addressed in the GALL-SLR Report and are usually denoted with generic Note I. To efficiently capture and identify multiple applicable AMR items in each subsection, and because these AMR items often are not associated with a Table 3.6.1 item, the subsections are organized by applicable AMR section and then by material and environment combinations.

For component type, material, and environment combinations not evaluated in the GALL-SLR Report, the staff reviewed the applicant's evaluation to determine whether the applicant has demonstrated that it will adequately manage the effects of aging in a way that maintains the intended function(s) consistent with the CLB for the subsequent period of extended operation. The following sections document the staff's evaluation.

3.6.2.3.1 Transmission Connectors Composed of Aluminum and Steel, and Switchyard Buses and Connections Composed of Aluminum, SS, Copper, Bronze, and Galvanized Steel, and Transmission Conductors Composed of Aluminum and Steel, Exposed to Air-outdoor

In SLRA Table 3.6.2-1, the applicant stated that the aging effects related to the following are not applicable: transmission conductors composed of aluminum and steel exposed to an air-outdoor environment (Table 3.6.1, Item 3.6.1-004), transmission connectors composed of aluminum and steel exposed to an air-outdoor environment (Table 3.6.1, Item 3.6.1-005); switchyard buses and connections composed of aluminum, copper, bronze, SS, and galvanized steel exposed to an air-outdoor environment (Table 3.6.1, Item 3.6.1-006); and transmission conductors composed of aluminum and steel exposed to an air-outdoor environment (Table 3.6.1, Item 3.6.1-007).

As a result, the applicant proposed no AMPs for the above component, material, and environment combinations. These AMR items cited generic Note I, which states that the aging effect in NUREG-2191 for this component, material, and environment combination is not applicable.

The staff's evaluation of the applicant's claim regarding SLRA Table 3.6.1, Items 3.6.1-004, 3.6.1-005, 3.6.1-006, and 3.6.1-007, is documented in SE Section 3.6.2.2.3.

3.6.2.3.2 High-Voltage Insulators

SLRA 3.6.2.3.1 and SLRA Table 3.6.2-1, associated with SLRA Table 3.6.1, Items 3.6.1-002 and 3.6.1-003, address high-voltage electrical insulators composed of porcelain, malleable iron, aluminum, galvanized steel, cement, toughened glass, polymers, silicone rubber, fiber glass, and aluminum alloy exposed to air-outdoor. In the SLRA, the applicant noted that loss of material due to mechanical wear caused by movement of transmission conductors due to significant wind and wind-driven particles impacting surfaces and reduced electrical insulation resistance due to presence of salt deposit, surface contamination, or peeling of silicone rubber sleeves for polymer insulators are not an aging effect at ONS. The applicant states that the in-scope high-voltage insulators provide electrical insulation for switchyard buses, transmission conductors, switchyard active components, and associated connections that are part of the circuits that supply power from the offsite power distribution system and electric utility transmission system to plant buses, including connecting the alternate AC source in the event of a station blackout (SBO). According to the applicant, these circuits provide power to in-scope SLR components used for coping during and recovery from an SBO event and during post-fire safe shutdowns when offsite power is credited. The applicant addresses each aging effect as follows.

Airborne Contamination

In SLRA Section 3.6.2.3.1, the applicant states that the in-scope 230-kV and 4.16-kV post and strain insulators were evaluated for susceptibility to airborne surface contamination from salt, dust, fog, cooling tower plume, foreign debris, and industrial effluents. ONS is not situated in an environment conducive to accelerated aging. ONS is in the upstate of South Carolina in a predominantly rural wooded area where salt and dust contamination and wind-driven particles are not aging factors. ONS has no cooling towers and uses freshwater from Lake Keowee for cooling and ultimate heat sink, and thus cooling tower plumes are not present. There are no nearby heavy industries, mining, factories, agriculture, or other facilities emitting significant foreign debris or industrial effluent that could promote high-voltage insulator aging effects. The applicant performed a 10-year review of OE for in-scope high-voltage insulators. Based on the applicant's review, accumulation of high-voltage insulator contamination or insulator flashover has not been experienced at ONS. Existing maintenance procedures include inspections for insulator contamination, corrosion, and other forms of degradation or damage. The applicant also reviewed the applicability of the draft ISG SLR-ISG-Electrical-2021-04, "Electrical," Appendix D (Proposed Revisions to AMP XI.E7, "High-Voltage Insulators") to ONS. As part of the review, the applicant performed walkdowns, and discussions were conducted with personnel responsible for the switchyards to determine if there were any in-scope polymer or toughened-glass type insulators, history of excessive insulator contamination or flashover, or other high-voltage insulator age-related issues. The applicant's walkdowns confirmed that there are no in-scope polymer or toughened-glass type insulators, history of excessive insulator contamination, flashover, or other high-voltage insulator aging issues. Additionally, high-voltage insulator cleaning due to contamination has never been determined to be necessary at ONS.

The staff reviewed UFSAR Chapter 2, "Site Characteristics," and the environmental pollutants that can degrade high-voltage insulators. Typical pollutants include saltwater sprays, chemicals from heavy industries or cooling towers, smoke from fossil plants, etc. The staff agrees with the applicant's conclusion that based on the location of ONS, the lack of substantial airborne contaminants, and corroborating OE, excessive high-voltage insulator surface contamination is not expected to occur. The staff finds that there is reasonable assurance that aging effects of surface contamination from salt, dust, fog, cooling tower plume, foreign debris, and industrial effluents are not applicable to ONS for the subsequent period of extended operation. Therefore, the staff concludes that aging management activity is not required for the in-scope high-voltage insulators due to airborne contamination.

Loss of Material – Mechanical Wear or Corrosion

In SLRA Section 3.6.2.3.1, the applicant states that high-voltage insulator loss of material can occur due to the oscillating movement of transmission conductors due to significant and sustained winds. These wind conditions can result in mechanical wear of metallic parts. Surface corrosion of high-voltage insulator metallic parts can also occur due to environmental contamination or if galvanized or other protective coatings are worn from significant wind-induced movement of transmission conductors. Mechanical wear is an aging effect for strain insulators when they are subject to excessive movement. Movement can be caused by wind blowing the supported transmission conductor, causing swinging. If this swinging is frequent and severe enough, wear could be caused on the metal contact points of the insulator string. Although transmission conductor swing is possible, ONS experience has shown that swinging is atypical. When persistent and substantial wind conditions induce conductor swing, after the winds subside, the swing ceases. The applicant noted that mechanical wear of high-voltage insulator strain on insulator metallic components has not been identified during routine inspections at ONS or plant-specific OE review.

Loss of material due to high-voltage insulator corrosion can also occur due to airborne contamination. A large buildup of contamination could result in corrosion of the high-voltage insulator metallic parts, which, if significant, could eventually impact the structural intended function. However, as previously stated, based on the ONS location, lack of airborne contaminants, and corroborating OE, high-voltage insulator metallic parts are not subject to a significant buildup of contamination from airborne contaminants. High-voltage insulator mechanical wear due to wind-induced transmission conductor movement and corrosion is not a significant aging effect at ONS and does not require aging management for the subsequent period of extended operation.

The staff notes that *EPRI* Report 1003057, "Plant Support Engineering License Renewal Handbook," states that mechanical wear in high-voltage insulators is an aging effect for strain and suspension insulators in that they are subject to movement. Movement of insulators can be caused by wind blowing on the supported transmission conductor, causing it to swing. If this swing is frequent enough, it could cause wear in the metal contact point of the insulator string and between an insulator and supporting hardware. The EPRI Report indicates this mechanism is possible but that industry OE has shown that transmission conductors are normally designed not to swing, and when they do (e.g., due to a substantial wind), transmission conductors do not continue to swing for a long period of time once the wind has subsided.

The staff also notes that rainfall will wash away minor contamination while the glazed insulator surface of porcelain insulators aids contamination removal. In addition, any flashover is generally caused by temporary salt buildup due to local weather events and is not dependent on the age of the insulators; therefore, it is not considered an aging mechanism when contamination buildup has been shown to be insignificant with no nearby sources of airborne chemical or industrial plumes.

The staff reviewed the applicant's discussion in SLRA 3.6.2.3.1, EPRI Report 1003057 and OE at ONS for high-voltage (HV) insulator failures. A staff review of the applicant's corrective action program did not reveal age- or external contamination–related failures of HV insulators. The applicant has an ongoing routine preventive and predictive maintenance program at ONS. Based on OE, the inspection and corrective actions implemented to maintain intended functions of in-scope HV insulators at ONS, the staff finds that there is reasonable assurance that the HV insulators will continue to perform their intended safety functions and additional aging management programs for HV insulators are not needed at ONS.

3.7 Conclusion for Aging Management Review Results

The staff reviewed SLRA Section 3, "Aging Management Review Results," and SLRA Appendix B, "Aging Management Programs," as supplemented. Based on its audits and review of the applicant's AMRs results and AMPs, the staff concludes that the applicant has demonstrated that it will adequately manage the applicable aging effects in a way that maintains intended functions consistent with the CLB for the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the applicant's applicable UFSAR supplement program summaries and concludes that, as required by 10 CFR 54.21(d), the UFSAR supplement describes the AMPs and activities credited for managing aging at ONS.

With regard to these matters, the staff concludes that actions have been identified and have been or will be taken, such that there is reasonable assurance that the activities authorized by subsequent renewed operating licenses for ONS Unit 1 and Unit 2, if issued, will continue to be conducted in accordance with the CLB, and that any changes made to the CLB in order to comply with 10 CFR Part 54 are in accordance with the Atomic Energy Act of 1954, as amended, and the NRC’s regulations.

SECTION 4 TIME-LIMITED AGING ANALYSES

4.1 Identification of Time Limited Aging Analyses and Exemptions

This section of the SE provides the staff's evaluation of the applicant's basis for identifying those time-limited aging analyses (TLAAs) and plant-specific exemptions, granted pursuant to 10 CFR 50.12, "Specific Exemptions," and in effect that are based on TLAAs, that need to be identified and evaluated in the SLRA.

The regulation in 10 CFR 54.3, "Definitions," defines TLAAs as those licensee calculations and analyses (henceforth referred to as "analysis" or "analyses") that:

(1) Involve SSCs within the scope of license renewal, as delineated in 10 CFR 54.4(a);

(2) Consider the effect or effects of aging;

(3) Involve time-limited assumptions defined by the current operating term, for example, 40 years

(4) Were determined to be relevant by the licensee in making a safety determination;

(5) Involve conclusions or provide the basis for conclusions related to the capability of the SSC to perform its intended functions, as described in 10 CFR 54.4(b); and

(6) Are contained or incorporated by reference in the CLB.

The regulation in 10 CFR 54.21(c)(1) requires an application for subsequent license renewal to contain a list of TLAAs and that the applicant demonstrate that:

(i) The analyses remain valid for the period of extended operation;

(ii) The analyses have been projected to the end of the period of extended operation; or

(iii) The effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

In addition, in accordance with 10 CFR 54.21(c)(2), an applicant for subsequent license renewal must provide a list of plant-specific exemptions granted pursuant to 10 CFR 50.12 and in effect that are based on TLAAs. The applicant must provide an evaluation that justifies the continuation of these exemptions for the subsequent period of extended operation.

4.1.1 Summary of Technical Information in the Application

4.1.1.1 Identification of TLAAs

SLRA Section 4.1, "Identification of Time-Limited Aging Analyses," as amended by letters dated January 7, 2022 (ADAMS Accession No. ML22010A129), and February 21, 2022 (ADAMS Accession No. ML22021A000), summarizes the methodology that the applicant used to identify those analyses that may conform to the definition of a TLAA in 10 CFR 54.3. SLRA Table 4.1.4-1, "Oconee Time-Limited Aging Analyses Categories and Dispositions," as amended by letter dated February 21, 2022, summarizes those analyses that the applicant identified as being TLAAs. The table also provides the applicant's basis for dispositioning each TLAA in accordance with 10 CFR 54.21(c)(1)(i), (ii), or (iii) and the section in the SLRA Chapter 4 that provides the applicant's required evaluation of the TLAA. SLRA Table 4.1.4-2, "Review of Time-Limited Aging Analyses Listed in NUREG-2192, Table 4.1-2," as amended by letter dated January 7, 2022, summarizes the applicant's determination on whether the generic analyses identified as TLAAs in NUREG-2192, "Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants" (ADAMS Accession No. ML17188A158) (SRP-SLR), Table 4.1-2, "Generic Time-Limited Aging Analyses," are TLAAs for the Oconee Nuclear Station (ONS) SLRA. SLRA Table 4.1.4-3, "Review of Generic Time-Limited Aging Analyses Listed in NUREG-2192, Table 4.7-1," summarizes the applicant's determination on whether the plant-specific analyses identified as TLAAs in SRP-SLR Table 4.7-1, "Examples of Potential Plant--Specific TLAA Topics," are plant--specific TLAAs for the SLRA.

In its letter dated January 7, 2022, the applicant amended SLRA Table 4.1.4-2 to identify the high-energy line break (HELB) analysis as an analysis that conforms to the definition of a TLAA in 10 CFR 54.3 and to state that the applicant included HELB analyses TLAA as part of the required evaluation of the TLAA in SLRA Section 4.3.3, "Metal Fatigue of Non-Class 1 Components."

In its letter dated February 21, 2022, the applicant amended SLRA Table 4.1.4-1 to revise the disposition of the "Leak-Before-Break Analysis for Reactor Coolant System Piping," from 10 CFR 54.21(c)(1)(i) to 10 CFR 54.21(c)(1)(ii), as described in amended SLRA Section 4.7.4.

SLRA Tables 4.1.4-1, 4.1.4-2, and 4.1.4-3 all indicate that the applicant discussed and evaluated its TLAAs in either SLRA Section 4.2 through 4.7 or in applicable subsections of these SLRA sections. The applicant's evaluations of these TLAAs support its bases for demonstrating acceptability of the TLAAs in accordance with 10 CFR 54.21(c)(1)(i), (ii), or (iii).

4.1.1.2 Identification of Regulatory Exemptions

The applicant stated that it reviewed the CLB to determine whether the CLB contained any regulatory exemptions that would need to be identified and evaluated in accordance with requirements stated in 10 CFR 54.21(c)(2). The applicant stated that its review of the CLB did not identify any exemptions for the CLB that were granted in accordance with 10 CFR 50.12, are based on a TLAA, and remain in effect in the CLB.

4.1.2 Staff Evaluation

The staff reviewed the information in SLRA Section 4.1 (including SLRA Tables 4.1.4-1 through 4.1.4-3) and the applicant's TLAA and regulation exemption identification methodology and results in accordance with the review procedures in SRP-SLR Section 4.1.3 and the acceptance criteria in SRP-SLR Section 4.1.2. As part of its review, the staff held an audit breakout session with the applicant on September 8, 2021, to discuss the methodology and results in SLRA Section 4.1. The staff summarizes, in its audit report, its observations regarding the specific TLAAs and regulatory exemptions that the applicant had identified as needing evaluation in the SLRA in Section 4.1 (ADAMS Accession No. ML22045A053). Records that the staff reviewed as part of its audit review are documented in Section 4.1 of the audit report.

4.1.2.1 Identification of TLAAs

4.1.2.1.1 Analyses in the CLB Conforming to the 10 CFR 54.3 TLAA Definition Criteria

SLRA Table 4.1.4-1 identifies those generic and plant-specific analyses in the CLB that the SLRA identifies and evaluates as TLAAs.

During its audit of the SLRA, the staff identified the HELB analysis for non-Class- 1 components as a potential TLAA. In its letter dated January 7, 2022, the applicant amended SLRA Table 4.1.2-2 to identify the HELB analysis for non-Class 1 components as a TLAA for the SLRA and added the HELB analysis to SLRA Section 4.3.3. The staff finds the identification of the HELB analysis as a TLAA acceptable because it is consistent with the change in the licensing basis of the HELB analysis, as approved in the staff's issuance of the license amendment of March 15, 2021 (ADAMS Accession No. ML21006A098). The staff's evaluation of the HELB analysis is described in SE Section 4.3.3.

The staff verified that the analyses identified as TLAAs in SLRA Tables 4.1.4-1, 4.1.4-2, and 4.1.4-3, as amended, conform to the six criteria for defining TLAAs in 10 CFR 54.3 and are TLAAs for the SLRA. Therefore, the staff finds that the identification of these TLAAs is acceptable because it complies with the requirements of 10 CFR 54.21(c)(1).

4.1.2.1.2 Absence of TLAA Bases - TLAAs for BWR-Designed Light Water Reactors that are Not Applicable to the SLRA

The staff verified that the following analyses cited in NUREG-2192 Tables 4.1-2 and 4.7-1 are only applicable to the CLBs for boiling-water reactor (BWR)-designed light water reactors and are not applicable to ONS: (a) reactor pressure vessel (RPV) circumferential weld relief–probability of failure and mean adjusted reference temperature analysis for the RPV circumferential welds (BWRs only), (b) reactor vessel axial weld probability of failure and mean adjusted reference temperature analysis (BWRs only), (c) re-flood thermal shock of the RPV, (d) re-flood thermal shock analyses for core shroud and other reactor vessel internals, (e) loss of pre-load for core plate rim hold-down bolts, (f) erosion of the main steam line flow restrictors, and (g) susceptibility to irradiation-assisted stress corrosion cracking (SCC).

Specifically, the staff confirmed that these analyses are not applicable to the CLBs for Units 1, 2, and 3 because the UFSAR confirms that the reactor units are pressurized-water reactors (PWRs) designed by the Babcock and Wilcox Company (B&W). Therefore, the staff finds that the applicant does not need to identify or evaluate these analyses as TLAAs in the SLRA because the staff has confirmed that the analyses are not contained or incorporated by reference in the CLB and do not meet Criterion 6 in 10 CFR 54.3(a).

4.1.2.1.3 Absence of TLAA Bases -Other Plant Analyses Not Identified As TLAAs

In SLRA Tables 4.1.4-2 and 4.1.4-3, as amended, the applicant identified that the following analyses or types of analyses do not qualify as TLAAs for the SLRA:

- Response to NRC Bulletin 88-08, "Thermal Stresses in Piping Connect to Reactor Coolant Systems"
- Fatigue of the spent-fuel pool liner
- Corrosion allowance calculations
- Flaw growth due to SCC
- Predicted lower limit

<u>Response to NRC Bulletin 88-08, "Thermal Stresses in Piping Connected to Reactor Coolant Systems</u>." In SLRA Table 4.1.4-2, the applicant stated that the analysis associated with its response to NRC Bulletin 88-08 does not conform to the definition of a TLAA in 10 CFR 54.3.

Specifically, in Note 1 of SLRA Table 4.1.4-3, the applicant stated that "No ASME Code Section III cumulative fatigue analyses were generated in response to NRC Bulletin 88-08. Ultrasonic inspections were performed in response to NRC Bulletin 88-08."

The staff noted that the applicant's letter dated February 26, 1998 (ADAMS Accession No. ML20203J930), included Supplement 1 of its initial response to NRC Bulletin 88-08 based on a high-pressure injection (HPI) line leakage event for Unit 2 that occurred on April 21, 1997, where the cause of the leak in the piping was due to flow anomalies and thermal stratification in the HPI piping. The staff acknowledged the applicant's change in its Bulletin 88-08 response in the staff's letter of August 11, 2000, to the applicant (ADAMS Accession No. ML003740377). Based on the staff's letter of August 11, 2000, the staff observed that, in its letter dated February 26, 1998, the applicant committed to performing an ASME Code Section III metal fatigue analysis (cumulative usage factor [CUF] analysis) for the HPI line that would account for stresses imparted by system backflows and potential thermal stratification occurring in the line and that the new analysis would serve as one of the remedial actions addressing and resolving the operating experience event of April 21, 1997. The staff also observed that the applicable line item in SLRA Table 4.1.4-3 for the Bulletin 88-08 response is based on the applicant's review of its original response to Bulletin 88-08 and the applicant's determination that the original design basis did not include any ASME Code, Section III, CUF analyses for the Class 1 portions of the HPI and residual heat removal (RHR) lines at Units 1, 2, and 3 (i.e., because they were not required by the original design code for the piping).

The staff also confirmed that the applicant included its applicable environmentally-assisted fatigue (CUF_{en}) calculations for the HPI piping and other Class 1 sentinel piping locations as part of the supporting information for the SLRA in Table 4.3.4-1 of non-proprietary report SLR-ONS-TLAA-0306NP, "Environmentally-Assisted Fatigue Oconee Subsequent License Renewal Application Supplemental Section 4.3.4," Revision 0 (Enclosure 4, Attachment 3, in the SLRA [ADAMS Accession No. ML21158A200]) and proprietary report SLR-ONS-TLAA-0306P, "Environmentally-Assisted Fatigue Oconee Subsequent License Renewal Application Supplemental Section 4.3.4," Revision 0 (Enclosure 5, Attachment 3, in the SLRA [ADAMS Accession No. ML21158A201]) [henceforth these reports will be referred to as "SLR-ONS-TLAA-0306NP/P" for the non-proprietary and proprietary versions]. The staff confirmed that the applicant's CUF_{en} calculations for the HPI lines include the system stop and check valves that were associated with the cause of flow bypass and thermal stratification in the HPI line, as previously discussed and summarized in the applicant's letter dated February 26, 1998, for the April 1997 event. Based on this confirmation, the staff considers that the applicant's updated Bulletin 88-08 response in the letter of August 26, 1998, has a direct relationship to the applicant's environmentally-assisted CUF_{en} calculations for the Class 1 sentinel piping locations in SLRA Section 4.3.4, including the CUF_{en} calculation for the HPI lines in Table 4.3.4-1 of SLR-ONS-TLAA-0306NP/P. The staff evaluated the applicant's environmentally-assisted fatigue TLAA in Section 4.3.4 of the SE.

<u>Fatigue of the spent-fuel pool liner</u>. The applicant stated that the CLB does not include any metal fatigue analyses for the spent -fuel pool liners in Units 1, 2, and 3. The staff reviewed the UFSAR for the facility and verified that the UFSAR does not include or reference any metal fatigue analyses for the spent -fuel pool liners in the reactor units. Therefore, the staff finds that the applicant does not need to evaluate this type of analysis as a TLAA in the SLRA because the CLB does not include or incorporate by reference any fatigue of the spent-fuel pool liner analysis that conforms to Criterion 6 for defining TLAAs in 10 CFR 54.3(a).

Corrosion allowance calculations. The applicant stated that the CLB does not include any corrosion allowance assessments for metallic components where the amount of additional metal in component design was established through the results of a time-dependent corrosion wear or wastage analysis. The staff reviewed the UFSAR for the facility and verified that the CLB does not include or reference any corrosion allowance analyses. Therefore, the staff finds that the applicant does not need to evaluate this type of analysis as a TLAA in the SLRA because the CLB does not include or incorporate by reference any corrosion allowance calculations that conform to Criterion 6 for defining TLAAs in 10 CFR 54.3(a).

Flaw growth due to SCC. In SLRA Table 4.1.4-3, the applicant stated that the CLB does not include any flaw growth analyses that assess crack growth due to SCC. The staff reviewed the UFSAR for the facility and verified that the CLB does not include or reference any SCC-induced crack growth analyses for SSCs in the unit-specific designs. Therefore, the staff finds that the applicant does not need to evaluate this type of analysis as a TLAA in the SLRA because the CLB does not include or incorporate by reference any analyses for flaw growth due to SCC that conform to Criterion 6 for defining TLAAs in 10 CFR 54.3(a).

Predicted lower limit. In SLRA Table 4.1.4-3, the applicant stated that the CLB does not include any time-dependent analyses of concrete structure predicted lower limit that qualify as a TLAA for the SLRA. The staff reviewed the UFSAR for the facility and verified that the CLB does not include or reference any time-dependent assessments of predicted lower limit for concrete structures at Units 1, 2, and 3. Therefore, the staff finds that the applicant does not need to evaluate this type of analysis as a TLAA in the SLRA because the CLB does not include or incorporate by reference any predicted lower limit analyses that conform to Criterion 6 for defining TLAAs in 10 CFR 54.3(a).

4.1.2.1.4 Staff Determination - TLAA Identification Results

Based on its review, the staff finds that the applicant has appropriately identified all plant analyses that conform to the definition of a TLAA in 10 CFR 54.3(a) and has included its evaluations of these TLAAs in Chapter 4 of the SLRA, as amended by letters dated January 7, 2022, and February 21, 2022. The staff did not identify any additional analyses contained or incorporated by reference in the CLB that would conform to the definition of a TLAA in 10 CFR 54.3(a) or would need to be identified and evaluated in the SLRA in accordance with the requirements in 10 CFR 54.21(c)(1).

4.1.2.2 Identification of Exemptions

The staff reviewed, in accordance with the review procedures in SRP-SLR Section 4.1, the applicant's regulatory exemption identification methodology and results and the applicant's statement in SLRA Section 4.1.4 that the CLB does not include any regulatory exemptions granted in accordance with 10 CFR 50.12 that remain in effect and are based on a TLAA. Specifically, the staff performed an independent search of the CLB and the NRC's ADAMS database to identify any exemptions for the CLB that were granted in accordance with the requirements in 10 CFR 50.12.

Based on its ADAMS search, the staff observed that the NRC had granted a total 23 regulatory exemptions in accordance with the exemption approval criteria in 10 CFR 50.12. As documented in the staff's audit report for SLRA Section 4.1, the staff observed that, with the exception of the regulatory exemption granted for use of ASME Code Case N-514, "Low Temperature Overpressure Protection," all of the regulatory exemptions fell outside the scope of the criteria in 10 CFR 54.21(c)(2) because the exemptions either involved one-time schedular changes for completing operating license condition requirements or alternatives that were not based on TLAAs or time-dependent assumptions.

The staff also noted that, on March 29,1999 (ADAMS Accession Nos. ML012050426 and ML20205D255), the staff granted an exemption from the requirements in 10 CFR Part 50, Appendix G, which permitted the applicant to use ASME Code Case N-514 as an alternative methodology for calculating the low temperature overpressure protection (LTOP) system. The staff also noted that the methods in ASME Code Case N-514 may be based on a TLAA because the Code Case methodology calculates the LTOP system setpoints as a function of the specific pressure-temperature (P-T) points in the applicant's P-T limit cooldown curves for the units, which are within the scope of the applicant's P-T limits TLAA in SLRA Section 4.2.5.

Subsequently, on July 29, 1999 (ADAMS Accession Nos. ML012050097 and ML012050083), the staff concluded that a regulatory exemption for the use of ASME Code Case N-514 was not needed for the applicant. Thus, the staff finds that applicant has established a valid basis that the regulatory exemption for the use of ASME Code Case N-514 no longer remains in effect for the CLB and does not need to be evaluated as a regulatory exemption in the SLRA pursuant to the staff's exemption criteria in 10 CFR 54.21(c)(2).

Based on its review, the staff verified and concludes that the CLB does not include any regulatory exemptions granted under 10 CFR 50.12 that are based on a TLAA and remain in effect for the CLB and that the CLB does not include any regulatory exemptions that require evaluation in the SLRA in accordance with the regulatory requirement in 10 CFR 54.21(c)(2).

4.1.3 Conclusion

Based on its review, the staff concludes that the applicant has provided an acceptable list of TLAAs as defined in 10 CFR 54.3(a) and has provided an evaluation of these TLAAs in SLRA Chapter 4. The staff also concludes that, in accordance with criteria in 10 CFR 54.21(c)(2), the CLB does not include any regulatory exemptions granted in accordance with 10 CFR 50.12 and that are based on a TLAA and remain in effect for the CLB.

4.2 Reactor Vessel Neutron Embrittlement Analysis

4.2.1 Neutron Fluence Projections

4.2.1.1 Summary of Technical Information in the Application

SLRA Section 4.2.1 describes the applicant's TLAA for neutron fluence projections of the reactor vessel that have been used as inputs to the neutron embrittlement analyses that evaluate the reduction of the fracture toughness aging effects resulting from neutron irradiation.

Updated neutron fluence projections were performed and documented in non-proprietary report ANP-3898NP, Revision 0, "Framatome Reactor Vessel and [Reactor Coolant Pump] RCP TLAA and Aging Management Review Input to the ONS SLRA" (Enclosure 4, Attachment 1 of the SLRA) (ADAMS Accession No. ML21158A200) and proprietary report ANP-3898P, Revision 0, "Framatome Reactor Vessel and RCP TLAA and Aging Management Review Input to the ONS SLRA," May 2021 (Enclosure 5, Attachment 1 of the SLRA) (ADAMS Accession No. ML21158A201) [henceforth these reports will be referred to as "ANP-3898NP/P" for the non-proprietary and proprietary versions]. RPV beltline and extended beltline fast neutron fluences

(E > 1.0 MeV) at the end of 80 years of operation (72 effective full-power years [EFPY]) were calculated for Units 1, 2, and 3. The SLRA states that the analysis methodologies used to calculate Units 1, 2, and 3 RPV fluences satisfy the guidance set forth in Regulatory Guide (RG) 1.190, “Calculational and Dosimetry Methods for Determining Pressure Vessel Neutron Fluence” (ADAMS Accession No. ML010890301). The SLRA also states that NRC has approved these methodologies for use, as described in detail in non-proprietary report BAW-2241NP-A, Revision 2, “Fluence and Uncertainty Methodologies” (ADAMS Accession No. ML073310660) and proprietary report BAW-2241P-A, Revision 2, “Fluence and Uncertainty Methodologies” (ADAMS Accession No. ML073310661) [henceforth these reports will be referred to as “BAW-2241NP/P-A” for the non-proprietary and proprietary versions].

The applicant dispositioned the TLAA on the neutron fluence in accordance with 10 CFR 54.21(c)(1)(ii) by demonstrating that the neutron fluence has been projected to the end of the subsequent period of extended operation.

4.2.1.2 Staff Evaluation

The staff reviewed the applicant’s TLAA for neutron fluence projections and the corresponding disposition of the TLAA in accordance with 10 CFR 54.21(c)(1)(ii), consistent with the review procedures in SRP-SLR Section 4.2.3.1.1 and the acceptance criteria in SRP-SLR Section 4.2.2.1.1. Specifically, the staff reviewed whether the applicant (a) identified the neutron fluence for each beltline material at the end of the subsequent period of extended operation, (b) used a staff-approved methodology to calculate the neutron fluence, and (c) applied a methodology that is consistent with the guidance in RG 1.190.

The NRC provides guidance for acceptable fluence calculations in RG 1.190. The staff has generically approved methods described in BAW-2241NP/P-A, Revision 2, for use in the traditional reactor vessel beltline based on their adherence to the guidance contained in RG 1.190. Specific examples of adherence to RG 1.190 guidance include using a cross-section library that was derived from the Evaluated Nuclear Data File/Brookhaven, Version VI (ENDF/B-VI) nuclear data file (i.e., BUGLE-93 cross sections are used), use of S8 angular quadrature, and extensive qualification to experimental data, including the pool critical assembly at Oak Ridge National Laboratory. Note that the traditional beltline is defined as the region of the reactor vessel that would include the axial extent of the vessel in proximity to active fuel.

The methodology described in BAW-2241NP/P-A, Revision 2 is a two-dimensional semi-analytical approach to calculate the RPV neutron fluence and uncertainty. The fluence calculations are performed with the discrete ordinates transport (DORT) code. BAW-2241NP/P-A uses several [r,θ] and [r,z] models to represent important geometrical items such as the core, lower and upper internal grids, thermal shield, reactor vessel, cavity, and concrete primary shield wall.

The staff noted that the same methods were used to perform fluence projections to the end of the renewed, 60-year operating license that the NRC approved in 2000 in NUREG-1743 “Safety Evaluation Report Related to the License Renewal of Oconee Nuclear Station Units 1, 2, and 3” (ADAMS Accession No. ML003695154). Therefore, the staff had previously determined that fluence projections obtained using the same methods as those described in the SLRA were acceptable for use at Units 1, 2, and 3.

The assumed lifetime of the reactor in the neutron fluence analyses, 72 EFPY, was determined based on the accrued EFPY for Units 1, 2, and 3 through Cycles 31, 29, and 30, respectively, and assuming a capacity factor of 100% for the duration of the subsequent period of extended operation. The staff finds this assumption acceptable and conservative because the plant cannot realistically achieve a 100% capacity factor, largely due to maintenance and refueling outages throughout the lifetime of the plant, which means this assumed 72-year neutron fluence period overestimates the actual neutron fluence that would be expected at the end of the subsequent period of extended operation.

Moreover, the NRC approved a measurement uncertainty recapture (MUR) power uprate for Units 1, 2, and 3 on January 26, 2021 (ADAMS Accession No. ML20335A001). The approved MUR allows for a 1.64% increase in operating power for the three units. The fluence projections in the SLRA conservatively factor in a 2.0% increase in power at the beginning of Cycle 30 for Unit 1, Cycle 29 for Unit 2, and Cycle 29 for Unit 3. At the time of the SLRA submittal, each unit was operating in Cycles 32, 30, and 31, respectively, and the MUR had not been implemented at any of the three units. The staff finds this consideration of the MUR operating conditions to be conservative and acceptable because the power assumed to be associated with the MUR in the fluence analyses was greater than the actual MUR power increase.

The fluence is reported for regions in the extended beltline region in accordance with Regulatory Issue Summary (RIS) 2014-11 (ADAMS Accession No. ML14149A165) and Section 4.2 of the SRP-SLR, where “extended beltline” is intended to refer to those regions of the reactor vessel that are above or below the active fuel region of the core. However, BAW-2241NP/P-A, Revision 2, is not approved for use outside of the traditional beltline. For the determination of the fluence in the extended beltline region, for example at the RPV nozzle and the transition forging, the model developed using BAW-2241NP/P-A, Revision 2, is extended, and an adjustment method is employed by Framatome, who, in partnership with the licensee, performed the fluence calculations to support the SLRA. In order to evaluate the fluence at an extended beltline location of interest (e.g., RPV nozzle, ¼T [one-quarter thickness], and ¾T [three-quarter thickness] locations), the adjustment method takes the product of the DORT-calculated fluence at the circumferential weld that connects the upper shell to the lower shell and the ratio of the DORT-calculated displacements per atom (dpa) at the extended beltline location of interest to the calculated dpa at the circumferential weld. In other words, in the extended beltline, fluence is attenuated through the thickness of the shell by considering the ratio of dpa at the depth in question to the dpa at the inner surface in the beltline. The dpa adjustment method allows for differences in the neutron spectrum between the surveillance capsule location and the extended beltline location to be accounted for in the fluence estimate.

Framatome’s dpa adjustment method is consistent with RG 1.99, Revision 2, “Radiation Embrittlement of Reactor Vessel Materials” (ADAMS Accession No. ML031430205) guidance that states “if dpa calculations are made as a part of the fluence analysis, the ratio of the dpa at the depth in question to the dpa at the inner surface may be substituted for the exponential attenuation factor in equation 3.”

Furthermore, the dpa adjustment method was compared to calculations using the methodology in non-proprietary report ANP-10348NP-A, Revision 0, “Fluence Methodologies for SLR” (ADAMS Accession No. ML21221A334) and proprietary report ANP-10348P-A, Revision 0, “Fluence Methodologies for SLR” (ADAMS Accession No. ML21221A335) [henceforth these reports will be referred to as “ANP-10348NP/P-A” for the non-proprietary and proprietary versions]. The Framatome SOLIDWORKS - VICTORA, ADVANTG, MCNP [Monte Carlo N-Particle] (SVAM) fluence method described in ANP-10348NP/P-A is a three-dimensional hybrid deterministic/Monte Carlo method that can be used to determine acceptably accurate fluence values for the beltline and extended beltline regions of the RPV and is acceptable for SLRAs.

The SVAM method methodology meets or exceeds RG 1.190 guidance. The comparison of the SVAM-calculated fluence estimates with the DORT dpa adjustment methodology, as shown in Figure 2-6 of ANP-3898NP/P, demonstrates that the dpa adjustment method is conservative relative to the approved SVAM method. As a result, the staff finds the use of the dpa adjustment methodology described in ANP-3898NP/P to be acceptable.

The staff finds that the applicant has demonstrated that the neutron fluence for the reactor vessel has been projected to the end of the subsequent period of extended operation pursuant to 10 CFR 54.21(c)(1)(ii). The analysis meets the acceptance criteria in SRP-SLR Section 4.2.2.1.1 because the methods used to calculate the neutron fluence in the traditional beltline are consistent with the NRC-approved methodology that meets RG 1.190 criteria (i.e., BAW-2241NP/P-A Revision 2) and the methods used to calculate the fluence in the extended beltline are in line with the RG 1.99 Revision 2 guidance and are sufficiently conservative. Additionally, the SLRA provided the neutron fluence projections for each beltline and extended beltline material at the end of the subsequent period of extended operation.

4.2.1.3 UFSAR Supplement

SLRA Section A3.2 provides the UFSAR supplement summarizing the TLAA for neutron fluence projections. The staff reviewed SLRA Section A3.2 consistent with the review procedures in SRP-SLR Section 4.2.3.1.1.2.

Based on its review of the UFSAR supplement, the staff finds the supplement acceptable because it meets the acceptance criteria in SRP-SLR Section 4.2.2.1.1.2. Additionally, the staff finds that the applicant provided an adequate summary description of its actions to address the TLAA for neutron fluence projections to the end of the subsequent period of extended operation, as required by 10 CFR 54.21(d).

4.2.1.4 Conclusion

Based on its review, the staff concludes that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(ii), that the neutron fluence analyses for the reactor vessel have been projected to the end of the subsequent period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation for the subsequent period of extended operation, as required by 10 CFR 54.21(d).

4.2.2 Upper-Shelf Energy

4.2.2.1 Summary of Technical Information in the Application

SLRA Section 4.2.2 describes the applicant’s TLAA for upper-shelf energy (USE). The applicant dispositioned the USE TLAA in accordance with 10 CFR 54.21(c)(1)(ii) by demonstrating that the analysis has been projected to the end of the subsequent period of extended operation.

4.2.2.2 Staff Evaluation

The staff reviewed the applicant’s USE TLAA and the corresponding disposition of the TLAA in accordance with 10 CFR 54.21(c)(1)(ii), consistent with acceptance criteria in SRP-SLR Section 4.2.2.1.2.2 and the review procedures in SRP-SLR Section 4.2.3.1.2.2.

The regulations in 10 CFR 50, Appendix G, Paragraph IV.A.1.a, require that RPV beltline materials must have initial USE values of at least 75 ft-lb and maintain a USE value of at least 50 ft-lb throughout the operating life of the RPV, unless it is demonstrated that lower USE values will provide margins of safety against fracture equivalent to those required by ASME Code, Section XI, Appendix G. The applicant stated that the USE values for the traditional beltline and extended beltline materials were determined using methods consistent with RG 1.99, Revision 2 (ADAMS Accession No. ML003740284), including the use of RPV material surveillance program data in accordance with Regulatory Position 2.2 in the RG. For RPV materials with USE projections below 50 ft-lb at the end of the subsequent period of extended operation (e.g., 72 EFPY), equivalent margins analyses (EMAs) were performed to demonstrate that the margins of safety against fracture are equivalent to those required by Appendix G of Section XI of the ASME Code. The applicant stated that EMAs were performed for the following beltline materials: (1) Linde 80 welds in Units 1, 2, and 3, (2) Unit 1 weld SA-1135, and (3) Unit 3 RPV outlet nozzle forgings and transition forging.

The applicant provided weight percent copper (wt. % Cu), initial USE values, and 72 EFPY neutron fluence values at the 1/4T location of the RPV in Tables 3-6, 3-7, and 3-8 of ANP-3898NP/P, Revision 0, for each beltline material for Units 1, 2, and 3, respectively. The staff reviewed the changes in the wt. % Cu and initial USE values between the SLRA and the CLB, identified in Tables 3-3 and 3-4 from ANP-3898NP/P, Revision 0, and finds them acceptable because they incorporate the latest available data and information to update these values. These values were used to project USE values to 72 EFPY following the methodology of RG 1.99, Revision 2. Report ANP-3898NP/P, Revision 0, also provided copper content and initial USE values for extended beltline locations that were not previously submitted. The staff reviewed these values and finds them acceptable because the bases use acceptable information in developing best-estimate wt. % Cu values and establishing initial USE. The statistical analyses wt. % Cu and initial USE values for identical heats of weld materials provides acceptable method of determining generic values. The generic initial USE for Linde 80 welds was based on a statistical analysis of Linde 80 weld values from the Reactor Vessel Working Group (RVWG) database. Generic initial USE for the ONS Unit 1 and Unit 2 inlet and outlet nozzle forgings and transition forgings and the ONS Unit 3 RPV inlet nozzle forgings were procured from Bethlehem Steel. Bethlehem steel provided initial USE values for these materials. The wt. % Cu values for these materials were obtained from the RVWG. The mean of measured values for the wt. % Cu of the RPV inlet and outlet nozzle forging to nozzle belt forging Linde 80 welds for ONS Units 1, 2 and 3 were provided. The use of the mean of measured values for a plate or forging or for weld samples made with the weld wire heat number that matches the critical vessel weld is consistent with Regulatory Guide 1.99, Revision 2, Section 1.1.

Except as noted above when EMAs were performed, the remaining RPV materials were appropriately demonstrated to exhibit USE levels at 72 EFPY that exceed 50 ft-lb, as required by 10 CFR 50, Appendix G, Paragraph IV.A.1.

Framatome topical reports BAW-2192, Revision 0, Supplement 1NP-A, Revision 0, “Low Upper-Shelf Toughness Fracture Mechanics Analysis of Reactor Vessels of B&W Owners Reactor Vessel Working Group for Levels A and B Service Loadings” (ADAMS Accession No. ML19101A344) and BAW-2178, Revision 0, Supplement 1NP-A, Revision 0, “Low Upper-Shelf Toughness Fracture Mechanics Analysis of Reactor Vessels of B&W Owners Reactor Vessel Working Group for Levels C and D Service Loadings,” (ADAMS Accession No. ML19101A345) provide approved EMAs for demonstrating that ASME Code, Section XI, acceptance criteria for Levels A through D service loadings for RPV materials are met for specific RPV materials projected to have USE values less than 50 ft-lb through 80 years of operation. These reports contain EMAs for all Linde 80 welds in Units 1, 2, and 3 identified as beltline and extended beltline materials for 72 EFPY.

