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NUREG-XXXX

Safety Evaluation Report

Related to the Subsequent License Renewal of Peach Bottom Atomic Power Station, Units 2 and 3

Docket Nos. DPR 44 and DPR 56

Exelon Generation Company, LLC

UPDATED REPORT

Office of Nuclear Reactor Regulation

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UPDATED REPORT

Manuscript Completed: November 2019
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ABSTRACT

This safety evaluation report (SER) documents the technical review of the Peach Bottom Atomic Power Station (PBAPS) Units 2 and 3 subsequent license renewal application by the U.S. Nuclear Regulatory Commission (NRC) staff.

By letter dated July 10, 2018 (Agencywide Documents Access and Management System (ADAMS) Package Accession No. ML18193A689), Exelon Generation Company, LLC (Exelon) submitted an application for subsequent license renewal. Exelon requested renewal for a period of 20 years beyond the current expiration at midnight on August 8, 2033, for Unit 2 and July 2, 2034, for Unit 3.

PBAPS Units 2 and 3 are located partly in Peach Bottom Township, York County, partly in Drumore Township, Lancaster County, and partly in Fulton Township, Lancaster County, in southeastern Pennsylvania on the westerly shore of Conowingo Pond at the mouth of Rock Run Creek. Each unit consists of a General Electric boiling water reactor (BWR)/4 reactor vessel with a Mark I primary containment. Each unit has a licensed power output of 4,016 megawatts-thermal. The NRC issued the initial operating licenses on October 25, 1973, for Unit 2 and July 2, 1974, for Unit 3. The NRC issued the first renewed operating licenses on May 7, 2003.

This SER presents the status of the NRC staff's review of information submitted through October 9, 2019. The confirmatory item previously identified in the SER, issued October 7, 2019 (ADAMS Accession No. ML19280D820), has been closed (see SER Section 1.6). In addition, this SER includes editorial corrections. On the basis of its review of the subsequent license renewal application, the NRC staff determines that Exelon has met the requirements of Title 10 of the *Code of Federal Regulations* Section 54.29(a) (see SER section 6).

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ABBREVIATIONS AND ACRONYMS

AAC	all-aluminum conductor
AAI	Applicant Action Items
AC	alternating current
ACAR	aluminum conductor, aluminum reinforced
ACI	American Concrete Institute
ACRS	Advisory Committee on Reactor Safeguards
ACSR	aluminum conductor, steel reinforced
ADAMS	Agencywide Documents Access and Management System
ADS	automatic depressurization system
AEA	Atomic Energy Act of 1954, as amended
AERM	aging effect requiring management
AFW	auxiliary feedwater
AHU	Air Handling Unit
AMP	aging management program
AMR	aging management review
ANL	Argonne National Laboratory
ANSI	American National Standards Institute
AOO	anticipated operational occurrence
AOT	abnormal operating transit
ART	adjusted reference temperature
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ATWS	anticipated transient without scram
BAC	bounding analysis curve
BTP	branch technical position
BWR	boiling-water reactor
BWROG	Boiling Water Reactor Owners Group
BWRVIP	Boiling Water Reactor Vessel and Internals Project
CAR	corrective action report
CASS	cast austenitic stainless steel
CCW	component cooling water
CF	chemistry factor
CFM	cubic feet per minute
CFR	*Code of Federal Regulations*
CLB	current licensing basis
CMAA	Crane Manufacturers Association of America
CMTR	certified materials test report(s)

CPRH-DB	core plate rim hold-down bolts
CR	control room
CRD	control rod drive
CRDM	control rod drive mechanism
CRDRL	control rod drive return line
CRE	control room envelope
CREVS	Control Room Emergency Ventilation System
CRGT	control rod guide tubes
CRVS	control room ventilation system
CS	core spray
CUF	cumulative usage factor
CUF_{en}	environmentally adjusted cumulative usage factor
CVCS	chemical volume and control system
DBA	design-basis accident
DBD	design-basis document
DBE	design-basis event
DC	direct current
DOE	Department of Energy
dpa	displacements per atom
EAF	environmentally assisted fatigue
ECC	emergency containment cooling
ECCS	emergency containment cooling system
EDG	emergency diesel generator
EDGB	emergency diesel generator building
EFPY	effective full power years
ELCSP	extended life core support plugs
EMA	equivalent margins analysis
EMDA	expanded materials degradation assessment
EOL	end of life
EPFM	elastic-plastic fracture mechanics
EPRI	Electric Power Research Institute
EPU	extended power uprate
EQ	environmental qualification
ESF	engineered safety features
ESW	emergency service water
FAC	flow-accelerated corrosion
FCG	fatigue crack growth
FERC	Federal Energy Regulatory Commission

FSAR	final safety analysis report
FW	feedwater
GALL-SLR	Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report
GDC	general design criteria
GE	General Electric
GEH	General Electric-Hitachi
GEIS	Generic Environmental Impact Statement
GL	Generic Letter
GSI	Generic Safety Issue
GTAW	gas tungsten arc weld
HELB	high-energy line break
HPCI	high-pressure coolant injection
HPLW	high-pressure lube water
HPSW	high pressure service water
HVAC	heating, ventilation, and air conditioning
I&C	Instrumentation and Control
IAEA	International Atomic Energy Agency
IASCC	irradiation‑assisted stress corrosion cracking
ICW	intake cooling water
ID	inside diameter
IGSCC	intergranular stress corrosion cracking
INPO	Institute of Nuclear Power Operations
IPA	integrated plant assessment
ISG	Interim Staff Guidance
ISI	inservice inspection
ISP	Integrated Surveillance Program
JPASW	jet pump auxiliary spring wedges
JPRRC	jet pump riser repair clamps
JPSJRC	jet pump slip joint repair clamps
K_{IC}	fracture toughness
LCO	limiting condition for operations
LEFM	linear elastic fracture mechanics
LF	lead factors
LLC	limited liability company

LOCA	loss-of-coolant accident
LPCI	low pressure coolant Injection
LRA	license renewal application
LST	lowest service temperature
LTOP	low-temperature overpressure protection
LWR	light water reactor
MEB	metal enclosed bus
MELLLA	Maximum Extended Load Limit Analysis
MELLLA+	Maximum Extended Load Line Limit Analysis Plus
MIC	microbiologically influenced corrosion
MRP	Materials Reliability Program
MRV	minimum required valve
MUR	measurement uncertainty recapture
NACE	National Association of Corrosion Engineers
NASA	National Aeronautics and Space Administration
NBS	National Bureau of Standards
NCVS	Normal Containment Ventilation System
NDT	nil-ductility temperature
NDTT	nil-ductility transition temperature
NEA	Nuclear Energy Agency
NEI	Nuclear Energy Institute
NEPA	National Environmental Policy Act of 1969, as amended
NESC	National Electrical Safety Code
NFPA	National Fire Protection Association
NOP	normal operating loads
NPP	nuclear power plant
NRC	Nuclear Regulatory Commission
NSAC	Nuclear Safety Analysis Center
NSCA	Nuclear Safety Capability Assessment
NSPC	nuclear safety performance criteria
OBE	operating basis earthquake
OE	operating experience
OECD	Organisation for Economic Co-operation and Development
PBAPS	Peach Bottom Atomic Power Station
PCA	Portland Cement Association
PDI	Performance Demonstration Initiative
PORV	pressure operated relief valve

PT	pressure-temperature limit
PTLR	Pressure and Temperature Limits Report
PTS	pressurized thermal shock
PVC	polyvinyl chloride
PWR	pressurized water reactor
PWROG	Pressurized Water Reactor Owners' Group
PWSCC	primary water stress corrosion cracking
PWST	primary water storage tank
QA	quality assurance
RAI	request for additional information
RAMA	Radiation Analysis Modeling Application
RCI	request for confirmation of information
RCIC	reactor core isolation cooling
RCP	reactor coolant pump
RCPB	reactor coolant pressure boundary
RCS	reactor coolant system
RCSC	Research Council on Structural Connections
RES	NRC's Office of Nuclear Regulatory Research
RFO	refueling outage
RG	regulatory guide
RHR	residual heat removal
RIS	Regulatory Information Summary
RPV	reactor pressure vessel
RT_{NDT}	reference temperature for nil ductility transition.
RT_{PTS}	reference temperature for pressurized thermal shock
RV	reactor vessel
RVCH	reactor vessel closure head
RVI	reactor vessel internals
RVID	Reactor Vessel Integrity Database
RWCU	reactor water cleanup
SBO	station blackout
SC	structure and component
SCC	stress corrosion cracking
SE	safety evaluation
SEE IN	Significant Event Evaluation and Information Network
SER	safety evaluation report
SFPC	spent fuel pool cooling
SG	steam generator

SGTS	standby gas treatment system
SI	safety injection
SLC	standby liquid control
SLR	subsequent license renewal
SLRA	subsequent license renewal application
SMAW	shield-metal arc welding
S-N	stress versus number of cycles
SPEO	subsequent period of extended operation
SR	surveillance requirement
SRB	sulfate reducing bacteria
SRM	staff requirements memorandum
SRP	standard review plan
SRP-SLR	Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants
SRV	safety relief valve
SS	stainless steel
SSC	system, structure, or component
SSE	safe shutdown earthquake
TLAA	time-limited aging analysis
TMI	Three Mile Island
TPCW	Turbine Plant Cooling Water
TR	Topical Report
TS	technical specifications
UFSAR	updated final safety analysis report
USE	upper-shelf energy
UT	ultrasonic testing
UUSE	un-irradiated upper shelf energy
UV	ultraviolet
WCAP	Westinghouse Commercial Atomic Power
WOG	Westinghouse Owners Group
°C	degrees Celsius
°F	degrees Fahrenheit

1 INTRODUCTION AND GENERAL DISCUSSION

1.1 Introduction

This safety evaluation report (SER) documents the U.S. Nuclear Regulatory Commission (NRC) staff's safety review of the subsequent license renewal application (SLRA) for Peach Bottom Atomic Power Station (PBAPS) Units 2 and 3, as filed by Exelon Generation Company, LLC (Exelon or the applicant), by letter dated July 10, 2018 (Agencywide Documents Access and Management System (ADAMS) Package Accession No. ML18193A689). Exelon's application seeks to renew PBAPS Renewed Facility Operating License Nos. DPR-44 and DPR-56 for an additional 20 years beyond the current expiration of their renewed licenses on August 8, 2033, for Unit 2 and July 2, 2034, for Unit 3. The NRC staff performed a safety review of Exelon's application in accordance with Title 10 of the *Code of Federal Regulations* Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants" (10 CFR Part 54). The NRC project manager for the SLRA safety review is Ms. Bennett Brady. Ms. Brady may be contacted by telephone at 301-415-2981 or by e-mail at Bennett.Brady@nrc.gov. Alternatively, send written correspondence to the following address:

Division of Materials and License Renewal
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001
Attention: Bennett Brady, Mail Stop O11-F1

PBAPS Units 2 and 3 are located in southeastern Pennsylvania on the shore of Conowingo Pond at the mouth of Rock Run Creek. The facility spreads over three Pennsylvania townships in two counties: Peach Bottom Township in York County, Drumore Township in Lancaster County, and Fulton Township in Lancaster County. Each unit consists of a General Electric boiling-water reactor nuclear steam supply system with licensed thermal power of 4,016 megawatts thermal. The NRC issued the initial operating licenses on October 25, 1973, for Unit 2 and July 2, 1974, for Unit 3. The NRC issued renewed operating licenses for PBAPS Units 2 and 3 on May 7, 2003. The PBAPS updated final safety analysis report (UFSAR) shows details of the plant and the site (ADAMS Accession No. ML19114A265).

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 PBAPS subsequent license renewal is based on Exelon's SLRA, the NRC staff's audits, and responses to the staff's requests for additional information (RAIs). Exelon supplemented its application and provided clarifications through its responses to the staff's questions in RAIs, audits, meetings, and docketed correspondence. The staff reviewed and considered information submitted through August 13, 2019.

The public may view a copy of the SLRA and all pertinent information and materials, including the UFSAR, at the NRC Public Document Room located on the first floor of One White Flint North, 11555 Rockville Pike, Rockville, MD 20852-2738 (phone 301-415-4737 or 800-397-4209). In addition, the public may view the SLRA, as well as materials related to the license renewal review, on the NRC Web site at http://www.nrc.gov. Finally, the public may view a hard copy of the SLRA at the Harford County Public Library: Whiteford Branch, 2407 Whiteford Rd, Whiteford, MD 21160.

This SER summarizes the results of the NRC staff's safety review of the SLRA and describes the technical details 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), dated July 2017 (ADAMS Accession No. ML17188A158).

SER Sections 2 through 4 address the NRC staff's evaluation of license renewal issues considered during its review of the application. SER Section 5 is reserved for the report of the Advisory Committee on Reactor Safeguards (ACRS) of the license renewal application and the safety evaluation report, as well as the staff's written response to any ACRS issues or concerns. The conclusions of this SER are in Section 6.

SER Appendix A, "License Renewal Commitments," contains a table showing Exelon's commitments for subsequent renewal of the operating license. SER Appendix B, "Chronology," contains a chronology of the principal correspondence between the staff and the applicant, as well as other relevant correspondence, regarding the SLRA review. SER Appendix C contains a list of principal contributors to the SER, and Appendix D contains a bibliography of the references that support the NRC 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 during the proposed license renewal period. There are no limitations in the AEA or NRC regulations limiting the number of times 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 the period of extended operation. The regulations of 10 CFR Part 54 establish the regulatory requirements for both initial license renewal and subsequent license renewal (SLR).

1.2.1 Preparations for Subsequent License Renewal

The NRC and the 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 began also collecting information to support the development of guidance documents for operation during the activity 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 by plants during the period of extended operation and the degradation that has been identified by the AMPs. A summary of the 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 NPP [Nuclear Power Plants] 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 ADAMS Accession No. ML16194A124.

Also, 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 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 also 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's International Generic Ageing Lessons Learned Programme, (iii) the Organisation for Economic Co-operation and Development (OECD)/Nuclear Energy Agency (NEA) Component Operational Experience and 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 aging management programs (AMPs) that will require modification for SLR.

Based on the information gathered from these conferences and forums, and from other sources from 2008 through 2014, the most significant technical issues identified as challenging operation beyond 60 years are: reactor pressure vessel embrittlement; irradiation-assisted stress corrosion cracking (IASCC) of reactor internals; concrete structures and containment degradation; and electrical cable environmental qualification, 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) in December 2016. 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 subsequent license renewal. The SRM also directed the staff to keep the Commission informed on the progress in resolving the following technical issues related to SLR: (i) reactor pressure vessel neutron embrittlement at high fluence, (ii) irradiation-assisted stress corrosion cracking 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 subsequent license renewal 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 aging management programs. The final GALL-SLR Report and SRP-SLR guidance documents include new aging management programs 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 BWR and PWR vessel internals programs to consider higher fluences during the SLR period. Thus, the SLR guidance documents provide a sound basis for development of applicant programs to manage the effects of aging associated with the 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 structures, systems, 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 nonsafety-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(a)].

(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, environmental qualification (EQ), pressurized thermal shock (PTS), anticipated transients without scram (ATWS), and station blackout (SBO).

As required by 10 CFR 54.21(a), a license renewal applicant 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), 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 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 also requires TLAA identification and updating. 10 CFR 54.3, "Definitions," establishes 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 PBAPS SLRA, Exelon stated that it used the process defined in the GALL-SLR Report, which summarizes 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 subsequent license renewal 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 applicants 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). In December 1996, the staff revised these regulations to facilitate the environmental review for license renewal. The staff prepared the Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS) to document its evaluation of possible environmental impacts associated with nuclear power plant license renewals. For certain types of environmental impacts, the GEIS contains generic impact findings that apply to all nuclear power plants (or distinct subsets of plants). These generic findings are codified in Appendix B, "Environmental Effect of Renewing the Operating License of a Nuclear Power Plant," to Subpart A, "National Environmental Policy Act – Regulations Implementing Section 102(2)," of 10 CFR Part 51. Under 10 CFR 51.53(a) and 10 CFR 51.53(c)(3)(i), a license renewal applicant may incorporate these generic findings in its environmental report and an applicant's environmental report need not contain an analysis of the impacts of the generic (i.e., Category 1) issues listed in 10 CFR Part 51. In accordance with 10 CFR 51.53(c)(3)(ii), an environmental report must include analyses of the environmental impacts that must be evaluated on a plant-specific basis (i.e., Category 2 issues).

In June 2013, the NRC staff issued a final rule (78 *Federal Register* (FR) 37281–37323 and 78 FR 46255) revising 10 CFR Part 51 to update the potential environmental impacts associated with the renewal of an operating license for a nuclear power reactor for an additional 20 years. The NRC issued Revision 1 to the GEIS (at 78 FR 37325) concurrently with the final rule. The revised GEIS specifically supports the revised list of environmental issues identified in the final rule. Revision 1 to the GEIS and Revision 1 to the 2013 final rule reflect lessons learned and knowledge gained during previous license renewal environmental reviews.

In accordance with the National Environmental Policy Act of 1969 and 10 CFR Part 51, the staff reviewed the PBAPS plant-specific environmental impacts of subsequent license renewal, including any new and significant information that was not considered in the GEIS. As part of its scoping process, the staff held a public scoping meeting on September 25, 2018, near the Peach Bottom site in Delta, PA, to assist the staff in identifying plant-specific environmental issues (ADAMS Accession No. ML18289A509). The staff issued an environmental scoping summary report in July 2019, which included the comments received during the scoping process and the NRC staff's responses to those comments (ADAMS Accession No. ML19037A348).

The NRC staff issued its draft plant-specific supplement to the GEIS (Supplement 10, Second Renewal) in July 2019, for public comment. The draft plant-specific GEIS Supplement documents the results of the NRC staff's environmental review and makes a preliminary recommendation on the license renewal action based on environmental considerations. The staff held a public meeting on September 12, 2019, in Delta, PA, to discuss the draft, plant-specific GEIS Supplement 10 (ADAMS Accession No ML19210D453). After considering comments on the draft GEIS supplement, the staff will publish the final, plant-specific GEIS Supplement 10 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 PBAPS 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 Part 54 sets forth the license renewal standards. This SER describes the results of the staff's safety review in accordance with 10 CFR Part 54 requirements.

Section 54.19(a) requires a license renewal applicant to submit general administrative information. Exelon provided such information in SLRA Section 1. The staff reviewed SLRA Section 1 and finds that Exelon 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, Exelon stated in SLRA Section 1.1.10:

> 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-28) for PBAPS states, in Article VII, that the agreement "shall terminate at the time of expiration of that license specified in Item 3 of the Attachment, which is the last to expire." As updated in Amendment 16, Item 3 of the Attachment to the indemnity agreement lists license number DPR-44 (for PBAPS Unit 2) and DPR-56 (for PBAPS Unit 3). Applicant requests that any necessary conforming changes be made to Article VII and Item 3 of the Attachment, and any other sections of the indemnity agreement as appropriate to ensure that the indemnity agreement continues to apply during both the terms of the current licenses and the terms of the renewed licenses. Applicant understands that no changes may be necessary for this purpose if the current license numbers for PBAPS Units 2 and 3 are retained.

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

10 CFR 54.21, "Contents of Application—Technical Information," requires that the SLRA contain (a) an integrated plant assessment, (b) a description of any CLB changes during the staff's review of the SLRA, (c) an evaluation of TLAAs, and (d) a UFSAR supplement. PBAPS SLRA Sections 3 and 4 and Appendix B address the license renewal requirements of 10 CFR 54.21(a), (b), and (c). PBAPS SLRA Appendix A satisfies the license renewal requirements of 10 CFR 54.21(d).

Section 54.21(b) requires that, each year following submittal of the SLRA and at least 3 months before the scheduled completion of the 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. On July 1, 2019, Exelon submitted its annual amendment stating that it had completed its review to identify any current licensing basis (CLB) changes made since the submittal of its SLRA that have a material effect on the content of the SLRA, including the UFSAR supplement. This amendment identified four changes to the CLB that are considered to materially affect the contents of the PBAPS SLRA. This submittal satisfies the 10 CFR 54.21(b) requirement to submit an annual amendment to the SLRA for 2019, as well as the requirement to submit an amendment addressing any such changes at least three months before scheduled completion of the NRC review of the SLRA in March 2020.

Section 54.22, "Contents of Application—Technical Specifications," 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 PBAPS SLRA Appendix D, Exelon states that it had not identified any technical specifications changes necessary for issuance of the PBAPS subsequent renewed operating licenses. This statement adequately addresses the 10 CFR 54.22 requirement.

The staff evaluated the technical information required by 10 CFR 54.21 and 10 CFR 54.22 in accordance with NRC regulations and SRP-SLR guidance. SER 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 will issue a report documenting its evaluation of the staff's SLRA review and SER. The NRC staff has reserved SER Section 5 for the ACRS report when it is issued. The staff will also include the staff's response to the ACRS report. SER Section 6 documents the findings required by 10 CFR 54.29.

1.4 <u>Interim Staff Guidance</u>

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. As of August 13, 2019, the staff has not issued any ISGs to the SRP-SLR or the GALL-SLR Report.

1.5 Summary of Open Items

An item is considered open if, in the staff's judgment, the staff has not determined that it meets all applicable regulatory requirements at the time of the issuance of this SER. After reviewing the PBAPS SLRA, including additional information and clarification from Exelon submitted through August 13, 2019, the NRC staff identified no open items.

1.6 Summary of Closure of Confirmatory Item

An item is considered confirmatory if, in the 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 SER, the staff had not received the necessary documentation to confirm the resolution. After reviewing the Peach Bottom SLRA, including additional information Exelon submitted through October 9, 2019, the staff closed the following confirmatory item previously identified in the "Safety Evaluation Report with Confirmatory Item Related to the License Renewal of Peach Bottom Atomic Power Station Units 2 and 3" (ADAMS Accession No ML19280D820). No further confirmatory items remain to be addressed. A summary of the basis for closing this confirmatory item is presented below.

Confirmatory Item 3.0.3.2.3-1 BWR Vessel Internals

In the original SLRA, Section B.2.1.7, Enhancement 1, the applicant proposed to install core plate wedges or submit for NRC approval an inspection plan for the core plate rim hold-down bolts to mitigate stress corrosion cracking. The NRC staff found that the SLRA did not provide sufficient information to approve the inspection plan.

After discussion with the NRC, Exelon proposed to revise Enhancement 1 in its BWR Vessel Internals program and this proposal was tracked as confirmatory item 3.0.3.2.3-1. On October 9, 2019, Exelon submitted an amendment to the SLRA that provided this revised enhancement. The staff's evaluation of this revised enhancement and finding of acceptability is documented in section 3.0.3.2.3 of this SER. This confirmatory item is closed.

1.7 Summary of Proposed License Conditions

After reviewing the PBAPS SLRA, including additional information and clarifications from Exelon, the NRC staff identified two proposed license conditions.

The first license condition requires Exelon, following 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 time-limited aging analyses for the subsequent period of extended operation, as required by 10 CFR 54.21(d)) in its next periodic UFSAR update required by 10 CFR 50.71(e). The regulations at 10 CFR 50.71(e) require 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." Exelon may make changes to the programs and activities described in the UFSAR and supplement provided Exelon 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 section.

The second license condition requires Exelon to complete future activities described in the UFSAR supplement before the beginning of the subsequent period of extended operation.

Exelon 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.

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* (CFR), Section 54.21, "Contents of Application – Technical Information," requires, in part, that a [subsequent] license renewal application (SLRA) contain an integrated plant assessment (IPA) that identifies the systems, structures, and components (SSCs) included within the scope of subsequent license renewal in accordance with 10 CFR 54.4(a), "Scope." The IPA requires a list of those structures and components (SCs), included in the SSCs within the scope of subsequent license renewal, which perform an intended function as described in 10 CFR 54.4 and are subject to aging management review (AMR). Section 54.21 of 10 CFR further requires that the application describe and justify the methods used to identify the SSCs within the scope of subsequent license renewal and the SCs 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 required by 10 CFR 54.21. SLRA Section 2.0 states, in part, that the applicant had 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), endorsed by NRC letter dated December 5, 2017 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML17339A596).

SLRA Section 2.1, "Scoping and Screening Methodology," describes the methodology used by Peach Bottom Atomic Power Station Units 2 and 3 (PBAPS or the applicant), to identify the SSCs within the scope of subsequent license renewal (scoping) and the SCs subject to an AMR (screening).

2.1.3 Scoping and Screening Program Review

The staff evaluated the applicant's scoping and screening methodology in accordance with the guidance in Section 2.1, "Scoping and Screening Methodology," of NUREG-2192, "Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants" (SRP-SLR) (ADAMS Accession No. ML19205A433). 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 both SSCs that are within the scope of subsequent license renewal 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). In addition, the staff reviewed the applicant's subsequent license renewal implementing procedures, evaluation reports, boundary drawings, and scoping and screening results documentation reviewed during the in-office audit (Summary Report at ADAMS Accession No. ML19205A206). The staff's review of the results of the applicant's implementation of this methodology (SLRA Sections 2.3 through 2.5) are discussed in Sections 2.3 through 2.5 of this document.

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

- updated final safety analysis report (UFSAR)
- fire protection program
- environmental qualification (EQ) master list
- maintenance rule database
- design baseline documents
- engineering drawings
- controlled plant component database
- NRC safety evaluation reports
- licensing correspondence
- engineering evaluations and calculations

2.1.3.1.2 Staff Evaluation

The NRC staff reviewed the applicant's scoping and screening methodology, subsequent license renewal implementing procedures, reports, drawings, and documentation, to ensure that they are consistent with the requirements of the Rule, the guidance in the SRP-SLR, and the industry guidance in NEI 17-01. The staff determines that the scoping and screening methodology implementing procedures (including subsequent license renewal guidelines, documents, and reports) are consistent with the Rule, the SRP-SLR, and NEI 17-01.