The staff confirmed that the weld chemistry data reported in Table 3-1 of BAW-2178, Revision 0, Supplement 1NP-A, Revision 0, and Table 3-1 of BAW-2192, Revision 0, Supplement 1NP-A, Revision 0, was consistent with weld chemistry copper content reported in Tables 3-6 to 3-8 of ANP-3898NP/P, Revision 0, for Units 1, 2, and 3, respectively, which were found to be acceptable in these previously approved topical reports.

The staff SEs for BAW-2192, Revision 0, Supplement 1P-A, Revision 0, and BAW-2178, Revision 0, Supplement 1P-A, Revision 0, conclude that the reports may be referenced in SLRAs for the plants within the scope of the report as a basis for demonstrating that the USE TLAA has been projected in accordance with 10 CFR 54.21(c)(1)(ii) for Linde 80 welds in those plants. One condition the staff identified was those individual users referencing the topical reports as the basis for demonstrating compliance with the 10 CFR Part 50, Appendix G, requirements related to USE must generate an 80-year neutron fluence at RPV locations in accordance with NUREG-2192 (SRP-SLR) to demonstrate that the neutron fluence estimates provided in Table 3-1 of the topical reports are applicable to their plants.

The staff confirmed that the EMAs in these reports for the Linde 80 weld materials of Units 1, 2, and 3 address the USE requirements for these materials for 72 EFPY because the plant neutron fluence levels are lower than those in the reports, except for one material, Unit 1 weld SA-1135. This weld is not bounded by the 80-year inside wetted surface fluence values reported in Table 3-1 of BAW-2178, Revision 0, Supplement 1P-A, and Table 3-1 of BAW-2192, Revision 0, Supplement 1P-A.

The staff finds from its review of the SLRA that BAW-2178, Revision 0, Supplement 1P-A, Revision 0, and BAW-2192, Revision 0, Supplement 1P-A, Revision 0, are applicable and provide acceptable EMAs for the Linde 80 welds (with the exception of Unit 1 weld SA-1135), consistent with the requirements of 10 CFR 50, Appendix G, Paragraph IV.A.1, which establishes minimum USE requirements. If the projected USE of an RPV steel falls below 50 ft-lb, the projected value must be demonstrated to provide a margin of safety against ductile fracture equivalent to that required by Appendix G of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section XI. 10 CFR 50, Appendix G, requires that this demonstration, called an EMA, be performed for all materials falling below 50 ft-lb.

The evaluation of Unit 1 weld SA-1135 in BAW-2192, Revision 0, Supplement 1P-A, Revision 0, and BAW-2178, Revision 0, Supplement 1P-A, Revision 0, used a neutron fluence of 1.90 x 10^{18} n/cm^2. However, the neutron fluence cited in SLRA Table 4.2.1-1 for weld SA-1135 was 2.91x10^{18} n/cm^2, which exceeds the value in the BAW reports. Therefore, an updated EMA analysis for Unit 1 weld SA-1135 was performed. Staff reviewed the analysis and confirmed that this weld continues to meet the acceptance criteria, the limiting weld (Unit 1, axial weld SA-1073) identified in the BAW reports does not change, and the updated EMA analysis for Unit 1 weld SA-1135 does not impact the conclusions or applicability of these reports to satisfy the USE requirements through EMAs for the Linde 80 weld materials that are projected to be less than 50 ft-lb at 72 EFPY for Unit 1. Therefore, the staff finds that the applicant has demonstrated that the EMA for Unit 1 weld SA-1135 meets the requirements of 10 CFR 50, Appendix G, Paragraph IV.A.1, because the lower values of Charpy USE were shown to provide margins of safety against fracture equivalent to those required by Appendix G of Section XI of the ASME Code.

Section 4 of ANP-3898NP/P, Revision 0, describes the additional analysis required to demonstrate compliance with the 10 CFR Part 50, Appendix G, USE criterion for the Unit 3 RPV outlet nozzle forgings and transition forging. The applicant provided EMAs for the Unit 3 RPV outlet nozzle forgings and transition forging. The EMAs were developed to show that the lower values of USE provide margins of safety against fracture equivalent to those required by Appendix G of Section XI of the ASME Code. The applicant stated that the selection of the design transients and the methodology for calculation of applied J-integrals for the RPV outlet nozzles and transition forging are consistent with the methodology used to calculate applied J-integrals for Linde 80 welds in BAW-2192, Revision 0, Supplement 1P-A, Revision 0, and BAW-2178, Revision 0, Supplement 1P-A, Revision 0. The staff confirmed that the unirradiated USE for the Unit 3 RPV outlet nozzle forgings was previously conservatively estimated at 78 ft-lb in the strong direction (ASTM L-T) orientation as described in American Society of Testing and Materials [ASTM] International E 185-82, "Standard Practice for Conducting Surveillance Tests for Light-Water Cooled Nuclear Power Reactor Vessels") and 52 ft-lb in the weak direction (ASTM T-L orientation as described in ASTM International E 185-82) based on the data reported in Pressurized Water Reactor Owner's Group (PWROG)-17090-NP-A, Revision 0, "Generic Rotterdam Forging and Weld Initial Upper-Shelf Energy Determination" (ADAMS Accession Number ML20024E238). The applicant stated that the EMA for the Unit 3 outlet nozzle forgings and transition forging materials (1) were based on the J-integral resistance (J-R) model in NUREG/CR-5729, "Multivariable Modeling of Pressure Vessel and Piping J-R Data"; (2) used projected RPV neutron fluence values at 80 years of operation; (3) considered Level A/B and Level C/D loading conditions; and (4) were based on the methodologies in ASME Code, Section XI, Appendix K. Based on its review of the SLRA, the staff finds that the applicant has demonstrated that the EMAs for the Unit 3 RPV outlet nozzle forgings and transition forging meet the requirements of 10 CFR 50, Appendix G, Paragraph IV.A.1, because the EMAs were performed to demonstrate that the lower values of USE were shown to provide margins of safety against fracture equivalent to those required by Appendix G of Section XI of the ASME Code.

Therefore, as discussed above, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(ii), that the USE analyses and EMAs have been projected to the end of the subsequent period of extended operation (i.e., to 72 EPFY) for Units 1, 2, and 3. Additionally, the staff finds that the USE TLAA meets the acceptance criteria in SRP-SLR Section 4.2.2.1.2.2 because, for each material, (a) the applicant has projected the USE analyses to the end of the subsequent period of extended operation and demonstrated that it meets the 50-ft-lb criterion, and (b) for RPV materials whose USE values for 72 EFPY have been projected to be less than 50 ft-lb, the applicant has performed an EMA projected to the end of the subsequent period of extended operation that meets the requirements of 10 CFR Part 50, Appendix G.

4.2.2.3 UFSAR Supplement

SLRA Section A4.2.2, "Upper-Shelf Energy," provides the UFSAR supplement summarizing the applicant's USE TLAA. The staff reviewed the UFSAR supplement consistent with the acceptance criteria in SRP-SLR Section 4.2.2.2 and the review procedures in SRP-SLR Section 4.2.3.2.

Based on its review of the UFSAR supplement, the staff finds that it meets the acceptance criteria in SRP-SLR Section 4.2.2.2 and is therefore acceptable. Additionally, the staff finds that the applicant provided an adequate summary description of its actions to address the USE TLAA, as required by 10 CFR 54.21(d).

4.2.2.4 Conclusion

Based on its review, the staff concludes that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(ii), that the USE TLAA for the ferritic RPV beltline and extended beltline materials have been projected to the end of the subsequent period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.2.3 Pressurized Thermal Shock

Section 50.61 establishes the fracture toughness requirements for protection against PTS events, including methods for performing adjusted reference temperature calculations (i.e., calculations of reference temperature for pressurized thermal shock [RT_{PTS}] values) for the ferritic base and weld materials of the RPV. The calculations of RT_{PTS} values are based on the cumulative neutron fluence exposures of the RPV beltline (e.g., those RPV materials that directly surround the reactor core) and extended beltline materials (e.g., other RPV materials that have a peak fluence greater than 1×10^{19} n/cm^2 with E > 1 million electron volts (MeV)) at the clad-base-metal interface projected to the end of the subsequent period of extended operation.

4.2.3.1 Summary of Technical Information in the Application

SLRA Section 4.2.3 describes the applicant's TLAA for projecting the RT_{PTS} values for the Units 1, 2, and 3 RPVs to the end of the subsequent period of extended operation. The applicant dispositioned the TLAA on PTS in accordance with 10 CFR 54.21(c)(1)(ii) by demonstrating that the TLAA has been projected to the end of the subsequent period of extended operation.

4.2.3.2 Staff Evaluation

The staff reviewed the applicant's TLAA on PTS and the corresponding disposition of the TLAA in accordance with 10 CFR 54.21(c)(1)(ii), consistent with the acceptance criteria defined in SRP-SLR Section 4.2.2.1.3.2 and the review procedures defined in SRP-SLR Section 4.2.3.1.3.2.

The staff performed its review to confirm that RT_{PTS} values projected to 72 EFPY would meet, as appropriate, the 270 °F screening criterion specified in 10 CFR 50.61 for plates, forgings, axial weld materials and 300 °F circumferential weld materials. The applicant's RT_{PTS} calculations are summarized in Tables 5-10, 5-11, and 5-12 in ANP-3898NP/P, Revision 0, for Units 1, 2, and 3, respectively. The staff also performed independent calculations of the RT_{PTS} values for the RPV materials to verify the validity of the values that were provided in Tables 5-10, 5-11, and 5-12. The staff's audit report (ADAMS Accession No. ML22045A053) for the TLAA, in part, cites the documents reviewed that provide the bases for the wt. % Cu and weight percent nickel (wt. % Ni) alloying contents, initial reference temperature for nil-ductility transition (RT_{NDT}) values (i.e., $RT_{NDT(U)}$ values), and σ_I variance values that were used as input parameters for the RT_{PTS} calculations, and the sources of any RPV surveillance data that may be applicable to the calculations of RT_{PTS}. Other than those cases evaluated below, the staff confirmed that the values used for the RT_{PTS} calculations are equal to or conservative relative to the CLB values for each unit.

During its audit, the staff verified that the changes in wt. % Cu alloying content for the lower nozzle belt (LNB) forgings in Unit 1 (Heat Number ZV-2861) and Unit 3 (Heat Number 4680) came from a proprietary RPV materials fabrication database and that the selected values were of the same material and heat number. The staff determined that the change in wt. % Cu value for the LNB forging in Unit 3 was conservative, yielding a higher RT_{PTS} value. Regarding the change in wt. % Cu value for the LBN forging in Unit 1, the staff determined that the new calculated RT_{PTS} value did not challenge the PTS screening criterion of 270 °F for RPV base metals. The staff questioned the applicant on how the applicant determined a generic wt. % Cu value for the Unit 3 RPV outlet nozzle forging (ONF) and transition forgings. In response to RAI 4.2.3-1 in a letter dated February 14, 2022 (ADAMS Accession No. ML22045A021), the applicant clarified that the ONF and transition forging heat numbers had no reported wt. % Cu content values, and therefore applicable values from various sources fabricated by the same vendor were used to yield a generic wt. % Cu value. The staff verified that the wt. % Cu content and generic wt. % Cu values came from a conservative statistical analysis.

Based on the results of its independent calculations, the staff verified that the RT_{PTS} calculations for the Unit 1 RPV at 72 EFPY are limited by the RPV lower shell axial weld SA-1426 and SA-1430 fabricated from Linde 80 Weld Heat 8T1762. For this weld, the applicant and staff calculated an RT_{PTS} value of 207.2 °F at 72 EFPY, consistent with Table 5-10 in ANP-3898NP/P, Revision 0. The staff verified that the applicant had been granted an exemption (ADAMS Accession No. ML120580196) to use T_0 for initial RT_{NDT}. The RT_{PTS} value of 207.2 °F meets the PTS screening criterion of 270 °F for RPV axial weld metals.

The staff verified that the RT_{PTS} calculations for the Unit 2 RPV at 72 EFPY are limited by the RPV upper-shell to lower-shell circumferential weld WF-25 fabricated from Linde 80 Weld Heat 299L44. For this weld, the applicant and staff calculated an RT_{PTS} value of 245.1 °F at 72 EFPY, consistent with Table 5-11 in ANP-3898NP/P, Revision 0. The staff verified that the applicant had been granted the same exemption to use T_0 for initial RT_{NDT}. The RT_{PTS} value of 245.1 °F meets the PTS screening criterion of 300 °F for RPV circumferential weld metals.

Similarly, the staff verified that the RT_{PTS} calculations for the Unit 3 RPV at 72 EFPY are limited by the RPV upper-shell to lower-shell circumferential weld WF-67 fabricated from Linde 80 Weld Heat 72442. For this weld, the applicant and staff calculated an RT_{PTS} value of 240.2 °F at 72 EFPY, consistent with Table 5-12 in ANP-3898NP/P, Revision 0. The staff verified that the applicant had been granted the same exemption to use T_0 for initial RT_{NDT}. The RT_{PTS} value of 240.2 °F meets the PTS screening criterion of 300 °F for RPV circumferential weld metals.

The staff noted that the calculated, limiting RT_{PTS} values use chemistry factor values from Tables 1 and 2 of 10 CFR 50.61. The available data from surveillance capsules do not affect the limiting RT_{PTS} values for the units.

Based on its review of the TLAA and independent calculations, the staff verified that the applicant performed the RT_{PTS} calculations for all RPV beltline and extended beltline materials at 72 EPFY in accordance with 10 CFR 50.61 and that the RT_{PTS} values for the RPV materials meet the PTS screening criteria in 10 CFR 50.61.

Therefore, the staff finds that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(ii), that the TLAA on PTS has been projected to the end of the subsequent period of extended operation. Additionally, the TLAA meets the acceptance criteria in SRP-SLR Section 4.2.2.1.3.2 because (a) the applicant has appropriately projected the RT_{PTS} values for the RPV beltline and extended beltline materials to the end of the subsequent period of extended operation, and (b) the applicant has demonstrated that the RT_{PTS} values meet the PTS screening criteria in 10 CFR 50.61.

4.2.3.3 UFSAR Supplement

SLRA Section A4.2.3, "Pressurized Thermal Shock," provides the UFSAR supplement summarizing the TLAA on PTS. The staff reviewed SLRA Section A4.2.3 consistent with the acceptance criteria in SRP-SLR Section 4.2.2.2 and the review procedures in SRP-SLR Section 4.2.3.2.

Based on its review of the UFSAR supplement, the staff finds that it meets the acceptance criteria in SRP-SLR Section 4.2.2.2 and is therefore acceptable. Additionally, the staff finds that the applicant provided an adequate summary description of its actions to address TLAA on PTS, as required by 10 CFR 54.21(d).

4.2.3.4 Conclusion

Based on its review, the staff concludes that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(ii), that the RT_{PTS} calculations for the RPV beltline and extended beltline materials have been projected to the end of the subsequent period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.2.4 Pressure-Temperature Limits

4.2.4.1 Summary of Technical Information in the Application

SLRA Section 4.2.4, "Pressure-Temperature Limits," summarizes the applicant's evaluation of the TLAA related to P-T limit calculations for the RPV components at Units 1, 2, and 3. The applicant dispositioned the TLAA in accordance with 10 CFR 54.21(c)(1)(iii) by demonstrating that the effects of neutron embrittlement on the intended functions of the RPV materials will be adequately managed during the subsequent period of extended operation.

The applicant stated that the P-T limits for the subsequent period of extended operation need not be submitted as a part of the SLRA because the P-T limits are required to be updated through the licensing process in 10 CFR 50.90 when necessary for P-T limits located in the technical specifications (TS). The applicant also stated that the CLB will ensure that the P-T limits for the subsequent period of extended operation will be updated prior to exceeding 44.6 EFPY for Unit 1, 45.3 EFPY for Unit 2, and 43.8 EFPY for Unit 3 for which the CLB P-T limits remain valid. The applicant further stated that SLRA Section B2.1.19, "Reactor Vessel Material Surveillance," program; SLRA Section B3.2, "Neutron Fluence Monitoring," program; and the TS will ensure that the updated P-T limits will be based on the updated adjusted reference temperature values.

4.2.4.2 Staff Evaluation

The staff reviewed the applicant's P-T limits for TLAA and the corresponding disposition in accordance with 10 CFR 54.21(c)(1)(iii), consistent with the acceptance criteria in SRP-SLR Section 4.2.2.1.4.3 and the review procedures in SRP-SLR Section 4.2.3.1.4.3.

The staff noted that the applicant's basis for dispositioning the TLAA in accordance with 10 CFR 54.21(c)(1)(iii) is consistent with the basis in SRP-SLR Section 4.2.2.1.4.3. This section of the SRP-SLR specifies that an applicant's 10 CFR 50.90 license amendment process is adequate for dispositioning P-T limits for TLAA in accordance with 10 CFR 54.21(c)(1)(iii) and applies to licensing bases that have P-T limit curves in the limiting conditions of operation of the plant-specific TS. Because the applicant will update the P-T limits through the 10 CFR 50.90 process for the subsequent period of extended operation before exceeding 44.6 EFPY for Unit 1, 45.3 EFPY for Unit 2, and 43.8 EFPY for Unit 3 for which the CLB P-T limits remain valid, the staff finds that applicant's disposition of the P-T limits TLAA in accordance with 10 CFR 54.21(c)(1)(iii) is consistent with the acceptance criteria in SRP-SLR Section 4.2.2.1.4.3 and is therefore acceptable.

Therefore, in accordance with 10 CFR 54.21(c)(1)(iii), the staff finds that the applicant will adequately manage the P-T limits through the subsequent period of extended operation.

4.2.4.3 UFSAR Supplement

SLRA Section A4.2.4, "Pressure-Temperature Limits," provides the UFSAR supplement summarizing the P-T limits for TLAA. The staff reviewed SLRA Section A4.2.4 consistent with the review procedures in SRP-SLR Section 4.2.3.2.

Based on its review of the UFSAR supplement, the staff finds that it meets the acceptance criteria in SRP-SLR Section 4.2.2.2 and is therefore acceptable. Additionally, the staff finds that the applicant provided an adequate summary description of its actions to address the P-T limits TLAA as required by 10 CFR 54.21(d).

4.2.4.4 Conclusion

Based on its review, the staff concludes that the applicant has provided an acceptable demonstration, in accordance with 10 CFR 54.21(c)(1)(iii), that the P-T limits will be adequately managed during the subsequent period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.2.5 Low Temperature Overpressure Protection

4.2.5.1 Summary of Technical Information in the Application

SLRA Section 4.2.5, "Low Temperature Overpressure Protection," summarizes the applicant's evaluation of the TLAA that assesses the low temperature overpressure protection (LTOP) enable temperature, power -operated relief valve (PORV) pressure setpoint, and LTOP P-T limits applicable to Units 1, 2, and 3. The applicant stated that the LTOP setpoints (i.e., enable temperature and PORV pressure) and LTOP P-T limits are based on the P-T limit calculation (SLRA Section 4.2.4), which is a TLAA. The applicant stated that the LTOP enable temperature, PORV pressure setpoint, and LTOP P-T limits will be updated through the

10 CFR 50.90 process at a later date and dispositioned the TLAA in accordance with 10 CFR 54.21(c)(1)(iii).

4.2.5.2 Staff Evaluation

The staff reviewed applicant's P-T limits TLAA and the corresponding disposition in accordance with 10 CFR 54.21(c)(1)(iii), consistent with the acceptance criteria in SRP-SLR Section 4.2.2.1.4.3 and the review procedures in SRP-SLR Section 4.2.3.1.4.3.

The staff noted that since the LTOP enable temperature, PORV pressure setpoint, and LTOP P-T limits are based on the P-T limit calculation, which the applicant is dispositioning as a TLAA in accordance with 10 CFR 54.21(c)(1)(iii), the applicant's disposition of the LTOP TLAA in accordance with 10 CFR 54.21(c)(1)(iii) is consistent with the basis in SRP-SLR Section 4.2.2.1.4.3. This section of the SRP-SLR specifies that an applicant's 10 CFR 50.90 license amendment process is adequate for dispositioning P-T limits for TLAA in accordance with 10 CFR 54 21(c)(1)(iii). Because the applicant will update the P-T limits for TLAA and the LTOP TLAA through the 10 CFR 50.90 process, the staff finds that the applicant's disposition of the LTOP TLAA in accordance with 10 CFR 54.21(c)(1)(iii) is consistent with the acceptance criteria in SRP-SLR Section 4.2.2.1.4.3 and is therefore acceptable.

Therefore, in accordance with 10 CFR 54.21(c)(1)(iii), the staff finds the applicant will adequately manage the LTOP enable temperature, PORV pressure setpoint, and LTOP P-T limits through the subsequent period of extended operation.

4.2.5.3 UFSAR Supplement

SLRA Section A4.2.5, "Low Temperature Overpressure Protection," provides the UFSAR supplement summarizing the LTOP TLAA. The staff reviewed SLRA Section A4.2.5, consistent with the review procedures in SRP-SLR Section 4.2.3.2.

Based on its review of the UFSAR supplement, the staff finds it meets the acceptance criteria in SRP-SLR Section 4.2.2.2 and is therefore acceptable. Additionally, the staff finds that the applicant provided an adequate summary description of its actions to address the LTOP TLAA as required by 10 CFR 54.21(d).

4.2.5.4 Conclusion

Based on its review, the staff concludes that the applicant has provided an acceptable demonstration, in accordance with 10 CFR 54.21(c)(1)(iii), that the LTOP enable temperature, PORV pressure setpoint, and LTOP P-T limits will be adequately managed during the subsequent period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.3 Metal Fatigue

SLRA Section 4.3 states that fatigue analyses are required on components designed to ASME Code Section III, Class 1. Other codes require a fatigue analysis or assume a stated number of full-range thermal and displacement transient cycles, such as ASME Code Section III, Class 2 and 3; USA Standard (USAS) B31.7 (currently known as American National Standards Institute or ANSI), "Nuclear Power Piping" Class 1; USAS (ANSI) B31.1, "Power Piping"; as allowed per

USAS (ANSI) B31.7, Class 2 and 3; and ASME Code Section VIII, "Rules for Construction of Pressure Vessels," Division 2.

The following are those analyses that were identified as fatigue TLAAs or support a fatigue TLAA:

- "Transient Cycle Projections for 80 Years" (SLRA Section 4.3.1)
- "Class 1 Component Fatigue Evaluation" (SLRA Section 4.3.2)
- "Non-Class 1 Piping Fatigue Analyses" (SLRA Section 4.3.3)
- "Environmentally-Assisted Fatigue" (SLRA Section 4.3.4)
- "Analytical Evaluation of Flaws" (SLRA Section 4.3.5)
- "Weld Overlay Fatigue Analysis" (SLRA Section 4.3.6)

4.3.1 Transient Cycle Projections for 80 Years

4.3.1.1 Summary of Technical Information in the Application

SLRA Section 4.3.1, as supplemented by letter dated January 7, 2022 (ADAMS Accession No. ML22010A129), describes the 80-year cycle projections for design transients. Fatigue analyses, which consider the effects of fatigue based on the numbers and amplitudes of the transients, are TLAAs. In contrast, the transient cycle projections for 80 years by themselves are not a TLAA, but the cycle projections form what is considered to be the time-limited aspect of various fatigue analyses.

The design transients and associated transient cycles are listed in UFSAR Table 5-2, "Transient Cycles for RCS Components Except Pressurizer Surge Line," and UFSAR Table 5-23, "Operating Design Transient Cycles for Pressurizer Surge Line." The 60-year CLB fatigue analyses are based on the original number of design cycles (40-year cycles), which bound the projected cycles for 60 years of operation. Cycle counts were projected to 80 years of operation based on the actual accumulation history through May 6, 2019, as shown in SLRA Table 4.3.1-1. The projected 80-year cycles are less than the original design cycles that are used in the fatigue analyses. Therefore, the 80-year projected operating cycles are bounded by the design cycles for 40 years of operation, which is also equivalent to the 60-year CLB cycles.

4.3.1.2 Staff Evaluation

The staff noted that SLRA Section 4.3.1 only addresses the 80-year cycle projections for design transients. The related fatigue TLAAs, which use these transient cycle projections, are separately addressed in SLRA Sections 4.3.2 (Class 1 fatigue analyses), 4.3.4 (environmentally assisted fatigue analyses), 4.3.5 (analytical flaw evaluations), and 4.3.6 (weld overlay fatigue analyses).

The purpose of the applicant's evaluation is to confirm the adequacy of the 80-year cycle projections based on the actual cycle accumulations. The cycle projections serve only as the baseline data for fatigue analyses and should be verified in comparison with the actual transient cycles that will be tracked during the subsequent period of extended operation in accordance with the Fatigue Monitoring program. The staff agrees with the applicant's evaluation that the 80-year cycle projections are used as an input to fatigue TLAAs but are not a fatigue TLAA by themselves. Accordingly, this section documents the staff's evaluation of the adequacy of the 80-year design transient cycle projections. The staff's evaluations of the fatigue TLAAs and associated TLAA dispositions are separately documented in Sections 4.3.2, 4.3.4, 4.3.5, and 4.3.6 of this SE.

The staff noted that the applicant's cycle projections for the plant used the maximum cycle accumulation rates among Units 1, 2, and 3 since December 2011 through May 6, 2019. The staff also noted that the 80-year cycle projections based on the actual cycle accumulation data are bounded by the CLB transient cycles that are equivalent to the original 40-year design cycles.

In comparison with the applicant's projection approach using the recent cycle accumulation rates (i.e., accumulation rates since December 2011 through May 6, 2019), the staff conducted cycle projections by using the maximum cycle accumulation rates among Units 1, 2, and 3 since the start of the operation at each unit through May 6, 2019. The 80-year projected cycles in the staff's evaluation were also bounded by the CLB design cycles in a similar manner with the applicant's cycle projection results. The staff found that the overall approach of the applicant for transient cycle projections is reasonable because the applicant used the actual cycle accumulation data, consistent with the guidance in SRP-SLR Section 4.3.2.1.1.1 that the cycle projections should be consistent with the historical plant operating characteristics, and the 80-year projected cycles are bounded by the CLB transient cycles. However, the staff identified some specific aspects of transient cycle projections that required clarification, as further evaluated below.

SLRA Section 4.3.1 indicates that the fatigue analyses are based on the numbers and amplitudes of thermal and pressure transients in UFSAR Table 5-2, "Transient Cycles for RCS Components Except Pressurizer Surge Line" and UFSAR Table 5-23, "Operating Design Transient Cycles for Pressurizer Surge Line." Specifically, SLRA Table 4.3.1-1 describes the 80-year projected transient cycles in comparison with the design transient cycles that are described in UFSAR Tables 5-2 and 5-23.

In its review, the staff noted that the following transients in UFSAR Table 5-2 are not listed in SLRA Table 4.3.1-1 for cycle projections and monitoring: (1) Transient 3, power loading 8 to 100 percent power; (2) Transient 4, power unloading 100 to 8 percent power; (3) Transient 5, 10 percent step load increase; (4) Transient 6, 10 percent step load decrease; (5) Transient 12, hydrotests; (6) Transient 18, loss of feedwater heater; (7) Transient 19, feed and bleed operations; and (8) Transient 20, miscellaneous transients. Therefore, the staff determined the need for additional information, which resulted in the issuance of RAI 4.3.1-1.

In its response dated January 7, 2022 (ADAMS Accession No. ML22010A129), the applicant stated that SLRA Table 4.3.1-1 lists the UFSAR transient cycles that are tracked in accordance with the CLB for 60 years of operation. The applicant also explained that Table 2 of "Revised Responses to NRC Requests for Additional Information," March 29, 1999, (ADAMS Accession No. ML15113A785) provides the UFSAR transients excluded from thermal fatigue cycle counting. The applicant indicated that the exclusion of transients from cycle counting for the 80-year operation period is consistent with that in the CLB.

The applicant further explained that the following transients are excluded from cycle counting in the CLB based on large allowable cycle numbers: Transient 3 (power loading 8 to 100 percent power), Transient 4 (power unloading 100 to 8 percent power), Transient 5 (10 percent step load increase), Transient 6 (10 percent power decrease), Transient 19 (feed and bleed operations), and Transient 20 (miscellaneous transients).

During a meeting on February 17, 2022, the applicant provided additional clarification as follows: (1) Transients 3, 4, 5, and 6 are associated with load-follow operations for a component design purpose, and (2) the "ONS Units have always been operated as base load" units and do not have a plan for load-follow operations (ADAMS Accession Nos. ML22063A116 and ML22063A114). The applicant also explained that, because Transients 19 and 20 do not involve a change in the temperature of piping systems, these transients do not cause thermal fatigue.

The staff finds that the exclusion of load-follow transients is acceptable because (1) these transients are associated with load-follow operations which the plant has not implemented and does not plan to implement, (2) the cycle counting exclusion is based on large allowable design cycles or negligible impact on fatigue, (3) the exclusion is consistent with the CLB approach, and (4) the bounding nature of the CLB design cycles support the continued use of the CLB approach regarding the cycle counting exclusion.

The applicant also stated in its RAI response that Transient 12A (hydrotest for RCS) is no longer performed at the plant. The applicant further clarified that Transient 12B (hydrotest secondary) causes no fatigue in the RCS and that Transient 18 (loss of feedwater heater) is excluded due to minimal fatigue effect on the RCS.

In its review, the staff finds that the exclusion of Transients 12A, 12B, and 18 from cycle counting and the associated RAI response are acceptable because (1) the applicant clarified that these transients are no longer performed or are associated with insignificant effect on the fatigue of the RCS, and (2) the exclusion based on negligible fatigue effect is consistent with the CLB approach for transient cycle counting.

SLRA Table 4.3.1-1, Note 1, and the related discussion in SLRA Section 4.3.4 indicate that the pressurizer surge line, main steam penetrations, and main feedwater penetrations have a reduced set of transient cycles compared to the design transient cycles listed in SLRA Table 4.3.1-1. However, SLRA Sections 4.3.1 and 4.3.4 do not clearly address whether the Fatigue Monitoring program will monitor actual cycles against the reduced set of the transient cycles. Therefore, the staff determined the need for additional information, which resulted in the issuance of RAI 4.3.1-2.

In its response dated January 7, 2022 (ADAMS Accession No. ML22010A129), the applicant explained that the reduced set of transient cycles for the pressurizer surge line is used in the ASME Code Section XI, Appendix L flaw tolerance analysis addressed in SLRA Section 4.3.4. The applicant also provided the reduced set of the transient cycles for the pressurizer surge line. For example, the CLB (60-year) design cycle number of Transient 1B2 (cooldown from 8 percent full power, type 2) is 300 cycles, while the reduced cycles of the transient used in the Appendix L analysis is 149 cycles for 60 years of operation.

The applicant further clarified that the reduced set of cycles for 60 years of operation is consistent with the 60-year projected cycles (i.e., projected cycles in the CLB) and that the 60-year projected cycles are divided by 6 to estimate the transient cycles for the 10-year inservice inspection interval. The applicant explained that these 10-year cycle estimates are used in the Appendix L analysis so that the transient cycles used in the analysis can reasonably represent the transient cycles that the pressurizer surge line will actually experience during each 10-year inservice inspection interval. The use of the 10-year cycle counts is also tied to the 10-year interval of the periodic inspections that will be performed as part of the ASME Code, Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program (SLRA Section B2.1.1) in conjunction with the Appendix L analysis.

In addition, the applicant clarified that, as addressed in Enhancement 1 of the Fatigue Monitoring program (SLRA Section B3.1), the Fatigue Monitoring program will monitor the transient cycles associated with the Appendix L analysis to ensure that the transient cycle assumptions used in the Appendix L analysis adequately represent the actual transient cycles.

The staff finds that the applicant's response regarding the transient cycle estimates of the pressurizer surge line discussed above is acceptable because (1) the applicant clarified the reduced set of cycles for the pressurizer surge line and the associated Appendix L flaw tolerance analysis, which are based on the estimated cycles for the 10-year inservice inspection interval; and (2) the transient cycles will be monitored by the Fatigue Monitoring program to ensure that the actual cycles do not exceed the transient cycles used in the Appendix L analysis and thus the Appendix L flaw tolerance analysis remains valid for 80 years of operation.

In its response, the applicant also clarified that the reduced set of transient cycles for the main steam and main feedwater penetrations is described in SLRA Table 4.6.3-1. The applicant explained that all allowable cycles in SLRA Table 4.6.3-1 are less than the design transient cycles, but greater than the 80--year projected cycles in SLRA Table 4.3.1-1. The fatigue analysis for the main steam and main feedwater penetrations does not need to calculate 10-year cycles because it does not involve an Appendix L flaw tolerance analysis. In addition, the applicant indicated that the reduced set of transient cycles will be monitored and tracked in the Fatigue Monitoring program to ensure that the actual cycles do not exceed the reduced transient cycles.

The staff finds that the applicant's response regarding the transient cycles for the main steam and main feedwater penetrations is acceptable because the reduced set of cycles involves transient cycle numbers greater than the 80-year projected cycles and will be monitored in the Fatigue Monitoring program to ensure the validity of the transient cycles used in the fatigue analysis for the main steam and main feedwater penetrations as addressed in Enhancement 3 of the Fatigue Monitoring program (SE Section 3.0.3.2.28).

Notes 2 and 7 of UFSAR Table 5-2 explain that the HPI and reactor vessel closure head components use the reduced cycles compared to the design cycles. However, SLRA Section 4.3.1 and Table 4.3.1-1 do not clearly address whether the reduced cycles will be monitored to ensure that the actual transient cycles do not exceed the reduced cycles used in the fatigue analysis for these components. Therefore, the staff determined the need for additional information, which resulted in the issuance of RAI 4.3.1-3.

In its response dated January 7, 2022 (ADAMS Accession No. ML22010A129), the applicant stated that UFSAR Table 5-2, Note 2, was revised as follows effective on May 22, 2021, and this revision will be reflected in UFSAR Revision 29: "Some components are evaluated to less than the design number of cycles and are tracked within the Thermal Fatigue Management program. The number of actual events is expected to remain below the analyzed number of events throughout the current 60-year plant life." The applicant also clarified that the Thermal Fatigue Management program in the revised note is the Fatigue Monitoring program for SLR.

The applicant also indicated the reduced cycles will be monitored in the Fatigue Monitoring program except the power loading and unloading cycles which are associated with load-follow operation. During the meeting on February 17, 2022, the applicant further clarified that the

“ONS Units have always been operated as base load” units and do not have a plan for load-follow operations (ADAMS Accession Nos. ML22063A116 and ML22063A114). Therefore, the staff finds that there is no need to monitor the power load and unload cycles based on the absence of load-follow operations and the large margin for these transients between the actual cycles and the cycles postulated for the fatigue analysis.

The staff finds the load-follow transients acceptable because (1) the reduced transient cycles except the power loading and unloading cycles will be monitored in the Fatigue Monitoring program to ensure that the actual cycles will not exceed the reduced cycles, (2) the plant does not perform load-follow operations, and (3) the power loading and unloading transient cycles used in the fatigue analysis involve a large margin between the actual cycles and the cycles postulated in the fatigue analysis.

SLRA Section 4.3.5 addresses the analytical evaluation of flaws for 80 years of operation. The section indicates that the flaws identified for initial license renewal have been re-evaluated or the component containing the flaw has been replaced. SLRA Section 4.3.5 also explains that these reanalyzed flaws are now acceptable for their full controlling design basis transient cycles as discussed in Section 4.3.1.

In comparison, UFSAR Table 5-2, Note 1, indicates that certain components have flaw tolerance evaluations, as addressed in UFSAR Sections 5.2.2 and 5.2.3.12.4, and that these evaluations assume a reduced number of heatup and cooldown cycles. Therefore, the staff found a need to further confirm that the analytical evaluations of the flaws discussed in SLRA Section 4.3.5 use the design transient cycles identified in SLRA Section 4.3.1 without using a reduced set of transient cycles. The staff needed a similar confirmation for the weld overlay fatigue analysis discussed in SLRA Section 4.3.6. Therefore, the staff determined the need for additional information, which resulted in the issuance of RAI 4.3.1-4.

In its response dated January 7, 2022 (ADAMS Accession No. ML22010A129), the applicant confirmed that, as discussed in SLRA Section 4.3.5, the applicant performed the SLR review of applicable flaw growth analyses identified for initial license renewal. The applicant clarified that all flaws in which reduced numbers of acceptable cycles required management under the Thermal Fatigue Management program (known as the Fatigue Monitoring program for SLR) have since been re-evaluated, or the component containing the flaw was replaced. The applicant also explained that the analytical evaluations of the flaws discussed in SLRA Section 4.3.5 use the design transients and cycles identified in SLRA Section 4.3.1 with no assumption of a reduced set of transient cycles for 80 years.

In addition, the applicant indicated that some of the full structural weld overlays (FSWOs) use a reduced set of transient cycles compared to the design cycles. Specifically, the weld overlays in the hot leg decay heat system (Units 1, 2, and 3) and the associated axial flaws are qualified for 33 years based on the reduced cycles. The cold-leg letdown weld overlay (Unit 3) with short radius elbow and associated axial flaw is qualified for 18 years. The weld overlays at the hot-leg surge nozzle (Units 2 and 3) and the circumferential flaw only for the pressurizer surge nozzle (Units 1, 2, and 3) are qualified for 10 years.

Accordingly, the applicant identified an additional enhancement to the ASME Code, Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program (SLRA Section B2.1.1) to establish adequate volumetric examination frequencies for these weld overlays that are qualified for the reduced sets of cycles compared to the full design cycles. The staff’s evaluation of the enhancement is documented in Section 3.0.3.2.1 of this SE. In its response, the applicant also confirmed that the Fatigue Monitoring program will ensure that either the full set of design cycles or the reduced set of allowed cycles for fatigue analyses will not be exceeded during the subsequent period of extended operation.

As discussed above, the staff finds that the response regarding the transient cycles used in the flaw evaluations (SLRA Section 4.3.5) and weld overlay analyses (SLRA Section 4.3.6) is acceptable because the applicant clarified that (1) the flaw evaluations use the full design cycles, (2) considering that some of the weld overlay analyses use reduced set of transients cycles, volumetric examinations will be periodically performed to confirm the integrity of the weld overlays, and (3) the Fatigue Monitoring program will monitor the transient cycles to ensure that the actual cycles do not exceed the full set of design cycles and the reduced set of allowed cycles, as applicable, for the fatigue analyses.

Based on its review, the staff finds (1) the applicant's transient cycle projections are adequately based on actual plant cycle data, (2) the 80-year projected cycles are bounded by the CLB design cycles, and (3) the projected cycles are adequate to be used in the fatigue analyses in conjunction with the cycle monitoring activities of the Fatigue Monitoring program (SE Section 3.0.3.2.28).

4.3.1.3 UFSAR Supplement

SLRA Section A4.3.1 provides the UFSAR supplement summarizing the 80-year transient cycle projections. The staff reviewed SLRA Section A4.3.1, consistent with the review procedures in SRP-SLR Section 4.3.3.2. Based on its review of the UFSAR supplement, the staff finds that it meets the acceptance criteria in SRP-SLR Section 4.3.2.2 and is therefore acceptable. The staff also finds that the applicant provided an adequate summary description to address the transient cycle projections for 80 years of operation, as required by 10 CFR 54.21(d).

4.3.1.4 Conclusion

Based on its review, the staff concludes that the applicant's 80-year projected design cycles are based on the actual transient cycle data, consistent with the guidance in SRP-SLR Section 4.3.2.1.1, and the 80-year projected cycles are bounded by the design cycles (i.e., CLB transient cycles). The staff also concludes that the 80-year projected cycles are reasonable for use in the fatigue analyses for SLR in conjunction with the Fatigue Monitoring program.

4.3.2 Class 1 Component Fatigue Evaluations

4.3.2.1 Summary of Technical Information in the Application

SLRA Section 4.3.2, as supplemented by letter dated January 7, 2022 (ADAMS Accession No. ML22010A129), describes the applicant's fatigue TLAA on ASME Code Section III, Class 1 components. The fatigue analyses pertain to the reactor vessel, reactor vessel internal (RVI) components, once through steam generators (OTSGs), reactor coolant pumps, pressurizer, control rod drive mechanism (CRDM) housing, RCS piping and connected lines, and pressurizer surge line. Each fatigue analysis for the Class 1 components in the CLB demonstrates that the CUFs for the components do not exceed the design limit of 1.0 based on the CLB design transient cycles. The design transient cycles are also bounding for the 80-year projected transient cycles.

The applicant dispositioned the TLAA in accordance with 10 CFR 54.21(c)(1)(iii) by demonstrating that the effects of cumulative fatigue damage on the intended functions of the Class 1 components will be adequately managed by the Fatigue Monitoring program for the subsequent period of extended operation. The Fatigue Monitoring program will be used to ensure that the CUFs for the Class 1 components do not exceed the design limit of 1.0, as identified in SLRA Section B3.1.

4.3.2.2 Staff Evaluation

The NRC staff reviewed the applicant's fatigue TLAA for ASME Code Section III Class 1 components and the corresponding disposition of the TLAA in accordance with 10 CFR 54.21(c)(1)(iii), consistent with the review procedures in SRP-SLR Section 4.3.3.1.1.3 and the acceptance criteria in SRP-SLR Section 4.3.2.1.1.3.

As submitted, SLRA Section 4.3.2.2 stated that the only specific fatigue analyses performed in the original design for RVI components were the fatigue analyses on flow-induced vibration, as reported in BAW-10051, Revision 1, "Design of Reactor Internals and Incore Instrument Nozzles for Flow-Induced Vibration." The analyses on high-cycle fatigue due to flow-induced vibration are separately discussed in SLRA Section 4.7.1.2, and the staff's evaluation is documented in Section 4.7.1.2 of this SE.

After operations began at the plant, the inservice inspections in 1981 and 1982 revealed failures in the bolts fastening the lower end of the reactor vessel thermal shield to the lower grid assembly (also called thermal shield bolts). These bolts were originally made of A-286 stainless steel, and the failed bolts were replaced with bolts fabricated with alloy X-750. The applicant performed fatigue analyses for the replacement bolts, including high-cycle fatigue due to flow-induced vibration and low-cycle fatigue due to design transients. The fatigue analyses for the replacement thermal shield bolts were evaluated in BAW-2248A for the initial license renewal term up to 60 years of operation and are addressed in SLRA Section 4.3.2.2 as a TLAA for 80 years of plant operation.