The applicant's scoping and screening implementing procedures contain guidance for (1) identifying SSCs within the scope of the Rule and (2) identifying structures and components within those SSCs that are subject to an aging management review. During the review of the implementing procedures, the staff focused on the consistency of the detailed procedural guidance with information contained in the SLRA, including the implementation of NRC staff positions documented in the SRP-SLR. After reviewing the SLRA and supporting documentation, the staff determines that the scoping and screening methodology implementing procedures are consistent with the methodology described in SLRA Section 2.1.

Sources of Current Licensing Basis Information

As defined in 10 CFR 54.3(a), "Definitions," the current licensing basis (CLB) is 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, 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 as documented in the most recent final safety analysis report (UFSAR) as required by 10 CFR 50.71 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 staff reviewed the implementing procedures and results documentation that the applicant used to identify SSCs within the scope of subsequent license renewal (as defined by 10 CFR 54.4(a)). The applicant's subsequent license renewal program guidelines list documents that it used to support scoping evaluations. The staff considered the scope and depth of the applicant's CLB review to verify that the methodology is sufficiently comprehensive to identify SSCs within the scope of subsequent license renewal 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 subsequent license renewal consistent with the plant's CLB.

2.1.3.1.3 Conclusion

Based on its review of SLRA Sections 2.0, 2.1.1 and 2.1.2, the 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, therefore, is acceptable.

2.1.4 Plant Systems, Structures, and Components Scoping Methodology

The applicant addressed SSC scoping in SLRA Section 2.1.5, "Scoping Procedure," which states that the scoping process is the systematic process used to identify the PBAPS SSCs within the scope of the subsequent license renewal rule. The applicant initially performed the scoping process at the system and structure level, in accordance with the scoping criteria identified in 10 CFR 54.4(a). The applicant identified system and structure functions and intended functions from a review of the source CLB documents and the first license renewal application.

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 it used to identify SSCs that are included within the scope of subsequent license renewal, in accordance with the requirements of 10 CFR 54.4(a)(1), in SLRA Section 2.1.5.1, "Safety-Related – 10 CFR 54.4(a)(1)," which states:

> At PBAPS, the safety-related plant components are identified in controlled engineering drawings and in the Passport equipment database. The safety-related classifications in the PBAPS Passport equipment database were populated using a controlled procedure, with classification criteria consistent with the above 10 CFR 54.4(a)(1) criteria. The classification criteria differences have been evaluated in a second license renewal basis document as described in Section 2.1.3.2 [of the SLRA] and accounted for during the second license renewal scoping process.
>
> Safety-related classifications for systems and structures are based on system and structure descriptions and analyses in the UFSAR, or on design basis documents such as engineering drawings, design specifications, evaluations, or calculations. Systems and structures that are identified as safety-related in the UFSAR or in design basis documents have been classified as satisfying the criteria of 10 CFR 54.4(a)(1) and have been included within the scope of second license renewal. Safety-related components listed in the Passport equipment database were also reviewed and the system or structure associated with the safety-related component was included within the scope of second license renewal in accordance with 10 CFR 54.4(a)(1) criteria. The review also confirmed that Anticipated Operational Occurrences (AOOs), Abnormal Operating Transient (AOTs), Design Basis Accidents (DBAs), External Hazards, Internal Events, and Special Events as described in the current licensing basis (CLB), were considered for second license renewal scoping.

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 design-basis event (DBE) 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 of this chapter, as applicable.

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

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

> identify SSCs that are relied upon to remain functional during and following DBEs [as defined in 10 CFR 50.49(b)(1)] to ensure the functions described in 10 CFR 54.4(a)(1).

The staff reviewed the applicant's basis documents that describe design-basis conditions in the CLB and address events defined by 10 CFR 50.49(b)(1) and 10 CFR 54.4(a)(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 was consistent with the SRP-SLR. The staff reviewed SLRA Section 2.1.5.1, 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 met the definition of safety-related specified in the Rule.

2.1.4.1.3 Conclusion

On the basis of its review of the SLRA, 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 subsequent license renewal is in accordance with the requirements in 10 CFR 54.4(a)(1), and, therefore, is acceptable.

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

2.1.4.2.1 Summary of Technical Information in the Application

The applicant addressed the methods used to identify SSCs included within the scope of subsequent license renewal, in accordance with the requirements of 10 CFR 54.4(a)(2) in SLRA Section 2.1.5.2, "Nonsafety-Related Affecting Safety-Related – 10 CFR 54.4(a)(2)," and 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, Appendix F, Revision 6) discusses the implementation of the 10 CFR 54.4(a)(2) scoping criteria, to include nonsafety-related SSCs whose failure may have the potential to prevent satisfactory accomplishments of safety functions.

<u>Nonsafety-Related SSCs Supporting Safety Functions</u>

SLRA Section 2.1.5.2, subsection, "Functional Support for Safety-Related SSC 10 CFR 54.4(a)(1) Functions," states, "The UFSAR and other CLB documents were reviewed to identify nonsafety-related systems required to support satisfactory accomplishment of a safety related function. Nonsafety-related systems credited in CLB documents to support a safety related function have been included within the scope of second [subsequent] license renewal."

<u>Nonsafety-Related SSCs Attached to Safety-Related SSCs</u>

SLRA Section 2.1.5.2, subsection, "Connected to and Provide Structural Support for Safety Related SSCs," states the following:

> For nonsafety-related SSCs directly connected to safety-related SSCs the nonsafety-related piping and supports, up to and including the first seismic or equivalent anchor (such as 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 (3) orthogonal directions) beyond the safety/nonsafety interface, are within the scope of second [subsequent] license renewal per

10 CFR 54.4(a)(2). The “first seismic or equivalent anchor” is defined such that the failure in the nonsafety-related pipe run beyond the first seismic or equivalent anchor will not render the safety-related portion of the piping unable to perform its intended function under CLB design conditions.

In addition, SLRA Section 2.1.5.2, subsection, “Connected to and Provide Structural Support for Safety-Relates SSCs,” states:

An alternative to specifically identifying a seismic anchor or equivalent anchor that supports the safety related/nonsafety related piping interface is to include enough of the nonsafety-related piping run to ensure these anchors are included and thereby ensure the piping and anchor intended functions are maintained. The intended function consists of two facets 1) providing structural support for the safety-related/nonsafety-related interface and 2) ensuring nonsafety-related piping loads are not transferred through the safety related/nonsafety related interface. In accordance with NEI 95-10, Appendix F, as referred to in NEI 17-01, the following methods (a) through (g) were considered to define end points for the portion of nonsafety-related piping attached to safety-related piping to be included in the scope of second license renewal. In these cases, the nonsafety related piping was included in scope for 10 CFR 54.4(a)(2) up to one of the following:

(a) A combination of restraints or supports that encompasses at least two (2) supports in each of three (3) orthogonal directions.

(b) 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 second license renewal scope includes the base mounted component as it has a support function for the safety related piping.

(c) A flexible connection that is considered a pipe stress analysis model end point when the flexible connection effectively decouples the piping system (i.e., does not support loads or transfer loads across it to connecting piping).

(d) A free end of nonsafety-related piping, such as a drain pipe that ends at an open floor drain.

(e) For nonsafety related piping runs that are connected at both ends to safety related piping, the entire run of nonsafety related piping is included in scope.

(f) A point where buried piping exits the ground. The buried portion of the piping should be included in the scope of second license renewal. A determination that the buried piping is well founded on compacted soil that is not susceptible to liquefaction must be documented.

(g) 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 current licensing basis, because significantly smaller piping does not impose loads on larger piping and does not support larger piping. The moment of inertia ratio used was 3 to 1.

Nonsafety-Related SSCs with the Potential for Spatial Interaction with Safety-Related SSCs

SLRA Section 2.1.5.2, subsection "Potential for Spatial Interactions with Safety-Related SSCs," discusses the evaluation of nonsafety-related SSCs that could potentially impact safety-related SSCs through spatial interaction (impact, spray, or leakage). The applicant's evaluation differentiates between the use of mitigative and preventive approach, as stated below.

> Mitigative Option: The mitigative option involves crediting plant mitigative features to protect safety related SSCs from failures of nonsafety-related SSCs. Plant mitigative features considered include pipe whip restraints, jet impingement shields, spray and drip shields, seismic supports, flood barriers, and physical barriers (e.g., floors, walls, doors, conduit). This option requires a demonstration that the mitigating features are adequate to protect safety related SSCs from failures of nonsafety-related SSCs regardless of failure location. If this level of protection can be demonstrated, then only the mitigative features need be included within the scope of second license renewal.
>
> Preventative: The preventive option involves identifying the nonsafety related SSCs that have a spatial relationship such that failure could adversely impact the performance of a safety related SSC intended function, and including the identified nonsafety related SSC within the scope of second license renewal without consideration of plant mitigative features.

Section 2.1.5.2 further states, relative to the use of the preventive option: "All liquid filled nonsafety-related SSCs located in these structures were assumed to be located in proximity to safety-related SSCs where potential spatial interaction could occur, and were therefore included in scope."

Scoping of Abandoned Equipment

SLRA Section 2.1.5.2, subsection, "Scoping of Abandoned Equipment," states, "Abandoned equipment is not included within the scope of subsequent license renewal if it has been confirmed to be isolated (cut/capped), vented, and drained. If this confirmation cannot be made, the system or portions thereof, are included within the scope of subsequent license renewal for aging management if there is the potential for 10 CFR 54.4(a)(2) spatial or structural interaction."

2.1.4.2.2 Staff Evaluation

The staff reviewed SLRA Sections 2.1.5.2, in which the applicant described the scoping methodology for nonsafety-related SSCs pursuant to 10 CFR 54.4(a)(2). During the review, the staff followed the guidance contained in SRP-SLR Section 2.1.3.1.2, "Nonsafety-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.

Nonsafety-Related SSCs Required to Perform a Function that Supports a Safety-Related Function

The staff reviewed SLRA Section 2.1.5.2 that describes the method used to identify nonsafety-related SSCs, which are required to perform a function relied upon by safety-related

SSCs to perform its safety function, to be included within the scope of subsequent license renewal in accordance with 10 CFR 54.4(a)(2). The staff confirmed that the applicant had reviewed the UFSAR, piping and instrumentation drawings, the equipment database, and other CLB documents to identify nonsafety-related SSCs, which perform a function relied upon by safety-related SSCs, and whose failure could prevent the performance of a safety function. The staff determined that the applicant had identified the nonsafety-related SSCs that perform a function relied upon by safety-related SSCs and whose failure could prevent the performance of a safety function, and included those SSCs within the scope of subsequent license renewal in accordance with 10 CFR 54.4(a)(2).

The staff finds that the applicant's methodology for identifying nonsafety-related SSCs that perform or support a safety function, for inclusion within the scope of subsequent license renewal, was in accordance with the guidance of the SRP-SLR and the requirements of 10 CFR 54.4(a)(2).

Nonsafety-Related SSCs Directly Connected to Safety-Related SSCs

The staff reviewed SLRA Section 2.1.5.2, which describes the method used to identify nonsafety-related SSCs, directly connected to safety-related SSCs, to be included within the scope of subsequent license renewal 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 nonsafety-related piping systems to include within the scope of subsequent license renewal: seismic anchors, equivalent anchors as defined in the CLB, equivalent anchors as defined in NEI 17-01 (which refers to NEI 95-10, Appendix F), and the bounding conditions identified in NEI 17-01 (which refers to NEI 95-10, Appendix F).

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

Nonsafety-Related SSCs with the Potential for Spatial Interaction with Safety-Related SSCs

The staff reviewed SLRA Section 2.1.5.2, which describe the methods, a combination of mitigative and preventive approaches, used to identify nonsafety-related SSCs, with the potential for spatial interaction with safety-related SSCs, to be included within the scope of subsequent license renewal in accordance with 10 CFR 54.4(a)(2).

The staff determined that the mitigative approach had been used in certain, specified locations, where safety-related SSCs were in the vicinity of fluid-filled nonsafety-related SSCs. The staff determined that the applicant did not take credit for distance without a mitigative feature employed and that the applicant had included the mitigative features (e.g., dikes, shields) within the scope of subsequent license renewal in accordance with 10 CFR 54.4(a)(2). The staff determined when the mitigative approach was not used, the preventive approach had been used and the applicant had identified specific structures that contained fluid-filled nonsafety-related systems that also contained safety-related SSCs. The staff determined that the applicant had included all fluid-filled nonsafety-related SSCs located within the structures within the scope of subsequent license renewal in accordance with 10 CFR 54.4(a)(2).

The staff finds that the applicant's methodology for identifying and including nonsafety-related SSCs, with the potential for spatial interaction with safety-related SSCs, within the scope of subsequent license renewal was 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

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

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

2.1.4.3.1 Summary of Technical Information in the Application

SLRA Section 2.1.5.3, "Regulated Events – 10 CFR 54.4(a)(3)," which describes the methods for identifying SSCs included within the scope of subsequent license renewal, in accordance with the requirements of 10 CFR 54.4(a)(3), states:

> 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 50.62), and station blackout (10 CFR 50.63).