The staff noted that Sections 3.4 and 4.5 of the BAW-2248A report address the low-cycle fatigue TLAA for RVI components other than the replacement bolts. Specifically, Section 4.5.1 of BAW-2248A states that the RVIs designers considered the RCS functional design requirements when performing their structural design. The section also states that meeting these requirements in the original design meant that the RVI components were implicitly designed for low-cycle fatigue based on the projected RCS design transients. Therefore, the staff noted that BAW-2248 identifies the implicit fatigue analysis as a TLAA for the B&W-designed RVI components.

As discussed above, the SLRA addresses only the low-cycle fatigue TLAA for the thermal shield replacement bolts, excluding the low-cycle fatigue TLAA for the other RVI components. Therefore, the staff noted that the fatigue TLAA in SLRA Section 4.3.2.2 is potentially inconsistent with BAW-2248A. Action Item 11 for the BAW-2248A report also addresses the monitoring activity to ensure that the implicit fatigue TLAA remains valid for the RVI components, including the thermal shield replacement bolts. The staff-imposed Action Item 11 states that the applicant must address the plant-specific plans to continue monitoring and tracking design transient occurrences. As such, the staff needed additional information to resolve this potential inconsistency between the implicit fatigue TLAA for RVI components, which are identified in BAW-2248A and the staff's SE for BAW-2248A (including Action Item 11) and the absence of such a TLAA from SLRA Section 4.3.2.

The staff issued RAI 4.3.2-1 regarding these concerns. In its RAI response dated January 7, 2022 (ADAMS Accession No. ML22010A129), the applicant dispositioned the implicit fatigue analysis in accordance with 10 CFR 54.21(c)(1)(iii) and proposed to use the Fatigue Monitoring program to ensure that the actual transient cycles do not exceed the design cycle so that the implicit fatigue analysis of the original design for RVI components will remain valid for the subsequent period of extended operation.

The staff finds that the RAI response is acceptable because (1) the applicant identified the implicit fatigue analysis for RVI components as a TLAA, consistent with the BAW-2248A report; (2) the applicant will use the Fatigue Monitoring program to monitor the design cycles, consistent with the Action Item 11 for the BAW report; and (3) the applicant revised the SLRA, consistent with the identification of the fatigue TLAA for RVI components.

The staff finds that the fatigue TLAA for the RVI components is acceptable because (1) the 80-year projected transient cycles are less than the CLB design cycles, which provides reasonable assurance that the CUF values will remain less than the design limit of 1.0, consistent with the CLB fatigue analysis; and (2) the Fatigue Monitoring program will monitor the actual transient cycles to ensure that the CUF values do not exceed the design limit of 1.0 by performing corrective action as needed (e.g., repair/replacement of components and refinement of fatigue analysis). The staff's evaluation of the Fatigue Monitoring program is documented in SE Section 3.0.3.2.28.

The applicant also addressed the fatigue TLAA for the following ASME Code Section III Class 1 components: (1) reactor vessels (SLRA Section 4.3.2.1); (2) OTSGs (SLRA Section 4.3.2.3); (3) reactor coolant pumps (SLRA Section 4.3.2.4); (4) pressurizers (SLRA Section 4.3.2.5); (5) RCS piping and connected lines, including high -pressure and low-pressure injection lines and reactor coolant drain lines (SLRA Section 4.3.2.7); and (6) pressurizer surge lines (SLRA Section 4.3.2.8).

The applicant indicated that these components were originally designed in accordance with the requirements for ASME Code Section III Class 1 components, or additional fatigue analyses were performed in accordance with the requirements for ASME Code Section III Class 1 components after the original design of the components (e.g., after the design per the ANSI B31.1 code). The applicant also stated that the CLB CUFs for these components, which are based on the CLB design transient cycles, meet the design limit of the ASME Code (i.e., not exceeding 1.0).

In its review, the staff noted that the MUR power uprate project for the plant, implemented in 2021, evaluated the potential effect of the power uprate on the fatigue analyses on the Class 1 components. The applicant determined that the MUR power uprate does not cause any reactor coolant temperature changes outside the design conditions, and therefore the power uprate does not affect the existing fatigue analyses, as approved by the staff (ADAMS Accession Nos. ML20050D379 and ML20335A001).

The staff also noted that the applicant projected the design transient cycles for 80 years of operation, as discussed in SLRA Section 4.3.1. The staff finds that the projected 80-year cycles are bounded by the design cycles (60-year CLB cycles), as described in SLRA Table 4.3.1-1. Based on the design cycles bounding for the projected 80-year cycles, the staff finds that the CUF values can continue to meet the design limit of 1.0 during the subsequent period of extended operation. The staff's evaluation of the 80-year transient cycle projections is documented in Section 4.3.1 of this SE.

In its review, the staff finds that the fatigue TLAAs for the ASME Code Section III Class 1 components are acceptable because (1) the 80-year projected transient cycles are less than the design cycles, as described in SLRA Section 4.3.1, which provides reasonable assurance that the CUF values will remain less than the design limit of 1.0, consistent with the CLB fatigue analysis; (2) the Fatigue Monitoring program will monitor the actual transient cycles to ensure that the CUF values do not exceed the design limit of 1.0 by performing corrective action as needed (e.g., repair/replacement of components and refinement of fatigue analysis); and (3) the reactor coolant temperature changes associated with the previously approved MUR power uprate (ADAMS Accession No. ML20335A001) are negligible so that the power uprate does not affect the existing fatigue analysis.

SLRA Section 4.3.2.6 explains that the CRDM housings at all three units were replaced when the reactor vessel closure heads were replaced in 2003 and 2004. The applicant also stated that these CRDM housings were structurally assessed against the original design reports and were shown to be acceptable for fatigue by meeting criteria for exemption from fatigue analysis requirements in accordance with paragraph N-415.1 of ASME Code Section III, 1968 Edition with Summer 1970 Addenda. The applicant further explained that the existing fatigue waiver considered the design transient cycles, and therefore this fatigue waiver analysis is identified as a TLAA for 80 years of operation.

In addition, SLRA Section 4.3.2.9 states that the licensing basis for the following RCS components at Units 1, 2, and 3 contain fatigue waivers in accordance with subparagraphs NB-3630(d)(2)(a) through (e) of ASME Code Section III, 1983 Edition: (1) pressurizer spray nozzles, (2) letdown lines, (3) decay heat line, (4) primary loop drain piping and nozzles, and (5) portion of core flood piping. In addition, the applicant stated that preemptive replacement and mitigation were designed for the hot-leg and cold-leg resistance temperature detector thermowells and pressure tap and flow meter nozzles in order to eliminate or mitigate alloy 600 and alloy 82/182 materials, which are susceptible to primary water SCC. These preemptive repairs also involved the waiver on Class 1 fatigue analyses in accordance with subparagraphs NB-3630(d)(2)(a) through (e) of ASME Code Section III, 1983 Edition.

The staff noted that the fatigue waiver for the CRDM housings, RCS components, and preemptive repairs (thermowells and pressure tap and flow meter nozzles) discussed above were based on the design transient cycles. The staff also noted the fatigue waiver for these components is based on the provisions for fatigue waiver in paragraph N-415.1 of ASME Code Section III, 1968 Edition with Summer 1970 Addenda or subparagraphs NB-3630(d)(2)(a) through (e) of ASME Code Section III, 1983 Edition.

As discussed above, the ASME Code provisions for fatigue waiver are based on transient cycles. For example, the number of cycles that the pressure will be cycled from atmospheric pressure to operating pressure and back to atmospheric pressure (such as startup-shutdown cycles) should not exceed a specific number of cycles determined by the design stress intensity (S_m) of the material and fatigue design curve in the Code. Because the applicant's fatigue waiver for 60 years of operation is based on the design transient cycles, the applicant can ensure that the fatigue waiver will remain valid for 80 years of operation by confirming that the 80-year projected cycles are less than the design transient cycles.

The staff finds that the fatigue TLAA on fatigue waiver for these ASME Code Section III Class 1 components is acceptable because (1) the 80-year projected transient cycles are less than the design cycles, which provides reasonable assurance that the basis of the fatigue waiver will remain valid during the subsequent period of extended operation; (2) the Fatigue Monitoring program will monitor the actual transient cycles to ensure that the actual transient cycles will not exceed the design transients by performing corrective action as needed (e.g., repair/replacement of components and refinement of fatigue analysis); and (3) the fatigue monitoring activities will ensure that the fatigue waiver will remain valid during the subsequent period of extended operation.

For the ASME Code Section III Class 1 component fatigue waivers, the staff finds the applicant has demonstrated, in accordance with 10 CFR 54.21(c)(1)(iii), that the effects of cumulative fatigue damage on the intended functions of the components will be adequately managed for the subsequent period of extended operation. Additionally, the ASME Code Section III Class 1 component fatigue waivers meet the acceptance criteria in SRP-SLR Section 4.3.2.1.1.3 because the applicant proposed to use the Fatigue Monitoring program for managing the effects of cumulative fatigue damage, consistent with the guidance in SRP-SLR Section 4.3.2.1.1.3. As previously noted, the staff's evaluation of the Fatigue Monitoring program is documented in SE Section 3.0.3.2.28.

4.3.2.3 UFSAR Supplement

SLRA Section A4.3.2 provides the UFSAR supplement summarizing the metal fatigue of ASME Code Section III Class 1 components. The staff reviewed SLRA Section A4.3.2, consistent with the review procedures in SRP-SLR Section 4.3.3.2.

Based on its review of the UFSAR supplement, the staff finds that it meets the acceptance criteria in SRP-SLR Section 4.3.2.2 and is therefore acceptable. The staff also finds that the applicant provided an adequate summary description to address the metal fatigue TLAA for ASME Code Section III Class 1 components, as required by 10 CFR 54.21(d).

4.3.2.4 Conclusion

Based on its review, the NRC staff concludes that the applicant has provided an acceptable demonstration, in accordance with 10 CFR 54.21(c)(1)(iii), that the effects of cumulative fatigue damage on the intended functions of ASME Code Section III, Class 1 components will be adequately managed by the Fatigue Monitoring program for the subsequent period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation for the subsequent period of extended operation, as required by 10 CFR 54.21(d).

4.3.3 Non-Class 1 Piping Fatigue Analyses

4.3.3.1 Summary of Technical Information in the Application

SLRA Section 4.3.3, as supplemented by letter dated January 7, 2022 (ADAMS Accession No. ML22010A129), describes the applicant's TLAA on metal fatigue of non-Class 1 piping. The piping is designed in accordance with the ANSI B31.7 and ANSI B31.1 codes. These non-Class 1 piping systems are not required to have an explicit analysis of cumulative fatigue usage, but cyclic loading is considered in a simplified manner in the design process. The transient cycle projections in SLRA Table 4.3.3-1 indicate that, except for the pressurizer sample line, the non-Class 1 piping will not exceed 7,000 temperature cycles for 80 years of operation, which means that no stress range reduction factor is required in the stress analysis. For the pressurizer sample line, a stress range reduction factor of 0.7 is applied in the piping stress analysis based on the number of temperature cycles for 80 years. The applicant also identified the HELB analysis as a TLAA because the HELB location postulation is based on the maximum allowable stress range for thermal expansion, which may need to be adjusted by the stress range reduction factor.

The applicant dispositioned the TLAA on the metal fatigue of non-Class 1 piping in accordance with 10 CFR 54.21(c)(1)(ii) by demonstrating that the fatigue analysis, including its potential impact on the HELB location postulation, has been projected to the end of the subsequent period of extended operation.

4.3.3.2 Staff Evaluation

The NRC staff reviewed the applicant’s fatigue TLAA for the non-Class 1 piping and the corresponding disposition of the TLAA in accordance with 10 CFR 54.21(c)(1)(ii), consistent with the review procedures in SRP-SLR Section 4.3.3.1.1.2 and the acceptance criteria in SRP-SLR Section 4.3.2.1.1.2.

The non-Class 1 piping was designed in accordance with the ANSI B31.7 (Class II and III provisions) and the ANSI B31.1 codes. For the non-Class 1 piping, the ANSI B31.7 and B31.1 codes do not require an explicit fatigue analysis that involves calculations of fatigue CUF values. Instead, the cyclic qualification is based on the number of equivalent full-temperature cycles and corresponding stress range reduction factors. If the total number of temperature cycles is 7,000 or fewer, a stress range reduction factor of 1.0 is applied to the allowable stress range for thermal expansion stress, which means the allowable stress does not need to be reduced due to the effects of cyclic loading. If the total number of temperature cycles is greater than 7,000, a stress range reduction factor of less than 1.0 is applied to the allowable stress range depending on the temperature cycles, as described in SLRA Table 4.3.3-1.

SLRA Table 4.3.3-2 describes the estimated 80-year thermal cycles for the non-Class 1 piping. However, the staff noted that the SLRA Table 4.3.3-2 did not clearly discuss the technical basis for the cycle projections. Therefore, the staff issued RAI 4.3.3-1 to resolve this concern.

In its response dated January 7, 2022 (ADAMS Accession No. ML22010A129), the applicant clarified that these thermal cycle projections were determined from a review of design specifications, historical plant data, operating procedures, and specific system-level knowledge to quantify system transients such as heatup and cooldown operations, testing, reactor trips, sampling, and swapping of trains for the non-Class 1 piping systems. The applicant also explained that additional conservatism was built into the projected cycle numbers of thermal transients for each system by adding a 15 percent margin factor.

As part of the RAI response, the applicant clarified that the cycle projections for non-Class 1 piping systems conservatively estimated 20 emergency feedwater actuations per year. The applicant explained that the 20 cycles per year is a bounding estimate based on the historical number of emergency feedwater actuations per year. A 15 percent margin factor is then applied to this number to yield 23 emergency feedwater actuations per year, which results in total estimated cycles of 1,840 in 80 years of operation. The staff noted that this cycle projection supports the applicant’s determination that the 80-year cycles of the final emergency feedwater lines to steam generator in the feedwater system do not exceed 7,000 cycles because the 80-year cycles of the piping lines consist of the heatup and cooldown cycles (720 cycles in SLRA Table 4.3-1) and the emergency feedwater actuations (1,840 cycles).

The staff finds that the RAI response regarding the cycle projections and their technical basis for the non-Class 1 piping systems is acceptable because (1) cycle projections are based on the relevant information for transient cycles such as design specifications, historical plant data, operating procedures, and specific system-level knowledge, and (2) an additional 15 percent margin is conservatively applied to the transient cycle projections for 80-year operation.

The staff also noted that, except for the pressurizer sample line, the other non-Class 1 piping systems are estimated to have thermal cycles fewer than 7,000, as provided in SLRA Table 4.3.3-2. Therefore, these piping systems can use a stress range reduction factor of 1.0. The pressurizer sample line, which involves a daily thermal cycle, is estimated to have a total of 29,200 cycles for 80 years of operation. Therefore, the applicant identified a stress range reduction factor of 0.7, which corresponds to the thermal cycle range between 22,000 and 45,000. However, the staff noted that SLRA Section 4.3.3 did not clearly discuss whether the stress analysis results for the pressurizer sample line remain valid even though the stress range reduction factor is less than 1.0. Therefore, the staff issued RAI 4.3.3-2 to resolve this concern.

In its response dated January 7, 2022 (ADAMS Accession No. ML22010A129), the applicant addressed why the use of the stress range reduction factor of 0.7 does not affect the validity of the stress analysis for the pressurizer sample line. During a meeting on February 17, 2022, the applicant also provided additional clarification regarding the stress analysis with the stress range reduction factor (ADAMS Accession No. ML22063A116).

In its response dated January 7, 2022, the applicant indicated that, in the stress analysis for the Unit 1 pressurizer sample line, the calculated thermal expansion stress with the stress range reduction factor is less than the allowable stress for thermal expansion. The applicant also explained that, for Units 2 and 3, the total calculated stress (summation of the sustained and thermal expansion stresses) with the stress range reduction factor is less than the primary plus thermal expansion allowable stress. The staff finds that the response is acceptable because (1) the stress analysis for the pressurizer sample line uses the appropriate stress range reduction factor, (2) the thermal expansion stress criterion (used for Unit 1) and the total longitudinal stress criterion (used for Units 2 and 3) are both acceptable provisions in the B31.1 code, and (3) the stress analysis results meet the B31.1 code.

The staff noted that the SLRA did not clearly describe whether the implicit fatigue analysis (SLRA 4.3.3) for the non-Class 1 piping systems, which involves a stress range reduction factor, may have a potential impact on the HELB location postulation. In comparison, Section 3.4.1 of "Proposed License Amendment Request to Revise the Oconee Nuclear Station CLB for High Energy Line Breaks Outside of the Containment Building," August 28, 2019, (ADAMS Accession No. ML19240A814) indicates that the applicant's HELB location postulation includes a criterion using the allowable stress range for thermal expansion (S_A) compared to the thermal expansion stress.

The S_A value needs to be adjusted by the stress range reduction factor that is based on the implicit fatigue analysis for the non-Class 1 piping systems, in accordance with the ANSI B31.1 code. Therefore, the staff found a need to clarify whether the implicit fatigue analysis, which involves a stress range reduction factor, is used with the HELB location postulation. The staff issued RAI 4.3.3-3 to address this issue.

In its response dated January 7, 2022 (ADAMS Accession No. ML22010A129), the applicant stated that license amendment numbers 421, 423, and 422, which revise the CLB for HELB outside of containment, were effective as of March 15, 2021 (ADAMS Accession No.

ML21006A098). The applicant also indicated that the SLRA was developed from the CLB information that pre-dated the issuance of the HELB license amendment.

In addition, the applicant explained that the allowable stress range (S_A) is utilized in the selection of longitudinal breaks and critical cracks in the HELB analysis. The applicant clarified that, because S_A involves a stress range reduction factor that depends on the number of thermal cycles, the determination of HELB locations involves an implicit time-limited fatigue analysis. Therefore, the applicant identified that the HELB analysis is a TLAA. The applicant dispositioned the HELB TLAA in accordance with 10 CFR 54.21(c)(1)(ii) in the evaluation of the metal fatigue TLAA for non-Class 1 components. Accordingly, in its RAI response dated January 7, 2022, the applicant revised SLRA Table 4.1.4-2 and Section 4.3.3, consistent with the identification of the HELB analysis as a TLAA.

The applicant also clarified that the pressurizer sample line is not within the scope of the HELB analysis, which is subject to a stress range reduction factor of less than 1.0, because the sample line located outside of containment is less than 1-inch nominal pipe size and HELBs (circumferential breaks, longitudinal breaks, or critical cracks) are not postulated on high-energy piping that has a nominal pipe size of 1 inch or less. The applicant further clarified that the HELB analysis does not postulate HELB locations based on CUF. The applicant explained that the HELB analysis evaluated high-energy piping located outside of containment for Class 2 and 3 equivalent piping, and therefore there is no Class 1 equivalent piping outside of the containment building.

The staff finds that the applicant’s response is acceptable because (1) the applicant identified the HELB analysis as a TLAA based on the time-limited assumption associated with the stress range reduction factor and its potential effect on the allowable stress range used in the determination of HELB locations, (2) the applicant revised the SLRA, consistent with the identification of the HELB TLAA, and (3) the applicant confirmed that the pressurizer sampling piping, which is subject to a stress range reduction factor of less than 1.0, is not included in the scope of the HELB analysis.

Based on its review, the staff finds that the metal fatigue TLAA for non-Class 1 piping except for the pressurizer sample line, including the HELB location postulation, is acceptable because (1) the equivalent full-temperature cycles are less than 7,000, and therefore there is no need to apply a stress range reduction factor of less than 1.0 on the allowable stress except for the pressurizer sampling piping, consistent with the CLB, and (2) the implicit fatigue analysis for the 80-year operation does not affect the break location postulations of the HELB analysis. The staff also finds that the metal fatigue TLAA for non-Class 1 pressurizer sample lines is acceptable because (1) an adequate stress range reduction factor of 0.7 was considered in the stress analysis for the piping, and (2) the pressurizer sample line is not in the scope of the HELB analysis, and therefore there is no impact on the HELB analysis due to the stress range reduction factor less than 1.0.

The staff finds that the applicant has demonstrated, in accordance with 10 CFR 54.21(c)(1)(ii), that the fatigue analysis for non-Class 1 piping, including its impact on the HELB location postulation, has been projected to the end of the subsequent period of extended operation. Additionally, the applicant’s fatigue TLAA meets the acceptance criteria in SRP-SLR Section 4.3.2.1.1.2 because the applicant demonstrated that the implicit fatigue analysis and associated stress range reduction factors are valid for the subsequent period of extended operation.

4.3.3.3 UFSAR Supplement

SLRA Appendix A4.3.3 provides the UFSAR supplement summarizing the metal fatigue of non-Class 1 components. The NRC staff reviewed SLRA Section A4.3.3, consistent with the review procedures in SRP-SLR Section 4.3.3.2.

Based on its review of the UFSAR supplement, the staff finds that it meets the acceptance criteria in SRP-SLR Section 4.3.2.2 and is, therefore, acceptable. The staff also finds that the applicant provided an adequate summary description to address the metal fatigue TLAA for the non-Class 1 components, as required by 10 CFR 54.21(d).

4.3.3.4 Conclusion

Based on its review, the NRC staff concludes the applicant has provided an acceptable demonstration, in accordance with 10 CFR 54.21(c)(1)(ii), that the fatigue analyses for non-Class 1 piping, including its potential impact on the HELB location postulation, have been projected to the end of the subsequent period of extended operation. The staff finds that there is no impact on the HELB location postulation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.3.4 Environmentally Assisted Fatigue

4.3.4.1 Summary of Technical Information in the Application

SLRA Section 4.3.4, which references SLR-ONS-TLAA-0306NP/P, describes the applicant's TLAA on the environmentally-assisted fatigue (EAF) of RCS pressure boundary components, including ASME Code Section III components and piping and ANSI B31.7 piping. The EAF analysis also considers the leading EAF locations described in NUREG/CR-6260, "Application of NUREG/CR-5999 Interim Fatigue Curves to Selected Nuclear Power Plant Components," and additional plant-specific locations that could be more limiting than the NUREG/CR-6260 locations. In the analysis, the environmental cumulative usage factor (CUF_{en}) value is calculated by applying the environmental fatigue correction factor (F_{en}) for the component material in accordance with NUREG/CR-6909, Revision 1, "Effect of LWR [Light Water Reactor] Water Environments on the Fatigue Life of Reactor Materials." The EAF evaluation reviewed the CLB fatigue evaluations for all ASME Code Section III RCS pressure boundary components and piping and ANSI B31.7 piping, including the NUREG/CR-6260 locations, to determine the leading locations (also referred to as sentinel locations) for EAF.

The applicant dispositioned the EAF TLAA in accordance with 10 CFR 54.21(c)(1)(iii) by demonstrating that the effects of EAF on the intended functions of the components and piping will be adequately managed by the Fatigue Monitoring program and the ASME Code, Section XI, Inservice Inspection, Subsections IWB, IWC and IWD program (SLRA Sections B3.1 and B2.1.1, respectively).

4.3.4.2 Staff Evaluation

The NRC staff reviewed the applicant's EAF TLAA and the corresponding disposition of the TLAA in accordance with 10 CFR 54.21(c)(1)(iii), consistent with the review procedures in SRP-SLR Section 4.3.3.1.2.3 and the acceptance criteria in SRP-SLR Section 4.3.2.1.2.3.

As background information, the applicant explained that the EAF analysis for initial license renewal included the evaluation of the NUREG/CR-6260 locations applicable to the plant. The staff also noted that the EAF TLAA for SLR further evaluated additional plant-specific RCS pressure boundary component locations that may be more limiting than those considered in NUREG/CR-6260.

The applicant indicated that the NUREG/CR-6260 locations are as follows: (1) reactor vessel lower head, (2) reactor vessel inlet and outlet nozzles, (3) pressurizer surge line, (4) makeup/HPI nozzle, (5) reactor vessel core flood nozzles, and (6) decay heat removal system Class 1 piping. Specifically, Table 4.3.4-1 in SLR-ONS-TLAA-0306NP/P addresses the EAF analysis results for these NUREG/CR-6260 locations.

However, the staff noted that the applicant identified the HPI piping stop-valve-to-check-valve location as a bounding EAF location for the HPI nozzle location identified as a leading location in NUREG/CR-6260. In the SLRA, the applicant did not provide a clear basis for determining the bounding nature of the stop-valve-to-check-valve location for the HPI nozzle location. Therefore, the staff issued RAI 4.3.4-3 to clarify the basis for identifying the stop-valve-to-check-valve location as the bounding location.

In its response dated January 7, 2022 (ADAMS Accession No. ML22010A129), the applicant clarified that the projected 80-year CUF_{en} value of the HPI piping stop-valve-to-check-valve weld location is greater than that of the HPI nozzle location, which is the nozzle safe-end-to-pipe weld location. The applicant also confirmed that the F_{en} value of the stop-valve-to-check-valve location is greater than that of the HPI nozzle location and that both of these welds are stainless steel. In addition, the applicant explained that periodic inspections are performed on the HPI piping and nozzle locations to ensure the integrity of the piping and component.

The staff finds the RAI response acceptable because the applicant clarified that (1) the HPI piping stop-valve-to-check-valve location is bounding for the HPI nozzle location in terms of the CUF_{en} and F_{en}, and (2) the periodic inspections can ensure the integrity of these welds. Therefore, the staff finds that the EAF analysis adequately included the HPI piping stop-valve-to-check-valve location as the leading EAF location for the HPI piping system.

The applicant also performed an EAF screening evaluation to identify additional plant-specific locations that may be more limiting than the NUREG/CR-6260 locations. The EAF screening evaluates the components that are exposed to reactor coolant and, therefore, involve environmental effects of reactor coolant on fatigue. In addition, the components and piping, which undergo essentially the same thermal and pressure transients during plant operations, are grouped into a thermal zone. Within each material type (e.g., low alloy steel, stainless steel, and nickel alloy), the location with the highest environmental usage factor is selected during the initial screening. The applicant also explained that, if the top two CUF_{en} values are within a factor of 2, the location with the second-highest CUF_{en} is also selected. If the third-highest CUF_{en} value is within 25 percent of the highest CUF_{en} value, the top three locations are selected in the thermal zone.

The staff finds that the EAF screening approach discussed above is acceptable because (1) the component and piping grouping is based on the same thermal and pressure transients such that the comparison of the CUF_{en} values in each thermal zone can result in relevant and comprehensive selections of leading EAF locations that can represent all the thermal zones, and (2) the highest CUF_{en} values are evaluated in each thermal zone, taking into account the differences between the highest CUF_{en} values so that the leading group of EAF locations can be adequately determined in each thermal zone.

The SLRA indicates that, to reduce excessive conservatism for stainless-steel locations due to the very large maximum F_{en}, the screening process calculates the F_{en} value as the average of the value based on a qualitative estimate of strain rate and the value based on the worst possible strain rate. However, the applicant did not clearly discuss the meanings of the qualitative estimate of strain rate and the value based on the worst possible strain rate. Therefore, the staff issued RAI 4.3.4-1 to clarify the meanings.

In its response dated January 7, 2022 (ADAMS Accession No. ML22010A129), the applicant clarified that the EAF screening was performed using the guidance in Section 3 of Electric Power Research Institute (EPRI) report 1024995, "Environmentally Assisted Fatigue Screening: Process and Technical Basis for Identifying EAF Limiting Locations." Specifically, the applicant explained that Table 3-1 of the EPRI report describes eight categories of strain rates from the extreme strain rate category to the very slow strain rate category. The staff noted that a best estimate of strain rate is selected from these strain rate categories based on the knowledge of the plant systems and transients.

The applicant also explained that the worst possible estimate of strain rate is the saturation value of strain rate that results in the highest possible contribution to the F_{en} value. The applicant further stated that the estimated F_{en} in the screening process was calculated based on an average of the F_{en} values associated with the best-estimate strain rate and the saturation strain rate value.

The staff finds that the applicant's response regarding the reduction in excessive conservatism for the F_{en} of stainless-steel locations is acceptable because (1) the best-estimate strain rate is determined by considering the representative strain rates of the plant systems and transients in the F_{en} calculations, (2) the saturation strain rate, which involves the maximum strain rate effect on the F_{en} value, is considered conservatively, and (3) the two strain rates (best-estimate and very conservative saturation values) are averaged in the strain rate degermation for EAF screening to provide a reasonable estimate of the F_{en} of stainless-steel locations.

The staff also noted that Table 4.3.4-1 in SLR-ONS-TLAA-0306NP/P describes the leading EAF locations for thermal zones. For the following thermal zones in the table, the staff further noted that the fabrication material for the leading EAF locations is only stainless steel: (1) pressurizer lower head and surge line, (2) pressurizer spray, (3) HPI, (4) decay heat removal system, and (5) core flood. In the SLRA, the applicant did not clearly discuss why these thermal zones do not identify any leading EAF locations fabricated with materials other than stainless steel (e.g., nickel alloy or carbon steel). Therefore, the staff issued RAI 4.3.4-7 to clarify the basis of identifying only stainless-steel material for the leading locations in these thermal zones.

In its response dated January 7, 2022 (ADAMS Accession No. ML22010A129), the applicant stated that the screening process to identify leading locations was performed for any locations with fatigue usage factors wetted by primary coolant in the primary pressure boundary systems. The applicant also confirmed that, for each of the thermal zones addressed in RAI 4.3.4-7, the EAF screening process evaluated carbon steel, low-alloy steel, and nickel-alloy materials in addition to stainless steel.

With respect to the pressurizer lower head and surge line, the applicant explained that the CUF_{en} values for materials other than stainless steel were considered, including the pressurizer heater forging to shell and lower head (carbon steel) and the pressurizer heater cover plate (low-alloy steel). The applicant also explained that the CUF_{en} results for these steel locations were found to be approximately half that of the limiting stainless-steel location so that the steel locations are bounded by the limiting stainless-steel location.

The applicant further discussed the pressurizer surge nozzle and the hot-leg surge nozzle locations at the terminal ends of the stainless-steel pressurizer surge piping. For these nozzle locations, the applicant stated that the wetted locations are all either stainless steel, due to the presence of cladding protecting the ferritic components, or nickel-alloy weld material. The applicant also clarified that stainless-steel and nickel-alloy material both use the same fatigue design curve, but nickel alloy has a lower F_{en} than stainless steel. Therefore, the applicant determined that the CUF_{en} values for the nozzle locations were bounded by the maximum CUF_{en} value in the stainless-steel pressurizer surge piping.

The applicant also clarified that all locations in the pressurizer spray, HPI, decay heat removal, and core flood piping lines are fabricated with stainless steel, except the terminal end nozzle locations that include nickel-alloy material locations. For these nozzle locations, the applicant further clarified that stainless-steel and nickel-alloy material both use the same fatigue design curve, but nickel alloy has a lower F_{en} than stainless steel, as discussed above. Considering the fatigue design curves and F_{en} values, the applicant determined that the CUF_{en} values for the piping end nozzle locations (nickel-alloy locations) were bounded by the maximum CUF_{en} value in the piping lines (stainless-steel locations).

In its review, the staff finds the applicant's response acceptable because (1) the applicant evaluated the CUF_{en} values for all the different materials in each thermal zone in the EAF screening process, and (2) the screening evaluation determined the leading EAF locations by appropriately considering the fatigue design curves, transient cycles, F_{en} values, and resultant CUF_{en} values for the different materials.

The applicant also performed further evaluation of the leading EAF locations, which involved the more detailed evaluations of the CUF_{en} values that were estimated in the screening process discussed above. The applicant indicated that further evaluations were performed in accordance with Revision 1 of NUREG/CR-6909 and those evaluations removed the conservatism associated with the conservative CUF_{en} values determined in the screening process. However, the applicant did not clearly discuss how the refined evaluations removed this conservatism. Therefore, the staff issued RAI 4.3.4-2 for additional information.

In its response dated January 7, 2022 (ADAMS Accession No. ML22010A129), the applicant referred to the statement in the SLR-ONS-TLAA-306NP report that conservatisms added as part of the initial screening for F_{en} values were removed as part of the analysis for 80 years of operation. The applicant clarified that, because only some conservatisms were removed, it would be more accurate if the word "conservatism" in the statement were to be replaced with the words "some conservatisms."

The applicant also explained that, in the EAF screening process, conservative F_{en} values were calculated by adjusting the parameters used to calculate F_{en} (e.g., strain rate, dissolved oxygen, and temperature) for a given thermal zone. For example, the screening F_{en} calculations used the maximum design temperature rather the actual service temperature of the thermal transient.

The applicant further explained that some conservativisms used in the screening CUF_{en} calculations were reduced by refining the computation of the F_{en} in the EAF analysis if necessary. The applicant clarified that, in some instances, the CUF values were reduced by reducing the number of cycles through the use of projected cycles for 80 years of operation based on the rate of cycle accumulation or in case the component was replaced after many years of service. The applicant also clarified that, in some cases, the F_{en} values were reduced by the use of service temperatures in lieu of maximum design temperature and by the use of a F_{en} value of 1 where load pair alternating stresses were below the threshold value for environmental effects.

In its review, the staff finds that the applicant's response is acceptable because the applicant clarified that some conservatisms of the screening CUF_{en} values were reduced in the EAF analysis by using (1) the actual service temperature rather than the maximum design temperature, (2) the 80-year projected transient cycles rather than the conservative design cycles, and (3) an F_{en} value of 1 is used when the stress amplitude is below the threshold value for environmental effect (e.g., stress amplitude threshold of 195 megapascals (MPa) for wrought and cast austenitic stainless steels (CASSs), as discussed in Section 4.2.13 of NUREG/CR-6909, Revision 1). The staff also noted that the Fatigue Monitoring program will monitor the transient cycles used in the EAF analysis to ensure the validity of the cycle assumptions for the subsequent period of extended operation (Enhancement 3 of the Fatigue Monitoring program as evaluated in SE 3.0.3.2.28).

As discussed above, the staff finds that the detailed further evaluations summarized in SLRA Table 4.3.4-1 are acceptable because the EAF analysis is performed in accordance with Revision 1 of NUREG/CR-6909, consistent with the guidance in SRP-SLR Section 4.3.2.1.2.

With respect to the aging management for EAF, the applicant indicated that the Fatigue Monitoring program (SLRA Section B3.1) and the ASME Section XI Inservice Inspection, Subsection IWB, IWC, and IWD program (SLRA Section B2.1.1) will manage the effects of fatigue on the intended functions of RCS pressure boundary components and piping that contact reactor coolant for the subsequent period of extended operation. In its review, the staff found a need for additional information on certain aspects of the aging management program for EAF as evaluated below.

Table 4.3.4-1 in SLR-ONS-TLAA-0306NP/P addresses the leading EAF locations. The table also indicates that the CRDM weld is part of the reactor vessel closure head (RVCH) replacement and that the 80-year CUF of the CRDM weld is based on reduced "power loading/unloading" cycles, which are excluded from cycle counting in the Fatigue Monitoring program. The staff found a need to confirm the adequacy of excluding the "power loading/unloading" transients (Transients 3 and 4) from the fatigue monitoring in relation to EAF TLAA. Therefore, the staff issued RAI 4.3.4-4 for additional information (ADAMS Accession No. ML21327A279).

In its response dated January 7, 2022, the applicant stated that the RVCHs were replaced on all three units between 2003 and 2004 and that the subject CRDM welds are the alloy 690 J-groove welds between the CRDM penetration nozzles and the replacement closure head (ADAMS Accession No. ML22010A129). The applicant also explained that the "power loading/unloading" transient cycles are 5,000 cycles in the replacement closure head design specification and that these cycles were further reduced to 4,100 cycles in the SLR EAF analysis, which results in a CUF_{en} value of 0.94.

The applicant further clarified that the units are operated as base load units and do not perform load-follow operations. The applicant stated that these Transient 3 and 4 events are rare, and even 4,100 events are many more than the units expect to experience during 80 years of operation. The applicant also explained in its response to RAI 4.3.2-1, that the estimated 80-year cycles of the “power loading/unloading” transients are approximately 1,000 cycles. During the meeting on February 17, 2022, the applicant further clarified the following: (1) the "ONS Units have always been operated as base load” units and do not have a plan for load-follow operations , (2) the estimated 1,000 cycle number for the plant loading/unloading transients is based on hypothetical load-follow operations for a design purpose, and (3) the estimated cycle number is conservative due to the absence of load-follow operations (ADAMS Accession Nos. ML22063A116 and ML22063A114).

In the RAI response dated January 7, 2022, the applicant indicated that the large margin between the cycles used in the EAF analysis, and the estimated 80-year cycles supports the exclusion of these transients from fatigue cycle monitoring, consistent with the CLB for 60 years of operation. The applicant also stated that the CLB approach of excluding these transients from fatigue monitoring based on the large cycle margin is documented in “Revised Responses to NRC Requests for Additional Information,” March 29, 1999, (ADAMS Accession No. ML15113A785).

In its review, the staff finds the applicant’s response acceptable because the applicant clarified that (1) the units do not perform load-follow operations, and (2) the “power loading/unloading” transients are excluded from fatigue monitoring based on the large margin between the actual cycles and the cycles used in the EAF analysis, consistent with the CLB approach.

The staff noted that Calculation Number OSC 11520, Revision 0, “Replacement Once-Through Steam Generators Tube-to-Tubesheet Weld Stress Analysis,” provides the fatigue analysis and CUF for the steam generator tube-to-tube sheet welds. Table 1.1 of the reference indicates that the projected CUF of the welds is slightly less than the design limit (1.0). However, the reference and SLRA Section 4.3.4 do not clearly address the EAF analysis for the steam generator tube-to-tube sheet welds. Therefore, the staff issued RAI 4.3.4-5 for additional information regarding the EAF analysis for these welds.

In its response dated January 7, 2022 (ADAMS Accession No. ML22010A129), the applicant stated that the fatigue analysis for the steam generator tube-to-tubesheet welds evaluates the weld root and weld outer surface locations. The applicant clarified that the weld root is not exposed to the reactor coolant, so the EAF analysis is not needed for the weld root location. The applicant also explained that in the EAF analysis, the weld outer surface is bounded by the CRDM weld in the RVCH, which is the leading location in the same thermal zone as the steam generator tube-to-tubesheet welds. The applicant stated that the EAF screening process grouped replacement steam generator and replacement reactor vessel head locations in the same thermal zone because these locations experience the same thermal transients. In addition, the applicant clarified that the projected 80-year CUF_{en} values of the CRDM weld and the bottom-mounted instrumentation (BMI) weld are 0.772 and 0.744, respectively, as described in SLRA Table 4.3.4-1. The staff also noted that the 80-year CUF_{en} for the steam generator weld outer surface is not significant because the 80-year projected CUF_{en} for this location is less than 0.15 based on the conservative consideration of environmental effects on the fatigue in the nickel alloy.

The staff finds the applicant’s response acceptable because the applicant clarified that (1) the weld root location of the steam generator tube-to-tubesheet weld is not exposed to reactor coolant, so the EAF analysis is not applicable to the weld root location, consistent with the CLB, and (2) the weld outer surface location is bounded by the CRDM weld and BMI weld locations in the EAF analysis.

The staff also noted that Enclosure 5 Attachment 1 of the SLRA indicates that the 80-year CUF_{en} for the core flood venturi exceeds the CUF_{en} limit (1.0), but the CUF_{en} is acceptable because it is not an RCS pressure boundary component that requires an EAF analysis. However, the staff noted that the enclosure does not clearly address how the applicant will ensure the integrity of the venturi that can be subject to fatigue initiation and cracking. Therefore, the staff issued RAI 4.3.4-6 for additional information on the fatigue management for the venturi.

In its response dated January 7, 2022 (ADAMS Accession No. ML22010A129), the applicant explained that the intended function of the venturi is flow restriction but not reactor coolant pressure boundary. The applicant also stated that visual testing (VT-3) inspections are performed on the venturi once in each 10-year inspection interval to confirm the integrity of the component. The applicant further clarified that the CUF_{en} calculation for the venturi is conservative because (1) the calculation uses the upper bound limit temperature for the F_{en} equation described in NUREG/CR-6909, Revision 1 (i.e., 325 °C), and (2) the F_{en} calculation also uses the slowest strain rate used in NUREG/CR-6909, Revision 1 for conservatism. In addition, the applicant confirmed that the 80-year projected CUF value of the venturi does not exceed the CUF limit of 1.0.

In its review, the staff finds the applicant's response acceptable because the applicant clarified that (1) the intended function of the venturi is flow restriction but is not part of reactor coolant pressure boundary, so the EAF analysis is not required for the venturi, and (2) the applicant performs periodic visual inspections to ensure the integrity of the component.

The staff noted that the Fatigue Monitoring program (SLRA Section B3.1) monitors the actual transient cycles against the design transient cycles to ensure that the actual cycles do not exceed the design transient cycles such that the CUF_{en} values will not exceed the design limit of 1.0 (SE Section 3.0.3.2.28). The staff finds that the applicant's use of the Fatigue Monitoring program is adequate to manage the effects of EAF because the program monitors the transient cycles to ensure that the CUF_{en} values meet the design limit, consistent with the guidance in GALL SLR AMP X.M1, "Fatigue Monitor," and SRP-SLR Section 4.3.2.1.2.3.

The applicant also proposed the use of the ASME Code, Section XI, Inservice Inspection, Subsections IWB, IWC, and IWD program (SLRA Section B2.1.1) to perform periodic inspections on the pressurizer surge line and HPI piping, which are evaluated in accordance with the provisions of ASME Code Section XI, Appendix L for flaw tolerance evaluations. As described in SLRA Table 4.3.4-2, the flaw tolerance evaluations confirm that the 10-year fatigue crack depths growing from postulated initial cracks do not exceed the maximum allowable crack depths in the pressurizer surge line and HPI piping. The staff finds that the applicant's use of the ASME Code, Section XI, Inservice Inspection, Subsections IWB, IWC, and IWD program is adequate to manage the effects of EAF because the program performs periodic inspections to ensure that the ASME Code Section XI, Appendix L flaw tolerance analysis remains valid and the structural integrity of the pressurizer surge line and HPI piping is maintained.