SLRA Section 2.1.5.3 further states:

> The regulation for pressurized thermal shock (10 CFR 50.61) is applicable to pressurized water reactors only, and therefore not applicable to PBAPS which is a boiling water reactor. For each of the other four regulations, a technical basis document was prepared to provide input into the scoping process. Each of the regulated event basis documents identify the systems and structures that are relied upon to demonstrate compliance with the applicable regulation. The basis documents also identify the source documentation used to determine the scope of components within the system that are credited to demonstrate compliance with each of the applicable 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 second license renewal.

2.1.4.3.2 Staff Evaluation

The staff reviewed SLRA Section 2.1.5.3, which describes the method used to identify, and to include within the scope of subsequent license renewal, those SSCs relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with specific Commission regulations. The regulations are fire protection (10 CFR 50.48, "Fire Protection"); environmental qualification (10 CFR 50.49, "Environmental Qualification of Electric Equipment Important to Safety for Nuclear Power Plants"); pressurized thermal shock (10 CFR 50.61, “Fracture Toughness Requirements for Protection Against Pressurized Thermal Shock Events) (the staff noted PTS is not applicable to BWRs such as Peach Bottom); anticipated transients without scram (10 CFR 50.62, “Requirements for Reduction of Risk from Anticipated Transients Without Scram (ATWS) Events for Light-Water-Cooled Nuclear Power Plants”); and station blackout (10 CFR 50.63, “Loss of All Alternating Current Power”).

The staff reviewed the applicant’s implementing procedures and technical basis documents that describe its method for identifying SSCs within the scope of subsequent license renewal in accordance with 10 CFR 54.4(a)(3). The implementing procedures describe a process that considered current licensing basis information (including the UFSAR), applicable portions of the SLRA, and subsequent license renewal drawings to verify that the appropriate SSCs were included within the scope of subsequent license renewal documents reviewed during the in-office audit (Summary Report, ADAMS Accession No. ML19205A206).

The staff reviewed implementing procedures, subsequent license renewal drawings, and selected scoping results documentation. The staff determined that the applicant had evaluated current licensing basis information to identify SSCs that perform functions addressed in 10 CFR 54.4(a)(3) and included these SSCs within the scope of subsequent license renewal as documented in the scoping results documentation. In addition, the staff determined that the scoping results documentation referenced the information sources used to determine the SSCs credited for compliance with the specified events.

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 subsequent license renewal and had evaluated CLB information to identify SSCs that perform functions addressed in 10 CFR 54.4(a)(3) and had included those SSCs within the scope of subsequent license renewal. Based on its review of information contained in the SLRA and the CLB documents reviewed, the staff determined that the applicant’s methodology was sufficient for identifying and including SSCs credited in performing functions within the scope of subsequent license renewal in accordance with the requirements of 10 CFR 54.4(a)(3).

2.1.4.3.3 Conclusion

Based on its review of SLRA Section 2.1.5.3, 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, therefore, is 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:

> The scoping and screening methodology is consistent with the guidelines presented in NEI 17-01, “Industry Guideline for Implementing the Requirements of 10 CFR Part 54 for Subsequent License Renewal.”

SLRA Section 2.1.1 states:

> The initial step in the scoping process was to define the entire plant in terms of systems and structures. The systems and structures were then individually

> evaluated against the scoping criteria in 10 CFR 54.4(a)(1), (a)(2), and (a)(3) to determine if the systems or structures perform or support a safety-related function, if failure of the systems or structures prevent performance of a safety related function, or if the systems or structures perform functions that are integral to one of the five subsequent license renewal regulated events. The intended function(s) that are the bases for including systems and structures within the scope of subsequent license renewal were also identified.

SLRA Section 2.1.1 further states, for mechanical, structural, and electrical systems, in part:

> A mechanical system was included within the scope of second license renewal if any portion of the system met the scoping criteria of 10 CFR 54.4. Mechanical systems determined to be within the scope of second license renewal were then further evaluated to determine those system components that are required to perform or support the identified system intended function(s).
>
> A structure was included within the scope of second license renewal if any portion of the structure met the scoping criteria of 10 CFR 54.4. Structures were then further evaluated to determine those structural components that are required to perform or support the identified structure intended function(s).
>
> Electrical and Instrumentation and Control (I&C) systems were scoped like mechanical systems and structures per the scoping criteria in 10 CFR 54.4(a)(1), (a)(2), and (a)(3). Electrical and I&C components within the in scope electrical and I&C systems were included within the scope of second license renewal. Likewise, electrical and I&C components within in scope mechanical systems were included within the scope of second license renewal.

SLRA Section 2.1.5, "Scoping Procedure," states, in part:

> The scoping process is the systematic approach used to identify the PBAPS systems, structures, and components within the scope of second license renewal. 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 functions and intended functions were identified from a review of the source CLB documents and the first license renewal application. In scope boundaries were established and documented in the system and structure scoping reports, based on the identified intended functions.

2.1.4.4.2 Staff Evaluation

The staff reviewed SLRA Sections 2.0, 2.1.1, and 2.1.5 and subsections, which describes the applicant's methodology for identifying SSCs within the scope of subsequent license renewal to verify that it met the requirements of 10 CFR 54.4(a). SLRA Section 2.1.1 stated that the applicant had defined the plant in terms of systems and structures and was completed for all systems and structures on site to ensure that the entire plant was assessed.

The staff reviewed SLRA Section 2.1.5 and its subsections, which describes the applicant's methodology for identifying SSCs within the scope of subsequent license renewal to verify that the applicant had met the requirements of 10 CFR 54.4(a) for identifying SSCs within the scope of subsequent license renewal. The staff determined that the applicant had developed implementing procedures to (1) identify the systems and structures that are subject to 10 CFR 54.4 subsequent license renewal review, (2) determine whether the system or structure performed its intended functions consistent with the criteria of 10 CFR 54.4(a), and (3) document the activities in scoping results documentation. The applicant completed the process, which defined the plant in terms of systems and structures, for all onsite systems and structures.

The NRC staff reviewed the applicant's implementing procedures and a sampling of results documentation and determined that the applicant had identified the SSCs within the scope of subsequent license renewal and documented the results of the scoping process in accordance with the implementing procedures. The results documentation included a description of the structure or system, a listing of functions performed by the system or structure, identification of intended functions, the 10 CFR 54.4(a) scoping criteria met by the system or structure, references, and the basis for the classification of the system or structure's intended functions.

The staff determined that the applicant had identified the SSCs within the scope of subsequent license renewal and documented the results of the scoping process in SLRA Section 2.3, "Scoping and Screening Results: Mechanical"; SLRA Section 2.4, "Scoping and Screening Results: Structures"; and SLRA Section 2.5, "Scoping and Screening Results: Electrical." SLRA Sections 2.3 through 2.5 included a description of the structure or system, a listing of functions performed by the system or structure, an identification of intended functions, the 10 CFR 54.4(a) scoping criteria met by the system or structure, scoping boundaries, system intended functions, UFSAR references, and components of types subject to aging management review. The staff determined that the applicant's process was consistent with the description provided in SLRA Sections 2.1 through 2.5 and the guidance in SRP-SLR Section 2.1.

2.1.4.4.3 Conclusion

On the basis of its review of information contained in the SLRA, the staff finds that the applicant's scoping methodology was consistent with the guidance contained in the SRP-SLR and identified those SSCs (1) that are safety-related, (2) whose failure could affect safety-related intended functions, and (3) that are necessary to demonstrate compliance with the NRC's regulations for fire protection, environmental qualification, anticipated transient without scram, and station blackout. The staff finds that the applicant's methodology is consistent with the requirements of 10 CFR 54.4(a) and, therefore, is acceptable.

2.1.5 Screening Methodology

2.1.5.1 Summary of Technical Information in the Application

SLRA Section 2.1.1 states:

> After completion of the scoping and boundary evaluations, the screening process was performed to evaluate the structures and components within the scope of subsequent license renewal to identify the long-lived and passive structures and components subject to an AMR. The passive intended functions of structures and components subject to an AMR were also identified.

SLRA Section 2.1.1 further states:

> Selected components, such as equipment supports, structural items, and passive electrical components, were scoped and screened as commodities. The structural commodities were evaluated for each in-scope structure and electrical commodities were evaluated collectively.

SLRA Section 2.1.6.1, “Identification of Structures and Components Subject to AMR,” states:

> For mechanical systems and civil structures, this process establishes evaluation boundaries, determines the SCs that comprise the system or structure, determines which of those SCs support system/structure intended functions, and identifies specific SC intended functions. Consequently, not all of the SCs for in-scope systems or structures are in the scope of SLR because some of the components in a system are outside the evaluation boundaries for subsequent license renewal. Once these in-scope SCs are identified, the process then determines which SCs are subject to an AMR per the criteria of 10 CFR 54.21(a)(1).

SLRA Section 2.1.6 further states:

> For electrical and I&C systems, a bounding approach as described in NEI 17-01 is taken. This approach establishes evaluation boundaries, determines the electrical and I&C component commodity groups that compose in-scope systems, identifies specific component and commodity intended functions, and then determines which component commodity groups are subject to an AMR per the criteria of 10 CFR 54.21(a)(1).

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 subsequent license renewal 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 imposed by the plant-specific CLB for the period of extended operation.

The staff reviewed SLRA Sections 2.1.1 and 2.1.6 that described the methodology for identifying the mechanical, structural, and electrical SCs within the scope of subsequent license renewal that are subject to an AMR. The applicant implemented a process for determining which SCs were subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1). SLRA Section 2.1.6 described the screening process, during which the applicant’s staff evaluated the component types and commodity groups, included within the scope of subsequent license renewal, to determine which ones were passive and long-lived and, therefore, subject to an AMR.

Mechanical and Structural

The staff reviewed the applicant's methodology used for mechanical and structural component screening as described in SLRA Sections 2.1.1 and 2.1.6 and subsections. 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 SCs subject to an AMR. The staff determined that the applicant had identified the SCs that met the passive criteria in accordance with the guidance contained in NEI 17-01, and among those SCs, those were not subject to replacement based on a qualified life or specified time period (long-lived). These passive, long-lived components were determined to be subject to an AMR.

Electrical

The staff reviewed the applicant's methodology used for electrical component screening as described in SLRA Section 2.1.1 and Section 2.1.6. The staff confirmed that the applicant had 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 SSCs subject to an AMR. The staff determined that the applicant had identified electrical commodity groups that met the passive criteria in accordance with NEI 17-01, and among those passive SCs, those SCs that were not subject to replacement based on a qualified life or specified time period (long-lived). These passive, long-lived components were determined to be subject to an AMR.

2.1.5.3 Conclusion

On the basis of its review of the SLRA, the staff finds that the applicant's screening methodology was consistent with the guidance contained in the SRP-SLR and identified those passive, long-lived components within the scope of subsequent license renewal 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, therefore, is acceptable.

2.1.6 Summary of Evaluation Findings

Based on its review of the SLRA, the staff finds that the applicant's description and justification of its methodology for identifying SSCs within the scope of subsequent license renewal 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, therefore, are acceptable.

2.2 Plant-Level Scoping Results

2.2.1 Introduction

In Section 2.1 of the SLRA, the applicant described its methodology for identifying systems, structures, and components within the scope of subsequent license renewal and subject to aging management review. SLRA Section 2.2 described how the applicant applied the scoping methodology to determine which systems and structures must be included within the scope of subsequent license renewal. The NRC staff reviewed the plant-level scoping results to determine whether the applicant had properly identified the following in accordance with the requirements of 10 CFR 54.4(a):

(1) All 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).

(2) All nonsafety related systems, structures, and components whose failure could prevent satisfactory accomplishment of any of the functions identified in paragraphs (a)(1)(i), (a)(1)(ii), or (a)(1)(iii) of 10 CFR 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 (10 CFR 50.49), pressurized thermal shock (10 CFR 50.61), anticipated transients without scram (10 CFR 50.62), and station blackout (10 CFR 50.63). [As noted in SER section 4.1.2.1.2, pressurized thermal shock is not applicable to PBAPS].

2.2.2 Summary of Technical Information in the Application

In SLRA Table 2.2-1, "Plant Level Scoping Results," the applicant lists the plant mechanical systems, structures, and plant electrical and instrumentation and controls systems within the scope of subsequent license renewal. Based on the design basis events considered in the plant's current licensing basis, other current licensing basis information relating to nonsafety-related systems and structures, and certain regulated events, the applicant identified plant level systems and structures within the scope of subsequent license renewal as defined by 10 CFR 54.4.

2.2.3 Staff Evaluation

Section 2.1 of this safety evaluation report contains the NRC staff's review and evaluation of the applicant's scoping and screening methodology. To verify that the applicant properly implemented its methodology, the staff's review focused on the implementation results shown in SLRA Table 2.2-1 to confirm that the applicant did not omit any plant-level systems and structures within the scope of subsequent license renewal.

The staff determined that the applicant had properly identified the systems and structures within the scope of subsequent license renewal in accordance with 10 CFR 54.4. In addition, the staff reviewed selected systems and structures that the applicant had not identified as being within the scope of license renewal to verify whether these systems and structures have any intended functions requiring their inclusion within the scope of license renewal. The staff conducted its review of the scoping implementation 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 2.2, "Plant-Level Scoping Results."

The staff sampled the contents of the UFSAR based on the systems and structures listed in Table 2.2-1 of the SLRA. The staff sought to determine if there were any systems or structures that may have intended functions within the scope of license renewal (as defined by 10 CFR 54.4) that had been omitted from the scope of license renewal. The staff identifies no such omissions.

2.2.4 Conclusion

The NRC staff reviewed SLRA Section 2.2 and the UFSAR supporting information to determine whether the applicant failed to identify any systems and structures within the scope of license renewal. The staff finds no such omissions. Based on its review, the staff finds that there is reasonable assurance that the applicant has adequately identified (in accordance with 10 CFR 54.4) the systems and structures within the scope of license renewal.

2.3 SCOPING AND SCREENING RESULTS—MECHANICAL

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

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

In accordance with the requirements of 10 CFR 54.21(a)(1), the applicant must list those passive, long-lived SCs that are within the scope of license renewal and that are subject to an AMR. To verify that the applicant properly implemented its methodology, the 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 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, has 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 staff reviewed the SLRA, applicable sections of the UFSAR, license renewal boundary drawings, and other licensing basis documents, as appropriate, for each mechanical system within the scope of license renewal. The staff 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 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). The staff issued requests for additional information (RAIs) as needed to resolve any omissions or discrepancies, as discussed below.

2.3.1 Reactor Vessel, Internals, and Reactor Coolant System

SLRA Sections 2.3.1, "Reactor Vessel, Internals, and Reactor Coolant System," identifies the reactor vessel, internals, and reactor coolant system SCs subject to an AMR for license renewal. The applicant described the supporting SCs of the reactor coolant system in the following SLRA sections:

- SLRA Section 2.3.1.1, "Reactor Pressure Vessel and Internals System"
- SLRA Section 2.3.1.2, "Reactor Pressure Vessel Instrumentation System"
- SLRA Section 2.3.1.3, "Reactor Recirculation System"
- SLRA Section 2.3.1.4, "Fuel Assemblies"

2.3.1.1 Reactor Pressure Vessel and Internals System

2.3.1.1.1 Summary of Technical Information in the Application

SLRA Section 2.3.1.1 describes the reactor pressure vessel and internals system components subject to an AMR and lists the license renewal boundary drawings that show the system boundaries. SLRA Table 2.3.1-1 provides a list of the component types subject to an AMR and their intended functions. SLRA Table 3.1.2-1 provides the results of the applicant's AMR for reactor pressure vessel and internals system SCs.

2.3.1.1.2 Staff Evaluation

The staff evaluated the system functions described in the SLRA and UFSAR to verify that the applicant has included within the scope of license renewal 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 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 SRP-SLR Section 2.3, "Scoping and Screening Results: Mechanical Systems," the staff reviewed the following:

- SLRA Section 2.3.1.1
- SLRA Table 2.3.1-1
- UFSAR Sections 3.3 and 4.2

2.3.1.1.3 Conclusion

Based on the staff's evaluation in SER Section 2.3.1.1.2 and on a review of the SLRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the reactor pressure vessel and internals system components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR, in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.1.2 Reactor Pressure Vessel Instrumentation System

2.3.1.2.1 Summary of Technical Information in the Application

SLRA Section 2.3.1.2 describes the reactor pressure vessel instrumentation system components subject to an AMR and lists the license renewal boundary drawings that show the system boundaries. SLRA Table 2.3.1-2 provides a list of the component types subject to an AMR and their intended functions. SLRA Table 3.1.2-2 provides the results of the applicant's AMR for reactor pressure vessel instrumentation system SCs.

2.3.1.2.2 Staff Evaluation

The staff evaluated the system functions described in the SLRA and UFSAR to verify that the applicant has included within the scope of license renewal 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 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 SRP-SLR Section 2.3, "Scoping and Screening Results: Mechanical Systems," the staff reviewed the following:

- SLRA Section 2.3.1.2
- SLRA Table 2.3.1-2
- UFSAR Section 7.8

2.3.1.2.3 Conclusion

Based on the staff's evaluation in SER Section 2.3.1.2.2 and on a review of the SLRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the reactor pressure vessel instrumentation system components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR, in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.1.3 Reactor Recirculation System

2.3.1.3.1 Summary of Technical Information in the Application

SLRA Section 2.3.1.3 describes the reactor recirculation system components subject to an AMR and lists the license renewal boundary drawings that show the system boundaries. SLRA Table 2.3.1-3 provides a list of the component types subject to an AMR and their intended functions. SLRA Table 3.1.2-3 provides the results of the applicant's AMR for reactor recirculation system SCs.

2.3.1.3.2 Staff Evaluation

The staff evaluated the system functions described in the SLRA and UFSAR to verify that the applicant has included within the scope of license renewal 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 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 SRP-SLR Section 2.3, “Scoping and Screening Results: Mechanical Systems,” the staff reviewed the following:

- SLRA Section 2.3.1.3
- SLRA Table 2.3.1-3
- UFSAR Sections 4.3 and 7.9

2.3.1.3.3 Conclusion

Based on the staff’s evaluation in SER Section 2.3.1.3.2 and on a review of the SLRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the reactor recirculation system components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR, in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.1.4 Fuel Assemblies

2.3.1.4.1 Summary of Technical Information in the Application

SLRA Section 2.3.1.4 describes the fuel assemblies components subject to an AMR and lists the license renewal boundary drawings that show the system boundaries. SLRA Table 2.3.1-4 provides a list of the component types subject to an AMR and their intended functions. SLRA Table 3.1.2-4 provides the results of the applicant’s AMR for fuel assemblies SCs.

2.3.1.4.2 Staff Evaluation

The staff evaluated the system functions described in the SLRA and UFSAR to verify that the applicant has included within the scope of license renewal 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 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 SRP-SLR Section 2.3, “Scoping and Screening Results: Mechanical Systems,” the staff reviewed the following:

- SLRA Section 2.3.1.4
- SLRA Table 2.3.1-4
- UFSAR Sections 3.2 and 3.6

2.3.1.4.3 Conclusion

Based on the staff’s evaluation in SER Section 2.3.1.4.2 and on a review of the SLRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the fuel assemblies components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR, in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.2 Engineered Safety Features

SLRA Section 2.3.2, "Engineered Safety Features," identifies the ESF SCs subject to an AMR for license renewal. The applicant described the supporting SCs of the ESFs in the following SLRA sections:

- SLRA Section 2.3.2.1, "Containment Atmosphere Control and Dilution System"
- SLRA Section 2.3.2.2, "Core Spray System"
- SLRA Section 2.3.2.3, "High Pressure Coolant Injection System"
- SLRA Section 2.3.2.4, "Primary Containment Isolation System"
- SLRA Section 2.3.2.5, "Reactor Core Isolation Cooling System"
- SLRA Section 2.3.2.6, "Residual Heat Removal System"
- SLRA Section 2.3.2.7, "Secondary Containment System"
- SLRA Section 2.3.2.8, "Standby Gas Treatment System"

SER Sections 2.3.2.1–2.3.2.8 include the staff's findings on its review of SLRA Sections 2.3.2.1–2.3.2.8, respectively.

2.3.2.1 Containment Atmosphere Control and Dilution System

2.3.2.1.1 Summary of Technical Information in the Application

SLRA Section 2.3.2.1 describes the containment atmosphere control and dilution system components subject to an AMR and lists the license renewal boundary drawings that show the system boundaries. SLRA Table 2.3.2-1 provides a list of the component types subject to an AMR and their intended functions. SLRA Table 3.2.2-1 provides the results of the applicant's AMR for containment atmosphere control and dilution system SCs.

2.3.2.1.2 Staff Evaluation

The staff evaluated the system functions described in the SLRA and UFSAR to verify that the applicant has included within the scope of license renewal 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 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 SRP-SLR Section 2.3, "Scoping and Screening Results: Mechanical Systems," the staff reviewed the following:

- SLRA Section 2.3.2.1
- SLRA Table 2.3.2-1
- UFSAR Section 5.2

2.3.2.1.3 Conclusion

Based on the staff's evaluation in SER Section 2.3.2.1.2 and on a review of the SLRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the containment atmosphere control and dilution system components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR, in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.2.2 Core Spray System

2.3.2.2.1 Summary of Technical Information in the Application

SLRA Section 2.3.2.2 describes the core spray system components subject to an AMR and lists the license renewal boundary drawings that show the system boundaries. SLRA Table 2.3.2-2 provides a list of the component types subject to an AMR and their intended functions. SLRA Table 3.2.2-2 provides the results of the applicant's AMR for core spray system SCs.

2.3.2.2.2 Staff Evaluation

The staff evaluated the system functions described in the SLRA and UFSAR to verify that the applicant has included within the scope of license renewal 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 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 SRP-SLR Section 2.3, "Scoping and Screening Results: Mechanical Systems," the staff reviewed the following:

- SLRA Section 2.3.2.2
- SLRA Table 2.3.2-2
- UFSAR Sections 1.6.2.11, 5.3.2, 6.4.3, 6.5.3.3, 7.4.3.3.2, 7.4.3.4, 7.19.1, Table 5.2.2, and Table A.10.1

2.3.2.2.3 Conclusion

Based on the staff's evaluation in SER Section 2.3.2.2.2 and on a review of the SLRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the core spray system components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR, in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.2.3 High-Pressure Coolant Injection System

2.3.2.3.1 Summary of Technical Information in the Application

SLRA Section 2.3.2.3 describes the high-pressure coolant injection system components subject to an AMR and lists the license renewal boundary drawings that show the system boundaries. SLRA Table 2.3.2-3 provides a list of the component types subject to an AMR and their intended functions. SLRA Table 3.2.2-3 provides the results of the applicant's AMR for high-pressure coolant injection system SCs.

2.3.2.3.2 Staff Evaluation

The staff evaluated the system functions described in the SLRA and UFSAR to verify that the applicant has included within the scope of license renewal 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 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 SRP-SLR Section 2.3, "Scoping and Screening Results: Mechanical Systems," the staff reviewed the following:

- SLRA Section 2.3.2.3
- SLRA Table 2.3.2-3
- UFSAR Sections 6.4.1, 6.5.3.1, and 7.4.3.2

2.3.2.3.3 Conclusion

Based on the staff's evaluation in SER Section 2.3.2.3.2 and on a review of the SLRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the high-pressure coolant injection system components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR, in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.2.4 Primary Containment Isolation System

2.3.2.4.1 Summary of Technical Information in the Application

SLRA Section 2.3.2.4 describes the primary containment isolation system components subject to an AMR and lists the license renewal boundary drawings that show the system boundaries. SLRA Table 2.3.2-4 provides a list of the component types subject to an AMR and their intended functions. SLRA Table 3.2.2-4 provides the results of the applicant's AMR for primary containment isolation system SCs.

2.3.2.4.2 Staff Evaluation

The staff evaluated the system functions described in the SLRA and UFSAR to verify that the applicant has included within the scope of license renewal 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 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 SRP-SLR Section 2.3, "Scoping and Screening Results: Mechanical Systems," the staff reviewed the following:

- SLRA Section 2.3.2.4
- SLRA Table 2.3.2-4
- UFSAR Section 5.2

2.3.2.4.3 Conclusion

Based on the staff's evaluation in SER Section 2.3.2.4.2 and on a review of the SLRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the primary containment isolation system components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR, in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.2.5 Reactor Core Isolation Cooling System

2.3.2.5.1 Summary of Technical Information in the Application

SLRA Section 2.3.2.5 describes the reactor core isolation cooling system components subject to an AMR and lists the license renewal boundary drawings that show the system boundaries. SLRA Table 2.3.2-5 provides a list of the component types subject to an AMR and their intended functions. SLRA Table 3.2.2-5 provides the results of the applicant's AMR for reactor core isolation cooling system SCs.

2.3.2.5.2 Staff Evaluation

The staff evaluated the system functions described in the SLRA and UFSAR to verify that the applicant has included within the scope of license renewal 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 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 SRP-SLR Section 2.3, "Scoping and Screening Results: Mechanical Systems," the staff reviewed the following:

- SLRA Section 2.3.2.5
- SLRA Table 2.3.2-5
- UFSAR Section 4.7

2.3.2.5.3 Conclusion

Based on the staff's evaluation in SER Section 2.3.2.5.2 and on a review of the SLRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the reactor core isolation cooling system components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR, in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.2.6 Residual Heat Removal System

2.3.2.6.1 Summary of Technical Information in the Application

SLRA Section 2.3.2.6 describes the residual heat removal system components subject to an AMR and lists the license renewal boundary drawings that show the system boundaries. SLRA Table 2.3.2-6 provides a list of the component types subject to an AMR and their intended functions. SLRA Table 3.2.2-6 provides the results of the applicant's AMR for residual heat removal system SCs.

2.3.2.6.2 Staff Evaluation

The staff evaluated the system functions described in the SLRA and UFSAR to verify that the applicant has included within the scope of license renewal 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 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 SRP-SLR Section 2.3, "Scoping and Screening Results: Mechanical Systems," the staff reviewed the following:

- SLRA Section 2.3.2.6
- SLRA Table 2.3.2-6
- UFSAR Sections 4.8 and 6.4.4

2.3.2.6.3 Conclusion

Based on the staff's evaluation in SER Section 2.3.2.6.2 and on a review of the SLRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the residual heat removal system components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR, in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.2.7 Secondary Containment System

2.3.2.7.1 Summary of Technical Information in the Application

SLRA Section 2.3.2.7 describes the secondary containment system components subject to an AMR and lists the license renewal boundary drawings that show the system boundaries. SLRA Table 2.3.2-7 provides a list of the component types subject to an AMR and their intended functions. SLRA Table 3.2.2-7 provides the results of the applicant's AMR for secondary containment system SCs.