For the RCS pressure boundary components and piping, the staff finds the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of EAF on the intended functions of the components and piping will be adequately managed for the subsequent period of extended operation. Additionally, it meets the acceptance criteria in SRP-SLR

Section 4.3.2.1.2.3 because the applicant proposed to use the Fatigue Monitoring program and the ASME Code, Section XI, Inservice Inspection, Subsections IWB, IWC, and IWD program in conjunction with the flaw tolerance evaluation per ASME Code, Section XI, Appendix L to manage the effects of EAF, consistent with the guidance in SRP-SLR Section 4.3.2.1.2.3. As previously noted, the staff's evaluation of the Fatigue Monitoring program is documented in SE Section 3.0.3.2.28, and its evaluation of the ASME Code, Section XI, Inservice Inspection, Subsections IWB, IWC, and IWD program is documented in SE Section 3.0.3.2.1.

4.3.4.3 UFSAR Supplement

SLRA Section A4.3.4 provides the UFSAR supplement summarizing the EAF analysis of the RCS pressure boundary components and piping. The staff reviewed SLRA Section A4.3.4, consistent with the review procedures in SRP-SLR Section 4.3.3.2.

Based on its review of the UFSAR supplement, the NRC staff finds that it meets the acceptance criteria in SRP-SLR Section 4.3.2.2 and is, therefore, acceptable. The staff also finds that the applicant provided an adequate summary description to address the EAF TLAA for the RCS pressure boundary components, as required by 10 CFR 54.21(d).

4.3.4.4 Conclusion

Based on its review, the NRC staff concludes the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of EAF on the intended functions of the RCS pressure boundary components and piping will be adequately managed by the Fatigue Monitoring program and the ASME Code Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program in conjunction with the flaw tolerance evaluation per ASME Code Section XI, Appendix L for the subsequent period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation for the subsequent period of extended operation, as required by 10 CFR 54.21(d).

4.3.5 Analytical Evaluation of Flaws

4.3.5.1 Summary of Technical Information in the Application

SLRA Section 4.3.5 describes the applicant's TLAA for flaw evaluations performed on previously detected indications for Class 1, Class 2, and Class 3 pressure retaining components. The applicant explained that the flaws were initially analyzed and dispositioned during the first license renewal for the period of extended operation. For SLR, the applicant reviewed the analyses and identified those that are still applicable. Additionally, the applicant reviewed its inservice inspection (ISI) records for the period since the initial license renewal and identified one new flaw (in an HPI piping weld in Unit 1) that required evaluation for the subsequent period of extended operation. All of the evaluations considered assumptions, such as thermal and pressure transients and operating cycles, for the licensed life of the plant.

The applicant dispositioned the TLAA for the applicable flaws in accordance with 10 CFR 54.21(c)(1)(iii) by demonstrating that the effects of metal fatigue on the intended functions will be adequately managed by the Fatigue Monitoring program for the subsequent period of extended operation.

4.3.5.2 Staff Evaluation

The SLRA states that the applicable flaws will be managed by the Fatigue Monitoring program, which is described in SLRA Section B3.1. The staff reviewed the applicant's TLAA for the flaw evaluations and the corresponding disposition of the TLAA in accordance with 10 CFR 54.21(c)(1)(iii), consistent with the review procedures in SRP-SLR Section 4.3.3.1.1.3 and the acceptance criteria in SRP-SLR Section 4.3.2.1.1.3.

During its audit (ADAMS Accession No. ML22045A053), the staff noted that the applicant identified locations as being applicable to this TLAA, which are summarized below:

Unit 1:

- Pressurizer near heater bundle
- Pressurizer support lugs
- OTSG at the upper head to tubesheet region
- Reactor vessel at the reactor vessel flange to shell region
- Control rod drive mechanism housing

Unit 2:

- Core flood tank dump valve to nozzle
- Pressurizer upper head to shell region
- Control rod drive mechanism housing

Unit 3:

- None

The staff's evaluation of the Fatigue Monitoring program is documented in SE Section 3.0.3.2.28, which determined that the program, when enhanced, will be adequate to manage the applicable aging effects of metal fatigue. Based on the applicant's implementation of the Fatigue Monitoring program, the staff finds the applicant has demonstrated, in accordance with 10 CFR 54.21(c)(1)(iii), that the effects of fatigue on the intended functions of the pressure-retaining components will be adequately managed for the subsequent period of extended operation.

Additionally, the TLAA meets the acceptance criteria in SRP-SLR Section 4.3.2.1.1.3 because (1) the applicant's use of the Fatigue Monitoring program is consistent with the SRP-SLR, and (2) this program continually monitors the occurrence of transient cycles, ensures the validity of this TLAA, and will trigger corrective actions before analyses become invalid during the subsequent period of extended operation.

4.3.5.3 UFSAR Supplement

SLRA Section A4.3.5 provides the UFSAR supplement summarizing the fatigue TLAA for the applicable pressure-retaining components. The NRC staff reviewed SLRA Section A4.3.5 consistent with the review procedures in SRP-SLR Section 4.3.3.2.

Based on its review, the staff finds that the UFSAR supplement meets the acceptance criteria in SRP-SLR Section 4.3.2.2 and is, therefore, acceptable. Additionally, the staff finds that the applicant provided an adequate summary description of its actions to address the fatigue TLAA for the applicable pressure-retaining components, as required by 10 CFR 54.21(d).

4.3.5.4 Conclusion

Based on its review, the NRC staff concludes that the applicant has provided an acceptable demonstration, in accordance with 10 CFR 54.21(c)(1)(iii), that the effects of fatigue on the intended functions of the applicable pressure-retaining components will be adequately managed by the Fatigue Monitoring program for the subsequent period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation for the subsequent period of extended operation, as required by 10 CFR 54.21(d).

4.3.6 Weld Overlay Fatigue Analysis

4.3.6.1 Summary of Technical Information in the Application

SLRA Section 4.3.6 describes the applicant's TLAA for flaw evaluations of structural weld overlays, including fatigue analyses and postulated flaw growth analyses. The SLRA states that the 40-year design cycles are postulated to bound 80 years of plant operation. As a result, the fatigue analyses for the structural weld overlays have an adequate margin to remain valid for the subsequent period of extended operation.

For the weld overlays at the pressurizer spray nozzle, pressurizer safety relief nozzle, and RCS hot leg surge nozzle (Unit 1 only), fatigue flaw growth analyses indicated no need to establish service limits when considering the thermal transients originally established for 40 years projected to 80 years of operation. The SLRA also states that the Fatigue Monitoring program will track cycles for significant fatigue transients listed in SLRA Table 4.3.1-1 and ensure corrective action is taken prior to potentially exceeding fatigue design limits.

For the weld overlays at the pressurizer surge nozzle, RCS hot-leg surge nozzle (Units 2 and 3), hot-leg decay heat nozzle, and RCS letdown nozzle, the applicant stated that the fatigue flaw growth analyses indicate service life limits that establish the required period for inspection of these weld overlays. For these locations, the SLRA states that a 25% sample of the weld overlay population will be inspected for cracking during the subsequent period of extended operation and that these inspections will be managed by the ASME Code, Section XI, Inservice Inspection, Subsections IWB, IWC, and IWD program. The sample population will include two of the most limiting weld overlays for each unit.

The applicant dispositioned the TLAA for the applicable flaws in accordance with 10 CFR 54.21(c)(1)(iii) by demonstrating that the effects of metal fatigue on the intended functions will be adequately managed by the Fatigue Monitoring program and the ASME Code Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program, for the subsequent period of extended operation.

4.3.6.2 Staff Evaluation

The staff reviewed the applicant's TLAA for the flaw evaluations and the corresponding disposition of the TLAA in accordance with 10 CFR 54.21(c)(1)(iii), consistent with the review procedures in SRP-SLR Section 4.3.3.1.1.3 and the acceptance criteria in SRP-SLR Section 4.3.2.1.1.3.

The SLRA states that the applicable flaws will be managed by the Fatigue Monitoring program and the ASME Code Section XI, Inservice Inspection, Subsections IWB, IWC, and IWD program, which are described in SLRA Section B3.1 and SLRA Section B2.1.1, respectively. The staff confirmed that the 40-year design cycles bound the projected cycles for 80 years of plant operation. The staff's evaluation of the Fatigue Monitoring program is documented in SE Section 3.0.3.2.28. The staff's evaluation of the ASME Code Section XI, Inservice Inspection, Subsections IWB, IWC, and IWD program, is documented in SE Section 3.0.3.2.1. Based on the applicant's implementation of the Fatigue Monitoring program and the ASME Code Section XI, Inservice Inspection, Subsections IWB, IWC, and IWD program, the staff finds that the applicant has demonstrated, in accordance with 10 CFR 54.21(c)(1)(iii), that the effects of metal fatigue on the intended functions of the structural weld overlays will be adequately managed for the subsequent period of extended operation.

Additionally, the TLAA meets the acceptance criteria in SRP-SLR Section 4.3.2.1.1.3 because (1) the applicant's use of the Fatigue Monitoring program is consistent with the SRP-SLR; (2) the Fatigue Monitoring program continually monitors the occurrence of transient cycles, ensures the validity of this TLAA, and will trigger corrective actions before analyses become invalid during the subsequent period of extended operation, and (3) the applicant's use of the ASME Code Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program, will inspect a 25% sample population of the structural weld overlays, which will include the two most limiting weld overlays for each unit.

4.3.6.3 UFSAR Supplement

SLRA Section A4.3.6 provides the UFSAR supplement summarizing the fatigue TLAA for the structural weld overlays. The staff reviewed SLRA Section A4.3.6 consistent with the review procedures in SRP-SLR Section 4.3.3.2.

Based on its review, the staff finds that the UFSAR supplement meets the acceptance criteria in SRP-SLR Section 4.3.2.2 and is, therefore, acceptable. Additionally, the staff finds that the applicant provided an adequate summary description of its actions to address the fatigue TLAA for the structural weld overlays, as required by 10 CFR 54.21(d).

4.3.6.4 Conclusion

Based on its review, the NRC staff concludes that the applicant has provided an acceptable demonstration, in accordance with 10 CFR 54.21(c)(1)(iii), that the effects of metal fatigue on the intended functions of the structural weld overlays will be adequately managed by the Fatigue Monitoring program and by the ASME Code Section XI, Inservice Inspection, Subsections IWB, IWC, and IWD program, for the subsequent period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation for the subsequent period of extended operation, as required by 10 CFR 54.21(d).

4.4 Environmental Qualification of Electric Equipment

4.4.1 Summary of Technical Information in the Application

SLRA Section 4.4 describes the applicant's TLAA for evaluation of the environmental qualification of electric equipment for the subsequent period of extended operation. Thermal, radiation, and cyclical aging analyses of plant electrical and instrumentation components located in harsh environments, developed to meet 10 CFR 50.49 requirements, have been identified as TLAAs. The applicant dispositioned the TLAA for the EQ of electric equipment in accordance with 10 CFR 54.21(c)(1)(iii) by demonstrating that the effects of EQ of electric components on the intended functions will be adequately managed by the "Environmental Qualification of Electric Equipment" program described in SLRA Section B3.3 for the subsequent period of extended operation.

4.4.2 Staff Evaluation

The staff reviewed the applicant's TLAA for the EQ of electric equipment and the corresponding disposition of 10 CFR 54.21(c)(1)(iii), consistent with the review procedures in SRP-SLR Section 4.4.3.1.3, which states that, pursuant to 10 CFR 54.21(c)(1)(iii), an applicant must demonstrate that the effects of aging on the intended functions will be adequately managed for the subsequent period of extended operation. The review used the acceptance criteria in SRP-SLR Section 4.4.2.1.3.

The EQ requirements established by 10 CFR 50.49 require each applicant to establish a program to qualify electrical equipment so that such equipment, in its end-of-life condition, will meet its performance specifications during and following design basis accidents. A program to address EQ of electric equipment important to the safety, in accordance with the requirements of 10 CFR 50.49, is considered an adequate program for the purposes of subsequent license renewal. Electric components in the applicant's EQ program identified as having a qualified life equal to or greater than the current operating term (i.e., 60 years) are considered TLAAs for SLR.

The staff reviewed SLRA Section 4.4 and the associated program basis documents to determine if the applicant's EQ program meets the requirements of 10 CFR 54.21(c)(1). The applicant's EQ program is implemented per the requirements of 10 CFR 54.21(c)(1)(iii) to show that components evaluated under the applicant's TLAA evaluation are adequately managed during the subsequent period of extended operation. The staff reviewed the applicant's EQ program, including the management of aging effects, to confirm that electric equipment requiring EQ will continue to operate consistent with the CLB during the subsequent period of extended operation.

The staff also conducted an audit of the information provided in SLRA Section B3.3 and the program basis documents, including reports provided to the staff during the audit. Based on the staff's review of SLRA Section B3.3 and the results of the audit, the staff concludes that the applicant's EQ program elements are consistent with the GALL-SLR Report AMP X.E1, "Environmental Qualification (EQ) of Electric Components." The staff's evaluation of the applicant's EQ of Electric Equipment program is documented in SE Section 3.0.3.2.29.

The staff also reviewed the applicant's EQ program reanalysis attributes evaluation and concludes that it is consistent with SRP-SLR Section 4.4.3.1.3 and SRP-SLR Table 4.4-1. Reanalysis of an aging evaluation addresses attributes of analytical methods, data collection and reduction methods, underlying assumptions, acceptance criteria, ongoing qualification, and corrective action (if acceptance criteria are not met). The applicant noted that EQ components not qualified for the current license term are to be refurbished or replaced, or have their qualified life extended through reanalysis or ongoing qualification prior to reaching the designated life aging limits established in the evaluation.

The staff finds that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of thermal, radiation, and cyclical aging of plant electrical and instrumentation and control components located in harsh environments, qualified to meet 10 CFR 50.49 requirements on the intended functions of the EQ electric equipment, will be adequately managed for the subsequent period of extended operation. The applicant's EQ program manages the effects of thermal, radiation, and cyclic aging using an aging evaluation based on 10 CFR 50.49(f) qualification methods. As required by 10 CFR 50.49(e)(5), EQ components are refurbished or replaced, or their qualification is extended prior to reaching the aging limit established in the evaluation.

Additionally, the applicant's TLAA for EQ of electric equipment meets the acceptance criteria in SRP-SLR Section 4.4.2.1.3 because the EQ program is capable of programmatically managing the qualified life of components within the scope of the program for license renewal, and the continued implementation of the EQ program provides assurance that the aging effects will be managed such that EQ electric components will continue to perform their intended functions for the subsequent period of extended operation consistent with the requirements of 10 CFR 54.21(c)(1)(iii).

4.4.3 UFSAR Supplement

SLRA Appendix A3.3 provides the UFSAR supplement summarizing the EQ of electric equipment. The staff reviewed SLRA Appendix A3.3, consistent with the review procedures in SRP-SLR Section 4.4.3.2.

The staff also noted that the applicant committed (Commitment No. 46) to continue the existing EQ of Electric Equipment program, including enhancements to add activities to perform visual inspections of accessible, passive EQ electric equipment located in adverse localized environments at least once every 10 years and to establish acceptance criteria for the visual inspection of accessible passive EQ electric equipment located in adverse localized environments.

Based on its review, the staff finds that the UFSAR supplement meets the acceptance criteria in SRP-SLR Section 4.4.3.2 and is therefore acceptable. Additionally, the staff finds that the applicant provided an adequate summary description of its actions to address EQ of electric equipment, as required by 10 CFR 54.21(d).

4.4.4 Conclusion

Based on its review, the staff concludes that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of thermal, radiation, and cyclic aging on the intended functions of the EQ electric equipment will be adequately managed by the EQ of Electric Equipment program for the subsequent period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.5 Concrete Containment Tendon Prestress

4.5.1 Summary of Technical Information in the Application

SLRA Section 4.5 describes the applicant's TLAA for post-tensioned containment tendon prestress forces for the subsequent period of extended operation. The SLRA notes that the prestressing forces are measured and plotted, and trend lines developed to ensure the average tendon group prestressing values remain above the respective minimum required values (MRV) until the next scheduled surveillance. SLRA Figures 4.5-1 through 4.5-9, show the trend lines projected to the end of the 80-year subsequent period of extended operation, and Figures 4.5-10 through 4.5-15 show the trend lines for the tendons that were replaced as part of the steam generator replacement project. In addition to projecting the forces to the end of the subsequent period of extended operation, the applicant noted that the Concrete Containment Unbonded Tendon Prestress program and the ASME Code, Section XI, Subsection IWL AMPs will monitor tendon forces and manage the effects of aging related to prestress force losses during the subsequent period of extended operation; this will also confirm the continued validity of the prestress force projections. Therefore, the applicant dispositioned the TLAA for the unbonded containment tendons in accordance with 10 CFR 54.21(c)(1)(iii) by demonstrating that the effects of loss of prestressing forces on the intended functions will be adequately managed by the Concrete Containment Unbonded Tendon Prestress and the ASME Code, Section XI, Subsection IWL programs for the subsequent period of extended operation.

The SLRA also noted that the original tendon program was not in accordance with ASME Code, Section XI, Subsection IWL requirements. Instead of selecting random tendons for each inspection, the original program examined a preselected, fixed population. Detensioning and retensioning the same tendons for each examination led to tendon damage that precluded them from future testing and made them unrepresentative of the larger tendon population.
In 1997, the program was updated to align with the ASME Code, Section XI, Subsection IWL program, and the inspection data since that date has been used to develop the trend lines. The applicant amended this SLRA section by letter, dated November 11, 2021 (ADAMS Accession No. ML21315A012).

4.5.2 Staff Evaluation

The staff reviewed the applicant's TLAA for the concrete containment unbonded tendon system and the corresponding disposition of the TLAA in accordance with 10 CFR 54.21(c)(1)(iii), consistent with the review procedures in SRP-SLR Section 4.5.3.1.3. The review procedures state that the applicant may reference the GALL-SLR Report in its SLRA to identify an appropriate program that is consistent with GALL-SLR Report AMP X.S1, "Concrete Containment Tendon Prestress," to manage the effects of aging (i.e., loss of tendon prestress) for the subsequent period of extended operation. The SRP-SLR also recommends further evaluation of the applicant's operating experience related to the containment prestress force.

The staff reviewed SLRA Section 4.5 and noted that it credits the program "Concrete Containment Unbonded Tendon Prestress," described in SLRA Section B3.4, to manage the loss of tendon prestress aging effect for the subsequent period of extended operation. The staff confirmed that the applicant identified the appropriate GALL-SLR Report program in accordance with the review procedures of SRP-SLR Section 4.5.3.1.3. The staff found the applicant's program, with justified exceptions, is consistent with the GALL-SLR Report AMP X.S1, and the staff's evaluation of the applicant's program is documented in SE Section 3.0.3.2.30. The staff also noted that the applicant appropriately designated SLRA Section B2.1.29, "ASME Section XI, Subsection IWL," for tendon selection and examinations performed in accordance with the ASME Code, Section XI, Subsection IWL. The staff's evaluation of the applicant's ASME Code, Section XI, Subsection IWL program is documented in SE Section 3.0.3.2.18.

The staff also reviewed the operating experience in the application, including the trend lines and predicted forces captured in SLRA Figures 4.5--1 through 4.5--15. The staff noted that the trend lines were developed using regression analysis based on actual measured tendon forces from all previous examinations since the program was updated in 1997. For the tendons impacted by the steam generator replacement, there are too few examination results to create a trend line; however, the measured values are well above the MRV, and these tendons will continue to be monitored by the program. The staff also noted that the predicted tendon forces at 80 years remain above the MRV for all tendon groups (i.e., dome, hoop, and vertical). Based on its review, the staff finds that the applicant has properly incorporated data from past surveillances and has developed acceptable regression trend lines based on all previous relevant inspections, and that the SLRA "Concrete Containment Unbonded Tendon Prestress," and "ASME Section XI, Subsection IWL" AMPs will also serve to confirm the continued validity of the prestress force projections.

The staff finds the applicant has demonstrated, in accordance with 10 CFR 54.21(c)(1)(iii), that the effects of loss of prestress on the intended functions of the containment tendon prestressing system will be adequately managed for the subsequent period of extended operation.

Additionally, the application meets the acceptance criteria in SRP-SLR Section 4.5.2.1.3 because the applicant has properly addressed operating experience related to concrete containment prestress forces, and the applicant's Concrete Containment Unbonded Tendon Prestress program, with justified exceptions, assesses the continued adequacy of concrete containment tendon prestressing forces; the staff determined that the program is an acceptable way to manage loss of prestress forces in the containment prestressing tendons.

4.5.3 UFSAR Supplement

SLRA Section A4.5 provides the UFSAR supplement summarizing the Concrete Containment Unbonded Tendon Prestress TLAA. The staff reviewed SLRA Section A4.5, consistent with the review procedures in SRP-SLR Section 4.5.3.2. Based on its review, the staff finds that the UFSAR supplement for this TLAA meets the acceptance criteria in SRP-SLR Section 4.5.2.2 and is, therefore, acceptable. Additionally, the staff finds that the applicant provided an adequate summary description of its actions to address the concrete containment prestress TLAA, as required by 10 CFR 54.21(d).

4.5.4 Conclusion

Based on its review, the staff concludes that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of loss in prestressing forces on the intended functions of the containment prestressing system will be adequately managed by the Concrete Containment Unbonded Tendon Prestress program for the subsequent period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation for the subsequent period of extended operation, as required by 10 CFR 54.21(d).

4.6 Containment Liner Plate, Metal Containments, and Penetrations Fatigue Analyses

4.6.1 Containment Liner Plate and Cold Penetrations

4.6.1.1 Summary of Technical Information in the Application

SLRA Section 4.6.1, as amended by letter dated February 14, 2022, (ADAMS Accession No. ML22045A021) in response to RAI 4.6.1-1, describes the applicant's TLAA for fatigue of the containment liner plate and cold penetrations of carbon steel and stainless-steel material. The applicant dispositioned the TLAA for the containment liner plate and cold penetrations in accordance with 10 CFR 54.21(c)(1)(ii) by demonstrating that the analysis has been projected to the end of the subsequent period of extended operation.

4.6.1.2 Staff Evaluation

The staff reviewed the applicant's TLAA, as amended, for the containment liner plate and cold penetrations and the corresponding disposition of the TLAA in accordance with 10 CFR 54.21(c)(1)(ii), consistent with the review procedures in SRP-SLR Section 4.6.3.1.1.2 and the acceptance criteria in SRP-SLR Section 4.6.2.1.1.2.

The staff noted from the SLRA, as amended, that temperature and pressure changes from RCS heatups and cooldowns and Type A integrated leak rate tests are the main contributors to fatigue cycling of the containment liner plate and cold penetrations of carbon steel and stainless-steel materials of construction, as listed in SLRA Table 4.6.1-1. The staff also noted that cold penetrations include containment mechanical, electrical, equipment, and personnel-related penetrations that experience temperatures less than 150 °F.

The staff reviewed UFSAR Section 3.8.1.5.3 and verified that the following cycle counts of fatigue loads were considered for the containment liner plate: (a) assumed 500 thermal cycles of the controlling combined fatigue loading due to containment interior temperature and pressure variations during startup and shutdown (i.e., heatup and cooldown) of the RCS and include Type A integrated leak rate tests; (b) 40 thermal cycles due to annual outdoor temperature variations for 40 years of operation; and (c) 1 thermal cycle due to the loss of coolant accident (LOCA), which is not a time-limited parameter. The staff also noted from the SLRA that because the containment liner is on the interior of a 3¾-ft thick concrete containment wall, the change in temperature from the outside to the inside of the containment wall would be insignificant to have a thermal fatigue impact; therefore, increasing the 40 cycles due to annual outdoor temperature variations to 80 cycles for 80 years of operation would be considered insignificant compared to, and can be considered included in, the 500 design cycles for the controlling combined fatigue loading. The staff also noted from the SLRA that the maximum projected number of Type A tests expected to be performed for 80 years of operation is approximately 25 per unit.

The staff also reviewed UFSAR Table 5-2 and SLRA Table 4.3.1-1 and noted that the number of original design transient cycles for RCS heatup and cooldown is 360 cycles. The staff also reviewed SLRA Table 4.3.1-1, "80-Year Transient Cycle Projections," and confirmed that the maximum number of projected heatup and cooldown cycles for the three units for 80 years of operation, based on a projection of actual observed transient cycles as of May 6, 2019, is 197 cycles, which is bounded by the 360 design cycles. The staff also notes that the LOCA has not occurred, which confirms that the assumed thermal cycle of one remains valid for the subsequent period of extended operation. The staff agrees that the cumulative (combined) total number of cycles of outdoor temperature variations (80), the total number of Type A tests (25), the projected number of heatup and cooldown cycles (197) based on observed transient counts (as of May 6, 2019), and the one LOCA cycle results in a transient cycle count, to the end of the subsequent period of extended operation, which is less than and bounded by the assumed cumulative 500 cycles evaluated in the design. The staff also noted from the SLRA, as amended, that for 80 years of operation, the cumulative effects of cyclic loading for the containment liner plate and cold penetrations were re-evaluated to the fatigue waiver (exemption) criteria in ASME Code, Section III (Code of record 1965 edition), Paragraph N-415.1, "Vessels Not Requiring Analysis for Cyclic Operation" to validate that a detailed fatigue analysis is not required. The applicant stated that this fatigue waiver evaluation, based on carbon steel SA-516 Grade 70 material, was bounding of the containment liner plate and cold penetrations materials of construction identified in SLRA Table 4.6.1-1 and met all six criteria in ASME Code, Section III, Paragraph N-415.1. The applicant concluded that the fatigue waiver analysis associated with the containment liner plate and cold penetrations meets all six criteria in the ASME Code, Section III, Paragraph N-415.1, for the cumulative 500 applied design cycles and will remain valid for the subsequent period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii).

For SLRA Section 4.6.1, as amended, the staff determined the need for additional information, which resulted in the issuance of a follow-up RAI. RAI 4.6.1-1a and the applicant's response is documented in ADAMS Accession No. ML22140A016.

In its response, the applicant described with technical detail (including material and cyclic inputs, design/operating pressure and temperature parameters, and fatigue parameter evaluations) how each of the six criteria for fatigue waiver (or exemption) in the 1965 edition of ASME Code, Section III, Paragraph N415.1 (Code of record), were satisfied for the containment liner plate and cold penetrations. The applicant explained its evaluation of the six conditions, consistent with the ASME code of record provisions, for 500 bounding full-range temperature and pressure fatigue cycles through the end of the subsequent period of extended operation due to the following: (a) atmospheric-to-operating pressure cycles, (b) normal operation pressure fluctuation (including Type A integrated leak rate tests), (c) temperature difference – startup and shutdown, (d) temperature difference – normal operation, (e) temperature difference – dissimilar materials, and (f) mechanical loads. The staff noted that each material used for the containment liner plate and cold penetration components were considered for the evaluation, and the applicant determined that the SA-516 Grade 70 was the limiting material based on design stress intensities. The staff also noted that the applicant evaluated and satisfied criterion (b) for both normal operating pressure fluctuations and the pressure during Type A integrated leak rate tests.

During its evaluation of the applicant's response to RAI 4.6.1-1a, the staff audited and verified that the applicant's fatigue waiver evaluation for containment liner plate and cold penetrations, summarized in the RAI response, is documented in Calculation OSC-2077-03-SLR-1009, Revision 2 (dated May 4, 2022), "Supporting Analysis for Subsequent License Renewal – Reactor Building Liner Plate and Penetration Design & Licensing Bases Review to Support A Fatigue Exemption Evaluation for ONS SLR Application." The staff finds the applicant's response acceptable because: (a) it demonstrated in sufficient technical detail how the applicant met each of the six criteria for fatigue waiver in the 1965 edition of the ASME Code, Section III, paragraph N-415.1, for the containment liner plate and cold penetrations; (b) the applicant justified that the SA-516 Grade 70 material was bounding of the materials of construction of the containment liner plate and cold penetrations because, based on design stress intensity values, this material was determined to be the limiting material for evaluation of the code fatigue waiver parameters; and (c) the projected cumulative fatigue design cycles (due to pressure, temperature, and mechanical load fluctuations) considered for the applicable fatigue waiver parameter evaluations is bounding of the expected cycles for the subsequent period of extended operation.

The staff finds that the applicant has demonstrated that the containment liner plate and cold penetrations are capable of withstanding the projected cumulative fatigue cycles expected through the end of the subsequent period of extended operation by satisfying the six fatigue waiver conditions stipulated in paragraph N-415.1 of Section III of the ASME Code (1965 edition).

The staff finds that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(ii), that the re-evaluation analyses for fatigue of the containment liner plate and cold penetrations have been projected to the end of the subsequent period of extended operation. Additionally, it meets the acceptance criteria in SRP-SLR Section 4.6.2.1.1.2 because the six fatigue waiver criteria in paragraph N-415.1 of the ASME Code, Section III, 1965 edition, were satisfied for the conservatively bounding projected design cycles for 80 years of operation due to fluctuations in operating temperature and pressure, including Type A ILRT, and mechanical loads.

4.6.1.3 UFSAR Supplement

SLRA Section A4.6.1, as amended by letter dated February 14, 2022, provides the UFSAR supplement summarizing the fatigue evaluation for the containment liner plate and cold penetrations. The staff reviewed SLRA Section A4.6.1 consistent with the review procedures in SRP-SLR Section 4.6.3.2.

Based on its review, the staff finds that the UFSAR supplement, as amended by letter dated February 14, 2022, meets the acceptance criteria in SRP-SLR Section 4.6.2.2 and is therefore acceptable. Additionally, the staff finds that the applicant provided an adequate summary description of its actions to address fatigue evaluation of the containment liner plate and cold penetrations, as required by 10 CFR 54.21(d).

4.6.1.4 Conclusion

Based on its review, the staff concludes that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(ii), that the fatigue evaluations of the containment liner plate and cold penetrations have been projected to the end of the subsequent period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.6.2 Metal Containment

4.6.2.1 Summary of Technical Information in the Application

SLRA Section 4.6.2 states that each unit has a concrete containment with a metal liner; therefore, the topic of metal containment fatigue analysis is not applicable.

4.6.2.2 Staff Evaluation and Conclusion

The staff reviewed UFSAR Section 3.8.1 and noted that Units 1, 2, and 3 have post-tensioned reinforced concrete containments with the inside surface lined with a ¼-inch-thick welded steel plate liner to provide leak-tightness. Therefore, the staff finds that Units 1, 2, and 3 do not have metal containments, and the topic of metal containment fatigue TLAAs is not applicable to the plant.

4.6.3 Containment Penetrations Fatigue Analyses

4.6.3.1 Summary of Technical Information in the Application

SLRA Section 4.6.3 describes the applicant's TLAA for fatigue of the main steam and main feedwater containment piping penetrations. The applicant dispositioned the TLAA for the containment main steam and main feedwater piping penetrations of carbon steel material in accordance with 10 CFR 54.21(c)(1)(iii) by demonstrating that the effects of fatigue damage due to cyclic loading on the intended functions of the main steam and main feedwater piping penetrations will be adequately managed by the Fatigue Monitoring program (SLRA Section B3.1) for the subsequent period of extended operation.

4.6.3.2 Staff Evaluation

The staff reviewed the applicant's TLAA for fatigue damage due to cyclic loading of the containment main steam and main feedwater piping penetrations, designated as hot penetrations, and the corresponding disposition of the TLAA in accordance with 10 CFR 54.21(c)(1)(iii), consistent with the review procedures in SRP-SLR Section 4.6.3.1.1.3 and the acceptance criteria in SRP-SLR Section 4.6.2.1.1.3.

The staff noted from the SLRA and UFSAR Section 3.8.1.5.3 that thermal load cycles in the piping system are partly isolated from the liner plate penetrations by concentric sleeves between the pipe and thickened liner plate, which were originally designed in accordance with fatigue considerations in the ASME Code, Section III, 1965 edition. The staff also noted that the main steam and main feedwater piping are the only piping systems penetrating the containment wall and liner plate that contribute significant thermal loading on the thickened liner plate. The staff noted that the original design of the primary containment penetrations was revised for the main steam and feedwater piping penetrations to the 1992 edition with 1992 addenda of ASME Code, Section III, Subsection NE, which included consideration of fatigue loads to a conservative number of cycles to be expected during plant life, which are less than the 40-year design cycles.

The staff noted that the allowable cycle count limits for the controlling transients for these penetrations, which are a subset of transients listed in SLRA Table 4.3.1-1, were refined from the original design and new values established for the current operating period and formed the basis of the SLRA fatigue evaluation. The staff also noted that refined allowable cycles and projected cycles for 80 years of operation based on current actual count of controlling transients (heatups, cooldowns, and reactor trips for the main steam penetrations and heatups, cooldowns, and seismic for the feedwater penetrations) are reported in SLRA Table 4.6.3-1, as amended by Supplement 2 dated November 11, 2021. As confirmed by the response to RCI 4.6.3-A (ADAMS Accession No. ML21336A001), the staff further noted that the fatigue usage evaluation load combinations involving governing heatup and cooldown transients included five operating basis earthquake (OBE) events of 10 cycles each for the main steam penetration evaluation and three OBE events of 10 cycles each for the main feedwater penetration evaluation. The staff reviewed SLRA Table 4.6.3-1, as amended by Supplement 2 dated November 11, 2021, and noted that the projected 80-year cycles for heatup, cooldown, and total reactor trips for the main steam penetration are 189, 197, and 204, respectively, and the corresponding refined allowable cycles are 262 for each of the transients. Likewise, the projected 80-year cycles for heatup and cooldown (both including seismic) for the main feedwater penetrations are 189 and 197, respectively, and the corresponding refined allowable cycles are 249 for each of these transients. Based on the above cycle counts, the applicant concluded that the projected cycles for 80 years of operation of controlling transients, which are projected from the actual current count (as of May 6, 2019), are bounded by the respective refined allowable cycles.

The staff further noted that the Fatigue Monitoring program, which will be consistent with enhancements to GALL-SLR AMP X.M1, “Fatigue Monitoring,” will track transient cycles in SLRA Table 4.3.1-1, which includes heatup, cooldown, and reactor trip cycles and seismic transients applicable to this TLAA and provides reasonable assurance that corrective action is taken prior to potentially exceeding allowable design fatigue cycles for the main steam and main feedwater penetration. The staff evaluation of the Fatigue Monitoring program is documented in SE Section 3.0.3.2.28. The staff thus concludes that the applicant has identified an acceptable program to adequately manage fatigue of the containment liner plate that supports the TLAA disposition in accordance with 10 CFR 54.21(c)(1)(iii).

The staff finds that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of fatigue on the intended functions of the containment main steam and main feedwater piping penetrations will be adequately managed for the subsequent period of extended operation.

Additionally, it meets the acceptance criteria in SRP-SLR Section 4.6.2.1.1.3 because, consistent with the TLAA acceptance criterion in 10 CFR 54.21(c)(1)(iii), the applicant has proposed the SLRA Section B3.1 Fatigue Monitoring program (described as an existing program with enhancements that will be consistent with the GALL-SLR AMP X.M1) to manage the effects of fatigue due to cyclic loading on the intended functions of the containment main steam and main feedwater piping penetrations during the subsequent period of extended operation. Per the SRP-SLR acceptance criteria, GALL-SLR AMP XI.M1 provides a program that may be used as the basis for accepting this TLAA in accordance with 10 CFR 54.21(c)(1)(iii), and the staff evaluation of the Fatigue Monitoring program is documented in SE Section 3.0.3.2.28.

4.6.3.3 UFSAR Supplement

SLRA Section A4.6.3, as amended in Supplement 2 by letter dated November 11, 2021, provides the UFSAR supplement summarizing the containment main steam and main feedwater piping penetrations fatigue evaluation. The staff reviewed the amended SLRA Section A4.6.3 consistent with the review procedures in SRP-SLR Section 4.6.3.2.

For the UFSAR supplement description, the staff determined the need for additional information, which resulted in the issuance of an RAI. RAI 4.6.3-1 and the applicant’s response by letter dated February 14, 2022, are documented in ADAMS Accession No. ML22045A021.

In its response, the applicant clarified that the CUF is the specific fatigue parameter that will be managed by the Fatigue Monitoring program and that the fatigue evaluations performed on the main steam and main feedwater penetrations use a refined number of allowable cycles detailed in SLRA Table 4.6.3-1 to achieve a cumulative usage factor less than unity. The applicant further stated that the transients that the Fatigue Monitoring program tracks are heatups, cooldowns, and the total number of reactor trips for the main steam penetrations, and heatups and cooldowns for the main feedwater penetrations; the 80-year projections for these transients remain below the refined allowable cycles. Accordingly, the applicant provided a revised UFSAR supplement summary description in SLRA Section A4.6.3 to clearly state the fatigue parameter (CUF) that will be monitored by the Fatigue Monitoring program, the acceptance criteria, and the specific transients that are monitored and tracked against the allowable cycles to ensure the acceptance criteria is maintained.

The staff finds the applicant's response to RAI 4.6.3-1 and changes to the SLRA acceptable because the applicant provided a revised UFSAR Supplement with information equivalent to that in SRP-SLR Table 4.6-1 for disposition under 10 CFR 54.21(c)(1)(iii) and sufficient to meet the acceptance criteria for the FSAR supplement in SRP-SLR Section 4.6.2.2.

Based on its review, the staff finds that the UFSAR supplement, as amended by letter dated February 14, 2022, meets the acceptance criteria in SRP-SLR Section 4.6.2.2 and is therefore acceptable. Additionally, the staff finds that the applicant provided an adequate summary description of its actions to address cumulative fatigue damage of the containment liner plate, as required by 10 CFR 54.21(d).

4.6.3.4 Conclusion

Based on its review, the staff concludes that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of fatigue on the intended functions of the main steam and main feedwater containment piping penetrations will be adequately managed by the Fatigue Monitoring program for the subsequent period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.7 Other Plant-Specific TLAAs

SLRA Section 4.7, "Other Plant-Specific Time-Limited Aging Analyses," provides the applicant's evaluations of those plant-specific analyses in the CLB that have been identified as plant-specific TLAAs. The applicant identifies that the following analyses in the CLB qualify as plant-specific TLAAs for the SLRA:

- Reactor Vessel Internals – Reduction in Fracture Toughness Due to Neutron Irradiation Embrittle" (SLRA Section 4.7.1.1)
- Reactor Vessel Internals – Flow-Induced Vibration Endurance Limits (SLRA Section 4.7.1.2)
- Reactor Vessel Internals – Irradiation Embrittlement (SLRA Section 4.7.1.3)
- Reactor Vessel Underclad Cracking Analysis (SLRA Section 4.7.2)
- Reactor Coolant Pump Flywheel Fatigue Analyses (SLRA Section 4.7.3)
- Leak-Before-Break Analysis for RCS Piping (SLRA Section 4.7.4)
- Crane Load Cycle Limits (SLRA Section 4.7.5)

4.7.1 Reactor Vessel Internals

4.7.1.1 Reactor Vessel Internals – Reduction in Fracture Toughness Due to Neutron Embrittlement

4.7.1.1.1 Summary of Technical Information in the Application

SLRA Section 4.7.1.1 describes the applicant's TLAA for RVI reduction in fracture toughness due to neutron irradiation embrittlement. The applicant states that, by letter dated February 20, 2012 (ADAMS Accession No. ML12053A332), it submitted for NRC review its plant-specific analysis constituting the updated TLAA for RVI reduction of fracture toughness. The applicant also stated that, in the staff's evaluation dated February 19, 2013 (ADAMS Accession No. ML13045A489), the staff concluded that the updated TLAA for Units 1, 2, and 3 was acceptable for the 60-year (i.e., 54 EFPY) licensing basis, in part because the applicant appropriately revised Appendix E of BAW-10008, Part 1, Revision 1 to conclude the reactor vessel internals would have adequate ductility at 60 years (54 EFPY) to withstand the postulated LOCA plus seismic event.

The applicant stated that, because the reduction of ductility analysis in BAW-10008, Part 1, Revision 1, met the definition of a TLAA for the 60-year license renewal basis, it must be re-evaluated in the SLRA for the subsequent period of extended operation.

The applicant stated that it performed an updated analysis of the stress intensity values for the specific RVI components in non-proprietary report ANP-3899NP, Revision 0, "Framatome Reactor Vessel Internals TLAA Input to the ONS SLRA," (Enclosure 4, Attachment 2, to the SLRA, ADAMS Accession No. ML21158A200) and proprietary report ANP-3899P, Revision 0, "Framatome Reactor Vessel Internals TLAA Input to the ONS SLRA," (Enclosure 5, Attachment 2, to the SLRA, ADAMS Accession No. ML21158A201) [henceforth these reports will be referred to as "ANP-3899NP/P" for the non-proprietary and proprietary versions] to determine whether the stress analyses and component-specific ductility assessments for the components in BAW-10008, Part 1, Revision 1, would remain valid for the subsequent period of extended operation. The SLRA states that the analysis performed in ANP-3899NP/P, Revision 0, demonstrates that the reduction of ductility analysis in BAW-10008, Part 1, Revision 1, will remain valid for the subsequent period of extended operation. The applicant also stated that it manages the effects of aging in the RVI components using the program in SLRA Section B2.1.7, "PWR Vessel Internals," and that the program will ensure that the effects of aging will be adequately managed during the subsequent period of extended operation.

Based on these statements, the applicant dispositioned the TLAA on RVI reduction of fracture toughness in accordance with 10 CFR 54.21(c)(1)(iii) by demonstrating that the effects of aging on the intended functions of the RVI components will be adequately managed through implementation of the PWR Vessel Internals program (SLRA Section B2.1.7) during the subsequent period of extended operation.

4.7.1.1.2 Staff Evaluation

The staff reviewed the applicant's TLAA on RVI reduction of fracture toughness and the corresponding disposition of the TLAA in accordance with 10 CFR 54.21(c)(1)(iii) consistent with the review procedures in SRP-SLR Section 4.7.3.1.3 and the acceptance criteria in SRP-SLR Section 4.7.2.1.3.

The staff performed an audit of the applicant's TLAA on RVI reduction of fracture toughness to determine whether the applicant provided a valid basis for dispositioning the TLAA using the acceptance criteria in 10 CFR 54.21(c)(1)(iii). The staff's audit of the RVI TLAA on RVI reduction of fracture toughness is summarized in Section 4.7.1.1 of the audit report for the SLRA (ADAMS Accession No. ML22045A053).

As summarized in Section 4.7.1.1 of the audit report, the staff noted that the applicant performed an updated reduction of ductility assessment of the RVI components in ANP-3899NP/P, Revision 0, to verify the continued validity of the analysis in BAW-10008, Part 1, Revision 1, as applied through the end of the subsequent period of extended operation. The staff noted that it found BAW-10008, Part 1, Revision 1, acceptable for incorporation in the CLB in 1972 (ADAMS Accession No. ML19319B162.)

The TLAA methodology in ANP-3899NP/P, Revision 0, uses a two-phase approach to the evaluation. Phase I includes the following three-step process to screen the RVI components for potential reduction of ductility impacts and to reconcile the analytical results of the assessed RVI components against the corresponding conclusions for the components in both of the Framatome BAW-10008, Part 1, Revision 1, and BAW-1621 reports:

(1) Phase I, Process Step 1 (Category 1 Assessment). RVI components analyzed in BAW-10008, Revision 1, were reanalyzed in Tables 2-4 through 2-8 of ANP-3899NP/P, Revision 0, using the updated faulted condition loadings (Case IV loadings, including asymmetric faulted loads) approved in BAW-1621 (which the staff found acceptable in 1983 (ADAMS Accession Nos. ML15238A802 and ML15238A804) and post-dated BAW-10008, Revision 1). For this process step, the components were considered as having acceptable ductility if the component-specific verification in ANP-3899NP/P, Revision 0, confirmed that the Case IV faulted stress intensity for the component would be less than the ASME Code, Section III-defined maximum allowable stress intensity value for the component in the unirradiated condition.

(2) Phase I, Process Step 2 (Category 2 Assessment). For this step, the components in Table 1 of BAW-10008, Revision 1, that did not screen out under the Category 1 Assessment were reviewed to determine if the component was highly irradiated to the level where the faulted stress intensity was verified to be below the irradiated yield strength in BAW-10008, Revision 1. That is, plasticity in the component is not expected to occur at 72 EFPY, and the material remains elastic with a large margin to the irradiation yield strength, such that the reduction in the ductility of the component would be considered acceptable for the subsequent period of extended operation.

(3) Phase I, Process Step 3 (Category 3 Assessment). Following disposition of Category 1 and 2 internals component items, the remaining items were evaluated to determine if the expected fluence exposure was low enough such that neutron embrittlement was considered negligible, reduction of ductility was minimal or will not occur at 80 years (72 EFPY), and unirradiated ductility properties were still applicable.

The staff confirmed that the approach in ANP-3899NP/P, Revision 0, applies the methods of analysis for component-specific stress inputs and stress intensity in the ASME Boiler and Pressure Vessel Code, Division 1, Section III (ASME Section III). The staff further confirmed that the loading conditions used in ANP-3899NP/P, Revision 0, are the same loading conditions and loading combinations for the specified components defined in BAW-10008, Revision 1, or for faulted loading conditions, as assessed and approved in approved BAW-1621. Given that the applicant has opted to disposition the RVI reduction of fracture toughness TLAA using the

PWR Vessel Internals program using 10 CFR 54.21(c)(1)(iii) as the basis for the TLAA, the staff considered that the net effect would be that any RVI component not satisfying the criteria in Category 1 or 2 would need to have reduction of ductility considered as an additional screened-in aging effect mechanism under the gap analysis of the PWR Vessel Internals program (i.e., beyond those aging mechanisms already screened-in for the components in Table 3-1 of MRP-227, Revision 1-A, as modified by RVI gap analysis using the 80-year screening results for the components MRP-189, Revision 3). Reduction of ductility is not an analyzed mechanism in MRP-227, Revision 1-A. The TLAA is performed to determine whether it needs to be included as an evaluated mechanism for any given RVI component in the gap analysis of the applicant's PWR Vessel Internals program. In this case, such RVI components would need to be considered for augmented aging management in the PWR Vessel Internals program beyond the current EPRI Materials Reliability Program (MRP) inspection categorization and recommendations for the specified RVI component in MRP-227, Revision 1-A.

Evaluation of Phase I, Process Step 1 Assessment. The staff confirmed that the applicant performed updated stress intensity analyses of the RVI components for comparison to the ASME Code, Section III, maximum allowable stress intensity values for the components, and used this basis to determine whether the yield strength of the component would continue to satisfy the ASME Code, Section III, allowable on unirradiated yield strength (in units of psi, as given in SLRA Table 4.7.1-1 for the component's applicable material). The staff verified that this resulted in the following RVI components being included in Category 2 for ANP-3899NP/P, Revision 0: (1) baffle plates in the core barrel assemblies, (2) upper core barrel (UCB) bolts in core support shield (CSS) assembly of Unit 3, (3) top and lower flanges in the CSS assemblies, (4) lower grid rib sections and lower grid rib section/lower grid shell forging joint bolts in the lower grid fuel assemblies, (5) support post/support forging joint welds in the lower grid fuel assemblies, (6) upper grid rib sections and upper grid support pad screws in the upper grid fuel assemblies, and (7) plenum covers and plenum cylinder reinforcing plates in the plenum cover assemblies.

From the RVI components listed in BAW-1621, the following items were included in Category 2: (1) Unit 3 UCB bolts, (2) CSS lower flange, (3) lower grid rib section, (4) lower grid rib section/lower grid shell forging bolt, (5) support post/support forging weld, (6) plenum cylinder, (7) upper grid rib section, and (8) upper grid pad joint bolt.

For the other RVI components that were confirmed as satisfying the criterion for the Category 1 assessment, the staff concludes that the components would not need to be considered for reduction of ductility impacts under the 10 CFR 54.21(c)(1)(iii) disposition basis for the TLAA.

Evaluation of Phase I, Process Step 2 Assessment. The staff verified that the RVI components identified above from both the BAW-10008, Revision 1, and BAW-1621 evaluations needed a Category 2 Assessment. The applicant noted that the only item to meet the high fluence criterion of Category 2 items was the baffle plates. The other RVI component-specific items proceeded to a Process Step 3 assessment.

The staff verified that, although the baffle plates were projected to be highly irradiated at 72 EFPY, the recalculated stress intensity value for baffle plates was projected to be well below the irradiated yield strength for the baffle plates reported in Section 2.3.1.1.2 of ANP-3899NP/P, Revision 0. Under this basis, the TLAA may be used to draw a conclusion that the baffle plates in the units will have acceptable ductile deformation capability during the subsequent period of extended operation. Thus, the TLAA is resolved for the baffle plates. Irrespective of the TLAA resolution, the staff noted that the PWR Vessel Internals program will continue to perform VT-3 visual inspections of the baffle plates. The staff's evaluation of this program is provided in SE Section 3.0.3.2.3.

Evaluation of Phase I, Process Step 3 Assessment. For the plenum cover, plenum cylinder, plenum cylinder reinforcing plate, and CSS top flange, the evaluation in ANP-3899NP/P, Revision 0, demonstrates that adequate uniform elongation would be exhibited at 72 EFPY to meet the criteria in BAW-10008, Revision 1. The staff finds this evaluation acceptable.

Phase II Assessment. The items remaining from Phase I, potentially susceptible to an unacceptable amount of reduction of ductility at 72 EFPY, are: (1) UCB bolts (Unit 3 only), (2) CSS lower flange, (3) lower grid rib section, (4) lower grid rib section/lower grid shell forging joint bolts, (5) support post/support forging joint – weld, (6) upper grid rib section, and (7) upper grid pad joint – bolts.

As described in Section 2.3.2 of ANP-3899NP/P, Revision 0, further review of the UCB bolts concluded that the bolts could be found acceptable by Category 1, with the unirradiated yield strength exceeding the Case IV faulted stress intensity for the component.

For the other six component-specific items, the applicant recalculated loads based on smaller break loadings due to NRC approval of leak-before-break (LBB) of the primary piping in the plant's CLB. Under these criteria, the recalculated stress intensities are compared to the applicable unirradiated ASME Code yield strength values at 600 °F in Table 2-10 of ANP-3899NP/P, Revision 0. The staff noted that the recalculated faulted condition stress intensity values are less than the unirradiated ASME Code yield strength at 600 °F for the six components items/welds. Thus, the applicant has found reduction of ductility to be acceptable for these six component items and no further analysis is required.

The staff finds these re-evaluations acceptable because the applicant used appropriate load levels based on LBB considerations within the plant's CLB and yield strength data that represents actual material performance.

Although the applicant has demonstrated acceptability of the RVI reduction of fracture toughness TLAA consistent with the plant CLB, the applicant has opted to disposition this TLAA using the PWR Vessel Internals program to satisfy the criterion in 10 CFR 54.21(c)(1)(iii) by demonstrating that the effects of aging on the intended functions of the RVI components will be adequately managed during the subsequent period of extended operation. To assess the robustness of the applicant's aging management, the staff considered the specific aging management proposed in SLRA Section B2.1.7 for each item assessed in Phase II:

- UCB bolts, including those in Unit 3: The staff noted that the applicant continues to maintain the UCB bolts (including those in Unit 3) as "Primary" category components for the program. The UCB bolts are screened-in for cracking and will continue to be inspected using ultrasonic test (UT) inspections methods consistent with Line Item B7 in Table 4-1 of the MRP-227, Revision 1-A report. The staff confirmed that the program will continue to look for evidence of cracking in the UCB bolts. Thus, based on its review, the staff concludes that the applicant has demonstrated that the UCB bolts in all units will be adequately managed by the PWR Vessel Internals program during the subsequent period of extended operation.
- Lower grid rib sections and lower grid rib section/lower grid shell forging joints: The staff noted that the applicant elevated the lower grid rib section from being "expansion" category components to "primary" category components for the 80-year programmatic

basis. The staff also verified that, under the elevated "primary" component basis, the applicant will be performing VT-3 inspections of the lower grid rib sections to look for evidence of "readily detectible" surface-breaking cracks in the grid rib sections. Based on its review, the staff concludes that the applicant has demonstrated that the PWR Vessel Internals program will adequately manage the lower grid rib sections in all units during the subsequent period of extended operation.

- CSS lower flange in the CSS assemblies; upper grid rib section and upper grid rib pad joint bolts in the upper grid fuel assemblies; and support post/support forging joint welds in the lower grid fuel assemblies: The staff noted that the applicant maintains these components as "no additional measures" for the 80-year programmatic basis. The staff finds this designation acceptable based on the determination that the recalculated faulted condition stress intensity values for these components, based on smaller break loadings due to LBB of the primary piping, are less than the unirradiated ASME Code yield strength at 600 °F. Therefore, no inspections of these components are necessary.

Summary.

The staff finds that the applicant has demonstrated acceptability of the RVI reduction of fracture toughness TLAA consistent with the plant CLB, and the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of loss of fracture toughness on the intended functions of the RVI components will be adequately managed by the PWR Vessel Internals program during the subsequent period of extended operation.

Additionally, the RVI reduction of fracture toughness TLAA meets the acceptance criteria in SRP-SLR Section 4.7.2.1.3 because the applicant has provided a sufficient basis for management of ductility reduction in the PWR Vessel Internals program that will be implemented during the subsequent period of extended operation.

4.7.1.1.3 UFSAR Supplement

By letter dated November 11, 2021, (ADAMS Accession No. ML21315A012), the applicant amended SLRA Section A4.7.1.1, which provides the UFSAR supplement summarizing the RVI reduction of fracture toughness TLAA. The staff reviewed amended SLRA Section A4.7.1.1 consistent with the review procedures in SRP-SLR Section 4.7.3.2.

Based on its review, the staff finds that the amended UFSAR supplement meets the acceptance criteria in SRP-SLR Section 4.7.2.2 and is therefore acceptable. Additionally, the staff finds that the applicant provided an adequate summary description of its actions to address the RVI reduction of fracture toughness TLAA, as required by 10 CFR 54.21(d).

4.7.1.1.4 Conclusion

Based on its review, the staff concludes that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of loss-of-fracture toughness on the intended functions of the RVI components will be adequately managed by the PWR Vessel Internals program described in SLRA Section B2.1.7 for the subsequent period of extended operation. The staff also concludes that the applicant has provided an adequate UFSAR supplement summary description of the TLAA as required by 10 CFR 54.21(d).

4.7.1.2 Reactor Vessel Internals – Flow-Induced Vibration Endurance Limits

4.7.1.2.1 Summary of Technical Information in the Application

SLRA Section 4.7.1.2 describes the applicant's TLAA for flow-induced vibration integrity of the RVI and bolting. The applicant dispositioned the TLAA for the flow-induced vibration endurance limits in accordance with 10 CFR 54.21(c)(1)(ii) by demonstrating that the analysis has been projected to the end of the subsequent period of extended operation.

4.7.1.2.2 Staff Evaluation

The staff reviewed the applicant's TLAA for the flow-induced vibration endurance limits and the corresponding disposition of the TLAA in accordance with 10 CFR 54.21(c)(1)(ii), consistent with the review procedures in SRP-SLR Section 4.7.3.1.2 and the acceptance criteria in SRP-SLR Section 4.7.2.1.2.

The staff identified that the applicant's methodology for assessing flow-induced vibration for 80 years of operation is consistent with those used for 60 years of operation but augmented to conservatively address environmentally-assisted fatigue affects using the environmentally-assisted fatigue criteria developed in NUREG/CR-6909, Revision 1. Per NUREG/CR-6909, Revision 1, the F_{en} factor is equal to 1.0 if the strain amplitude is less than 0.10% (or 28.3 kilo-pound per square inch (ksi) stress amplitude). The staff finds the use of NUREG/CR-6909, Revision 1, to address environmentally-assisted fatigue acceptable because it is consistent with the guidance in GALL-SLR Report AMP X.M1 and SRP-SLR Section 4.3. The staff reviewed the stress resulting from flow induced vibration (FIV) and noted that the maximum stress amplitudes for the RVI (austenitic steels) and RVI bolts (high-strength bolt steel) are less than 28.3 ksi; thus, the staff finds the use of a F_{en} factor of 1.0 to be appropriate and consistent with NUREG/CR-6909, Revision 1. The staff finds that the applicant considered the fatigue curves published in the 2013 edition of the ASME Code, Section III, which is incorporated by reference into 10 CFR 50.55a, in its fatigue evaluation of the RVI and RVI bolts.

The staff evaluated Table 3-1 and Table 3-2 of ANP-3899NP/P, Revision 0, for the applicant's extrapolated fatigue curves published in the 2013 edition of the ASME Code, Section III, to account for additional cycles during the subsequent period of extended operation. Specifically, the staff noted that the assumed number of cycles during the subsequent period of extended operation (i.e., 10^{13} cycles) would be one order of magnitude greater than the 40-year design cycles (i.e., 10^{12} cycles), which the staff finds to be a conservative assumption based on the original 40-year design. The staff noted that in order to account for these additional cycles, the applicant assumed a decay rate consistent with the available data in the high-cycle regime used to develop the ASME fatigue curves, which the staff finds to be reasonable.

The staff noted that the applicant provided a summary of the flow-induced vibration stress results associated with the B&W reactor vessel internals and bolting items in ANP-3899NP/P, Revision 0. Based on its review, the staff noted that the alternating stress associated with FIV for the reactor vessel internals and bolting is less than the endurance limit (i.e., stress level below which an infinite number of loading cycles can be applied to a material without causing fatigue failure) of the material specific ASME fatigue curves.

The staff finds the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(ii), that the analysis for the flow-induced vibration integrity of the RVI and bolting has been projected to the end of the subsequent period of extended operation. Additionally, it meets the acceptance criteria in SRP-SLR Section 4.7.2.1.2 because the applicant has demonstrated that the alternating stress associated with flow-induced vibration for the reactor vessel internals and bolting is less than the endurance limit of the material through the subsequent period of extended operation.

4.7.1.2.3 UFSAR Supplement

SLRA Section A4.7 provides the UFSAR supplement summarizing the TLAA for flow-induced vibration integrity of the RVI and bolting. The staff reviewed SLRA Section A4.7 consistent with the review procedures in SRP-SLR Section 4.7.3.2.

Based on its review, the staff finds that the UFSAR supplement meets the acceptance criteria in SRP-SLR Section 4.7.2.2 and is therefore acceptable. Additionally, the staff finds that the applicant provided an adequate summary description of its actions to address the flow-induced vibration integrity of the RVI and bolting, as required by 10 CFR 54.21(d).

4.7.1.2.4 Conclusion

Based on its review, the staff concludes that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(ii), that the analysis for the flow-induced vibration integrity of the RVI and bolting have been projected to the end of the subsequent period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.7.1.3 Reactor Vessel Internals Irradiation Embrittlement

4.7.1.3.1 Summary of Technical Information in the Application

SLRA Section 4.7.1.3 describes the applicant's TLAA for the neutron fluence projections of the RVI to ensure that the level of embrittlement of the RVI induced by irradiation is acceptable. This TLAA confirms that the RVI neutron fluence values used for evaluation of TLAA item 4.7.1.1, "Reduction in Fracture Toughness due to Neutron Embrittlement," and the PWR Vessel Internals program (GALL-SLR Report AMP XI.M16A, "PWR Vessel Internals," SLRA section B2.1.7 and A2.7) are not exceeded.

RVI neutron fluence projections were performed and documented in ANP-3899NP/P, Revision 0. RVI fast neutron fluences (E > 1.0 MeV) at the end of 80 years of operation (72 EFPY), were calculated for Units 1, 2, and 3. The analysis employed two methodologies to calculate the Units 1, 2, and 3 RVI fluences that are described in detail in BAW-2241NP/P-A, Revision 2, "Fluence and Uncertainty Methodologies" (ADAMS Accession No. ML073310660 [Non--Proprietary]) and ANP-10348NP/P-A, Revision 0.

The applicant dispositioned the TLAA on the neutron fluence in accordance with 10 CFR 54.21(c)(1)(ii) by demonstrating that RVI neutron fluence values assumed in TLAA 4.7.1.1 remain valid to the end of the subsequent period of extended operation.

4.7.1.3.2 Staff Evaluation

The staff reviewed the applicant's TLAA for RVI irradiation embrittlement and the corresponding disposition of the TLAA in accordance with 54.21(c)(1)(ii), consistent with the review procedures in SRP-SLR Section 4.7.2.1.2.

Framatome, in partnership with the licensee, performed the fluence calculations to support the SLRA. Framatome employed two methodologies to calculate the RVI neutron fluence: BAW-2241NP/P-A, Revision 2, and ANP-10348NP/P-A, Revision 0. BAW-2241NP/P-A, Revision 2, is a two-dimensional semi-analytical approach to calculate the RPV neutron fluence and uncertainty. The fluence calculations in this method are performed with the DORT discrete ordinates transport code. BAW-2241NP/P-A uses several [r,θ] and [r,z] models to represent important geometrical items, such as the core, lower and upper internal grids, thermal shield, reactor vessel, cavity, and concrete primary shield wall. Additionally, the NRC approved Framatome SVAM fluence method described in ANP-10348NP/P-A, Revision 0 is a more modern, three-dimensional hybrid deterministic/Monte Carlo method that can be used to determine acceptably accurate fluence values for the RPV beltline and regions outside of the beltline and is acceptable for SLR applications. Both methods meet or exceed the guidance set forth in RG 1.190, "Calculational and Dosimetry Methods for Determining Pressure Vessel Neutron Fluence" (ADAMS Accession No. ML010890301), though RG 1.190 does not provide detailed guidance for fluence estimates outside of the traditional beltline. The traditional beltline can be defined as the region of the reactor vessel that would include the axial extent of the vessel in proximity to active fuel.

BAW-2241NP/P-A, Revision 0, is not approved for use outside of the traditional beltline, and there are deficiencies of the DORT RVI calculations in this method. Some specific modeling enhancements were made in areas such as the cross-section database used in the DORT model, which deviate from that approved in BAW-2241NP/P-A, Revision 2, in order to more accurately estimate the RVI fluence. Despite these enhancements, known deficiencies in the RVI DORT calculations remain, several of which are described in Section 5.3.2 of ANP-3899NP/P, Revision 0, and are restated below:

(1) Homogenization of the RVI in the DORT models was shown to lead to systematic underprediction of the fluence, according to Oak Ridge National Lab.

(2) In the BUGLE-96 library, the iron isotope nuclear data is collapsed using the neutron flux spectrum based on a fine-group (VITAMIN-B6) solution at ¼ of the RPV thickness near the core midplane. The spectrum in the internals at locations outside of the effective height of the core is likely to be different. Therefore, the BUGLE-96 nuclear data library may not be ideal for fluence estimates in locations outside of the RPV beltline region.

(3) The four energy groups in the thermal range available in BUGLE-96 may not be sufficient in locations far away from the core.

(4) Symmetric quadratures may have insufficient accuracy in regions above and below the core. Higher order or biased quadrature sets may be more appropriate.

As a result of the known deficiencies in the DORT RVI fluence modeling, Framatome also employed the ANP-10348NP/P-A SVAM methodology, which is approved to provide detailed modeling of and to calculate the fluences for regions outside of the traditional beltline. The two methods are used in conjunction. Section 5.2 of ANP-3899NP/P, Revision 0, provides additional detail describing a conservative approach to apply either method at a given location.

Many of the deficiencies in the BAW-2241NP/P-A, Revision 2 DORT-based method described above are not present in the ANP-10348NP/P-A SVAM methodology. For example, while the DORT method combines several two-dimensional models for evaluation and homogenizes the RVI, the ANP-10348NP/P-A SVAM method uses a three-dimensional model with a detailed, heterogeneous representation of the RVI.

A single analysis was conducted to represent Units 1, 2, and 3, employing the SVAM/DORT methodology described above, due to the similar design, fabrication, operation, and fuel loading patterns of the three units. The staff finds the use of a single representative analysis for the three units to be acceptable because of the level of similarity across the three units.

The assumed lifetime of the reactor in the RVI neutron fluence analyses was 72 EFPY, as assumed in the other TLAAs that relate to neutron fluence projections (e.g., TLAA item 4.2.1). The 72 EFPY was determined based on the accrued EFPY for Units 1, 2, and 3 through Cycles 31, 29, and 30, respectively, and assuming a capacity factor of 100% for the duration of the subsequent period of extended operation. The staff finds this assumption acceptable and conservative because the plant cannot realistically achieve a 100% capacity factor, which means this assumed 72-year neutron fluence period overestimates the actual neutron fluence that would be expected at the end of the subsequent period of extended operation.

Furthermore, an MUR power uprate was approved by the NRC for Units 1, 2, and 3 on January 26, 2021 (ADAMS Accession No. ML20335A001). The approved MUR allows for a 1.64% increase in operating power for the three units. Since power is a fundamental input to fluence calculations, this increase in power should not be neglected. As such, the fluence projections for the RVI in the SLRA conservatively factor in a 2.0% increase in power at the beginning of Cycle 30 for Unit 1, Cycle 29 for Unit 2, and Cycle 29 for Unit 3. At the time of SLRA submission, each unit was operating in Cycles 32, 30, and 31, respectively, and the MUR had not been implemented at any of the three units yet. The staff finds this consideration of the MUR operating conditions to be conservative and acceptable because the power assumed to be associated with the MUR in the fluence analyses was greater than the actual MUR power increase.

The staff finds the method of predicting RVI neutron fluence values to be acceptable because of the considerations described above. The methods employed conservative plant-specific assumptions and used two previously NRC-approved fluence calculational methods, one of which—the ANP-10348NP/P-A, Revision 0, SVAM method—has been previously found acceptable for use in estimating fluence outside of the RPV beltline.

The RVI fluence projections were compared to the fluence inputs assumed in TLAA item 4.7.1.1 to ensure that TLAA 4.7.1.1 remains applicable and that the RVI do not experience significant irradiation embrittlement. The fluence estimates used in TLAA 4.7.1.1 are based on MRP-189 Revision 3 (ADAMS Accession No. ML20091K286), which was developed to bound the B&W fleet of reactors. TLAA item 4.7.1.1 is based on the evaluation in BAW-10008, Part 1, Revision 1, which identifies several items to be assessed for susceptibility to irradiation embrittlement:

- Baffle plates
- Plenum cover
- Plenum cylinder reinforcing plate
- CSS top flange

The staff's review of TLAA item 4.7.1.3 focused on whether the margin between the predicted fluences for the units and the assumed fluences for the TLAA 4.7.1.1 evaluation was sufficient to account for the uncertainties associated with the fluence predictions, such that reasonable assurance exists that the fluences for the components will not exceed the fluences assumed in the TLAA evaluations in the subsequent period of extended operation.

The margin for the predicted neutron fast fluences using the DORT/SVAM method described above and the RVI components mentioned in BAW-10008, Part 1, Revision 1, and evaluated in TLAA 4.7.1.1 is discussed in ANP-3899NP/P, Revision 0, Section 5, and stated in Table 5-3. Table 5-3 shows a significant margin of the predicted fluence values to the values assumed in TLAA 4.4.1.1 for the RVI components of interest described above and evaluated in TLAA 4.7.1.1. Therefore, TLAA 4.7.1.1 uses conservative fluence values.

The staff finds that the neutron fluence values assumed in TLAA 4.4.1.1 for the RVI components of interest evaluated in TLAA 4.7.1.1 are acceptable because the predicted fluence values at 72 EFPY were calculated with an acceptable method, as previously discussed, and because a significant margin exists between the predicted and TLAA 4.7.1.1 assumed values, such that a substantial level of uncertainty can be absorbed without exceeding the assumed values.

The staff finds that the applicant has demonstrated that the RVI neutron fluence values assumed in TLAA 4.7.1.1 remain valid to the end of the subsequent period of extended operation pursuant to 10 CFR 54.21(c)(1)(ii). The analysis meets the acceptance criteria in SRP-SLR Section 4.7.2.1.2 because the applicant has shown that the projected RVI fluence estimates were calculated in an acceptable manner and remain below the fluence assumed in the TLAA 4.7.1.1 evaluation with an acceptable level of margin.

4.7.1.3.3 UFSAR Supplement

SLRA Section A4.7.1.3 provides the UFSAR supplement summarizing the TLAA for RVI fluence projections and irradiation embrittlement. The staff reviewed SLRA Section A4.7.1.3 consistent with the review procedures in SRP-SLR Section 4.7.2.1.2.

Based on the review of the UFSAR supplement, the staff finds it acceptable because it meets the acceptance criteria in SRP-SLR Section 4.7.3.1.2. Additionally, the staff finds that the applicant provided an adequate summary description of its actions to address the TLAA for RVI irradiation embrittlement to the end of the subsequent period of extended operation, as required by 10 CFR 54.21(d).

4.7.1.3.4 Conclusion

Based on its review, the staff concludes that the applicant has acceptably demonstrated, pursuant to 10 CFR 54.21(c)(1)(ii), that the RVI neutron fluence values assumed in TLAA 4.7.1.1 remain valid to the end of the subsequent period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.7.2 Reactor Vessel Underclad Cracking

4.7.2.1 Summary of Technical Information in the Application

SLRA Section 4.7.2 describes the applicant's TLAA for reactor vessel underclad cracking. The applicant dispositioned the TLAA related to reactor vessel underclad cracking in accordance with 10 CFR 54.21(c)(1)(ii) by demonstrating that the analysis has been projected to the end of the subsequent period of extended operation.

SLRA Section 4.7.2 states that intergranular separations in the heat-affected zone of reactor vessel low-alloy steel under austenitic stainless steel cladding (i.e., underclad cracking) was evaluated for MUR conditions at 54 EFPY. Furthermore, the applicant stated that the methodology used to evaluate underclad cracking for the reactor vessels at 80 years of operation is consistent with the methodology in Appendix C of BAW 2251A, “Demonstration of Management of Aging Effects for the Reactor Vessel.” The applicant stated that a plant-specific analysis (i.e., ANP-3898NP/P, Revision 0) was performed for 72 EFPY and MUR conditions using current fracture toughness information, applied stress intensity factor solutions, and fatigue crack growth correlations for SA-508 Class 2 materials and is evaluated in accordance with the methodology prescribed in ASME Section XI, 2013 Edition, IWB-3612.

4.7.2.2 Staff Evaluation

The staff reviewed the applicant’s TLAA for underclad cracking of the RPV and the corresponding disposition of the TLAA in accordance with 10 CFR 54.21(c)(1)(ii), consistent with the review procedures in SRP-SLR Section 4.7.3.1.2.

The staff noted that the reactor vessel shell consists of three sub-assemblies: (1) upper shell assembly, (2) shell assembly, and (3) lower vessel head assembly. For the evaluation of underclad cracks, the applicant explained that the five locations of interest are the flange, nozzle belt, shell taper, shell and transition forging. The staff noted that the original reactor vessel heads were replaced in 2003–2004 because of cracking discovered in a number of penetration nozzles. The applicant confirmed that the replacement closure head is not susceptible to underclad cracking due to compliance with the guidance in RG 1.43, “Control of Stainless Steel Weld Cladding of Low Alloy Steel Components;” thus, the staff finds it appropriate that the applicant did not evaluate the replacement closure head for underclad cracking during the subsequent period of extended operation.

The staff noted that the analysis assumed a flaw with an initial flaw depth of 0.353 inches, which corresponds to the sum of the maximum detected flaw depth of underclad cracks (0.165 inches) and the clad thickness (0.188 inches). It should also be noted that this initial flaw depth is conservatively based on the maximum detected crack depth reported by the industry. Since these underclad cracks are detected flaws and the final flaw size at the end of 80 years is predicted, the staff finds it appropriate that the stress intensity factor due to the final flaw size at 80 years is computed for Service Level A through D (normal/upset/emergency/faulted) conditions and compared to the ASME Code, Section XI, IWB-3612 standards to ensure that the required safety margins are met.

The staff noted that Article A-4200 of ASME Code, Section XI, Appendix A, expresses the lower bound plane-strain fracture toughness (K_{Ic}) for critical crack initiation as “$K_{Ic} = 33.2 + 20.734 \exp [0.02 (T – RT_{NDT})]$,” where T is the crack tip temperature, RT_{NDT} is the nil-ductility reference temperature of the material, K_{Ic} is in units of ksi√in, and T and RT_{NDT} are in units of °F. The staff noted that the bounding value of RT_{PTS} at 72 EFPY (regardless of location or material in the reactor vessel) were used for the axially and circumferentially oriented flaws in its evaluation of underclad cracking. The staff finds the applicant’s use of these bounding values of RT_{PTS} at 72 EFPY acceptable because they account for the neutron embrittlement at 80 years of operation for the axially and circumferentially oriented flaws at the location of interest (i.e., cladding to base-metal interface) of the most-embrittled components.

The applicant explained that the flaw growth due to cyclic loading was calculated using the fatigue crack growth rate model from ASME Code, Section XI, Appendix A, Section A-4300, 2013 edition. The staff noted that 10 CFR 50.55a(a)(1)(ii) incorporates by reference the

2013 edition of ASME Code, Section XI, without limitations on the use of Appendix A; thus, the staff finds its use in the applicant's underclad cracking analysis to be acceptable.

The staff noted for this flaw evaluation the applicant considered the normal, upset, emergency, and faulted condition transient events, including the number of cycles in its CLB, experienced by the inside surface of the reactor vessel as defined in the ASME Code, Section III, Design Specification. The staff noted that transients that occur in the pressurizer or in the steam generator were not included in the flaw evaluation for the reactor vessel underclad cracking and finds this acceptable because they do not contribute to crack growth of the postulated underclad cracks and are represented as a steady state condition in the reactor vessel downcomer region.

The staff noted that the transients (including number of cycles) described in UFSAR Section 5.2.1.4 and listed in UFSAR Table 5-2 are consistent with those identified in this flaw evaluation. Furthermore, Section 5.5.6 of the TS requires a program that provides controls to track the UFSAR Section 5.2.1.4 cyclic and transient occurrences to ensure that components are maintained within the design limits. Thus, as a measure of defense-in-depth, the staff finds that the TS requirements ensure that transient cycle counts do not exceed the CLB design limit.

The staff noted that the minimum required margin per IWB-3612 for Levels A/B (normal/upset) and Levels C/D (emergency/faulted) loading conditions is 3.16 ($\sqrt{10} = 3.16$) and 1.41 ($\sqrt{2} = 1.41$), respectively. The staff noted that for the final crack sizes at each of the five locations, the applicant demonstrated that flaws in both the axial and circumferential orientations meet the acceptance criteria of Article IWB-3612 for Levels A/B and Levels C/D loading conditions. The staff noted that the lowest fracture toughness margin for Levels A and B (normal/upset) loading conditions is 3.94 for the axially oriented flaw at the flange top, and the lowest fracture toughness margin for Levels C and D (emergency/faulted) loading conditions is 1.62 for the circumferentially oriented flaw at the shell taper; thus, the postulated flaws meet the acceptance criteria in IWB-3612 through the subsequent period of extended operation.

The staff finds that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(ii), that the analysis for underclad cracking of the RPV has been projected to the end of the subsequent period of extended operation. Additionally, it meets the acceptance criteria in SRP-SLR Section 4.7.2.1.2 because the applicant's evaluation conservatively addressed the embrittled condition of its reactor vessel for 80 years of operation, accounted for transient cycles for 80 years of plant operation, performed a flaw evaluation consistent with the methodology in ASME Code, Section XI, and demonstrated that the required margins in IWB-3612 are satisfied for the subsequent period of extended operation.

4.7.2.3 UFSAR Supplement

SLRA Section A4.7.2 provides the UFSAR supplement summarizing the TLAA for underclad cracking of the RPV. The staff reviewed SLRA Section A4.7.2, consistent with the review procedures in SRP-SLR Section 4.7.3.2.

Based on its review, the staff finds that the UFSAR supplement meets the acceptance criteria in SRP-SLR Section 4.7.2.2 and is therefore acceptable. Additionally, the staff finds that the applicant provided an adequate summary description of its actions to address underclad cracking of the RPV, as required by 10 CFR 54.21(d).

4.7.2.4 Conclusion

Based on its review, the staff concludes that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(ii), that the analysis for underclad cracking of the RPV has been projected to the end of the subsequent period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.7.3 Reactor Coolant Pump Flywheel Analysis

4.7.3.1 Summary of Technical Information in the Application

SLRA Section 4.7.3 describes the applicant’s TLAA for the number of reactor coolant pump (RCP) motor starts as a potential initiator for fatigue cracking in the RCP motor flywheel. The applicant dispositioned the TLAA for the analysis for the RCP flywheel in accordance with 10 CFR 54.21(c)(1)(ii) by demonstrating that the analysis has been projected to the end of the subsequent period of extended operation.

4.7.3.2 Staff Evaluation

The staff reviewed the applicant’s TLAA for the RCP flywheel and the corresponding disposition of the TLAA in accordance with 10 CFR 54.21(c)(1)(ii), consistent with the review procedures in SRP-SLR Section 4.7.3.1.2 and the acceptance criteria in SRP-SLR Section 4.7.2.1.2.

The applicant stated that the RCP flywheel has been designed for 10,000 loading cycles. Utilizing plant data from January 1, 2000, to January 1, 2019, from the station’s operator aid computer, the applicant determined that, on average, each RCP is started 3 times per year. The staff finds it reasonable and appropriate that the applicant relied on data from plant operation to determine the number of start-and-stop cycles for the RCP. However, the applicant indicated that the number of RCP starts from initial plant startup to January 1, 2000, is unknown, as is the number of future starts. To account for these deviations, the applicant assumed that each RCP is started, on average, double what the data concludes, which yields 6 starts per year. The staff finds this assumption to be reasonable because, in general, operation of the plant continually improves and becomes more efficient due to enhancements in operating practices, which reduces the number of start-and-stop cycles for the RCP. The applicant explained that if each flywheel experiences 6 starts per year, then at the end of the 80 years of operation, each RCP would have roughly 480 loading cycles. Based on the applicant’s assumption of 6 starts per year, the staff finds that the applicant conservatively projected RCP start-and-stop cycles for the subsequent period of extended operation.

The staff noted that the flywheel is designed for 10,000 starts; thus, the staff finds there is a significant margin between the projected start-and-stop cycle count of 480 and the 10,000 design cycles. Because there is over a factor of 20 between the projected 80-year start-and-stop cycles and the design number of cycles, the staff finds it reasonable that doubling the readily available plant data will account for unexpected or unanticipated occurrences of start-and-stop cycles during 80 years of plant operation. Thus, the staff finds that fatigue cracking on the RCP flywheel resulting from start-and-stop cycles is adequately addressed for 80 years of plant operation.

The staff finds the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(ii), that the analysis for the RCP flywheel has been projected to the end of the subsequent period of extended operation. Additionally, it meets the acceptance criteria in SRP-SLR Section 4.7.2.1.2 because the applicant demonstrated that the number of RCP starts projected for 80 years of plant operation will remain below the manufacturer's specified limitation of 10,000 cycles.

4.7.3.3 UFSAR Supplement

SLRA Section A4.3.2 provides the UFSAR supplement summarizing the RCP flywheel analysis. The staff reviewed SLRA Section A4.3.2 consistent with the review procedures in SRP-SLR Section 4.7.3.2.

Based on its review, the staff finds that the UFSAR supplement meets the acceptance criteria in SRP-SLR Section 4.7.2.2 and is therefore acceptable. Additionally, the staff finds that the applicant provided an adequate summary description of its actions to address the RCP flywheel analysis, as required by 10 CFR 54.21(d).

4.7.3.4 Conclusion

Based on its review, the staff concludes that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(ii), that the RCP flywheel analysis has been projected to the end of the subsequent period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.7.4 Leak-Before-Break Analysis for RCS Piping

4.7.4.1 Summary of Technical Information in the Application

SLRA Section 4.7.4, as supplemented by letter dated February 21, 2022 (ADAMS Accession No. ML22021A000), describes the applicant's TLAA on the LBB evaluation for the RCS piping. BAW-1847, Revision 1, "The B&W Owners Group Leak-Before-Break Evaluation of Margins Against Full Break for RCS Primary Piping of B&W Designed NSSS," dated September 1985, described the application of LBB to the RCS main coolant piping during the initial 40-year operating period. The TLAA aspects of BAW-1847, Revision 1, are a fatigue flaw growth evaluation and a qualitative assessment of thermal aging of CASS for the reactor coolant inlet and outlet nozzles.

For the LBB evaluation involving fatigue flaw growth, projected cycles for 80 years of operation are evaluated. The 80-year projected cycles are compared to the original cycles analyzed in BAW-1847, Revision 1, to demonstrate that the original cycles analyzed are bounding, and therefore the fatigue flaw growth aspect of the LBB evaluation is acceptable for the subsequent period of extended operation; assurance that the original cycles analyzed will not be exceeded is provided by continued monitoring using the Fatigue Monitoring program.

The second aspect of the LBB evaluation involves thermal aging of the CASS material. The applicant stated that BAW-1847, Revision 1, evaluated the susceptibility of thermal aging of the RCS items fabricated from CASS. For SLR, the flaw stability analysis was updated to consider the most recent data per NUREG/CR-4513, Revision 2, "Estimation of Fracture Toughness of Cast Stainless Steel during Thermal Aging in LWR Systems," dated March 2016, for the subsequent period of extended operation.

As amended by letter dated February 21, 2022 (ADAMS Accession No. ML22021A000), the applicant dispositioned the RCS LBB TLAA in accordance with 10 CFR 54.21(c)(1)(ii) by demonstrating that the analysis has been projected to the end of the subsequent period of extended operation.

4.7.4.2 Staff Evaluation

The staff reviewed the LBB TLAA for the RCS piping and the corresponding disposition of 10 CFR 54.21(c)(1)(ii), consistent with the review procedures in SRP-SLR Section 4.7.3.1.2 and the acceptance criteria in SRP-SLR Section 4.7.2.1.2. These SRP-SLR sections provide the guidance for plant-specific TLAAs. In addition, SRP NUREG-0800, Section 3.6.3, Revision 1, “Leak -Before -Break Evaluation Procedures,” dated March 2007 (ADAMS Accession No. ML063600396), provides detailed guidance for LBB analyses and the staff’s review of the analyses. The SRP guidance addresses acceptable methods to meet 10 CFR Part 50, Appendix A, General Design Criterion (GDC) 4 regarding LBB analyses.

The applicant stated that the original transient cycles used in the fatigue flaw growth analysis that were defined for 40 years of operation for the RCS components were compared to the projected cycles for 80 years. The comparison indicates that none of the original 40-year transient cycles are projected to be exceeded for 80 years. In addition, the Fatigue Monitoring program (SLRA Section B3.1) will ensure that the projected cycles for 80 years of operation will not exceed the original transient cycles that were defined for 40 years. Therefore, the analysis summarized in BAW-1847, Revision 1, for fatigue flaw growth remains valid for the subsequent period of extended operation because none of the original 40 year transient cycles will be exceeded for 80 years and the Fatigue Monitoring program will ensure that the projected cycles for 80 years of operation will not exceed the original transient cycles that were projected for 40 years of operation.

The applicant stated that the susceptibility of the RCS main coolant piping to thermal aging was qualitatively addressed in BAW-1847, Revision 1. The applicant stated that there are no RCS main coolant piping segments fabricated from CASS. However, the applicant stated that the heat-affected zone (HAZ) of the welded joint that connects the wrought austenitic stainless-steel 28-inch pump transition piece to the CASS RCP inlet (suction) and exit (discharge) nozzles may be susceptible to thermal embrittlement. In BAW-1847, Revision 1, the values of fracture toughness for aged CASS were assumed to be bounded by the ferritic piping and ferritic weldments. For license renewal, the flaw stability analysis was acceptably updated using the lower bound fracture toughness curves in NUREG/CR-6177, “Assessment of Thermal Embrittlement of Cast Stainless Steel.”

For the ONS SLR, the more recent fracture toughness data from NUREG/CR-4513, Revision 2, was evaluated and determined to be limiting compared to the NUREG/CR-6177 fracture toughness data for the specific RCP material heats evaluated. In addition, screening based on NUREG-2191, GALL-SLR Report AMP XI.M12, “Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS),” was used to screen out any RCP items that were not deemed susceptible to thermal aging embrittlement. Unit 1 RCP components screened out and were not susceptible to thermal aging embrittlement. Units 2 and 3 RCPs did not screen out and were evaluated using the most limiting heat-specific fracture toughness curves per NUREG/CR-4513, Revision 2. The suction and discharge nozzles of the RCP casings are attached to the 28-inch cold-leg pipes and have similar geometry and loading applied to them as the limiting location used in the LBB analysis.