2.3.2.7.2 *Staff Evaluation*

The staff evaluated the system functions described in the SLRA and UFSAR to verify that the applicant has included within the scope of license renewal 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 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 SRP-SLR Section 2.3, "Scoping and Screening Results: Mechanical Systems," the staff reviewed the following:

- SLRA Section 2.3.2.7
- SLRA Table 2.3.2-7
- UFSAR Section 5.3

The staff's review identified the need for additional information in order to complete the review of the applicant's scoping and screening results and, as a result, the staff issued request for additional information (RAI) 2.3.2.7-1. The RAI and the applicant's response are documented in Agencywide Documents Access and Management System (ADAMS) Accession No. ML19143A053.

The staff identified that the primary and secondary containment isolation control diagrams (system boundary drawings) showed that redundant secondary containment isolation valves in several ventilation ducts that penetrated the secondary containment boundary, including the ductwork between the valves, were subject to an aging management review. However, the ductwork between the secondary containment boundary and the inboard isolation valve and the ductwork from the outboard valve to any necessary structural support was not indicated as subject to an aging management review. Specifically, the staff questioned whether the outboard piping fits the scoping criterion titled, "Connected to and Provide Structural Support for Safety-Related SSCs," as contained in LRA Section 2.1.5.1, "Nonsafety-Related Affecting Safety-Related – 10 CFR 54.4(a)(2)."

The applicant stated that the following changes to the SLRA and supporting information had been implemented to identify components in the secondary containment system that are within the scope of license renewal and subject to an AMR:

- Revised the primary and secondary containment isolation control diagrams (system boundary drawings) to reflect that the ductwork on the inboard side of the isolation valves through the secondary containment wall is in the scope of SLR pursuant to 10 CFR 54.4(a)(2) and subject to an AMR.
- Revised the primary and secondary containment isolation control diagrams (system boundary drawings) to reflect that for locations where the outboard valve is not self-supported, the ductwork to the next base mounted component is in the scope of SLR pursuant to 10 CFR 54.4(a)(2) and subject to an AMR.
- Revised SLRA Section 2.1.5.2, "Nonsafety-Related Affecting Safety-Related – 10 CFR 54.4(a)(2)," to add a statement that the secondary containment system includes nonsafety-related components that are relied upon to support the secondary containment boundary.

- Revised SLRA Section 2.3.2.7, “Secondary Containment System,” to add a 10 CFR 54.4(a)(2) intended function to resist nonsafety related SSC failure that could prevent satisfactory accomplishment of a safety related function. The revision also includes a statement that the secondary containment system includes nonsafety related components that form a portion of the secondary containment pressure boundary and support pressure boundary integrity.

The staff reviewed the additions and modifications to the SLRA for conformance with the requirements of 10 CFR 54.4(a)(2) and 10 CFR 54.21(a)(1), which added a description of the secondary containment system intended function identifying that nonsafety-related components form a portion of the secondary containment pressure boundary and support pressure boundary integrity. The staff determined that the applicant had appropriately identified secondary containment system components within the scope of license renewal and subject to an aging management review, consistent with the requirements of 10 CFR 54.4(a)(2) and 10 CFR 54.21(a)(1).

2.3.2.7.3 Conclusion

Based on the staff’s evaluation in SER Section 2.3.2.7.2 and on a review of the SLRA, UFSAR, and license renewal boundary drawings, and RAI responses, the staff concludes that the applicant appropriately identified the secondary containment system components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR, in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.2.8 Standby Gas Treatment System

2.3.2.8.1 Summary of Technical Information in the Application

SLRA Section 2.3.2.8 describes the standby gas treatment (SGTS) system components subject to an AMR and lists the license renewal boundary drawings that show the system boundaries. SLRA Table 2.3.2-8 provides a list of the component types subject to an AMR and their intended functions. SLRA Table 3.2.2-8 provides the results of the applicant’s AMR for standby gas treatment system SCs.

2.3.2.8.2 Staff Evaluation

The staff evaluated the system functions described in the SLRA and UFSAR to verify that the applicant has included within the scope of license renewal 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 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 SRP-SLR Section 2.3, “Scoping and Screening Results: Mechanical Systems,” the staff reviewed the following:

- SLRA Section 2.3.2.8
- SLRA Table 2.3.2-8
- UFSAR Section 5.3.3

The staff's review identified an area in which additional information was necessary to complete the review of the applicant's scoping and screening results, which resulted in the issuance of RAI 2.3.2.8-1. The RAI and the applicant's response are documented in ADAMS Accession No. ML19143A053.

The staff identified that the primary and secondary containment isolation control diagrams (system boundary drawings) for the two reactor buildings showed that the following two sections of ductwork in each building were not subject to an AMR: (1) ductwork penetrating the refuel floor leading to each set of two parallel safety-related standby gas treatment system (SGTS) suction isolation valves; and (2) the connected ductwork on the outboard side of each set of two safety-related secondary containment isolation valves to the suction of the normal reactor building ventilation exhaust fans. Specifically, the staff questioned whether these ductwork sections provided structural support for the safety-related isolation valves, as discussed in LRA Section 2.1.5.1, "Nonsafety-Related Affecting Safety-Related – 10 CFR 54.4(a)(2)."

In its response, the applicant described changes to the SLRA and supporting information to identify additional SGTS components that are within the scope of license renewal and subject to an AMR. In addition, the applicant provided the basis for concluding that ductwork on the outboard side of each set of two safety-related secondary containment isolation valves to the suction of the normal reactor building ventilation exhaust fans was not within the scope of SLR. Specifically, the applicant described the following changes:

- Revised the primary and secondary containment isolation control diagrams (system boundary drawings) to reflect that the ductwork penetrating the refuel floor leading to each set of two parallel safety-related standby gas treatment system (SGTS) suction isolation valves is in the scope of SLR pursuant to 10 CFR 54.4(a)(2) and subject to an AMR.
- Revised the SGTS control diagrams (system boundary drawings) to reflect that that the reactor building differential pressure instrumentation lines were in the scope of SLR pursuant to 10 CFR 54.4(a)(2) and subject to an AMR.
- Revised SLRA Section 2.1.5.2, "Nonsafety-Related Affecting Safety-Related – 10 CFR 54.4(a)(2)," to add a statement that the SGTS includes nonsafety-related components that are relied upon to support the secondary containment boundary.
- Revised SLRA Section 2.3.2.8, "Standby Gas Treatment System," to modify the 10 CFR 54.4(a)(2) intended function to resist nonsafety-related SSC failure that could prevent satisfactory accomplishment of a safety related function. The revision added a statement that the SGTS includes nonsafety-related components that form a portion of the secondary containment pressure boundary and support pressure boundary integrity.

The staff reviewed the additions and modifications to the SLRA for conformance with the requirements of 10 CFR 54.4(a)(2) and 10 CFR 54.21(a)(1), which added a description of the SGTS intended function identifying that the nonsafety-related components form a portion of the secondary containment pressure boundary and support pressure boundary integrity. The staff determined that the applicant had appropriately identified secondary containment system components within the scope of license renewal and subject to an aging management review, consistent with the requirements of 10 CFR 54.4(a)(2) and 10 CFR 54.21(a)(1). The SLRA revision retained a discussion of nonsafety-related instrument lines that are relied upon to preserve the structural support intended function of the SGTS.

2.3.2.8.3 Conclusion

Based on the staff's evaluation in SER Section 2.3.2.8.2 and on a review of the SLRA, UFSAR, license renewal boundary drawings, and RAI responses, the staff concludes that the applicant appropriately identified the standby gas treatment system components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR, in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.3 Auxiliary Systems

SLRA Section 2.3.3, "Auxiliary Systems," identifies the auxiliary systems SCs subject to an AMR for license renewal. The applicant described the supporting SCs of the auxiliary systems in the following SLRA sections:

- SLRA Section 2.3.3.1, "Auxiliary Steam System"
- SLRA Section 2.3.3.2, "Backup Instrument Nitrogen to ADS"
- SLRA Section 2.3.2.3, "Battery and Emergency Switchgear Ventilation System"
- SLRA Section 2.3.3.4, "Chilled Water System"
- SLRA Section 2.3.3.5, "Condensate Transfer System"
- SLRA Section 2.3.3.6, "Control Rod Drive System"
- SLRA Section 2.3.3.7, "Control Room Ventilation System"
- SLRA Section 2.3.3.8, "Cranes and Hoists System"
- SLRA Section 2.3.3.9, "Diesel Generator Building Ventilation System"
- SLRA Section 2.3.3.10, "Domestic Water System"
- SLRA Section 2.3.3.11, "Emergency Cooling Water System"
- SLRA Section 2.3.3.12, "Emergency Diesel Generator System"
- SLRA Section 2.3.3.13, "Emergency Service Water System"
- SLRA Section 2.3.3.15, "Fuel Handling System"
- SLRA Section 2.3.3.16, "Fuel Pool Cooling and Cleanup System"
- SLRA Section 2.3.3.17, "High Pressure Service Water System"
- SLRA Section 2.3.3.18, "Offgas and Recombiner System"
- SLRA Section 2.3.3.19, "Plant Equipment and Floor Drain System"
- SLRA Section 2.3.3.20, "Post Accident Sampling System"
- SLRA Section 2.3.3.21, "Process Sampling System"
- SLRA Section 2.3.3.22, "Pump Structure Ventilation System"
- SLRA Section 2.3.3.23, "Radiation Monitoring System"
- SLRA Section 2.3.3.24, "Radwaste System"
- SLRA Section 2.3.3.25, "Reactor Building Closed Cooling Water System"
- SLRA Section 2.3.3.26, "Reactor Water Cleanup System"
- SLRA Section 2.3.3.27, "Refueling Water Storage and Transfer System"
- SLRA Section 2.3.3.28, "Safety Grade Instrument Gas System"
- SLRA Section 2.3.3.29, "Service Water System"
- SLRA Section 2.3.3.30, "Standby Liquid Control System"
- SLRA Section 2.3.3.31, "Suppression Pool Temperature Monitoring System"
- SLRA Section 2.3.3.32, "Torus Water Cleanup System"
- SLRA Section 2.3.3.33, "Torus Water Storage and Transfer System"
- SLRA Section 2.3.3.34, "Traveling Water Screen System"

- SLRA Section 2.3.3.35, “Turbine Building Closed Cooling Water System”
- SLRA Section 2.3.3.36, “Water Treatment System”

SER Sections 2.3.3.1–2.3.3.36 include the staff’s findings on its review of SLRA Sections 2.3.3.1–2.3.3.36, respectively.

2.3.3.1 Auxiliary Steam System

2.3.3.1.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.1 describes the auxiliary steam system components subject to an AMR and lists the license renewal boundary drawings that show the system boundaries. SLRA Table 2.3.3-1 provides a list of the component types subject to an AMR and their intended functions. SLRA Table 3.3.2-1 provides the results of the applicant’s AMR for auxiliary steam system SCs.

2.3.3.1.2 Staff Evaluation

The staff evaluated the system functions described in the SLRA and UFSAR to verify that the applicant has included within the scope of license renewal 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 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 SRP-SLR Section 2.3, “Scoping and Screening Results: Mechanical Systems,” the staff reviewed the following:

- SLRA Section 2.3.3.1
- SLRA Table 2.3.3-1
- UFSAR Section 10.23

2.3.3.1.3 Conclusion

Based on the staff’s evaluation in SER Section 2.3.3.1.2 and on a review of the SLRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the auxiliary steam system components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR, in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.2 Backup Instrument Nitrogen to Automatic Depressurization System

2.3.3.2.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.2 describes the backup instrument nitrogen to automatic depressurization (ADS) system components subject to an AMR and lists the license renewal boundary drawings that show the system boundaries. SLRA Table 2.3.3-2 provides a list of the component types subject to an AMR and their intended functions. SLRA Table 3.3.2-2 provides the results of the applicant’s AMR for backup instrument nitrogen to ADS system SCs.

2.3.3.2.2 Staff Evaluation

The staff evaluated the system functions described in the SLRA and UFSAR to verify that the applicant has included within the scope of license renewal 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 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 SRP-SLR Section 2.3, "Scoping and Screening Results: Mechanical Systems," the staff reviewed the following:

- SLRA Section 2.3.3.2
- SLRA Table 2.3.3-2
- UFSAR Sections 4.4 and 10.17

2.3.3.2.3 Conclusion

Based on the staff's evaluation in SER Section 2.3.3.2.2 and on a review of the SLRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the backup instrument nitrogen to ADS system components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR, in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.3 Battery and Emergency Switchgear Ventilation System

2.3.3.3.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.3 describes the battery and emergency switchgear ventilation system components subject to an AMR and lists the license renewal boundary drawings that show the system boundaries. SLRA Table 2.3.3-3 provides a list of the component types subject to an AMR and their intended functions. SLRA Table 3.3.2-3 provides the results of the applicant's AMR for battery and emergency switchgear ventilation system SCs.

2.3.3.3.2 Staff Evaluation

The staff evaluated the system functions described in the SLRA and UFSAR to verify that the applicant has included within the scope of license renewal 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 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 SRP-SLR Section 2.3, "Scoping and Screening Results: Mechanical Systems," the staff reviewed the following:

- SLRA Section 2.3.3.3
- SLRA Table 2.3.3-3
- UFSAR Sections 7.19 and 10.14

The staff's review identified an area in which additional information was necessary to complete the review of the applicant's scoping and screening results, which resulted in the issuance of two RAIs: RAI 2.3.3.3-1 and RAI 2.3.3.3-2. The RAIs and the applicant's responses are documented in ADAMS Accession No. ML19143A053.

In RAI 2.3.3.3-1, the staff identified that the emergency switchgear, battery room, laboratory supply & exhaust diagram showed heating coil housings, filter housings, and instrument lines, which were all connected to ductwork identified as subject to an AMR, that were not listed as component types subject to an AMR in SLRA Table 2.3.3-3. Specifically, the staff requested clarification as to how aging management of these component types was addressed in the SLRA and clarification as to whether rotation of the filter drum and pressure boundary integrity of the instrument lines was necessary to support the 10 CFR 54.4(a)(3) fire protection intended function.

In its response, the applicant described changes to the SLRA and supporting information to clarify how the SLRA addressed the aging management of these component types. Specifically, the applicant provided the following clarifications and revisions:

- Explained that the heating coils are located internal to the ductwork, and the ductwork serves as the housing, which is included in SLRA Table 3.3.2-3, "Battery and Emergency Switchgear Ventilation System Summary of Aging Management Evaluation," in the ducting and components component type with a pressure boundary intended function.
- Revised the external environment of the heating coil tubes in SLRA Section 3.3.2.1.1, "Auxiliary Steam System," and SLRA Table 3.3.2-1, "Auxiliary Steam System Summary of Aging Management Evaluation," to reflect that the external environment for the tubes, which are identified under the "Heat Exchanger – (HVAC Heater Coils) Tubes" component type, are exposed to condensation rather than indoor air since they are located internal to the ductwork.
- Clarified that the filter housing and the instrument tubing associated with the filter are included in SLRA Table 3.3.2-3, "Battery and Emergency Switchgear Ventilation System Summary of Aging Management Evaluation," in the ducting and components component type with a pressure boundary intended function. The applicant also stated that the rotation of the filter is an active function and is, therefore, not subject to an aging management review.
- Revised the emergency switchgear, battery room, laboratory supply & exhaust diagram to show that the instrument tubing for the filter drums is in scope for license renewal and subject to an AMR.

The staff reviewed the additions and modifications to the SLRA for conformance with the requirements of 10 CFR 54.4(a)(2) and 10 CFR 54.21(a)(1). The staff found that the heating coil housings, filter housings, and instrument lines were appropriately identified under the "ducting and components" component type as within the scope of license renewal and subject to an aging management review, consistent with the requirements of 10 CFR 54.4(a)(2) and 10 CFR 54.21(a)(1).

In RAI 2.3.3.3-2, the staff identified that the emergency switchgear, battery room, laboratory supply & exhaust diagram showed the system ventilation exhaust hoods as not being subject to aging management review (AMR). Specifically, the staff requested clarification regarding how aging management of these component types was addressed in the SLRA and clarification on whether integrity of these components was necessary to prevent blockage of the ductwork and, thereby, support the 10 CFR 54.4(a)(3) fire protection intended function.

In its response, the applicant described changes to the SLRA and supporting information to clarify how the aging management of these component types was addressed in the SLRA. Specifically, the applicant provided the following clarifications and revisions:

- Clarified that the ventilation exhaust hoods are included in SLRA Table 3.3.2-3, "Battery and Emergency Switchgear Ventilation System Summary of Aging Management Evaluation," under the "ducting and components" component type with galvanized steel material, air - outdoor environment, and pressure boundary intended function.
- Revised the emergency switchgear, battery room, laboratory supply & exhaust diagram to show that the exhaust hoods are in scope, and that both vents are located on the radwaste building roof to be consistent with SLRA Section 2.3.3.3 and PBAPS UFSAR Section 10.14.3.1. In addition, the applicant revised SLRA Table 3.3.2 3 to include [heating, ventilation, and air conditioning] HVAC closure bolting in the air - outdoor environment.

The staff reviewed the clarifications and modifications to the SLRA for conformance with the requirements of 10 CFR 54.4(a)(2) and 10 CFR 54.21(a)(1). The staff found that the exhaust hoods were appropriately identified under the "ducting and components" component type as within the scope of license renewal and subject to an aging management review, consistent with the requirements of 10 CFR 54.4(a)(2) and 10 CFR 54.21(a)(1).

2.3.3.3.3 Conclusion

Based on the staff's evaluation in SER Section 2.3.3.3.2 and on a review of the SLRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the battery and emergency switchgear ventilation system components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR, in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.4 Chilled Water System

2.3.3.4.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.4 describes the chilled water system components subject to an AMR and lists the license renewal boundary drawings that show the system boundaries. SLRA Table 2.3.3-4 provides a list of the component types subject to an AMR and their intended functions. SLRA Table 3.3.2-4 provides the results of the applicant's AMR for chilled water system SCs.

2.3.3.4.2 Staff Evaluation

The staff evaluated the system functions described in the SLRA and UFSAR to verify that the applicant has included within the scope of license renewal 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 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 SRP-SLR Section 2.3, "Scoping and Screening Results: Mechanical Systems," the staff reviewed the following:

- SLRA Section 2.3.3.4
- SLRA Table 2.3.3-4
- UFSAR Section 10.11

2.3.3.4.3 Conclusion

Based on the staff's evaluation in SER Section 2.3.3.4.2 and on a review of the SLRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the chilled water system components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR, in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.5 Condensate Transfer System

2.3.3.5.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.5 describes the condensate transfer system components subject to an AMR and lists the license renewal boundary drawings that show the system boundaries. SLRA Table 2.3.3-5 provides a list of the component types subject to an AMR and their intended functions. SLRA Table 3.3.2-5 provides the results of the applicant's AMR for condensate transfer system SCs.

2.3.3.5.2 Staff Evaluation

The staff evaluated the system functions described in the SLRA and UFSAR to verify that the applicant has included within the scope of license renewal 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 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 SRP-SLR Section 2.3, "Scoping and Screening Results: Mechanical Systems," the staff reviewed the following:

- SLRA Section 2.3.3.5
- SLRA Table 2.3.3-5
- UFSAR Sections 4.8.5, 6.5.3, 11.7, and 11.8

2.3.3.5.3 Conclusion

Based on the staff's evaluation in SER Section 2.3.3.5.2 and on a review of the SLRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the condensate transfer system components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR, in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.6 Control Rod Drive System

2.3.3.6.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.6 describes the control rod drive system components subject to an AMR and lists the license renewal boundary drawings that show the system boundaries. SLRA Table 2.3.3-6 provides a list of the component types subject to an AMR and their intended functions. SLRA Table 3.3.2-6 provides the results of the applicant's AMR for control rod drive system SCs.

2.3.3.6.2 Staff Evaluation

The staff evaluated the system functions described in the SLRA and UFSAR to verify that the applicant has included within the scope of license renewal 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 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 SRP-SLR Section 2.3, "Scoping and Screening Results: Mechanical Systems," the staff reviewed the following:

- SLRA Section 2.3.3.6
- SLRA Table 2.3.3-6
- UFSAR Section 3.4

2.3.3.6.3 Conclusion

Based on the staff's evaluation in SER Section 2.3.3.6.2 and on a review of the SLRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the control rod drive system components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR, in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.7 Control Room Ventilation System

2.3.3.7.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.7 describes the control room ventilation system components subject to an AMR and lists the license renewal boundary drawings that show the system boundaries. SLRA

Table 2.3.3-7 provides a list of the component types subject to an AMR and their intended functions. SLRA Table 3.3.2-7 provides the results of the applicant's AMR for control room ventilation system SCs.

2.3.3.7.2 Staff Evaluation

The staff evaluated the system functions described in the SLRA and UFSAR to verify that the applicant has included within the scope of license renewal 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 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 SRP-SLR Section 2.3, "Scoping and Screening Results: Mechanical Systems," the staff reviewed the following:

- SLRA Section 2.3.3.7
- SLRA Table 2.3.3-7
- UFSAR Sections 7.19 and 10.13

The staff's review determined additional information was necessary to complete the review of the applicant's scoping and screening results, which resulted in the issuance of three RAIs: RAI 2.3.3.7-1, RAI 2.3.3.7-2, and RAI 2.3.3.7-3. The RAIs and the applicant's responses are documented in ADAMS Accession No. ML19143A053.

In RAI 2.3.3.7-1 and RAI 2.3.3.7-3, the staff identified that the control room HVAC diagrams showed heating coil housings that were not listed as component types subject to an AMR in SLRA Table 2.3.3-7. The housings were shown as in line with control room HVAC ductwork identified as subject to an AMR. Specifically, the staff requested information on how aging management of the heating coil housing component type was addressed in the SLRA.

In its response, the applicant clarified that the heating coils are located internal to the ductwork, and the ductwork serves as the housing, which is included in SLRA Table 3.3.2-7, "Control Room Ventilation System Summary of Aging Management Evaluation," under the "ducting and components" component type with a pressure boundary intended function. The applicant also stated that the control room HVAC diagram notes addressing aging management of the heating coils was revised to state the following, as applicable:

> The Control Room [Fresh Air supply preheat] [Ventilation reheat] coil consists of heating coils located in the HVAC housing. The heating coils are evaluated with the Auxiliary Steam System for aging management review. The air side components are evaluated with the Control Room Ventilation System for aging management review."

As discussed, in SLRA Section 2.3.3.3, "Battery and Emergency Switchgear Ventilation System," the applicant revised the external environment for heating coils internal to ducts to reflect the potential for condensation. The applicant stated that the resulting change to aging management of auxiliary steam heating coils also applies to the Control Room HVAC system.

The staff reviewed the clarifications and modifications to the SLRA supporting information for conformance with the requirements of 10 CFR 54.4(a)(2) and 10 CFR 54.21(a)(1). The staff found that the heating coil housings were appropriately identified under the "ducting and components" component type as within the scope of license renewal and subject to an aging management review, consistent with the requirements of 10 CFR 54.4(a)(2) and 10 CFR 54.21(a)(1).

In RAI 2.3.3.7-2, the staff identified that the Control Room HVAC diagram showed control room ventilation ducts that penetrate the control room envelope (CRE) and in-line components (e.g., instrumentation tubing, filter housings, and cooling coil housings) that were not indicated as subject to an AMR. The staff also noted that SLRA Section 2.4.20, "Turbine Building and Main Control Room Complex," did not clearly address how the aging management of the structural components that comprise the CRE were comprehensively evaluated in the SLRA. Specifically, the staff requested clarification regarding how aging management of structures and components that form the CRE was addressed in the SLRA.

In its response, the applicant described changes to the SLRA and supporting information to clarify how the aging management of the component types and structures that form the CRE was addressed in the SLRA. Specifically, the applicant provided the following clarifications and revisions:

- Revised the Control Room HVAC diagram to show that the ductwork and associated components (such as filter housings, heating and cooling coil housings, and fan housings) that penetrate the control room boundary are within the scope of license renewal for the CRE pressure boundary intended function and subject to an AMR. In addition, the applicant revised SLRA Section 3.3.2.1.7, "Control Room Ventilation System Materials," Table 3.3.1, "Summary of Aging Management Evaluations for the Auxiliary Systems," and Table 3.3.2-7, "Control Room Ventilation System Summary of Aging Management Evaluation," to include the outdoor air environment for the control room HVAC exhaust hoods and associated bolting.
- Clarified that the aging management of control room pressure monitoring instrument tubing is addressed in SLRA Table 3.3.2-7 as part of the component types "piping, piping components" and "valve bodies." The applicant also revised SLRA Section 3.3.2.1.7, Section 3.3.2.2.8, "Cracking Due to Stress Corrosion Cracking in Aluminum Alloys," Table 3.3.1, and SLRA Table 3.3.2-7 to include aluminum alloy as an additional material for the pressure sensing element, which is included with the "piping, piping components" component type.
- Clarified that the rooms that comprise the main control room complex are included in the scope of the structures monitoring program and the structural component types that comprise the CRE boundary were assigned a component function of "structural pressure barrier" in SLRA Section 2.4.20, "Turbine Building and Main Control Room Complex." In addition, the applicant stated that hazard barriers and elastomers are addressed separately under a specific commodity group in SLRA Section 2.4.10, "Hazard Barriers and Elastomers." The applicant listed the following component types that have a structural pressure boundary function as part of the CRE:
    - Concrete: Above-grade exterior, accessible and inaccessible areas
    - Concrete: Interior, accessible and inaccessible areas
    - Door Seal
    - Doors

- Penetration Seals
- Penetration Sleeves
- Roofing
- Seals, gaskets, and moisture barriers (caulking, flashing and other sealants)

The staff reviewed the clarifications and modifications to the SLRA for conformance with the requirements of 10 CFR 54.4(a) and 10 CFR 54.21(a)(1). The staff found that the applicant appropriately identified the Control Room HVAC and structural components forming the CRE as within the scope of license renewal and subject to an aging management review, consistent with the requirements of 10 CFR 54.4(a) and 10 CFR 54.21(a)(1).