The LBB evaluations for the Units 2 and 3 discharge and suction nozzles of the RCP casings used heat-specific fracture toughness curves per NUREG/CR-4513, Revision 2. The applicant stated the analysis considered a bounding 10 gallons per minute (gpm) leakage crack size for the RCP discharge and suction nozzles, which is consistent with the method used in BAW-1847, Revision 1. In the revised analysis, the applicant used the absolute sum load combination method and, in accordance with SRP 3.6.3, Revision 1, a margin of 1.0 on load was used. The staff's review of the flaw stability confirmed that the ratio of the critical flaw size to the leakage flaw size was 3.1 for both nozzles, which is greater than the required margin of 2 in accordance with SRP 3.6.3. Based on the results of this analysis, the staff concluded that all the required margins for LBB per SRP 3.6.3 were met.

Since the flaw stability analysis part of the TLAA was updated as described in SLRA Section 4.7.4, the staff issued RAI 4.7.4-1 requesting that the applicant clarify why the disposition of the TLAA was not in accordance with 10 CFR 54.21(c)(1)(ii) since the flaw stability analysis was updated. By letter dated February 21, 2022 (ADAMS Accession No. ML22052A002), the applicant's RAI response stated that SLRA Table 4.1.4-1 and SLRA Section 4.7.4 were revised to reflect the disposition of the TLAA in accordance 10 CFR 54.21(c)(1)(ii). The staff found this response acceptable because it provided an accurate disposition of the TLAA.

The staff finds that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(ii), that the LBB analysis has been projected to the end of the subsequent period of extended operation. The analysis meets the acceptance criteria in SRP-SLR Section 4.7.2.1.2 because (1) the fatigue flaw growth analysis remains valid, and (2) the reduction of the fracture toughness of the RCP discharge and suction nozzles was projected to the end of the subsequent period of extended operation. As noted in the SLRA, the applicant will also monitor the transient cycles applicable to the flaw growth analysis using the Fatigue Monitoring program (SLRA Section B3.1).

4.7.4.3 UFSAR Supplement

By letter dated March 31, 2022 (ADAMS Accession No, ML22090A046), the applicant amended SLRA Section A4.7.4, the UFSAR supplement that summarizes the LBB TLAA for the RCS main coolant piping. The staff reviewed the amended SLRA Section A4.7.4, consistent with the review procedures in SRP-SLR Section 4.7.3.2.

Based on its review of the amended UFSAR supplement, the staff finds that it meets the acceptance criteria in SRP-SLR Section 4.7.2.2 and is therefore acceptable. The staff also finds that the applicant provided an adequate summary description to address the LBB TLAA for the RCS main coolant piping, as required by 10 CFR 54.21(d).

4.7.4.4 Conclusion

Based on its review, the staff concludes that the applicant has acceptably demonstrated, in accordance with 10 CFR 54.21(c)(1)(ii), that the LBB analysis has been projected to the end of the subsequent period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.7.5 Crane Load Cycle Limit

4.7.5.1 Summary of Technical Information in the Application

SLRA Section 4.7.5 describes the applicant's TLAA for crane load cycle limits. The applicant dispositioned the TLAAs for the reactor building polar cranes (Units 1, 2, and 3), spent fuel pool cranes (Units 1, 2, and 3), spent fuel auxiliary cranes (Unites 1, 2, and 3), turbine building pump aisle crane, turbine aisle crane, turbine aisle auxiliary crane, and heater bay crane in accordance with 10 CFR 54.21(c)(1)(i) by demonstrating that the analyses remain valid for the subsequent period of extended operation.

4.7.5.2 Staff Evaluation

The staff reviewed the applicant's TLAA for the reactor building polar cranes, spent fuel pool cranes, spent fuel auxiliary cranes, turbine building pump aisle crane, turbine aisle crane, turbine aisle auxiliary crane, and heater bay crane and the corresponding disposition of the TLAA in accordance with 10 CFR 54.21(c)(1)(i), consistent with the review procedures in SRP-SLR Section 4.7.3.1.1 and the acceptance criteria in SRP-SLR Section 4.7.2.1.1.

Reactor Building Polar Cranes

The applicant conservatively projected 1,752 lifts for each unit in SLRA Table 4.7-5, "Evaluation of Containment Polar Crane Operation," for the 80-year plant operating life, including the subsequent period of extended operation. The staff reviewed the basis for the estimated number of lifts for each heavy load type in the table and finds that the estimates for the expected number of lifts over the plant life to the end of subsequent period of extended operation are reasonable. Therefore, this confirms that the applicant's conservative projected number of 1,752 lifts remains well below the CLB load cycle limit of 100,000 provided for service Class A in Crane Manufacturers Association of America (CMAA) Specification No. 70, 1975, and the reactor building polar cranes' TLAAs remain valid for the subsequent period of extended operation.

Spent Fuel Pool Cranes

The applicant conservatively projected 3,316 lifts for the shared spent fuel pool crane for Units 1 and 2 and 2,658 lifts for Unit 3 in SLRA Table 4.7-6, "Evaluation of Spent Fuel Pool Crane Operation," for the 80-year plant operating life, including the subsequent period of extended operation. The staff reviewed the basis for the estimated number of lifts for each heavy load type in the table and finds that the estimates for the expected number of lifts over the plant life to the end of subsequent period of extended operation are reasonable. Therefore, this confirms that the applicant's conservative projected number of 3,316 lifts for the shared spent fuel pool crane for Units 1 and 2 and 2,658 lifts for Unit 3 remain well below the CLB load cycle limit of 100,000 provided for service Class A in CMAA Specification No. 70, 1975, and the spent fuel pool cranes' TLAAs remain valid for the subsequent period of extended operation.

Spent Fuel Auxiliary Cranes

The applicant conservatively projected 1,880 lifts for the shared spent fuel pool auxiliary crane for Units 1 and 2 and 940 lifts for Unit 3 in SLRA Table 4.7-7, "Evaluation of Spent Fuel Auxiliary Crane Operation," for the 80-year plant operating life, including the subsequent period of extended operation. The staff reviewed the basis for the estimated number of lifts for each heavy load type in the table and finds that the estimates for the expected number of lifts over the plant life to the end of subsequent period of extended operation are reasonable. Therefore, this confirms that the applicant's conservative projected number of 1,880 lifts for the shared spent fuel pool auxiliary crane for Units 1 and 2 and 940 lifts for Unit 3 remain well below the CLB load cycle limit of 100,000 provided for service Class A in CMAA Specification No. 70, 1975, and the spent fuel auxiliary cranes' TLAAs remain valid for the subsequent period of extended operation.

Turbine Building Pump Aisle Crane

The applicant conservatively projected 3,820 lifts in SLRA Table 4.7-8, "Evaluation of Turbine Building Pump Aisle Crane Operation," for the 80-year plant operating life, including the subsequent period of extended operation. The staff reviewed the basis for the estimated number of lifts for each heavy load type in the table and finds that the estimates for the expected number of lifts over the plant life to the end of subsequent period of extended operation are reasonable. Therefore, this confirms that the applicant's conservative projected number of 3,820 lifts remains well below the CLB load cycle limit of 100,000 provided for service Class A in CMAA Specification No. 70, 1975, and the turbine building pump aisle crane TLAA remains valid for the subsequent period of extended operation.

Turbine Aisle Crane

The applicant conservatively projected 6,922 lifts in SLRA Table 4.7-9, "Evaluation of Turbine Aisle Crane Operation," for the 80-year plant operating life, including the subsequent period of extended operation. The staff reviewed the basis for the estimated number of lifts for each heavy load type in the table and finds that the estimates for the expected number of lifts over the plant life to the end of the subsequent period of extended operation are reasonable. Therefore, this confirms that the applicant's conservative projected number of 6,922 lifts remains well below the CLB load cycle limit of 100,000 provided for service Class A in CMAA Specification No. 70, 1975, and the turbine aisle crane TLAA remains valid for the subsequent period of extended operation.

Turbine Aisle Auxiliary Crane

The applicant conservatively projected 6,922 lifts in SLRA Table 4.7-10, "Evaluation of Turbine Aisle Auxiliary Crane Operation," for the 80-year plant operating life, including the subsequent period of extended operation. The staff reviewed the basis for the estimated number of lifts for each heavy load type in the table and finds that the estimates for the expected number of lifts over the plant life to the end of the subsequent period of extended operation are reasonable. Therefore, this confirms that the applicant's conservative projected number of 6,922 lifts remains well below the CLB load cycle limit of 100,000 provided for service Class A in CMAA Specification No. 70, 1975, and the turbine aisle auxiliary crane TLAA remains valid for the subsequent period of extended operation.

Heater Bay Crane

The applicant conservatively projected 3,525 lifts in SLRA Table 4.7-11, "Evaluation of Heater Bay Crane Operation," for the 80-year plant operating life, including the subsequent period of extended operation. The staff reviewed the basis for the estimated number of lifts for each heavy load type in the table and finds that the estimates for the expected number of lifts over the plant life to the end of the subsequent period of extended operation are reasonable. Therefore, this confirms the applicant's conservative projected number of 3,525 lifts remains well below the CLB load cycle limit of 100,000 provided for service Class A in CMAA Specification No. 70, 1975, and the heater bay crane TLAA remains valid for the subsequent period of extended operation.

The staff finds the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(i) that the analyses for the reactor building polar cranes, spent fuel pool cranes, spent fuel auxiliary cranes, turbine building pump aisle crane, turbine aisle crane, turbine aisle auxiliary crane, and heater bay crane remain valid for the subsequent period of extended operation. Additionally, it meets the acceptance criteria in SRP-SLR Section 4.7.2.1.1 because the applicant has demonstrated that the crane load cycle analyses remain below the bounds of the CMAA-70 allowable load cycles and therefore are valid through the subsequent period of extended operation.

4.7.5.3 UFSAR Supplement

SLRA Appendix A, Section A4.7.5, provides the UFSAR supplement summarizing the cranes that are subject to this TLAA and lists the cranes' number of expected lifts for the subsequent period of extended operation as well as the limiting number of lifts. The staff reviewed SLRA Section A4.7.5, consistent with the review procedures in SRP-SLR Section 4.7.3.2.

Based on its review, the staff finds that the UFSAR supplement meets the acceptance criteria in SRP-SLR Section 4.7.2.2 and is therefore acceptable. Additionally, the staff finds that the applicant provided an adequate summary description of its actions to address the crane cycle load limits, as required by 10 CFR 54.21(d).

4.7.5.4 Conclusion

Based on its review, the staff concludes that the applicant has acceptably demonstrated, pursuant to10 CFR 54.21(c)(1)(i), that the analyses for the crane load cycle limits remain valid for the subsequent period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.8 Conclusion for TLAAs

The staff reviewed SLRA Section 4, "Time Limited Aging Analyses (TLAAs)." Based on its review, the staff concludes that the applicant has provided a sufficient list of TLAAs, as defined in 10 CFR 54.3, and that the applicant has demonstrated that: (1) the TLAAs remain valid for the subsequent period of extended operation, as required by 10 CFR 54.21(c)(1)(i); (2) the TLAAs have been projected to the end of the subsequent period of extended operation, as required by 10 CFR 54.21(c)(1)(ii); or (3) the effects of aging on intended function(s) will be adequately managed during the subsequent period of extended operation, as required by 10 CFR 54.21(c)(1)(iii). The staff also reviewed the UFSAR supplement for the TLAAs and finds that it contains descriptions of the TLAAs sufficient to satisfy the requirements of 10 CFR 54.21(d). In addition, the staff concludes, as required by 10 CFR 54.21(c)(2), that no plant-specific, TLAA based exemptions are in effect.

With regard to these matters, the staff concludes that there is reasonable assurance that the applicant will continue to conduct the activities authorized by the renewed licenses in accordance with the CLB and that any changes made to the CLB in order to comply with 10 CFR 54.29 (a) are in accordance with the Atomic Energy Act of 1954, as amended, and NRC's regulations.

SECTION 5 REVIEW BY THE ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

In accordance with Title 10 of the *Code of Federal Regulations* 54.25, "Report of the Advisory Committee on Reactor Safeguards," the subsequent license renewal application (SLRA) for the Oconee Nuclear Station (ONS), Units 1, 2, and 3 will be referred to the Advisory Committee on Reactor Safeguards (ACRS) for a review and report. The ACRS also reviews the U.S. Nuclear Regulatory Commission staff's safety evaluation (SE) for the SLRA. The applicant and the staff will attend a meeting of the full committee of the ACRS to discuss issues associated with the SLRA. After the ACRS completes its review of the SLRA and the SE, it will issue a report discussing the results of its review.

SECTION 6 CONCLUSION

The U.S. Nuclear Regulatory Commission (NRC) staff reviewed the subsequent license renewal application (SLRA) for Oconee Nuclear Station (ONS), Units 1, 2, and 3 in accordance with NRC's regulations and the guidance in NUREG-2192, Revision 0, "Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants" (ADAMS Accession No. ML17188A158) (SRP-SLR) and NUREG-2191, "Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report" (ADAMS Accession Nos. ML17187A031 and ML17187A204). Title 10 of the *Code of Federal Regulations* (10 CFR) Section 54.29, "Standards for issuance of a renewed license", sets the standards for issuance of subsequent renewed licenses. In accordance with 10 CFR 54.29, the Commission may issue a subsequent renewed license if it finds, among other things, that: (a) actions have been identified and have been or will be taken, such that there is reasonable assurance that the activities authorized by the subsequent renewed license will continue to be conducted in accordance with the current licensing basis and (b) any applicable requirements of Subpart A, "National Environmental Policy Act—Regulations Implementing Section 102(2)," of 10 CFR Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions" (addressing environmental review), have been satisfied.

Based on its review of the ONS SLRA, the NRC staff determined that the applicant has met the requirements of 10 CFR 54.29(a). Specifically, actions have been identified and have been taken or will be taken with respect to: (1) managing the effects of aging during the subsequent period of extended operation on the functionality of structures and components that have been identified to require review under 10 CFR 54.21(a)(1) and (2) time-limited analyses that have been identified to require review under 10 CFR 54.21(c).

Concerning 10 CFR 54.29(b), the NRC staff's environmental review under the requirements of 10 CFR Part 51, Subpart A is ongoing. The staff will publish its environmental review findings separately from this report.

APPENDIX A

SUBSEQUENT LICENSE RENEWAL COMMITMENTS

A. SUBSEQUENT LICENSE RENEWAL COMMITMENTS

During the review of the Oconee Nuclear Station (ONS), Units 1, 2, and 3 subsequent license renewal application by the staff of the U.S. Nuclear Regulatory Commission (NRC or the staff), Duke Energy Carolinas, LLC (Duke Energy or the applicant) made commitments related to the aging management programs (AMPs) used to manage aging effects for structures and components. The following table lists these commitments along with the implementation schedules and sources for each commitment. The subsequent period of extended operation (SPEO) for ONS begins on February 6, 2033, for Unit 1, October 6, 2033, for Unit 2, and July 19, 2034, for Unit 3.

Table A-1. ONS License Renewal Commitments

Item No.	Program	Commitment	AMP	Implementation	Source
1	*ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD* program	The *ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD AMP* is an existing program that will be enhanced to: 1. Revise procedures to require inspections to be performed for components associated with sentinel locations assessed under ASME Code, Section XI, Non-Mandatory Appendix L for the following: • Reactor coolant system pressurizer surge line piping (hot leg elbow). • High pressure injection piping, stop valve-to-check valve (usage bounds high pressure injection nozzle). 2. Revise program documents to: (a) specify volumetric inspections for each inspection interval for those FSWO components qualified to 1/6 of the 60-year design cycles (i.e., Units 2 and 3 Hot Leg Surge Nozzles and Units 1, 2, and 3 Pressurizer Surge Nozzles); and (b) specify volumetric inspections at a frequency that ensures the qualified life is not exceeded between inspections for those FSWO components qualified to less than 60 years of operation (i.e., Units 1, 2, and 3 Hot Leg Decay Heat FSWOs and Unit 3 Cold Leg Letdown (FSWO).	B2.1.1	Program enhancements for SLR will be implemented six months prior to the SPEO.	SLRA, Appendix A, Table A6.0-1 (ML21158A193, ML21158A194) RAI Set 1 (ML22010A129)
2	*Water Chemistry* program	The existing *Water Chemistry* program is credited.	B2.1.2	Ongoing	SLRA, Appendix A, Table A6.0-1 (ML21158A193, ML21158A194)
3	*Reactor Head Closure Stud Bolting* program	The *Reactor Head Closure Stud Bolting* AMP is an existing program that will be enhanced to: 1. Revise procurement requirements for reactor head closure stud bolting to incorporate guidance from RG 1.65, Revision 1 and NUREG-2191, Chapter XI.M3, to ensure newly procured bolting material does not exceed the limit for maximum measured yield strength of 150 ksi and ultimate tensile strength of 170 ksi.	B2.1.3	Program enhancements for SLR will be implemented six months prior to the SPEO.	SLRA, Appendix A, Table A6.0-1 (ML21158A193, ML21158A194)

Item No.	Program	Commitment	AMP	Implementation	Source
4	*Boric Acid Corrosion* program	The existing *Boric Acid Corrosion* program is credited.	B2.1.4	Ongoing	SLRA, Appendix A, Table A6.0-1 (ML21158A193, ML21158A194)
5	*Cracking of Nickel-Alloy Components and Loss of Material Due to Boric Acid Induced Corrosion in Reactor Coolant Pressure Boundary Components* program	The existing *Cracking of Nickel-Alloy Components and Loss of material Due to Boric Acid Induced Corrosion in Reactor Coolant Pressure Boundary Components* program is credited.	B2.1.5	Ongoing	SLRA, Appendix A, Table A6.0-1 (ML21158A193, ML21158A194)
6	*Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)* program	The *Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)* program is a new condition monitoring program that will provide assurance that the reactor coolant pressure boundary cast austenitic stainless steel components (i.e., pump casings) with the potential for significant thermal aging embrittlement meet their intended functions. Industry and plant-specific OE will be considered in the development and implementation of this program.	B2.1.6	Program will be implemented six months prior to the SPEO.	SLRA, Appendix A, Table A6.0-1 (ML21158A193, ML21158A194)
7	*PWR Vessel Internals* program	The *PWR Vessel Internals* AMP is an existing program that will be enhanced as follows: 1. The PWR Vessel Internals AMP will be updated as necessary to provide guidance for implementing the changes to primary and expansion items in MRP-227, Rev 1-A, Tables 4-1, 4-4 (and Table 5-1 for Element 6 only), as modified by the ONS gap analysis reported in Appendix B2.1.7. (Elements 4 and 6) 2. Enhancements to MRP-227, Revision 1-A, Table 4-1, B&W Plants Primary, for the ONS Units: • Remove visual VT-3 examination of high-strength bolt locking devices. • Examination method/frequency for the plenum cover assembly and core support shield assembly (Item	B2.1.7	Program enhancements for SLR will be implemented six months prior to the SPEO.	SLRA, Appendix A, Table A6.0-1 (ML21158A193, ML21158A194) RAI B2.1.7-4a (ML22245A008)

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		B1) will be updated. The initial one-time physical measurement required by the MRP-227 guideline is complete for all Oconee units; no relevant indications have been observed. Subsequent visual (VT-3) examination will be performed during each 10-year ISI interval. • Examination coverage for the plenum cover assembly and core support shield assembly (Item B1) will be updated. Accessible top surfaces of the plenum cover support ring/plenum cover weldment rib pads and CSS top flange when the RV closure head and plenum assembly will be removed as areas for examination. • The expansion link to vent valve bodies for the control rod guide tube assembly, control rod guide tube spacer castings (Item B2) will be removed. It has been determined that the vent valve bodies are not susceptible to thermal aging embrittlement (see MRP-189, Revision 3, Section 3.2, Item J.2). There is no expansion link for the control rod guide tube assembly, control rod guide tube spacer castings (Item B2). • New age-related degradation mechanisms will be added for the core support shield assembly, upper core barrel bolts (Item B7). The new age-related degradation mechanisms are irradiation-enhanced stress relaxation and irradiation-enhanced creep, fatigue, and wear. • An expansion link note will be added for the core support shield assembly, upper core barrel bolts (Item B7). The note states that the primary-expansion relationship between the upper core barrel, lower core barrel, and flow-distributor bolts and the upper thermal shield and lower thermal shield bolts/studs is for stress corrosion cracking only. • A new expansion link note will be added for the core barrel assembly, lower core barrel bolts (Item B8). The note states that the primary-expansion relationship between the upper core barrel, lower			

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		core barrel, and flow distributor bolts and the upper thermal shield and lower thermal shield bolts/studs is for stress corrosion cracking only. • A new age-related mechanism will be added for the core barrel assembly, baffle-to-former bolts (Item B9). The new age-related degradation mechanism is void swelling. • An expansion link note will be added for the core barrel assembly, baffle-to-former bolts (Item B9). The note states that the core barrel-to-former bolts are Category A for void swelling, so expansion does not apply. • A new age-related degradation mechanism will be added for the core barrel assembly, baffle plates (Item B10). The new age-related degradation mechanism is void swelling. • Expansion links for the core barrel assembly, baffle plates (Item B10) will be revised. Core barrel cylinder (including vertical and circumferential seam welds) and lower grid rib section will be removed as expansion links. Former plates will be retained as an expansion link. • An expansion link note will be added for the flow distributor assembly, flow distributor bolts (Item B12). The note states the Primary-Expansion relationship between the upper core barrel, lower core barrel, and flow distributor bolts and the upper thermal shield and lower thermal shield bolts/studs/nuts is for stress corrosion cracking only. • An age-related degradation mechanism will be removed for the incore monitoring instrumentation guide tube assembly, incore monitoring instrumentation guide tube spiders, incore monitoring instrumentation guide tube spider-to-lower grid rib section welds (Item B15). Thermal aging embrittlement will be removed as an applicable degradation mechanism for the incore monitoring instrumentation spiders as ferrite screening has determined that these items are not susceptible to thermal aging embrittlement.			

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		• A new expansion link for the incore monitoring instrumentation guide tube assembly, incore monitoring instrumentation guide tube spiders, incore monitoring instrumentation guide tube spider-to-lower grid rib section welds (Item B15) will be added. The new expansion link is upper grid fuel assembly support pad items: pad, Alloy X-750 dowel, cap screws, and their locking welds (Item B15.2).
		• Examination coverage for the incore monitoring instrumentation guide tube assembly, incore monitoring instrumentation guide tube spiders, incore monitoring instrumentation guide tube spider-to-lower grid rib section welds (Item B15) will be clarified. Clarification of the meaning of adjacent will be provided along with a corresponding note.
		• New Primary Items will be added:
		  ○ Core barrel assembly: core barrel cylinder top flange circumferential weld region (Unit 2) (Item B16)
		  ○ Core barrel assembly: core barrel cylinder center circumferential weld regions (Unit 2) (Item B17)
		  ○ Lower grid rib assembly: lower grid rib section (Item B18)
		• New Expansion and Secondary Expansion Links will be added for the new Primary Items as reported below (i.e., Items B16.1 through B16.5 relative to Item B16, and Items B17.1 through B17.5 relative to Item B17).
		• Essentially 100% of the Primary category core barrel cylinder top flange circumferential weld region (B16, Unit 2 only) and the Primary category core barrel cylinder center circumferential weld region (Item B17, Unit 2 only) will be examined prior to entering the subsequent period of extended operation. Alternately, in lieu of examination, these items can be addressed by evaluation that is submitted for NRC staff approval at least four years prior to Unit 2 entering the subsequent period of extended operation.			

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		3. Enhancements to MRP-227, Revision 1-A, Table 4-4, B&W Plants Expansion, for the ONS Units:
		• Remove visual VT-3 examination of high-strength bolt locking devices.
		• Vent valve assembly, vent valve bodies (Item B2.1) will be removed as an expansion Item as it has been determined that these component items are not susceptible to thermal aging embrittlement (see MRP-189, Revision 3, Section 3.2, Item J.2).
		• A new age-related degradation mechanism for the core barrel assembly, baffle-to-baffle bolts (Item B9.1) will be added. The new age-related degradation mechanism is void swelling.
		• A new age-related degradation mechanism for the core barrel assembly, former plates (Item B10.2) will be added. The new age-related degradation mechanism is void swelling.
		• Lower grid rib section (Item B10.3) will be reclassified as a primary item.
		• Examination method/frequency for the lower grid assembly, lower thermal shield studs (Item B8.1) will be updated. The updated examination method is a new visual (VT-3) examination of the lower thermal shield nuts.
		• New expansion items will be added based on a revision to primary item incore monitoring instrumentation guide tube spiders and spider-to-lower grid rib section welds (Item B15).
		• New expansion items will be added for core barrel cylinder welds: Items B16.1 through B16.5, which are tied to new primary item B16, core barrel cylinder top flange circumferential weld region (Unit 2)
		  ○ Core barrel cylinder top flange circumferential weld region (Unit 1) (Item B16.1)
		  ○ Core barrel cylinder top flange circumferential weld region (Unit 3) (Item B16.2)
		  ○ Core barrel cylinder bottom flange circumferential weld region (Unit 2) (Item B16.3)
		  ○ Core barrel cylinder bottom flange			

Item No.	Program	Commitment	AMP	Implementation	Source
		circumferential weld region (Unit 1) (Item B16.4) (Secondary Expansion of Item B16.1) o Core barrel cylinder bottom flange circumferential weld region (Unit 3) (Item B16.5) (Secondary Expansion of Item B16.2) o Core barrel cylinder center circumferential weld region (Unit 1) (Item B17.1) o Core barrel cylinder center circumferential weld region (Unit 3) (Item B17.2) o Core barrel cylinder vertical seam weld region (Unit 2) (Item B17.3) o Core barrel cylinder vertical seam weld region (Unit 1) (Item B17.4) (Secondary Expansion of Item B17.1) o Core barrel cylinder vertical seam weld region (Unit 3) (Item B17.5) (Secondary Expansion of Item B17.2) 4. Enhancements to MRP-227, Revision 1-A, Table 5-1, B&W Plants Acceptance and Expansion Criteria, for the ONS Units: • Remove references to visual VT-3 examination of high-strength bolt locking devices. • The expansion link to vent valve bodies for the control rod guide tube assembly spacer castings (Item B2) will be removed. • Expansion criteria wording for the core barrel assembly, upper core barrel bolts (Item B7) will be updated to include expansion to 100% of the lower thermal shield nuts. • Expansion Criteria wording for the core barrel assembly, lower core barrel bolts (Item B8) will be updated to include expansion to 100% of the lower thermal shield nuts. • Expansion links to the core barrel cylinder (including vertical and center circumferential seam welds) (Item B10.1) and lower grid rib section (Item B10.3) for the core barrel assembly, baffle plates (Item B10) will be removed. • Expansion criteria for core barrel assembly, baffle plates (Item B10) will be updated. The expansion			

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		criteria will be updated to remove the expansion links to core barrel cylinder (including vertical and center circumferential seam welds) (Item B10.1) and lower grid rib section (Item B10.3) from the wording.
		• Expansion criteria wording for the flow distributor assembly, flow distributor bolts (Item B12) will be updated to include expansion to 100% of the lower thermal shield nuts.
		• An expansion link for the incore monitoring instrumentation guide tube assembly, incore monitoring instrumentation guide tube spiders, and incore monitoring instrumentation guide tube spider-to-lower grid rib section welds (Item B15), will be added. The expansion link will be added to the upper grid fuel assembly support pad items: pad, Alloy X-750 dowel, cap screws, and their locking welds (Item B15.2). This item expands from the existing expansion item lower grid assembly, lower grid fuel assembly support pad component items: pad, pad-to-rib section welds, Alloy X-750 dowel, cap screws, and their locking welds (Item B15.1) as a secondary expansion.
		• New primary items will be added:
		  ○ Core barrel assembly, core barrel cylinder top flange circumferential weld zone (Unit 2) (Item B16)
		  ○ Core barrel assembly, core barrel cylinder center circumferential weld region (Unit 2) (Item B17)
		  ○ Lower Grid Assembly, lower grid rib section (B18)
		• New Expansion Links, Expansion Criteria, and Acceptance Criteria will be added:
		  ○ For the core barrel cylinder top flange circumferential weld region (Item B16), Expansion Links will include Items B16.1 through B16.5 with expansion criteria as discussed above. Acceptance criteria will be as follows: The specific relevant condition for the EVT-1 examination is a detectable crack-like surface indication. The examination acceptance criteria for the UT and/or ECT examination(s) shall be established as part of the examination technical justification.			

Item No.	Program	Commitment	AMP	Implementation	Source
		○ For the core barrel cylinder center circumferential weld region (Item B17), Expansion Links will include Items B17.1 through B17.5 with expansion criteria as discussed above. Acceptance criteria will be as follows: The specific relevant condition for the EVT-1 examination is a detectable crack-like surface indication. The examination acceptance criteria for the UT and/or ECT examination(s) shall be established as part of the examination technical justification. • Essentially 100% of the Primary category core barrel cylinder top flange circumferential weld region (B16, Unit 2 only) and the Primary category core barrel cylinder center circumferential weld region (Item B17, Unit 2 only) will be examined prior to entering the subsequent period of extended operation. Alternately, in lieu of examination, these items can be addressed by evaluation that is submitted for NRC staff approval at least four years prior to Unit 2 entering the subsequent period of extended operation.			
8	*Flow-Accelerated Corrosion* program	The *Flow-Accelerated Corrosion* AMP is an existing program that will be enhanced to reassess infrequently used piping systems excluded from the scope of the program with respect to evaluations performed to determine susceptibility to both wall thinning due to flow accelerated corrosion and wall thinning due to erosion mechanisms to ensure adequate bases exist to justify this exclusion for the SPEO.	B2.1.8	Program enhancements for SLR will be implemented six months prior to the SPEO.	SLRA, Appendix A, Table A6.0-1 (ML21158A193, ML21158A194) RAI Set 2 (ML22045A021)
9	*Bolting Integrity* program	The *Bolting Integrity* AMP is an existing program that will be enhanced to: 1. Revise applicable procedures and specifications to include reference to EPRI Report 1015336, EPRI Report 1015337, and NUREG-1339, as appropriate. 2. Revise procedures governing the direct visual examination of bolted joints to include inspection parameters such as lighting, distance, and offset. 3. Perform volumetric inspections of non-ASME high strength bolting (with actual yield strength greater than	B2.1.9	Program enhancements for SLR will be implemented six months prior to the SPEO.	SLRA, Appendix A, Table A6.0-1 (ML21158A193, ML21158A194) Supplement 1 (ML21302A208) RAI Set 2 (ML22045A021)

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		or equal to 150 ksi (1,034 MPa)) greater than 2 inches in diameter in accordance with the method described in ASME Code Section XI, Table IWB-2500-1, Examination Category B-G-1. 4. Perform visual inspections of a representative sample of 20 percent of closure bolting where leakage is difficult to detect (submerged connections or systems containing air/gas) or a maximum of 17 bolts for each material and environment population per unit, whichever is less, during each ten year period. If the minimum sample size is not achieved during a ten year period, then alternative inspections will be credited. For submerged bolting in the Condenser Circulating Water intake pump casing upper flanges, alternative inspections will include diver inspections and periodic (minimum semiannual) vibration monitoring of the pump/motor assemblies. Divers will inspect for degraded, visibly loose, missing, or broken bolts. Evidence of loose or missing bolting and significant loss of material (i.e., appreciable material loss that could adversely affect intended function) identified during inspections will be entered into the corrective action program. Vibration readings will be trended, and any unacceptable vibration levels will be entered into the corrective action program for evaluation and resolution. For submerged bolting in the Spent Fuel Pool fuel transfer tube isolation valves, alternative inspections will include remote video or photographic inspections. Comparison to previous video or photographic inspection results (if available) will be performed to identify changes related to loss of material, bolt loosening or signs of leakage. Evidence of loose or missing bolting or significant loss of material (i.e., appreciable material loss that could adversely affect intended function) identified during inspections will be entered into the corrective action program. For systems containing air/gas, alternative inspections will include one or more of the following: (a) visual inspection for discoloration when leakage from inside the piping system would discolor the external surfaces of the component; (b) monitoring and trending of pressure			Follow-up Responses to RAI Set 2 and 3 (ML22090A046) RAI B2.1.9-2a (ML22159A151)

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		decay when the bolted connection is located within an isolated boundary; (c) soap bubble testing on the external mating surface of the bolted component; or (d) thermography, when the temperature of the process fluid is higher than ambient conditions around the component. 5. Perform additional inspections of a minimum of 20 percent of similar bolting or five additional inspections, whichever is less, for each sample based inspection (each bolt, etc.) that does not meet acceptance criteria. If the additional inspections identify bolting that does not meet acceptance criteria, then an extent of condition and extent of cause analysis will be conducted to determine the further extent of inspections. Additional inspections of similar bolting (same material, environment, and aging effect(s)) will be performed at all three units and will occur within the same interval in which the original inspection was conducted. The corrective action program will be used to determine if changes to inspection frequency is appropriate if any inspection results indicate that loss of function will occur prior to the next scheduled inspection. 6. Revise applicable procedures and specifications to ensure that the use of bolting with measured yield strength greater than or equal to 150 kilo-pounds per square inch (ksi) or 1,034 megapascals (MPa) in newly designed applications is avoided when practical engineering design considerations allow. 7. Revise the fleet work planning procedure to specifically prohibit the use of products containing molybdenum disulfide (MoS_2) as bolting thread lubricants. 8. Perform visual inspections of a representative sample of 20 percent of closure bolting for components that are not normally pressurized or a maximum of 17 bolts for each material and environment population per unit, whichever is less, during each ten year period.			
10	*Steam Generators* program	The existing *Steam Generators* program is credited.	B2.1.10	Ongoing	SLRA, Appendix A, Table A6.0-1 (ML21158A193, ML21158A194)

Item No.	Program	Commitment	AMP	Implementation	Source
11	*Open-Cycle Cooling Water* program	The *Open-Cycle Cooling Water System* AMP is an existing program that will be enhanced to: 1. Perform periodic inspection, cleaning, and eddy current testing of the 'A' and 'B' Chiller condensers at least once every five years. 2. Perform a minimum of 20 inspections for recurring internal corrosion in raw water systems every 24 months until the rate of recurring internal corrosion occurrences no longer meets the criteria for recurring internal corrosion as defined in Section 3.3.2.2.7 of NUREG-2192. The selected inspection locations will be periodically reviewed to validate their relevance and usefulness and adjusted as appropriate. Evaluation of the inspection results will include (1) a comparison to the nominal wall thickness or previous wall thickness measurements to determine rate of corrosion degradation; (2) a comparison to the design minimum allowable wall thickness to determine the acceptability of the component for continued use; and (3) a determination of reinspection interval. 3. Perform periodic internal visual inspections of the visible portion of the supply and return piping to the radwaste equipment cooling system from the condenser circulating water system intake piping in conjunction with the performance of the intake piping internal coating inspections. Visual inspections will be performed to identify direct evidence of internal degradation and indirect evidence of through wall leakage including the presence of backfill material or gravel within the pipe. 4. Provide additional guidance in procedures for inspections of non-ASME Code components for items such as lighting, distance, offset, surface coverage, presence of protective coatings, and cleaning processes. 5. Provide additional guidance for trending of heat exchanger inspection results to evaluate the adequacy of inspection frequencies. 6. If inspections identify wall-thickness below the minimum required wall thickness and the cause of the aging effect for each applicable material and environment is not	B2.1.11	Program enhancements for SLR will be implemented six months prior to the SPEO.	SLRA, Appendix A, Table A6.0-1 (ML21158A193, ML21158A194)

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		corrected by repair or replacement for all components constructed of the same material and exposed to the same environment, additional inspections will be conducted. The number of increased inspections is determined in accordance with the corrective action program; however, no fewer than five additional inspections will be conducted for each inspection that did not meet acceptance criteria, or 20 percent of each applicable material, environment, and aging effect combination is inspected, whichever is less. The additional inspections include inspections at all of the units with the same material, environment, and aging effect combination. 7. Incorporate programmatic guidance contained in engineering support documents into controlled plant procedures subject to administrative controls in accordance with the Duke Energy QA program.			
12	*Closed Treated Water Systems* program	The *Closed Treated Water Systems* AMP is an existing program that will be enhanced to: 1. Perform condition monitoring using techniques (visual, surface, or volumetric) capable of detecting loss of material, cracking, and fouling as appropriate. Perform visual inspections for loss of material and fouling whenever the system boundaries of the closed treated water systems are opened. Perform surface or volumetric examinations when susceptible materials are inspected for cracking. 2. In each ten year period during the SPEO, perform sufficient number of inspections to ensure that the minimum representative sample of 20% of the population up to 17 inspections per unit is met. A population is definedas components having the same material, water treatment program and aging effect combination. Perform inspections on those components that are more likely to be susceptible to aging based on time in service and severity of operating conditions. 3. Perform additional inspections when inspections do not meet acceptance criteria. Perform at least 5 additional inspections for every inspection not meeting	B2.1.12	Program enhancements 1 through 6 will be implemented six months prior to the SPEO. Program enhancement 7 baseline UT inspections will be implemented in the 10 years prior to entering the SPEO with follow-up UT inspections within 6 years after the baseline inspection.	SLRA, Appendix A, Table A6.0-1 (ML21158A193, ML21158A194) Supplement 3 (ML21349A005)

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		acceptance criteria or 20% of each applicable material, environment,and aging effect combination, whichever is less. 4. Provide additional guidance in procedures for inspections of non-ASME code components for items such as lighting, distance, offset, surface coverage, presence of protective coatings, and cleaning processes. 5. Where practical, project the rate of any degradation until the next scheduled inspection or the end of the SPEO (whichever is shorter). Adjust the sampling bases (e.g., selection, size, frequency) as necessary based on the projections. 6. If subsequent inspections identify aging effects, the corrective action program will be used to determine the extent of condition and extent of cause to determine further extent of inspections. Perform additional inspections on all units with the same material, environment, and aging effect combinations and within the interval of the original inspection (e.g., refueling outage interval, ten year inspection interval). 7. Supplemental volumetric examinations will be performed in both the Unit 1/2 and the Unit 3 Recirculating Cooling Water System in locations where chemistry controls such as corrosion inhibitors or biocide treatments may not be effective at mitigating corrosion. Volumetric examinations will consist of initial baseline inspections in the 10 year period prior to entering the SPEO and follow-up inspections in order to establish wall loss rate. Baseline and follow-up inspections will be performed at 5 locations in both the Unit 1/2 and the Unit 3 Recirculating Cooling Water Systems. The inspections will be performed at leading or bounding locations in these systems (e.g., low flow/stagnant areas, dead legs, or under sludge or slime deposits). Follow-up inspections will be performed at an interval based on the results of the baseline inspections, not to exceed 6 years (i.e., after the initial baseline inspections).			
13	*Inspection of Overhead Heavy Load and*	The *Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems* AMP is an existing	B2.1.13	Program enhancements for SLR will be implemented sixmonths prior to the SPEO.	SLRA, Appendix A, Table A6.0-1

Item No.	Program	Commitment	AMP	Implementation	Source
	Light Load (Related to Refueling) Handling Systems program	program that will be enhanced to: 1. Provide additional procedural guidance to include visual inspections looking for deformation and cracking of bridges, structural members, and structural components. 2. Provide additional procedural guidance to specify bolted connections are monitored for loss of material, cracking, loose or missing bolts or nuts, and other conditions indicative of loss of preload. 3. Include evaluation of findings according to ASME B30.2 or other applicable ASME B30 series in applicable procedures. 4. Enhance maintenance procedures to ensure repairs are performed in accordance with ASME B30.2 or other applicable ASME B30 series in addition to manufacturers literature as necessary.			(ML21158A193, ML21158A194)
14	*Compressed Air Monitoring* program	The *Compressed Air Monitoring* AMP is an existing program that will be enhanced to perform opportunistic visual inspections of select component internal surfaces exposed to a dry air environment for signs of loss of material due to corrosion. Inspections will be performed by station personnel who have been qualified to the task per approved training procedures and programs. Acceptance criteria will ensure that internal surfaces that show signs of corrosion, that could indicate the potential loss of function of the component, are identified. The program will require corrective actions to be taken if loss of material due to corrosion is identified on internal surfaces of components.	B2.1.14	Program enhancements for SLR will be implemented sixmonths prior to the SPEO.	SLRA, Appendix A, Table A6.0-1 (ML21158A193, ML21158A194)
15	*Fire Protection* program	The *Fire Protection* AMP is an existing program that will be enhanced to perform periodic visual inspection every 18 months for identification of corrosion that may lead to loss of material on the external surfaces of the standby shutdown facility CO_2 fire protection system.	B2.1.15	Program enhancements for SLR will be implemented sixmonths prior to the SPEO.	SLRA, Appendix A, Table A6.0-1 (ML21158A193, ML21158A194)
16	*Fire Water System* program	The *Fire Water System* AMP is an existing program that will be enhanced to: 1. Perform internal visual inspections of deluge system piping by removing a hydraulically remote nozzle to identify internal corrosion, foreign material, and obstructions to flow. Internal visual inspections will be performed in 50 percent of the deluge systems within the scope of the *Fire Water System* AMP that are not	B2.1.16	Program will be implemented and inspections or tests will begin 5 years prior to the SPEO. Inspections or tests that are tobe completed prior to the SPEO will be completed 6 months prior to the SPEO or no later than the	SLRA, Appendix A, Table A6.0-1 (ML21158A193, ML21158A194) Supplement 1 (ML21302A208)

Item No.	Program	Commitment	AMP	Implementation	Source
		subject to flow testing every five years. During the subsequent five year inspection period, the alternate systems will be inspected such that piping in 100 percent of the deluge systems within the scope of the program is inspected every ten years. Follow-up volumetric wall thickness examinations will be performed if internal visual inspections detect an unexpected level of degradation due to corrosion and corrosion product deposition. 2. Prior to 50 years in service, sprinkler heads will be submitted for field-service testing by a recognized testing laboratory consistent with NFPA 25, 2011 Edition, Section 5.3.1. 3. Perform a one-time volumetric wall thickness inspection on a representative sample of deluge system supply piping that is periodically subjected to flow during functional testing. The representative sample will be based on the population of deluge system piping that is periodically subject to flow but is normally dry. The one-time volumetric wall thickness inspection activity will include criteria for selection of inspection locations, acceptance criteria, and will specify the need for follow-up examinations based on inspection results. 4. Perform an obstruction investigation in accordance with NFPA 25, 2011 Edition, Section 14.3 if evidence of unacceptable internal flow blockage that could result in failure of system function is identified during internal inspections. When unacceptable internal flow blockage is detected, corrective actions will include removal of the material, an extent of condition determination, review for increased inspections, follow-up examinations, and a flush in accordance with NFPA 25 Annex D.5, *Flushing Procedures*. 5. Revise inspection procedures to include inspection parameters for items such as lighting, distance, offset, presence of protective coatings, and cleaning processes and to provide specific guidance for the identification and documentation of indications of age-related degradation. For internal surfaces this includes indications of corrosion such as surface irregularities		last refueling outage priorto the SPEO.	Supplement 2 (ML21315A012) RAI Set 2 (ML22045A021) RAI Set 4 (ML22112A016)

Item No.	Program	Commitment	AMP	Implementation	Source
		and signs of fouling which could lead to flow blockage. For external surfaces age-related degradation includes indications of corrosion beyond minor surface rusting and signs of current or past leakage. 6. Perform flow testing of at least one hose station in each building every five years to demonstrate the capability to provide the design pressure at required flow. Flow testing will be performed at the hydraulically most remote hose station. If acceptance criteria are not met, at least two additional tests shall be performed within five years. If subsequent tests do not meet acceptance criteria, an extent of condition and extent of cause analysis is conducted to determine the further extent of tests. The additional tests include at least one test at one of the other units with the same material, environment, and aging effect combination. 7. Perform external visual inspections of the elevated water storage tank in accordance with Section 9.2.5.5 of NFPA 25, 2011 Edition at least once every two years. 8. Perform flushing of the mainline strainers following system actuation in accordance with Section 10.2.7 of NFPA 25, 2011 Edition. 9. Perform main drain testing of the deluge system risers at least once every two years. Main drain testing of deluge systems will be performed in accordance with the procedure described in Sections 13.2.5 and A.13.2.5 of NFPA 25, 2011 Edition. When there is a ten percent reduction in full flow pressure when compared to an established baseline value, the cause of the reduction shall be identified and corrected if necessary. If acceptance criteria are not met, at least two additional tests shall be performed within two years. If subsequent tests do not meet acceptance criteria, an extent of condition and extent of cause analysis is conducted to determine the further extent of tests. The additional tests include at least one test at one of the other units with the same material, environment, and aging effect combination. 10. Acceptance criteria and corrective actions for internal inspections of the elevated water storage tank will be in			

Item No.	Program	Commitment	AMP	Implementation	Source
		accordance with the *Internal Coatings/Linings for In-ScopePiping, Piping Components, Heat Exchangers and Tanks* program. Tank wall thickness measurements will be conducted if interior pitting or general corrosion (beyond minor surface rust) is detected. 11. Personnel involved with inspection of the internal coatings of the elevated water storage tank and evaluation of degraded conditions will be trained and qualified in accordance with an ASTM international standard endorsed in Regulatory Guide 1.54, including NRC staff limitations associated with a particular standard.			
17	*Outdoor and Large Atmospheric Metallic Storage Tanks* program	The *Outdoor and Large Atmospheric Metallic Storage Tanks* AMP is a new condition monitoring program that manages loss of material on the external surfaces of the Unit 1, 2 and 3 borated water storage tanks and ensures there is no significant degradation of the tank bottoms. Sealant or caulking will be applied to the base of each tank at the concrete-component interface. These are indoor large volume tanks that contain water and are designed with internal pressures approximating atmospheric that are sited on concrete. This program includes preventive measures to mitigate corrosion by protecting the external surfaces of the steel components in accordance with standard industry practices.	B2.1.17	The program for SLR will be implemented six months priorto the SPEO or no later than the last refueling outage prior to the SPEO.	SLRA, Appendix A, Table A6.0-1 (ML21158A193, ML21158A194) Supplement 1 (ML21302A208)
18	*Fuel Oil Chemistry* program	The *Fuel Oil Chemistry* AMP is an existing program that will be enhanced to: 1. Monitor the standby shutdown facility fuel oil day tank quarterly for the presence of water by draining oil from the bottom of the tank and remove the water, if found. 2. Monitor the fuel oil stored in the standby shutdown facility fuel oil day tank quarterly for the presence of bacteria and fungus. 3. Perform volumetric wall thickness measurement of the standby shutdown facility fuel oil day tank if evidence of degradation is identified visually during the 10 year internal inspection.	B2.1.18	Program enhancements for SLR will be implemented six months prior to the SPEO or no later than the last refueling outage prior to the SPEO.	SLRA, Appendix A, Table A6.0-1 (ML21158A193, ML21158A194)
19	*Reactor Vessel Material Surveillance* program	The existing *Reactor Vessel Material Surveillance* AMP is credited.	B2.1.19	Ongoing	SLRA, Appendix A, Table A6.0-1 (ML21158A193, ML21158A194)

Item No.	Program	Commitment	AMP	Implementation	Source
20	*One-Time Inspection* program	The *One-Time Inspection* AMP is a new condition monitoring program consisting of a one-time inspection of selected components to verify: a. the system wide effectiveness of an AMP that is designed to prevent or minimize aging to the extent that it will not cause the loss of intended function during the SPEO; b. the insignificance of an aging effect; and c. the long-term loss of material that will not cause a loss of intended function for steel components exposed to environments that do not include corrosion inhibitors as apreventive action. Industry and plant specific OE will be considered in the development and implementation of the program.	B2.1.20	Program will be implemented and inspections begin 10 years before the SPEO. Inspections that are to be completed prior to the SPEO are completed 6 months priorto the SPEO or no later than the last refueling outage priorto the SPEO.	SLRA, Appendix A, Table A6.0-1 (ML21158A193, ML21158A194)
21	*Selective Leaching* program	The *Selective Leaching* AMP is a new condition monitoring program that will monitor components constructed of materials which are susceptible to selective leaching. The *Selective Leaching* program includes a one-time inspection for susceptible components exposed to a treated water environment, as well as opportunistic and periodic inspections for susceptible components exposed to raw water, waste water, and soil (which may include groundwater) environments. The *Selective Leaching* AMP also includes a one-time inspection for gray cast iron components exposed to a closed cycle cooling water environment. Opportunistic and periodic inspections will be performed for malleable iron and ductile iron components exposed to closed cycle cooling water. Industry and plant-specific OE will be considered in the development and implementation of this program.	B2.1.21	Program will be implementedno later than 10 years prior tothe SPEO. The one-time inspections and initial periodicinspections are required to beperformed within the 10 yearsprior to the SPEO, and no later than 6 months prior to the SPEO, or no later than the last refueling outage prior to the SPEO.	SLRA, Appendix A, Table A6.0-1 (ML21158A193, ML21158A194) RAI Set 1 (ML22010A129)
22	*ASME Code Class 1Small-Bore Piping* program	The *ASME Code Class 1 Small-Bore Piping* AMP is a new condition monitoring program that augments the existing ASME Code, Section XI requirements and is applicable to ASME Code Class 1 small-bore piping and systems with a nominal pipe size diameter less than four inches and greater than or equal to one inch. This program provides for volumetric examination of a sample of full penetration (butt) welds and partial penetration (socket) welds in Class 1 piping to manage cracking due to stress corrosion cracking or thermal or vibratory fatigue loading.	B2.1.22	Program will be implemented within the 6 years prior to the SPEO. The one-time inspections and initial periodicinspections will be performedwithin the 6 years prior to the SPEO. These inspections willbe completed no later than 6 months prior to the SPEO or no later than the last refuelingoutage prior to the	SLRA, Appendix A, Table A6.0-1 (ML21158A193, ML21158A194)

Item No.	Program	Commitment	AMP	Implementation	Source
		Volumetric examinations will employ techniques that have been demonstrated to be capable of detecting flaws and discontinuities in the examination volume of interest. The extent and schedule for volumetric examination is based on plant-specific OE and whether actions have been implemented that effectively mitigate the cause(s) of any past cracking. The program provides for periodic inspection of a sample of the population of welds (butt welds or socket welds)that have experienced cracking and have not implemented corrective actions to effectively mitigate the cause(s) of the cracking. Industry and plant-specific OE will be considered in the development and implementation of this program.		SPEO. Subsequent periodic inspections will be performed every 10 years during the SPEO.	
23	*External Surfaces Monitoring of Mechanical Components* program	The *External Surfaces Monitoring of Mechanical Components* AMP is a new condition monitoring program that will manage the aging effects of: • loss of material, cracking, and reduction of heat transfer of metallic components; • hardening or loss of strength, loss of material, and cracking or blistering of polymeric components; • hardening or loss of strength, and loss of material of elastomeric components; • loss of material, cracking, and loss of preload for HVAC closure bolting; and • reduced thermal insulation resistance. Periodic visual inspections, not to exceed a refueling outage interval, of metallic, polymeric, and elastomeric components,and insulation metallic jacketing (or protective outer layer if metal jacketing is not used) will be conducted. Industry and plant-specific OE will be considered in the development and implementation of this program.	B2.1.23	The program for SLR will be implemented six months priorto the SPEO.	SLRA, Appendix A, Table A6.0-1 (ML21158A193, ML21158A194)
24	*Inspection of Internal Surfaces in Miscellaneous Piping and Ducting*	The *Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components* AMP is a new condition monitoring program that will manage loss of material and cracking of metallic components, as well as loss of material, cracking, blistering, hardening and loss of strength of polymeric and elastomeric materials. The program also manages loss of coating integrity for certain components that do not perform a	B2.1.24	The program for SLR will be implemented six months priorto the SPEO.	SLRA, Appendix A, Table A6.0-1 (ML21158A193, ML21158A194)

Item No.	Program	Commitment	AMP	Implementation	Source
	Components program	pressure boundary intended function and where loss of coating integrity would not impact the intended functions of downstream components. Reduction of heat transfer and flow blockage will also be managed. This program will consist of visual inspections of all accessible internal surfaces (or external surfaces of components located internal to other components such that the external surface is not normally accessible) of piping, piping components, ducting, heat exchanger components, polymeric and elastomeric components, and other mechanical components. Periodic wall thickness measurements may be conducted in lieu of visual inspections for managing loss of coating integrity. Periodic visual (VT-1) or surface examinations will be performed to detect cracking of stainless steel components exposed to a diesel exhaust, potable raw water, and waste water and in copper alloys exposed to waste water. Industry and plant-specific OE will be considered in the development and implementation of this program.			Response to RAI B2.1.27-1 (ML21295A035) Annual Update and Supplement 4 (ML22158A028)
25	*Lubricating Oil Analysis* program	The *Lubricating Oil Analysis* AMP is an existing program that will be enhanced to update procedures to specify that in all cases, phase-separated water in any amount is not acceptable.	B2.1.25	Program enhancements for SLR will be implemented six months prior to the SPEO.	SLRA, Appendix A, Table A6.0-1 (ML21158A193, ML21158A194)
26	*Buried and Underground Piping and Tanks* program	The *Buried and Underground Piping and Tanks* AMP is an existing program that will be enhanced to: 1. Install a cathodic protection system in accordance with NACE SP0169-2007 for buried carbon steel piping within the scope of this program. 2. Complete a modification to abandon the buried copper alloy instrument air system piping within the scope of this program. 3. Annual cathodic protection system monitoring will be performed with a maximum grace period of two months.The system will be monitored at least once during each calendar year. 4. Utilize an inspection method that has been demonstrated to be capable of detecting cracking when visual inspections of coated stainless steel piping detect coating degradation or damage which could potentially result in stress corrosion cracking of the base material. Indications of cracking will be evaluated in accordance with applicable codes and plant-specific design criteria.	B2.1.26	Program enhancements for SLR will be implemented and inspections begin 10 years before the SPEO and inspections required during the 10 year interval prior to the SPEO will be completed no later than 6 months prior to the SPEO. The cathodic protection system for buried steel piping will be installed no later than 5years prior to the SPEO. Modification to abandon the buried copper alloy instrument air system piping will be implemented no later than 6 months prior to the SPEO.	SLRA, Appendix A, Table A6.0-1 (ML21158A193, ML21158A194) Supplement 2 (ML21315A012)

Item No.	Program	Commitment	AMP	Implementation	Source
		5. Perform wall thickness measurement if visual inspections identify evidence of corrosion beyond minor surface rusting for both coated and uncoated metallic piping or tanks. The results of the wall thickness measurement will be used to calculate a corrosion rate and project wall thickness through the end of the SPEO. If the depth or extent of degradation of the base metal could have resulted in a loss of pressure boundary function when the loss of material is extrapolated to the end of the SPEO, then additional inspections will be performed as follows: When measured pipe wall thickness, projected to the end of the SPEO, does not meet the minimum pipe wall thickness requirements due to external corrosion, the number of inspections within the affected piping category will be doubled or increased by five, whichever is smaller. If adverse indications are found in the expanded sample, an extent of condition and extent of cause analysis to determine the further extent of inspections. Timing of any additional inspections will be based on the severity of the identified degradation and the consequences of leakage or loss of function. Any additional inspections will be performed within the same 10-year inspection interval in which the original degradation was identified, or within four years after the end of the 10-year interval if the degradation was identified in the latter half of the 10-year interval. Expansion of sample size may be limited by the extent of piping subject to the observed degradation mechanism or if the piping system or portion of the systemis replaced or otherwise mitigated within the same 10-year inspection interval in which the original degradation was identified or within four years after the end of the 10-year interval, if the degradation was identified in the latter half of the 10-year interval. 6. Perform inspections of buried steel condenser circulating water system piping at least once every ten years. The minimum number of inspections will be determined based on the effectiveness of preventive actions in accordance with NUREG-2191, Table XI.M41-2. Ten linear feet of piping will be exposed for			

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		each inspection. Inspections of the large diameter condenser circulating water system intake piping will expose a quadrant (i.e., 9 to 12 o'clock or 12 to 3 o'clock) of the piping. External inspections of the large diameter condenser circulating water system intake piping will be supplemented by low frequency electromagnetic testing performed from the internal surface of the same section of piping that is externally inspected with follow-up ultrasonic wall thickness measurements performed of areas identified as low pointsduring low frequency electromagnetic testing. 7. Perform visual inspections of at least two ten-linear foot sections of buried stainless steel piping at least once every ten years. Piping inspection locations will be selected based on risk (i.e., susceptibility to degradation and consequences of failure). 8. Perform visual inspections of at least four ten linear foot sections of underground coated steel piping at least once every ten years. Piping inspection locations will be selected based on risk (i.e., susceptibility to degradation and consequences of failure). 9. Internal volumetric inspections of the standby shutdown facility diesel engine fuel oil tank will cover at least 25% of the surface area of the tank and include at least some of both the top and bottom of the tank. 10. Personnel performing inspections of buried coated piping and tanks will either: 1) possess an Association for Materials Protection and Performance coating inspector program level 2 or level 3 inspector qualification, 2) complete the EPRI *Comprehensive Coatings Course* and complete the EPRI *Buried Pipe Condition Assessment and Repair Training Computed Based Training Course*, or 3) be qualified as a coatings specialist in accordance with ASTM D7108. 11. If significant coating damage is identified during visual inspections, then perform an evaluation to determine if the coating damage was caused by nonconforming backfill. If it is determined that the coating damage was caused by nonconforming backfill, then conduct an extent of condition evaluation to determine the extent of			

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		degraded backfill in the vicinity of the observed damage.			
27	*Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks* program	The *Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks* AMP is a new condition monitoring program that manages degradation of internal coatings/linings exposed to raw water, treated water, treated borated water, or lubricating oil that can lead to loss of material of base metals or downstream effects such as reduction in flow, pressure, or heat transfer when coatings/ linings become debris. Industry and plant-specific OE will be considered in the development and implementation of this program.	B2.1.27	Program will be implemented no later than 10 years prior to the SPEO. Baseline inspections that may be required in the 10 year period prior to the SPEO will be completed no later than six months prior to the SPEO, or no later than the last refueling outage prior to the SPEO.	SLRA, Appendix A, Table A6.0-1 (ML21158A193, ML21158A194)
28	*ASME Section XI, Subsection IWE* program	The *ASME Section XI, Subsection IWE* AMP is an existing program that will be enhanced to: 1. The program will be enhanced to specify that for "high strength" structural bolting consisting of ASTM A325, ASTM F1852, ASTM F2280, and/or ASTM A490 bolts, the preventative actions for storage, lubrication, bolting and coating material selection, and stress corrosion cracking potential discussed in Section 2.0 of Research Council for Structural Connections publication, "*Specification for Structural Joints Using High-Strength Bolts,*" will be used. Procedures will be revised to specify that whenever replacement of bolting is required, bolting material, installation torque or tension, and use of lubricants and sealants are in accordance with the guidelines of EPRI NP-5769, "*Degradation and Failure of Bolting in Nuclear Power Plants*," EPRI TR-104213, "*Bolted Joint Maintenance & Application Guide*," and the additional recommendations of NUREG-1339, "*Resolution of Generic Safety Issue 29: Bolting Degradation of Failure in Nuclear Power Plants*." 2. Include inspection attributes for the aging mechanisms listed in NUREG-2191. For non-coated surfaces this includes evidence of cracking, discoloration, wear, pitting, excessive corrosion, arc strikes, gouges, surface discontinuities, dents, and other signs of surface irregularities including discernible liner plate bulges. For painted or coated surfaces this includes evidence of flaking, blistering, peeling, discoloration, and other signs of potential distress of the underlying metal shell or liner system, including discernible liner plate bulges.	B2.1.28	Program enhancements for SLR will be implemented no later than 6 months prior to the SPEO.	SLRA, Appendix A, Table A6.0-1 (ML21158A193, ML21158A194) Supplement 3 (ML21349A005) RAI Set 2 (ML22045A021)

Item No.	Program	Commitment	AMP	Implementation	Source
		3. Specify a one-time volumetric examination of metal liner surfaces that are inaccessible from one side if triggered by plant-specific OE. The trigger for this supplemental examination is a plant-specific occurrence or recurrence of measurable metal liner corrosion (base metal material loss exceeding 10% of nominal plate thickness) initiated on the inaccessible side or areas, identified since the date of issuance of the first renewed license. This supplemental volumetric examination consists of a sample of one-foot square locations that include both randomly-selected and focused areas most likely to experience degradation based on OE and/or other relevant considerations such as environment. The supplemental volumetric examinations for each unit will occur within two refueling outages after identifying the trigger for the examination in any unit. Any identified degradation is addressed in accordance with the applicable provisions of the ASME Section XI, Subsection IWE program. The sample size, locations, and any needed scope expansion (based on findings) for this one-time set of volumetric examinations should be determined on a plant-specific basis to demonstrate statistically with 95% confidence that 95% of the accessible portion of the containment liner is not experiencing corrosion degradation with greater than 10% loss of nominal thickness.			
29	*ASME Section XI, Subsection IWL* program	The *ASME Section XI, Subsection IWL* AMP is an existing program that will be enhanced to: 1. Incorporate monitoring for changes in material properties of increase in porosity and permeability, and loss of strength and pattern cracking with darkened edges. 2. Specify that inspection results are documented and compared to previous results to identify changes from prior inspections.	B2.1.29	Program enhancements for SLR will be implemented no later than 6 months prior to the SPEO.	SLRA, Appendix A, Table A6.0-1 (ML21158A193, ML21158A194)
30	*ASME Section XI, Subsection IWF* program	The *ASME Section XI, Subsection IWF* AMP is an existing program that will be enhanced to: 1. Perform periodic evaluations of the acceptability of inaccessible areas of supports (e.g., portions of supports encased in concrete or grout, buried underground, portions of supports covered by insultation, or	B2.1.30	Program enhancements for SLR will be implemented and a one-time inspection of an additional 5% of the sample size specified in Table IWF-2500-1 for Class 1, 2, and 3 piping supports is	SLRA, Appendix A, Table A6.0-1 (ML21158A193, ML21158A194) Supplement 2

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		encapsulatedby guard pipe), when conditions exist in accessible areas that could indicate the presence of, or result in, degradation to inaccessible areas of supports. Perform these evaluations once every ten years during the SPEO. 2. Procedures will be revised to specify that for structural bolting consisting of ASTM A325, ASTM F1852, ASTM F2280, and/or ASTM A490, the preventive actions for storage, lubricants, bolting and coating material selection, and stress corrosion cracking potential discussed in Section 2 of RCSC (Research Council for Structural Connections) publication, "*Specification for Structural Joints Using High-Strength Bolts*," will beused. (Element 2) 3. Procedures will be revised to specify that whenever replacement of bolting is required, bolting material, installation torque or tension, and use of lubricants and sealants will be in accordance with the guidelines of EPRI NP-5769, EPRI TR-104213, and the additional recommendations of NUREG-1339. 4. Perform a one-time inspection within five years prior to entering the SPEO of an additional 5% of the sample populations for Class 1, 2, and 3 piping supports. The additional supports will be selected from the remaining population of IWF piping supports and will include components that are most susceptible to age-related degradation. 5. Procedures will be revised to specify that, for NSSS component supports, high strength bolting greater than one inch nominal diameter, volumetric examination comparable to that of ASME Code, Section XI, Table IWB-2500-1, Examination Category B-G-1 will be performed to detect cracking in addition to VT-3 examination. In each 10 year period during the SPEO, a representative sample of bolts will be inspected. The sample of high strength bolting greater than one inch nominal diameter subject to volumetric examination will consist of 20 percent of the population or a maximum of 17 bolts per unit. The sample shall include the bolting that is most susceptible to age-related degradation (i.e.,		conducted within 5 years prior to the SPEO, and is to be completed prior to the SPEO. Other enhancements are completed 6 months prior to the SPEO or no later than the last refueling outage prior to the SPEO.	(ML21315A012) RAI Set 2 (ML22045A021) Supplement 3 (ML21349A005)

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		based on time in service, aggressive environment, etc.). 6. If a component does not exceed the acceptance standards of IWF-3400 but is repaired to as-new condition, the sample is increased or modified to include another support that is representative of the remaining population of supports that were not repaired. 7. Revise the fleet work planning procedure to specifically prohibit the use of products containing molybdenum disulfide (MoS2) and other lubricants containing sulfur that could contribute to SCC as bolting thread lubricants.			
31	*10 CFR Part 50, Appendix J* program	The existing *10 CFR Part 50, Appendix J* program is credited.	B2.1.31	Ongoing	SLRA, Appendix A, Table A6.0-1 (ML21158A193, ML21158A194)
32	*Masonry Walls* program	The *Masonry Walls* AMP is an existing program that will be enhanced to: 1. Update the parameters monitored to identify potential shrinkage and/or separation of masonry walls and include loss of material in addition to the currently managed cracking at joints. 2. Perform periodic visual inspections of a representative sample of approximately four percent, or 225 square feet, whichever is less, of exterior masonry walls that are covered by metal siding, on a five year frequency, to look for loss of material, cracking, or other signs of degradation. While siding panels are infrequently removed for maintenance activities, opportunistic visual inspections can be counted in this sample.	B2.1.32	Program enhancements for SLR will be implemented no later than 6 months prior to the SPEO.	SLRA, Appendix A, Table A6.0-1 (ML21158A193, ML21158A194) Supplement 3 (ML21349A005)
33	*Structures Monitoring* program	The *Structures Monitoring* AMP is an existing program that will be enhanced to: 1. Add the following structures to the scope of the program: a. Site Assembly Siren Equipment House b. Technical Support Building Cable Vault c. 100 kV Structure d. Protected Service Water Building e. Protected Service Water Duct Banks f. Borated Water Storage Tank Superstructure g. HP Office Building h. Administration Building	B2.1.33	Program enhancements for SLR will be implemented no later than 6 months prior to the SPEO.	SLRA, Appendix A, Table A6.0-1 (ML21158A193, ML21158A194) Supplement 3 (ML21349A005) RAI Set 2 (ML22045A021)

Item No.	Program	Commitment	AMP	Implementation	Source
		i. Keowee Beaker Vault 2. Procedures will be revised to specify that structural components inspected include piping supports, line supports, structural bolting, anchor bolts and embedments, supports and bracings associated with masonry walls, pipe whip restraints and jet impingement shields, transmission towers, panels and other enclosures, racks, sliding surfaces, sump and pool liners, wear plates, electrical cable trays and conduits, tube tracks, electrical duct banks, manholes, louvers, aluminum components, liners, sump, drains/curbs, piles, unit vent, lead shield supports, doors, penetration seals, polymeric materials (plexiglass covers), and other elastomeric materials. 3. Expand the monitoring and evaluation of raw water and ground water chemistry, for pH, chlorides, and sulfates, on a frequency not to exceed five years that accounts for seasonal variations (e.g., quarterly monitoring every fifth year), from locations that are representative of the groundwater in contact with structures within the scope of SLR. 4. For structural bolting consisting of ASTM A325, ASTM F1852, ASTM F2280, and/or ASTM A490, provide guidance for storage, lubricants, bolting and coating material selection, and the steps to minimize stress corrosion cracking potential discussed in Section 2 of RCSC (Research Council for Structural Connections) publication, "*Specification for Structural Joints Using High-Strength Bolts.*" 5. Provide guidance so that when replacement bolting is required, bolting material, installation torque or tension, and use of lubricants and sealants will be in accordance with the guidelines of EPRI NP-5769, EPRI TR-104213, and the additional recommendations of NUREG-1339. 6. Provide guidance for proper specification of new high strength bolting material and lubricant to prevent or mitigate degradation and failure of structural bolting in accordance with the guidelines of EPRI NP-5769, EPRITR-104213, and the additional recommendations of NUREG-1339. 7. Expand the program to include details regarding inspection and evaluation for steel liners.			Annual Update and Supplement 4 (ML22158A028)

Item No.	Program	Commitment	AMP	Implementation	Source
		8. Provide inspection and evaluation criteria for structural concrete using quantitative second tier criteria of Chapter 5 in ACI 349.3R. The program will be enhanced to explicitly mention the changes in material properties of increase in porosity and permeability, and loss of strength and patterncracking with darkened edges. 9. Develop a new implementing procedure or revise an existing implementing procedure to address aging management of inaccessible areas exposed to potentially aggressive groundwater/soil environment that will includethe following: a. Monitor raw water and ground water chemistry, for pH,chlorides, and sulfates, on a frequency not to exceed five years that accounts for seasonal variations (e.g., quarterly monitoring every fifth year), from locations that are representative of the groundwater in contact with structures within the scope of SLR. b. Enter adverse results, which exceed water chemistry criteria, into the corrective action program. As part of the corrective actions, if aggressive groundwater is identified that might affect structures in scope for SLR, perform additional water testing at additional locations and perform soil testing in order to confirm the extent, severity, and potential aging mechanisms resulting from the aggressive groundwater/soil. c. Develop engineering evaluations to evaluate the waterchemistry results to assess the impact, if any, on below-grade concrete, including the potential for further degradation due to the aggressive groundwater,as well as consideration of current conditions. As part of the engineering evaluations, determine if additional actions are warranted, which might include enhanced inspection techniques and/or increased frequency, destructive testing, and focused inspections of representative accessible (leading indicator) or below grade, inaccessible concrete structural elements exposed to aggressive groundwater/soil.			

Item No.	Program	Commitment	AMP	Implementation	Source
		d. Develop the initial engineering evaluations prior to the SPEO. Develop follow-up engineering evaluations on an interval not to exceed five years. e. If aggressive groundwater or soil is identified, at a minimum, perform focused inspections of representative, accessible (leading indicator) structural elements, or if accessible areas will not be leading indicators for the potential aging mechanisms, excavate and inspect buried concrete elements exposed to aggressive groundwater/soil. f. If degraded concrete is identified, as part of the focused inspections of leading indicators (representative, accessible or exposed inaccessible concrete), enter adverse results that exceed ACI 349.3R second tier criteria into the corrective action program, and expose inaccessible concrete so that theextent of the condition can be determined, baseline conditions documented, and additional actions identified such as repairs, new preventative actions, additional evaluations, and future inspections. 10. Monitor and trend through-wall groundwater leakage, infiltration volumes, and leakage water chemistry for signs of concrete or steel reinforcement degradation. Develop additional engineering evaluations, which consider more frequent inspections, as well as destructive testing of affected concrete to validate existing concrete properties, and leakage water chemistry results. If leakage volumes allow, consider water chemistry analysis of the leakage pH, along with mineral, chloride, sulfate and iron content in thewater. 11. Expand the program to monitor accessible sliding surfaces for indications of significant loss of material due to wear or corrosion, and for accumulation of debris or dirt. Establish acceptance criteria for sliding surfaces as no significant loss of material due to wear or corrosion, and no debris or dirt that could restrict or prevent sliding of the surfaces, as required by design. 12. Expand the program to monitor elastomeric vibration isolators and bearing pads, structural sealants, and			

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		seismic joint fillers for cracking, loss of material, and hardening. Supplement visual inspection of elastomeric elements with tactile inspection to detect hardening, if the intended function is suspect. Establish acceptance criteria,for elastomeric pads and vibration isolation elements, as no loss of material, cracking, or hardening that can lead to reduction or loss of isolation or support function. Establish acceptance criteria for structural sealants, and seismic joint fillers, as no loss of material, cracking, or hardening that can lead to loss of sealing and resulting leakage that could lead to a loss of intended function. 13. Require that personnel performing inspections and evaluations meet the qualifications specified within ACI 349.3R with respect to knowledge of inservice inspection of concrete and visual acuity requirements. 14. Perform inspections under the enhanced program in order to establish quantitative baseline inspection data to a sufficient detail to allow for trending, prior to the SPEO. 15. Revise inspection procedures to base inspection acceptance criteria on quantitative requirements derived from industry codes and standards, including but not limited to ACI 349.3R, ACI 318, SEI/ASCE 11, or the relevant AISC specifications and consider industry and plant OE. Use justified quantitative acceptance criteria whenever applicable. 16. Provide evaluation criteria for structural concrete using quantitative second tier criteria of Chapter 5 in ACI 349.3R. Base the acceptance criteria for concrete surfaces on the "second-tier" evaluation criteria provided in Chapter 5 of ACI 349.3R. 17. Clarify that loose bolts and nuts are not acceptable unless accepted by engineering evaluation. 18. Inspection results that do not meet the acceptance criteria are entered into the corrective action program and are evaluated by engineering. Conditions that are not repaired are projected to the next scheduled inspection to ensure that the component will continue to perform its' intended function. If inspection results			

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		cannot be projected to the next scheduled inspection, then the inspection frequency is adjusted to ensure that a loss of the component's intended function does not occur prior to the next scheduled inspection. 19. Expand the program to monitor stainless steel components for indications of significant loss of material and cracking through visual inspections. Establish acceptance criteria for stainless steel components as no significant loss of material or cracking that could result in a loss of intended function, as required by design. 20. Remove statements in the current station procedures that allow for potential to extend inspections to a 10-year frequency based on adequate justification. 21. Revise station Structures Monitoring procedures to explicitly state that more frequent inspections may be needed based on evaluation of observed degradation. 22. Revise program procedures to specify that evaluation of inspection results includes consideration of the acceptability of inaccessible areas when conditions exist in accessible areas that could indicate the presence of, or result in, degradation to such inaccessible areas (e.g., exposed to groundwater/soil environment, structural components covered by metal siding). 23. Opportunistic engineering inspections should be performed on structural elements covered by metal siding when portions are exposed for any reason (e.g., maintenance activities, modification, etc.). 24. Enhance procedures to include structural steel bracing and edge supports associated with masonry walls are inspected for deflection or distortion, loose bolts, and loss of material due to corrosion. 25. Expand the program to monitor polymeric materials for cracking or blistering, loss of material, and loss of strength. Establish acceptance criteria for polymeric material as no loss of material, cracking or blistering, and loss of strength that can lead to reduction or loss of function.			
34	*Inspection of Water Control Structures*	The *Inspection of Water Control Structures Associated With Nuclear Power Plants* AMP is an existing program that will be enhanced to:	B2.1.34	Program enhancements for SLR will be implemented no later than 6 months prior to the SPEO.	SLRA, Appendix A, Table A6.0-1

Item No.	Program	Commitment	AMP	Implementation	Source
	Associated With Nuclear Power Plants program	1. Provide guidance for structural bolting consisting of ASTM A325, ASTM F1852, and/or ASTM A490, for storage, lubricants, bolting and coating material selection and the steps to minimize stress corrosion cracking potential discussed in Section 2 of RCSC (Research Council for Structural Connections) publication, *"Specification for Structural Joints Using High-Strength Bolts"*. 2. Provide guidance so that when replacement bolting is required, bolting and coating material, installation torque or tension, and use of lubricants and sealants will be in accordance with the guidelines of EPRI NP-5769, EPRI TR-104213, and the additional recommendations of NUREG-1339. 3. Provide guidance for proper specification of new high strength bolting and coating material and lubricant to prevent or mitigate degradation and failure of structural bolting in accordance with the guidelines of EPRI NP-5769, EPRITR-104213, and the additional recommendations of NUREG-1339. 4. Provide inspection and evaluation criteria for structural concrete using quantitative second tier criteria of Chapter 5 in ACI 349.3R. The program will be enhanced to incorporate monitoring for movements (e.g., settlement, heaving, and deflection), conditions at junctions with abutments and embankments, pattern cracking with darkened edges, the changes in material properties of increase in porosity and permeability, and loss of strength. 5. Expand the program to monitor accessible sliding surfaces for indications of significant loss of material due to wear or corrosion, and for accumulation of debris or dirt. Establish acceptance criteria for sliding surfaces as no significant loss of material due to wear or corrosion, and no debris or dirt that could restrict or prevent sliding of the surfaces, asrequired by design. 6. Require that personnel performing inspections and evaluations meet the qualifications specified within ACI 349.3R with respect to knowledge of inservice inspection of concrete and visual acuity requirements.			(ML21158A193, ML21158A194) RCI Set 1 (ML21336A001) Supplement 3 (ML21349A005)

Item No.	Program	Commitment	AMP	Implementation	Source
		7. Create provisions for special inspections immediately following the occurrence of significant natural phenomena, such as large floods, earthquakes, hurricanes, tornadoes,or intense local rainfalls. 8. Require the evaluation of raw water and groundwater chemistry that is sampled from a location that is representative of the water in contact with structures withinthe scope of SLR by the responsible engineer. This will be done on an interval not to exceed five years and account for seasonal variations (e.g., quarterly monitoring every fifth year). 9. Develop a new implementing procedure or revise an existing implementing procedure to enhance the aging management of inaccessible areas exposed to potentially aggressive groundwater/soil environment that will include the following: a. Monitor raw water and ground water chemistry, for pH, chlorides, and sulfates, on a frequency not to exceed five years that accounts for seasonal variations (e.g., quarterly monitoring every fifth year), from locations that are representative of the groundwater in contact with structures within the scope of SLR. b. Enter adverse results, which exceed water chemistry criteria, into the corrective action program. As part of the corrective actions, if aggressive groundwater is identified that might affect structures in scope for SLR, perform additional water testing at additional locations and perform soil testing in order to confirm the extent,severity, and potential aging mechanisms resulting from the aggressive groundwater/soil. c. Develop engineering evaluations to evaluate the water chemistry results to assess the impact, if any, on below-grade concrete, including the potential for further degradation due to the aggressive groundwater, as well as consideration of current conditions. As part of the engineering evaluations, determine if additional actions are warranted, which might include enhanced			

Item No.	Program	Commitment	AMP	Implementation	Source
		inspection techniques and/or increased frequency, destructive testing, and focused inspections of representative accessible (leading indicator) or below grade, inaccessible concrete structural elements exposed to aggressive groundwater/soil. d. Develop the initial engineering evaluations prior to the SPEO. Develop follow-up engineering evaluations on an interval not to exceed five years. e. If aggressive groundwater and soil is identified, at a minimum, perform focused inspections of representative, accessible (leading indicator) structural elements, or if accessible areas will not be leading indicators for the potential aging mechanisms, excavate and inspect buried concrete elements exposed to aggressive groundwater/soil. f. If degraded concrete is identified, as part of the focused inspections of leading indicators (representative, accessible or exposed inaccessible concrete), enter adverse results that exceed ACI 349.3R second tier criteria into the corrective action program, and expose inaccessible concrete so that the extent of the condition can be determined, baseline conditions documented, and additional actions identified such as repairs, new preventative actions, additional evaluations, and future inspections. 10. Monitor and trend through-wall groundwater leakage, infiltration volumes, and leakage water chemistry for signs of concrete or steel reinforcement degradation. Develop additional engineering evaluations, which consider more frequent inspections, as well as destructive testing of affected concrete to validate existing concrete properties, and leakage water chemistry results. If leakage volumes allow, consider water chemistry analysis of the leakage pH,along with mineral, chloride, sulfate and iron content in the water. 11. Perform inspections under the enhanced program in			

Item No.	Program	Commitment	AMP	Implementation	Source
		order to establish quantitative baseline inspection data to a sufficient detail to allow for trending, prior to the SPEO. 12. Provide evaluation criteria for structural concrete using quantitative second tier criteria of Chapter 5 in ACI 349.3R. Base the acceptance criteria for concrete surfaces on the "second-tier" evaluation criteria provided in Chapter 5 of ACI 349.3R. 13. Clarify that loose bolts and nuts are not acceptable unless accepted by engineering evaluation. 14. Degradation of sheet piles is accepted by engineering evaluation or subject to corrective actions. 15. Revise inspection procedures to base inspection acceptance criteria on quantitative requirements derived from industry codes and standards, including but not limited to ACI 349.3R, ACI 318, SEI/ASCE 11, or the relevant AISC specifications and consider industry and plant OE. Use justified quantitative acceptance criteria whenever applicable.			
35	*Protective Coating Monitoring and Maintenance* program	The *Protective Coating Monitoring and Maintenance* AMP is an existing program that will be enhanced to: 1. Revise procedures to explicitly state peeling and physical damage are considered in the condition assessment. 2. Revise procedures to reference ASTM D-5163-08.	B2.1.35	Program enhancements for SLR will be implemented no later than 6 months prior to the SPEO.	SLRA, Appendix A, Table A6.0-1 (ML21158A193, ML21158A194)
36	*Electrical Insulation for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements* program	The *Electrical Insulation for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements* AMP is an existing program that will be enhanced to: 1. As part of the periodic inspections, add review of previously identified and mitigated adverse localized environments' cumulative aging effects applicable to in-scope cable and connection insulation to confirm that the insulation's intended functions continue to be supported during the SPEO. 2. Add a description of potential testing and its sampling: If testing is evaluated to be necessary after visual inspections identify degraded or damaged conditions (e.g., unacceptable surface anomalies) that may adversely affect the performance of cable or	B2.1.36	Program enhancements for SLR will be implemented no later than 6 months prior to the SPEO, or no later than the last refueling outage prior to the SPEO.	SLRA, Appendix A, Table A6.0-1 (ML21158A193, ML21158A194)

Item No.	Program	Commitment	AMP	Implementation	Source
		connection insulation intended functions, then proven test(s) applicable to condition monitoring of the insulation are performed (e.g., thermography may be included). For a large number of cables identified as degraded, a sample population will be tested. The sample size will be 20 percent of each affected cable and connection type with a maximum sample size of 25. Among the factors to consider for developing the test sample population are cable or connection type, environment, voltage level, circuit loading, and insulation material which is the most important factor per EPRI guidance. Testing as part of an existing maintenance, calibration, or surveillance program may be credited. The basis for the sample selection will be documented. 3. Add acceptance criteria for potential testing of accessible cables and connections with unacceptable visual inspection results to the Oconee AMP description: Test results are to be within the acceptance criteria, as identified in the Oconee procedures.			
37	*Electrical Insulation for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification (EQ) Requirements Used in Instrumentation Circuits* program	The *Electrical Insulation for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification (EQ) Requirements Used in Instrumentation Circuits* AMP is a new program that will manage the effects of reduced insulation resistance of non-EQ cable and connection insulation in instrumentation circuits with sensitive, high voltage, low level current signals and that are subjected to adverse localized environments caused by temperature, radiation, or moisture. The program evaluates electrical insulation material for cables and connections subjected to an adverse localized environment at least once every 10 years. The AMP will apply to the in-scope non-EQ portions of circuits in the area radiation monitoring system (e.g., high range containment area radiation monitors) and the neutron flux monitoring nuclear instrumentation system. Industry and plant-specific OE will be considered in the development and implementation of the program.	B2.1.37	Program for SLR will be implemented 6 months prior to the SPEO, or no later than the last refueling outage prior to the SPEO.	SLRA, Appendix A, Table A6.0-1 (ML21158A193, ML21158A194)
38	*Electrical Insulation for*	The *Electrical Insulation for Inaccessible Medium-Voltage Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification*	B2.1.38	Program enhancements for SLR will be implemented no later than	SLRA, Appendix A, Table A6.0-1

Item No.	Program	Commitment	AMP	Implementation	Source
	Inaccessible Medium-Voltage Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program	*Requirements* AMP is an existing program that will be enhanced to: 1. Add inspections for water accumulation performed after event-driven occurrences, such as heavy rain, rapid thawing of heavy ice and snow, or flooding. 2. For the periodic water accumulation inspections, add documented verification that either automatic or passive drainage systems or manual pumping are effective in preventing medium-voltage cable exposure to significant moisture. 3. Remove from program descriptions the original 'significant voltage' portion of exposures to determine the inaccessible medium-voltage cables for testing. 4. Revise the inaccessible medium-voltage cable testing and water accumulation inspection matrix to include inspection methods, test methods, and acceptance criteria.		6 months prior to the SPEO, or no later than the last refueling outage prior to the SPEO.	(ML21158A193, ML21158A194)
39	*Electrical Insulation for Inaccessible Instrument and Control Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements* program	The *Electrical Insulation for Inaccessible Instrument and Control Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements* AMP is a new condition monitoring program that will manage the aging effect of reduced electrical insulation resistance due to exposure to significant moisture. The program will apply to the electrical insulation for inaccessible (e.g., installed underground in buried conduits, cable trenches, cable troughs, duct banks, vaults, manholes, or direct buried), non-EQ in-scope instrument and control cables and splices that are exposed to significant moisture. Industry and plant-specific OE will be considered in the development of this program.	B2.1.39	Program will be implemented 6 months prior to the SPEO, or no later than the last refueling outage prior to the SPEO.	SLRA, Appendix A, Table A6.0-1 (ML21158A193, ML21158A194)
40	*Electrical Insulation for Inaccessible Low-Voltage Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification*	The *Electrical Insulation for Inaccessible Low-Voltage Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements* AMP is a new condition monitoring program that will manage the aging effects of reduced electrical insulation resistance due to exposure to significant moisture. The program will apply to the electrical insulation for inaccessible (e.g., installed underground in buried conduits, cable trenches, cable troughs, duct banks, vaults, manholes, ordirect buried), non-EQ in-scope low voltage power cables (operating voltage less than 2	B2.1.40	Program will be implemented 6 months prior to the SPEO, or no later than the last refueling outage prior to the SPEO.	SLRA, Appendix A, Table A6.0-1 (ML21158A193, ML21158A194)

Item No.	Program	Commitment	AMP	Implementation	Source
	Requirements program	kV), exposed to significant moisture. Industry and plant-specific OE will be evaluated in the development of this program.			
41	*Metal Enclosed Bus* program	The *Metal Enclosed Bus* AMP is a new condition monitoring program that uses inspections and sampling and will manage the identified aging effects of in-scope metal enclosed bus. Industry and plant-specific OE will be considered in the development and implementation of this program.	B2.1.41	The program will be implemented no later than 6 months prior to the SPEO. Initial inspections and resistance measurements will be performed no later than 6 months prior to the SPEO, or no later than the last refueling outage prior to the SPEO.	SLRA, Appendix A, Table A6.0-1 (ML21158A193, ML21158A194)
42	*Fuse Holders* program	The *Fuse Holders* AMP is a new condition monitoring program that will manage susceptibility to the following aging effects: increased resistance of connection due to chemical contamination, corrosion, and oxidation or fatigue caused by ohmic heating, thermal cycling, electrical transients, frequent removal and replacement, or vibration. The program also manages degradation of electrical insulation for the fuse holders with metallic clamps susceptible to the aging effects identified. Industry and plant-specific OE will be considered in the development and implementation of this program.	B2.1.42	The program for SLR will be implemented no later than 6 months prior to the SPEO, or no later than the last refuelingoutage prior to the SPEO.	SLRA, Appendix A, Table A6.0-1 (ML21158A193, ML21158A194)
43	*Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements* program	The *Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements* program is a new condition monitoring program that will manage aging effects by testing a representative sample of electrical connectors prior to the SPEO. The results will be evaluated to determine if there is a need for subsequent periodic testing on a 10-year frequency. Industry and plant-specific OE will be considered in the development and implementation of this program.	B2.1.43	The program for SLR will be implemented and testing of a representative sample of electrical connectors completed, no later than 6 months prior to the SPEO, or no later than the last refueling outage prior to the SPEO.	SLRA, Appendix A, Table A6.0-1 (ML21158A193, ML21158A194)
44	*Fatigue Monitoring* program	The *Fatigue Monitoring* AMP is an existing program that will be enhanced to: 1. Require monitoring and tracking of transient cycles associated with the ASME Code, Section XI, Appendix L analysis be performed between the inspections for each ASME Code, Section XI, Appendix L locations. Consistent with existing program cycle counting, a surveillance limit will be established to initiate corrective action prior to exceeding transient cycle assumptions in the ASME Code,Section XI, Appendix L analysis.	B3.1	Program enhancements for SLR will be implemented no later than six months prior tothe SPEO.	SLRA, Appendix A, Table A6.0-1 (ML21158A193, ML21158A194)

Item No.	Program	Commitment	AMP	Implementation	Source
		2. Require periodic validation of chemistry parameters used to determine F_{en} factors used. 3. Expand existing corrective action guidance associated with exceeding a cycle counting surveillance limit to recommend consideration of component repair, component replacement, performance of a more rigorous analysis, performance of an ASME Code, Section XI, Appendix L flaw tolerance analysis, or scope expansion to consider other locations with the highest expected CUF_{en} values.			
45	*Neutron Fluence Monitoring* program	The existing *Neutron Fluence Monitoring* program is credited.	B3.2	Ongoing	SLRA, Appendix A, Table A6.0-1 (ML21158A193, ML21158A194)
46	*Environmental Qualification of Electric Equipment* program	The *Environmental Qualification of Electric Equipment* AMP is an existing program that will be enhanced to: 1. Add activities to perform visual inspections of accessible, passive EQ electric equipment located in adverse localized environments at least once every 10 years. 2. Establish acceptance criteria for the visual inspection of accessible passive EQ electric equipment located in adverse localized environments.	B3.3	Program enhancements for SLR will be implemented no later than 6 months prior to the SPEO, or no later than the last refueling outage prior to the SPEO.	SLRA, Appendix A, Table A6.0-1 (ML21158A193, ML21158A194)
47	*Concrete Containment Unbonded Tendon Prestress* program	The existing *Concrete Containment Unbonded Tendon Prestress* program is credited.	B3.4	Ongoing	SLRA, Appendix A, Table A6.0-1 (ML21158A193, ML21158A194)
48	*Secondary Shield Wall Tendon Surveillance* program	The *Secondary Shield Wall Tendon Surveillance* AMP is an existing program that will be enhanced to: 1. Perform lift-off testing on each of the three units on three (3) horizontal, one (1) diagonal, and one (1) vertical tendon, pulled from one end, every second refueling outage, i.e., every 48 months. 2. Enhance station procedures to include a review of previous visual inspection and lift-off data results for the tendons selected for inspection. Revise station procedures to use the tendon lift-off data to trend the prestressing forces and to project tendon prestress	B4.1	Program enhancements for SLR will be implemented no later than 6 months prior to the SPEO, or no later than the last refueling outage prior to the SPEO.	SLRA, Appendix A, Table A6.0-1 (ML21158A193, ML21158A194) RAI Set 2 (ML22045A021) RAI Round 2 (ML22110A207)

Item No.	Program	Commitment	AMP	Implementation	Source
		losses through the next two operating cycles, i.e., every 48 months. 3. Perform a visual inspection on both ends of the tendons selected for lift-off testing every other refueling outage, i.e., 48 months, during the same outage as the lift off tests. 4. Perform visual inspections on tendon caps and stressing hardware on both ends of the following randomly selected tendons; one (1) upper horizontal, (1) middle horizontal, (1) lower horizontal, (1) diagonal, and (1) vertical, per unit, every second refueling outage, i.e., every 48 months, occurring on alternate outages from the lift-off tests.			

APPENDIX B

CHRONOLOGY

B. Chronology

This appendix lists chronologically the routine licensing correspondence between the staff of the U.S. Nuclear Regulatory Commission (NRC or the staff) and Duke Energy Carolinas, LLC (Duke Energy or the applicant). This appendix also lists other correspondence under Oconee Nuclear Station, Units 1, 2, and 3 (ONS or Oconee) Docket Nos. 50-269, 50-270 and 50-287 related to the staff's review of the ONS subsequent license renewal application (SLRA). These documents may be obtained online in the NRC's Agencywide Documents Access and Management System (ADAMS) Public Documents collection at https://www.nrc.gov/reading-rm/adams.html. To begin the search, select "Begin Web-based ADAMS Search." For problems with ADAMS, please contact the NRC's Public Document Room (PDR) reference staff at 1-800-397-4209, 301-415-4737, or by e-mail to pdr.resource@nrc.gov.

Table B-1. Chronology

Date	Accession No.	Subject
6/07/2021	ML21158A193 (Package)	Oconee Nuclear Station, Units 1, 2, and 3, Application for Subsequent Renewed Operating Licenses
6/22/2021	ML21167A039 (Package)	Oconee SLRA - Receipt and Availability Letter (86 FR 33784)
7/22/2021	ML21194A231 (Package)	Oconee SLRA - Acceptance and Opportunity for Hearing - Letter and FRN (86 FR 40662)
7/22/2021	ML21189A139	Oconee SLRA - Portal Letter
7/23/2021	ML21196A076	Oconee Nuclear Station, Units 1, 2, and 3 - Aging Management Audit Plan regarding the Subsequent License Renewal Application Review
9/21/2021 - 9/28/2021	ML21271A586 (Package)	Oconee SLRA - RAI B2.1.27-1
10/22/2021	ML21295A035	Oconee Nuclear Station (ONS), Units 1, 2, and 3, Subsequent License Renewal Application, Response to NRC Request for Additional Information B2.1.27-1
10/28/2021	ML21302A208	Oconee Nuclear Station, Units 1, 2, and 3, Subsequent License Renewal Application Supplement 1
11/04/2021	ML21313A232 (Package)	Oconee SLRA - Requests for Confirmation of Information - Set 1
11/11/2021	ML21315A012	Oconee Nuclear Station (ONS), Units 1, 2, and 3 - Subsequent License Renewal Application Supplement 2
11/23/2021	ML21327A277 (Package)	Oconee SLRA - Requests for Additional Information (Set #1) + 2nd Round RAI B2.1.27-1a
11/23/2021	ML21330A017 (Package)	Oconee SLRA - Requests for Confirmation of Information - Set 2
12/2/2021	ML21336A001	Oconee Nuclear Station (ONS), Units 1, 2, and 3 - Subsequent License Renewal Application Response to NRC Requests for Confirmation of Information - Set 1
12/15/2021	ML21349A005	Oconee Nuclear Station, Units 1, 2, and 3, Subsequent License Renewal Application Supplement 3
12/17/2021	ML21351A000	Oconee Nuclear Station (ONS), Units 1, 2, and 3 - Response to NRC Requests for Confirmation of Information - Set 2

Date	Accession No.	Subject
1/05/2022	ML22010A059 (Package)	Oconee SLRA - Requests for Confirmation of Information - Set 3
1/07/2022	ML22010A129	Oconee Nuclear Station, Units 1, 2, and 3, Subsequent License Renewal Application Responses to NRC Request for Additional Information Set 1 and Second Round Request for Additional Information B2.1.27-1a
1/11/2022	ML22012A039 (Package)	Oconee SLRA - Request for Additional Information - Set #2
1/18/2022	ML22019A098 (Package)	Oconee SLRA - Requests for Additional Information - Set #3
1/19/2022 – 1/21/2022	ML22024A002 (Package)	Oconee SLRA - Audit Report - Audit Questions Transmitted to Duke Energy
1/21/2022	ML22021A000	Oconee Nuclear Station (ONS), Units 1, 2, and 3: Subsequent License Renewal Application - Response to NRC Requests for Confirmation of Information - Set 3
1/31/2022	ML22035A189	Email from NRC (Angela Wu) to Duke (Paul Guill) - Oconee SLRA - Request for Public Meeting
2/14/2022	ML22045A053	Oconee SLRA – Audit Report [REPORT FOR THE AGING MANAGEMENT AUDIT REGARDING THE SUBSEQUENT LICENSE RENEWAL APPLICATION REVIEW (EPID NO. L-2021-SLR-0000)]
2/14/2021	ML22045A021	Oconee Nuclear Station (ONS), Units 1, 2, and 3, Responses to NRC Request for Additional Information Set 2
2/17/2022	ML22063A114	Duke Presentation for Public Meeting on February 17, 2022
2/21/2022	ML22052A002	Oconee Nuclear Station (ONS), Units 1, 2, and 3 - Subsequent License Renewal Application: Responses to NRC Request for Additional Information Set 3
2/23/2022	ML22063A115	Email from Duke to NRC - Follow Up Item from February 17, 2022 Public Meeting
3/07/2022 - 4/05/2022	ML22075A196 (Package)	Oconee SLRA - Summary of March 7, 2022 Public Meeting
3/08/2022	ML22069A000 (Package)	Oconee SLRA - Requests for Confirmation of Information - Set #4
3/08/2022	ML22063A116	Oconee SLRA - Summary of Public Meeting dated February 17, 2022
3/11/2022	ML22074A002	Email from Duke to NRC - Follow-up Item from March 7, 2022 Public Meeting - SSW Tendon AMP
3/11/2022	ML22024A139	Oconee SLRA [REQUEST FOR WITHHOLDING INFORMATION FROM PUBLIC DISCLOSURE REGARDING THE SUBSEQUENT LICENSE RENEWAL APPLICATION (EPID NO. L-2021- SLR-0000)]
3/16/2022	ML22080A074 (Package)	Oconee SLRA - RAI Set #4 (2nd Round RAIs)
3/21/2022	ML22081A003 (Package)	Oconee SLRA - 2nd Round RAI B4.1-3
3/22/2022	ML22081A027	Oconee Nuclear Station, Units 1, 2, and 3, Subsequent License Renewal Application - Responses to NRC Requests for Confirmation of Information - Set 4

Date	Accession No.	Subject
3/29/2022	ML22091A088 (Package)	Oconee SLRA - 2nd Round RAI 4.6.1-1a
3/31/2022	ML22090A046	Oconee Nuclear Station, Units 1, 2, and 3 - Subsequent License Renewal Application, Follow-up Request for Additional Information Set 2 and 3 Updates
4/04/2022	ML22084A614	Oconee SLRA - Summary of March 16, 2022 (Closed Public Meeting)
4/11/2022	ML22094A190	Oconee Nuclear Station, Units 1, 2, and 3 Schedule Revision for the Subsequent License Renewal Application Review
4/20/2022	ML22110A207	Oconee Nuclear Station (ONS), Units 1, 2, and 3 - Subsequent License Renewal Application, Response to ONS SLRA 2nd Round RAI B4.1-3
4/22/2022	ML22112A006 ML22112A007	Oconee SLRA - Final RCI 3.5.2.2.2.6-L Email from Marieliz Johnson (NRC) to Steve Snider (Duke) - Oconee SLRA - Request for Confirmation of Information 3.5.2.2.2.6-L
4/22/2022	ML22112A016	Oconee Nuclear Station (ONS), Units 1, 2, and 3 - Subsequent License Renewal Application Responses to NRC Request for Additional Information Set 4
4/27/2022	ML22122A129 (Package)	Oconee SLRA - 2nd Round Requests for Additional Information (FE 3.5.2.2.2.6 - Irradiation Structural)
4/28/2022	ML22122A016 (Package)	Oconee SLRA - 2nd Round Request for Additional Information B2.1.9-2a
5/03/2022	ML22124A142 (Package)	Oconee SLRA - 2nd Round Request for Additional Information B2.1.7-4a
5/02/2022	ML22111A314	Oconee Nuclear Station, Units 1, 2, and 3 Limited Aging Management Audit Plan Regarding the Subsequent License Renewal Application Review (EPID NO. L-2021-SLR-0000)
5/11/2022	ML22131A023	Oconee Nuclear Station (ONS), Units 1, 2, and 3 - Subsequent License Renewal Application Response to NRC Requests for Confirmation of Information - RAI 3.5.2.2.2.6-L
4/25/2022 – 5/04/2022	ML22130A003 (Package)	Oconee SLRA - Summary of April 28, 2022 Public Meeting
5/20/2022	ML22140A016	Oconee Nuclear Station (ONS), Units 1, 2, and 3 - Subsequent License Renewal Application Response to ONS SLRA Second Round RAI 4.6.1-1a
5/27/2022	ML22147A001	Oconee Nuclear Station, Units 1, 2, and 3, Subsequent License Renewal Application Response to ONS SLRA Request for Additional Information (RAI) 3.1.2-1
6/01/2022	ML22157A001	Email from NRC (Angela Wu) to Duke (Paul Guill) - Oconee SLRA - Additional NRC Comments on RAI 4.6.1-1a
6/01/2022	ML22154A200 (Package)	Oconee SLRA - 2nd Round RAI B2.1.7-4b
6/07/2022	ML22158A028	Oconee, Units 1, 2, and 3, Subsequent License Renewal Application First Annual Amendment To The License Renewal Application And Subsequent License Renewal Application Supplement 4

Date	Accession No.	Subject
6/08/2022	ML22159A151	Oconee Nuclear Station (ONS), Units 1, 2, and 3 - Subsequent License Renewal Application - Response to ONS SLRA Second Round RAI B2.1.9-2a
7/08/2022	ML22189A010	Oconee Nuclear Station, Units 1, 2, and 3, Subsequent License Renewal Application Response to ONS SLRA Second Round RAI B2.1.7-4b
6/28/2022 - 7/18/2022	ML22192A062 (Package)	Oconee SLRA - Summary of June 30, 2022 Public Meeting
7/25/2022	ML22206A007	Oconee Nuclear Station (ONS), Units 1, 2, and 3 - Subsequent License Renewal Application: Responses to ONS SLRA - Second Round RAIs - TRP 76 (Irradiation Structural) - FE 3.5.2.2.2.6
8/05/2022	ML22193A254	Oconee SLRA – Audit Report [REPORT FOR THE LIMITED SCOPE AGING MANAGEMENT AUDIT REGARDING THE SUBSEQUENT LICENSE RENEWAL APPLICATION REVIEW – PWR VESSEL INTERNALS (EPID NO. L-2021-SLR-0000)]
8/08/2022	ML22200A077	Oconee SLRA - Summary of July 14, 2022 and July 28, 2022 Public Meetings
6/14/2022 - 7/08/2022	ML22234A117 (Package)	Oconee SLRA – Feedback to TRP 76
8/30/2022	ML22234A003 (Package)	Oconee Nuclear Station, Units 1, 2, and 3, Subsequent License Renewal Application - Summary for August 18, 2022, Closed Public Meeting
9/02/2022	ML22245A010	Oconee Nuclear Station (ONS), Units 1, 2, and 3 - Subsequent License Renewal Application Response to ONS SLRA Second Round RAI B2.1.7-4a
9/14/2022	ML22222A007	Oconee Nuclear Station, Units 1, 2, and 3 - Request for Withholding Information from Public Disclosure Regarding the Subsequent License Renewal Application (EPID NO. L-2021-SLR-0000)
09/20/2022	ML22221A006	Oconee Nuclear Station, Units 1, 2, and 3 - Request for Withholding Information from Public Disclosure Regarding the Subsequent License Renewal Application (EPID NO. L-2021-SLR-0000)
10/20/2022	ML22264A032	Oconee Nuclear Station, Units 1, 2, and 3 – Request for Withholding Information from Public Disclosure Regarding the Subsequent License Renewal Application – Duke Energy Letter Dated July 8, 2022 (Responses To Request For Additional Information) (EPID NO. L-2021-SLR-0000)
10/27/2022	ML22298A075	Oconee Nuclear Station, Units 1, 2, and 3 – Request for Withholding Information from Public Disclosure Regarding the Subsequent License Renewal Application – Duke Energy Letter Dated July 25, 2022 (Responses to Request for Additional Information) (EPID NO. L-2021-SLR-0000)
11/03/2022	ML22301A011	Oconee Nuclear Station, Units 1, 2, and 3 – Request for Withholding Information from Public Disclosure Regarding the Subsequent License Renewal Application – Duke Energy Letter Dated September 2, 2022 (Responses to Request for Additional Information) (EPID NO. L-2021-SLR-0000)

APPENDIX C

PRINCIPAL CONTRIBUTORS

C. Principal Contributors

This appendix lists the principal contributors for the development of this safety evaluation and their areas of responsibility.

Table C-1. Principal Contributors

Name	Responsibility
Anchondo-Lopez, Isaac	Reviewer—Aging Management— Mechanical and Materials
Allik, Brian	Reviewer—Aging Management—Mechanical and Materials
Alvarado, Lydiana	Reviewer—Aging Management— Mechanical and Materials
Bloom, Steve	Management Oversight
Buford, Angie	Management Oversight
Cintron-Rivera, Jorge	Reviewer—Aging Management—Electrical
Colaccino, Joseph	Management Oversight
Collins, Jay	Reviewer—Aging Management—Mechanical and Materials
Curran, Gordon	Reviewer—Scoping and Screening—Mechanical and Materials
Dijamco, David	Reviewer—Aging Management—Mechanical and Materials
Dinh, Thinh	Reviewer—Scoping and Screening—Fire Protection
Fairbanks, Carolyn	Reviewer—Aging Management—Mechanical and Materials
Fu, Bart	Reviewer—Aging Management—Mechanical and Materials
Gardner, William (Tony)	Reviewer—Aging Management—Mechanical and Materials
Gavula, James	Reviewer—Aging Management—Mechanical and Materials
Gibson, Lauren	Management Oversight
Hammock, Jessica	Project Manager
Hiser, Allen	Reviewer—Aging Management—Mechanical and Materials
Honcharik, John	Reviewer—Aging Management—Mechanical and Materials
Iqbal, Naeem	Reviewer—Scoping and Screening—Fire Protection
Istar, Ata	Reviewer—Aging Management—Structural
Jackson, Christopher	Reviewer—Scoping and Screening—Mechanical and Materials
Jenkins, Joel	Reviewer—Aging Management—Mechanical and Materials
Johnson, Andrew	Reviewer—Aging Management—Mechanical and Materials
Johnson, Marieliz	Project Manager
Johnston, Jeanne	Management Oversight
Jones, Steve	Reviewer—Scoping and Screening—Mechanical and Materials
Kalikian, Roger	Reviewer—Aging Management—Mechanical and Materials
Karipineni, Nageswara	Reviewer—Scoping and Screening— Mechanical and Materials
Klein, Paul	Reviewer—Aging Management—Mechanical and Materials
Krepel, Scott	Management Oversight
Lee, Brian	Reviewer—Scoping and Screening—Mechanical and Materials
Lehman, Bryce	Reviewer—Aging Management—Structural Reviewer—Scoping and Screening—Structural
Li, Chang	Reviewer—Scoping and Screening—Mechanical and Materials
Lopez, Juan	Reviewer—Aging Management—Structural
Lukes, Robert	Management Oversight
Makar, Gregory	Reviewer—Aging Management—Mechanical and Materials
Matharu, Gurcharan	Reviewer—Scoping and Screening—Electrical
Medoff, James	Reviewer—Aging Management—Mechanical and Materials

Name	Responsibility
Messina, Joseph	Reviewer—Aging Management—Mechanical and Materials
McConnell, Matthew	Reviewer—Aging Management—Electrical
Min, Seung	Reviewer—Aging Management—Mechanical and Materials
Mitchell, Matthew	Management Oversight
Nguyen, Duc	Reviewer—Aging Management—Electrical
Parks, Benjamin	Reviewer—Aging Management—Mechanical and Materials
Pratt, David	Reviewer—Aging Management—Mechanical and Materials
Prinaris, Andrew	Reviewer—Aging Management—Structural
Reichelt, Eric	Reviewer—Aging Management—Mechanical and Materials
Rezai, Ali	Reviewer—Aging Management—Mechanical and Materials
Rogers, Bill	Reviewer—Scoping and Screening Methodology
Stubbs, Angelo	Reviewer—Scoping and Screening—Mechanical and Materials
Terry, Leslie	Reviewer—Aging Management—Mechanical and Materials
Thomas, George	Reviewer—Structural
Wang, George	Reviewer—Aging Management—Structural
Whitman, Jennifer	Management Oversight
Wittick, Brian	Management Oversight
Wu, Angela	Project Manager
Xi, Zuhan	Reviewer—Aging Management—Structural
Yee, On	Reviewer—Aging Management—Mechanical and Materials
Yoder, Matthew	Reviewer—Aging Management—Mechanical and Materials
Yoo, Mark	Project Manager

APPENDIX D

REFERENCES

D. References

This appendix lists the references used throughout this safety evaluation (SE) for review of the Oconee Nuclear Station (ONS) Units 1, 2, and 3 subsequent license renewal application.

Table D-1. References

References
U.S. Nuclear Regulatory Commission (NRC)
Appendix G to Title 10, *Code of Federal Regulations* (10 CFR Part 50, Appendix G), "Fracture Toughness Requirements."
Appendix R to Title 10, *Code of Federal Regulations*, (10 CFR 50, Appendix R), "Fire Protection Program for Nuclear Power Facilities Operating Prior to January 1, 1979."
Appendix B to Title 10, *Code of Federal Regulations*, (10 CFR 50, Appendix B), "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," Criterion XVI, "Corrective Action."
Title 10 of the *Code of Federal Regulations* (10 CFR), Sections 50.48(a) and (c), "National Fire Protection Association Standard NFPA 805."
NRC Generic Letter 89-13, "Service Water System Problems Affecting Safety-Related Equipment," July 18, 1989 (Agencywide Documents Access and Management System [ADAMS] Accession No. ML031150348).
NRC Regulatory Issue Summary 2014-11, "Information on Licensing Applications for Fracture Toughness Requirements for Ferritic Reactor Coolant Pressure Boundary Components," October 2014 (ADAMS Accession No. ML14149A165).
NRC letter to S. M. Snider, Site Vice President, ONS, "Oconee Nuclear Station, Units 1, 2, and 3 – Report for the Aging Management Audit Regarding the Subsequent License Renewal Application Review," February 14, 2022 (ADAMS Accession No. ML22045A053).
NRC letter to M. S. Tuckman, Executive Vice President, Nuclear Generation, "Oconee Nuclear Station, Units 1, 2, and 3 RE: Supplement 1 to the Duke Energy Corporation Response to NRC Bulletin 88-08 (TAC Nos. MA1059, MA1060, and MA1061)," August 11, 2000 (ADAMS Accession No. ML003740377).
NRC letter from Mr. S. Williams (NRC) to Mr. J. E. Burchfield, Vice President, ONS, "Oconee Nuclear Station Units 1, 2, and 3 – Issuance of Amendment Nos. 421, 423, and 422 RE: Revision of Licensing Basis for High Energy Line Breaks Outside of Containment," March 15, 2021 (ADAMS Accession No. ML21006A098).
NRC letter to W. R. McCollum, Vice President, ONS, "Exemption from the Requirements of 10 CFR Part 50, Section 50.60 and Appendix G – Oconee Nuclear Stations Units 1, 2, and 3," March 29, 1999 (ADAMS Accession No. ML012050426).
NRC letter to W. R. McCollum, Vice President, ONS, "Oconee Nuclear Station, Units 1, 2, and 3 RE: Exemption from the Requirements of 10 CFR Part 50, Section 50.60(a) (TAC Nos. MA5473, MA5474, and MA5475)," July 29, 1999 (ADAMS Accession No. ML012050097).
NRC letter to J. E Burchfield, Vice President, ONS, "Oconee Nuclear Station, Units 1, 2, and 3 – Issuance of Amendment Nos. 420, 422, and 421 Re: Measurement Uncertainty Recapture Power Uprate," January 26, 2021 (ADAMS Accession Number ML20335A001).
NRC letter to T. Preston Gillespie, Site Vice President, ONS, "Oconee Nuclear Station, Units 1, 2, and 3 - Issuance of Amendments Regarding Transition to a Risk-Informed, Performance-Based Fire Protection Program in Accordance with 10 CFR 50.48(c)," December 29, 2010 (ADAMS Accession Number ML103630612).
NRC letter to Preston Gillespie, Site Vice President, ONS, Units 1, 2, and 3, "Issuance of Amendments Regarding Authorizing a Change to the Updated Final Safety Analysis Report Allowing the Use of Fiber Reinforced Polymer on Masonry Brick Walls for the Mitigation of Differential Pressure Created by High Winds (TAC Nos. ME1710, ME1711, and ME1712," June 27, 2011 (ADAMS Accession No. ML11164A257).
SLR-ISG-2021-04-ELECTRICAL, "Updated Aging Management Criteria for Electrical Portions of the Subsequent License Renewal Guidance," February 2021 (ADAMS Accession No. ML20181A395).
SLR-ISG-2021-02-MECHANICAL, "Updated Aging Management Criteria for Mechanical Portions of Subsequent License Renewal Guidance," February 2021 (ADAMS Accession No. ML20181A434).
SLR-ISG-2021-03-STRUCTURES, "Updated Aging Management Criteria for Structures Portions of Subsequent License Renewal Guidance," February 2021 (ADAMS Accession No. ML20181A381).

References
SLR-ISG-2021-01-PWRVI, “Updated Aging Management Criteria for Reactor Vessel Internal Components for Pressurized-Water Reactors,” January 2021 (ADAMS Accession No. ML20217L203).
NRC Generic Letter 88-08, “Thermal Stresses in Piping Connected to Reactor Coolant Systems,” June 22, 1988 (ADAMS Accession No. ML031220144).
Standard Review Plan (SRP, NUREG-0800), SRP Section 3.6.3, Rev. 1, “Leak-Before-Break Evaluation Procedures,” March 2007 (ADAMS Accession No. ML063600396).
NUREG-1339, “Resolution of Generic Safety Issue 29: Bolting Degradation or Failure in Nuclear Power Plants,” June 1990 (ADAMS Accession No. ML031430208).
NUREG-1509, “Radiation Effects on Reactor Pressure Vessel Supports,” May 1996 (ADAMS Accession No. ML073510018).
NUREG-1723, “Safety Evaluation Report Related to the License Renewal of Oconee Nuclear Station, Units 1, 2, and 3,” March 2000 (ADAMS Accession No. ML003695154).
NUREG-2191, Volumes 1 and 2, “Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report,” July 2017 (ADAMS Accession Nos. ML17187A031 and ML17187A204).
NUREG-2192, “Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants [SRP-SLR],” July 2017 (ADAMS Accession No. ML17188A158).
NUREG/CR-4513, Revision 2, “Estimation of Fracture Toughness of Cast Stainless Steels during Thermal Aging in LWR [Light-Water Reactor] Systems,” May 2016 (ADAMS Accession No. ML16145A082).
NUREG/CR-6177, “Assessment of Thermal Embrittlement of Cast Stainless Steels,” Argonne National Lab., May 1994 (ADAMS Accession No. ML070040170).
NUREG/CR-6260, “Application of NUREG/CR-5999 Interim Fatigue Curves to Selected Nuclear Power Plant Components,” March 1995 (ADAMS Accession No. ML031480219).
NUREG/CR-6909, “Effect of LWR Water Environments on the Fatigue Life of Reactor Materials,” Revision 1, May 2018 (ADAMS Accession No. ML16319A004).
RG 1.99, “Radiation Embrittlement of Reactor Vessel Materials,” Revision 2, May 1988 (ADAMS Accession No. ML031430205).
RG 1.190, “Calculational and Dosimetry Methods for Determining Pressure Vessel Neutron Fluence,” Revision 0, March 2001 (ADAMS Accession No. ML010890301).
Industry Codes and Standards by Source
American Concrete Institute (ACI)
ACI 349.3R-02, “Evaluation of Existing Nuclear Safety-Related Concrete Structures,” Farmington Hills, Michigan, American Concrete Institute, 2002.
American Society of Mechanical Engineers (ASME)
ASME Boiler and Pressure Vessel Code, Section III, “Nuclear Power Plant Components,” 1965 Edition, Summer 1967 Addendum.
ASME Boiler and Pressure Vessel Code, Section XI, “Rules for In-Service Inspection of Nuclear Power Plant Components,” 2007 edition.
ASME Boiler and Pressure Vessel Code, Section XI, Division 1, “Rules for Inservice Inspection of Nuclear Power Plant Components,” Subsections IWB, IWC, IWD, IWE, and IWL.
ASME Code, Section III, Paragraph N-415.1, “Vessels Not Requiring Analysis for Cyclic Operation,” 1965 edition.
ASME Code Case N-514, “Low Temperature Overpressure Protection,” ASME Section XI, Division 1, March 1998 (NOTE: the Code Case that ASME International copyrighted was subsequently annulled by the organization; the NRC issued the granted exemption of January 27, 1997, prior to the ASME International annulment of the Code Case).
American Society for Testing and Materials (ASTM)
ASTM D7234, “Standard Test Method for Pull-Off Adhesion Strength of Coatings on Concrete Using Portable Pull-Off Adhesion Testers,” American Society for Testing and Materials.
Electric Power Research Institute (EPRI)
EPRI NP-5769, “Degradation and Failure of Bolting in Nuclear Power Plants,” Palo Alto, CA, EPRI, April 1988.
EPRI TR–104213, “Bolted Joint Maintenance & Application Guide,” Palo Alto, CA, EPRI, December 1995.

References
EPRI TR-1024995, "Environmentally-Assisted Fatigue Screening: Process and Technical Basis for Identifying EAF [Environmentally-Assisted Fatigue] Limiting Locations," August 2012.
EPRI TR 3002000590, "Closed Cooling Water Chemistry Guideline," Revision 2, Palo Alto, California, EPRI, December 2013 (Proprietary Information), December 13. 2013.
EPRI Report 3002005294, "Soil Sampling and Testing Methods to Evaluate the Corrosivity of the Environment for Buried Piping and Tanks at Nuclear Power Plants," Palo Alto, California, EPRI, November 6, 2015.
EPRI Report 1015336, "Nuclear Maintenance Application Center: Bolted Joint Fundamentals," Palo Alto, California, EPRI, December 2007.
EPRI Report 1015337, "Nuclear Maintenance Applications Center: Assembling Gasketed, Flanged Bolted Joints," Palo Alto, California, EPRI, December 2007.
EPRI TR 3002011710, "Irradiation Damage of the Concrete Biological Shield: Basis for Evaluation of Concrete Biological Shield Wall for Aging Management," Palo Alto, California, EPRI, May 2018.
EPRI TR 3002017168, "Materials Reliability Program: Pressurized Water Reactor Internals Inspection and Evaluation Guidelines (MRP-227, Revision 1-A)," June 2020 (ADAMS Accession No. ML20175A112).
EPRI TR 3002013218 (MRP-189 Revision 3), "Materials Reliability Program: Screening, Categorization, and Ranking of Babcock & Wilcox–Designed Pressurized Water Reactor Internals Component Items and Welds," December 2019 (ADAMS Accession No. ML20091K286).
EPRI Non-Proprietary Letter No. MRP 2010-066, "EPRI MRP Final Response to: Request for Additional Information Number 4, RE: Electric Power Research Institute Topical Report 1016596, 'Materials Reliability Program: Pressurized Water Reactor Internals Inspection and Evaluation Guidelines (MRP-227-Rev. 0),'" October 29, 2010 (ADAMS Accession No. ML103160381).
Industry Sources
Nuclear Energy Institute (NEI)
NEI 17-01, "Industry Guideline for Implementing the Requirements of 10 CFR Part 54 for Subsequent License Renewal," March 2017 (ADAMS Accession No. ML17081A239).
Babcock and Wilcox Owners Group (BWOG) & Pressurized Water Reactor Owners Group (PWROG)
BWOG Non-Proprietary Topical Report No. BAW-1543, Revision 4, "Supplement to the Master Integrated Reactor Vessel Surveillance Program," March 2018 (ADAMS Accession No. ML18184A520).
Babcock and Wilcox (B&W) Report No. BAW-1621, "B&W 177-FA Owners Group – Effects of Asymmetric LOCA Loadings – Phase II Analysis," July 1980 (ADAMS Accession No. ML19320B058).
B&W Report No. BAW-1621, Supplement 1, "B&W 177-FA Owners Group – Effects of Asymmetric LOCA [Loss-of-Coolant Accident] Loadings – Phase II Analysis – Supplement 1 Responses to NRC Questions" June 1981 (ADAMS Accession No. ML20009B628).
BWOG Non-Proprietary Topical Report No.BAW-2241P/NP-A, Revision 2, "Fluence and Uncertainty Methodologies," April 2006 (ADAMS Accession No. ML073310660 [Non-Proprietary]).
BWOG Non-Proprietary Topical Report No. BAW-1847, Revision 1, "Leak-Before-Break Evaluation of Margins Against Full Break for RCS Primary Piping of B&W Designed NSS," September 1985 (ADAMS Accession No. ML20138R230).
BWOG Topical Report No. BAW-2248A, "Demonstration of the Management of Aging Effects for the Reactor Vessel Internals," Framatome Technologies, March 2000 (ADAMS Accession No. ML003708443).
BWOG Non-Proprietary Topical Report No. BAW-2251, "Demonstration of the Management of Aging Effects for the Reactor Vessel," June 1996 (ADAMS Accession No. ML20115B833).
BWOG Topical Report No. BAW-10046A, Revision 2, "Methods of Compliance with Fracture Toughness and Operational Requirements of 10 CFR 50, Appendix G," June 1986 (ADAMS Accession No. ML20207G642).
Pressurized Water Reactor Owners Group/Westinghouse Non-Proprietary Class 3 Report No. WCAP-17096-NP-A, Revision 2, "Reactor Internals Acceptance Criteria Methodology and Data Requirements," August 2016 (ADAMS Accession No. ML16279A320).
Framatome TR ANP-10348P/NP-A Rev. 0, "Fluence Methodologies for SLR," June 2021 (ADAMS Accession No. ML21221A334 [Non-Proprietary]).
Framatome TR ANP-3898NP/P, Revision 0, "Framatome Reactor Vessel and RCP TLAA and Aging Management Review Input to the ONS SLRA," May2021 (ADAMS Accession No. ML21158A200).

References
Framatome TR ANP-3899P/NP, Revision 0, "Framatome Reactor Vessel Internals TLAA Input to the ONS SLRA," May 2021 (ADAMS Accession No. ML21158A200 [Non-Proprietary]).
B&W Proprietary Report No. BAW-10008, Part 1, Revision 1, "Reactor Internals Stress and Deflection due to Loss-Of-Coolant Accident and Maximum Hypothetical Earthquake," June 1970 (Proprietary).
Duke Energy
ONS, Units 1, 2, and 3 UFSAR, Revision 27, Chapter 3, "Design of Structures, Components, Equipment and Systems," ADAMS Accession No. ML18192A903 and Chapter 3, Appendix 3B, "Figures," ADAMS Accession No. ML18192A907.
Duke Energy Letter No. RA-21-0132, "Duke Energy Carolinas, LLC (Duke Energy), Oconee Nuclear Station, Units 1, 2, and 3, Docket Numbers 50-269, 50-270, 50-287, Renewed License Numbers DPR-38, DPR-47, DPR-55, Application for Subsequent Renewed Operating Licenses," June 7, 2021 (ADAMS Accession No. ML21158A194).
Duke Energy Letter No. RA-21-0332, "Duke Energy Carolinas, LLC (Duke Energy), Oconee Nuclear Station, Units 1, 2, and 3, Docket Numbers 50-269, 50-270, 50-287, Renewed License Numbers DPR-38, DPR-47, DPR-55, Subsequent License Renewal Application Responses to NRC Request for Additional information Set 1 and Second Round Request for Additional Information B2.1.27-1a," November 23, 2021 (ADAMS Accession No. ML21327a277.
Duke Energy Letter No. RA-22-0036, "Duke Energy Carolinas, LLC (Duke Energy), Oconee Nuclear Station, Units 1, 2 and 3, Docket Numbers 50-269, 50-270, 50-287, Renewed License Numbers DPR-38, DPR-47, and DPR-55, Subsequent License Renewal Application, Responses to NRC Request for Additional Information Set 2," February 14, 2022 (ADAMS Accession No. ML22045A021).
Duke Energy Letter No. RA-22-0193, "Duke Energy Carolinas, LLC (Duke Energy), Oconee Nuclear Station, Units 1, 2 and 3, Docket Numbers 50-269, 50-270, 50-287, Renewed License Numbers DPR-38, DPR-47, and DPR-55, Subsequent License Renewal Application, Responses to RAI B2.1.7-4b," July 8, 2022 (ADAMS Accession No. ML22189A010).
Duke Energy Letter No. RA-22-0192, "Duke Energy Carolinas, LLC (Duke Energy), Oconee Nuclear Station, Units 1, 2 and 3, Docket Numbers 50-269, 50-270, 50-287, Renewed License Numbers DPR-38, DPR-47, and DPR-55, Subsequent License Renewal Application, Response to RAI B2.1.7-4a," September 2, 2022 (ADAMS Accession No. ML22245A010).
Duke Energy letter from W. R. McCollum, Vice President, ONS, to the U.S. NRC Document Control Desk, "Oconee Nuclear Site, Docket Nos. 50-269, 50-270, and 50-287, Response to NRC Bulletin 88-08, Supplement 1," February 26, 1998 (ADAMS Accession No. ML20203J930).
Duke Energy Report No. SLR-ONS-TLAA-0306P/NP, "Oconee Nuclear Station, Environmentally-Assisted Fatigue, Oconee Subsequent License Renewal Application, Supplement Section 4.3.4" in ADAMS Accession No. ML21158A200 [Non-Proprietary]).
Duke Energy letter from T. Preston Gillespie, Vice President, ONS, to the U.S. NRC Document Control Desk, "Duke Energy Carolinas, LLC, Oconee Nuclear Station (ONS), Units 1, 2, and 3, Docket Numbers 50-269, 50-270, and 50-287, License Renewal Commitment to Submit a Time Limited Aging Analysis for the Reactor Vessel Internals to the NRC for Review," February 20, 2012 (ADAMS Accession No. ML12053A332).
Other Sources
American Water Works Association (AWWA), C105, "Polyethylene Encasement for Ductile-Iron Pipe Systems," Denver, Colorado, American Water Works Association, 2010.
AREVA Proprietary Engineering Information Record No. 51-9038244-002, "Oconee Nuclear Station Units 1, 2, and 3, Update of Irradiation Embrittlement in BAW-10008 Part 1, Revision 1," April 4, 2011 (ADAMS Accession No. ML12053A333 [Non-Proprietary]).
P. M. Bruck, T. C. Esselman, B. M. Elaidia, J. J. Wall, E. L. Wong, "Structural Assessment of Radiation Damage in Light Water Power Reactor Concrete Biological Shield Walls," Nuclear Engineering and Design, 350 (2019), 9-20.
Research Council on Structural Connections (RCSC), "Specification for Structural Joints Using ASTM A325 or A490 Bolts," Chicago, IL, Research Council on Structural Connections, June 2004.
National Association of Corrosion Engineers (NACE) Standard Practice SP0169-2007, "Control of External Corrosion on Underground or Submerged Metallic Piping Systems," 2017.
National Fire Protection Association (NFPA) 25, "Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems, 2011 Edition," Quincy, Massachusetts.
NFPA 805, "Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants," 2001 Edition, Quincy, Massachusetts.

References
Albright, Lyle F, "Albright's Chemical Engineering Handbook," Chemical Rubber Company (CRC) Press, November 2008.