2.3.3.7.3 Conclusion

Based on the staff's evaluation in SER Section 2.3.3.7 2 and on a review of the SLRA, UFSAR, and license renewal boundary drawings, and RAI responses, the staff concludes that the applicant appropriately identified the control room ventilation system components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR, in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.8 Cranes and Hoists System

2.3.3.8.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.8 describes the cranes and hoists system components subject to an AMR and lists the license renewal boundary drawings that show the system boundaries. SLRA Table 2.3.3-8 provides a list of the component types subject to an AMR and their intended functions. SLRA Table 3.3.2-8 provides the results of the applicant's AMR for cranes and hoist system SCs.

2.3.3.8.2 Staff Evaluation

The staff evaluated the system functions described in the SLRA and UFSAR to verify that the applicant has included within the scope of license renewal 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 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 SRP-SLR Section 2.3, "Scoping and Screening Results: Mechanical Systems," the staff reviewed the following:

- SLRA Section 2.3.3.8
- SLRA Table 2.3.3-8
- UFSAR Section 10.4

2.3.3.8.3 Conclusion

Based on the staff's evaluation in SER Section 2.3.3.8.2 and on a review of the SLRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the cranes and hoists system components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR, in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.9 Diesel Generator Building Ventilation System

2.3.3.9.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.9 describes the diesel generator building ventilation system components subject to an AMR and lists the license renewal boundary drawings that show the system boundaries. SLRA Table 2.3.3-9 provides a list of the component types subject to an AMR and their intended functions. SLRA Table 3.3.2-9 provides the results of the applicant's AMR for diesel generator building ventilation system SCs.

2.3.3.9.2 Staff Evaluation

The staff evaluated the system functions described in the SLRA and UFSAR to verify that the applicant has included within the scope of license renewal 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 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 SRP-SLR Section 2.3, "Scoping and Screening Results: Mechanical Systems," the staff reviewed the following:

- SLRA Section 2.3.3.9
- SLRA Table 2.3.3-9
- UFSAR Section 10.14

2.3.3.9.3 Conclusion

Based on the staff's evaluation in SER Section 2.3.3.9.2 and on a review of the SLRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the diesel generator building ventilation system components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR, in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.10 Domestic Water System

2.3.3.10.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.10 describes the domestic water system components subject to an AMR and lists the license renewal boundary drawings that show the system boundaries. SLRA Table 2.3.3-10 provides a list of the component types subject to an AMR and their intended functions. SLRA Table 3.3.2-10 provides the results of the applicant's AMR for domestic water system SCs.

2.3.3.10.2 Staff Evaluation

The staff evaluated the system functions described in the SLRA and UFSAR to verify that the applicant has included within the scope of license renewal 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 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 SRP-SLR Section 2.3, "Scoping and Screening Results: Mechanical Systems," the staff reviewed the following:

- SLRA Section 2.3.3.10
- SLRA Table 2.3.3-10
- UFSAR Section 10.18

2.3.3.10.3 Conclusion

Based on the staff's evaluation in SER Section 2.3.3.10.2 and on a review of the SLRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the domestic water system components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR, in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.11 Emergency Cooling Water System

2.3.3.11.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.11 describes the emergency cooling water system components subject to an AMR and lists the license renewal boundary drawings that show the system boundaries. SLRA Table 2.3.3-11 provides a list of the component types subject to an AMR and their intended functions. SLRA Table 3.3.2-11 provides the results of the applicant's AMR for emergency cooling water system SCs.

2.3.3.11.2 Staff Evaluation

The staff evaluated the system functions described in the SLRA and UFSAR to verify that the applicant has included within the scope of license renewal 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 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 SRP-SLR Section 2.3, “Scoping and Screening Results: Mechanical Systems,” the staff reviewed the following:

- SLRA Section 2.3.3.11
- SLRA Table 2.3.3-11
- UFSAR Section 10.24

2.3.3.11.3 Conclusion

Based on the staff’s evaluation in SER Section 2.3.3.11.2 and on a review of the SLRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the emergency cooling water system components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR, in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.12 Emergency Diesel Generator System

2.3.3.12.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.12 describes the emergency diesel generator system components subject to an AMR and lists the license renewal boundary drawings that show the system boundaries. SLRA Table 2.3.3-12 provides a list of the component types subject to an AMR and their intended functions. SLRA Table 3.3.2-12 provides the results of the applicant’s AMR for emergency diesel generator system SCs.

2.3.3.12.2 Staff Evaluation

The staff evaluated the system functions described in the SLRA and UFSAR to verify that the applicant has included within the scope of license renewal 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 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 SRP-SLR Section 2.3, “Scoping and Screening Results: Mechanical Systems,” the staff reviewed the following:

- SLRA Section 2.3.3.12
- SLRA Table 2.3.3-12
- UFSAR Sections 1.6, 5.2, and 8.5

2.3.3.12.3 Conclusion

Based on the staff’s evaluation in SER Section 2.3.3.12.2 and on a review of the SLRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the emergency diesel generator system components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR, in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.13 Emergency Service Water System

2.3.3.13.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.13 describes the emergency service water system components subject to an AMR and lists the license renewal boundary drawings that show the system boundaries. SLRA Table 2.3.3-13 provides a list of the component types subject to an AMR and their intended functions. SLRA Table 3.3.2-13 provides the results of the applicant's AMR for emergency service water system SCs.

2.3.3.13.2 Staff Evaluation

The staff evaluated the system functions described in the SLRA and UFSAR to verify that the applicant has included within the scope of license renewal 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 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 SRP-SLR Section 2.3, "Scoping and Screening Results: Mechanical Systems," the staff reviewed the following:

- SLRA Section 2.3.3.13
- SLRA Table 2.3.3-13
- UFSAR Sections 10.9, 14.10.5.1, and 14.10.5.3

2.3.3.13.3 Conclusion

Based on the staff's evaluation in SER Section 2.3.3.13.2 and on a review of the SLRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the emergency service water system components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR, in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.14 Fire Protection System

2.3.3.14.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.14 describes the fire protection system components subject to an AMR and lists the license renewal boundary drawings that show the system boundaries. SLRA Table 2.3.3-14 provides a list of the component types subject to an AMR and their intended functions. SLRA Table 3.3.2-14 provides the results of the applicant's AMR for fire protection system SCs.

2.3.3.14.2 Staff Evaluation

The staff evaluated the system functions described in the SLRA and UFSAR to verify that the applicant has included within the scope of license renewal 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 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 SRP-SLR Section 2.3, "Scoping and Screening Results: Mechanical Systems," the staff reviewed the following information:

For Peach Bottom Atomic Power Station, Units 2 and 3 (PBAPS), the staff reviewed SLRA Section 2.3.3.14; NUREG-1769, "Safety Evaluation Report Related to License Renewal of Peach Bottom Atomic Power Station, Units 2 and 3," March 2003 (ADAMS Package Accession No. ML031010136); relevant subsequent license renewal boundary drawings as listed in SLRA Section 2.3.3.14; Updated Final Safety Analysis Report (UFSAR) Section 1.6.5.6, Section 10.12, and fire protection program; and the following fire protection current licensing basis (CLB) documents listed in PBAPS, license condition 2.C.4:

- Peach Bottom Station, Units 2 and 3, License Amendment 53, Re: Fire Protection Modifications, May 23, 1979, ADAMS Accession Nos. ML011300018, ML021570226.
- Supplement No. 1 to the Safety Evaluation of the Peach Bottom Atomic Power Station, August 14, 1980, ADAMS Package Accession Nos. ML120380514 (non-public), ML011310223.
- Supplement No. 2 to the Safety Evaluation of the Peach Bottom Atomic Power Fire Protection Program, September 15, 1980, ADAMS Package Accession No. ML120380491(non-public).
- Supplement No. 3 to the Safety Evaluation of the Peach Bottom Atomic Power Station Fire Protection Program, October 10, 1980, ADAMS Package Accession No. ML120380487 (non-public).
- Supplement No. 4 to the Safety Evaluation of the Peach Bottom Atomic Power Station, November 24, 1980, ADAMS Package Accession No. ML120380482 (non-public).
- Safety Evaluation for the Peach Bottom Atomic Power Station, Units 2 and 3, Fire Protection Program, September 16, 1993, ADAMS Accession Nos. ML12038A219 (non-public), ML081690220 (non-public).
- Peach Bottom Power Station, Units 2 and 3, License Amendments 194 and 198: re Removal of Fire Protection Requirements, August 24, 1994, ADAMS Accession No. ML011450057 (non-public).

SLRA Section 2.3.3.14 lists the SLR boundary drawings that reflect the boundaries for subsequent license renewal. SLRA Section 2.3.3.14 states the fire protection system includes various types of water, foam, and carbon dioxide suppression systems. Additionally, the fire protection system includes active and passive features such as walls, floors, fire doors, fire dampers, penetration seals, fire wraps, combustible free zones, and water curtains which retard fires from spreading from one area of the plant to another. Heat and smoke detection are accomplished by the appropriate detectors installed in areas where fire potential exists and, in all areas, containing safety-related equipment except where a specific exemption was granted by the NRC. The circuits of these installations go directly to local system panels. The local panels contain detector circuits for supervisory and alarm functions and trouble circuits for remote indication. Circuits for annunciation are physically separated from those circuits that actuate the fire suppression systems. Detection of fire by any smoke or heat detector will activate an audible control room alarm with visual annunciation and a printed record of event.

During its review, the staff evaluated the fire protection components described in the SLRA, UFSAR, and subsequent license renewal boundary drawings to verify that the applicant included within the scope of subsequent license renewal 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 subsequent license renewal to verify that it included all passive or long-lived components subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

SLRA Section 2.3.3.14 states that the fire protection system provides the capability to control postulated fires in plant areas to maintain safe shutdown capability. The fire protection system includes nonsafety-related, water-filled lines in the circulating water pump structure and other areas of the plant that contain safety-related equipment that have the potential for spatial interactions (spray or leakage) or structurally interact with safety-related structures, systems, and components. SLRA Table 2.3.3-14 identifies the fire protection system component types that are within the scope of the subsequent license renewal, with AMR results in SLRA Table 3.3.2-14.

The staff's review identified additional information that was necessary to complete its review of SLRA Section 2.3.3.14 scoping and screening results, which resulted in the issuance of request for additional information (RAI) 2.3.3.14-1, RAI 2.3.3.14-2, and RAI 2.3.3.14-3. The RAIs and the applicant's responses are documented in a letter dated May 23, 2019 (ADAMS Accession No. ML19143A053.)

In RAI 2.3.3.14-1, the staff noted that the following SLRA boundary drawings show the associated fire protection systems or components as out of scope:

LRA Drawing	Systems/Components	Location
SLR-PB-318, Sheet 1	Auxiliary Boiler Building Fire Suppression System	B8 and C8
SLR-PB-318, Sheet 1	West Side Dewatering Building Water Curtain	H6
SLR-PB-318, Sheet 10	Post Indicator Valves	E3, G6

The staff requested the applicant to verify whether the fire protection systems and components listed in the above table are within the scope of subsequent license renewal, in accordance with 10 CFR 54.4(a), and whether they are subject to an AMR, in accordance with 10 CFR 54.21(a)(1). The staff requested that the applicant clarify whether those fire protection systems and components were excluded from the scope of license renewal and deemed not to be subject to an AMR.

In its response, dated May 23, 2019, the applicant provided the results of the scoping and screening for the listed fire protection component types addressed in RAI 2.3.3.14-1 (ADAMS Accession No. ML19143A053). The applicant stated:

Auxiliary Boiler Building Fire Suppression System – The auxiliary boiler building fire suppression system is not within the scope of license renewal in accordance with 10 CFR 54.4(a) or subject to an aging management review in accordance with 10 CFR 54.21(a)(1) based upon the justification that it is not credited in the Peach Bottom Fire Protection Plan or other CLB documents and does not perform a 10 CFR 54.4 (a)(3) function in support of the commission's regulations for fire protection.

West Side Dewatering Building Water Curtain – The west side dewatering building water curtain is not within scope of license renewal in accordance with 10 CFR 54.4(a) or subject to an aging management review in accordance with 10 CFR 54.21(a)(1) based upon the justification that it is not credited in the Peach Bottom Fire Protection Plan or other CLB documents, and does not perform a 10 CFR 54.4 (a)(3) function in support of the commission's regulations for fire protection.

Post Indicator Valves – The post indicator valves identified on drawing SLR-PB-318, Sheet 10, Coordinates E3 (37B-12320) and G6 (37B-12492) are within the scope license renewal in accordance with 10 CFR 54.4(a) and should have been colored green on the subject boundary drawing. As shown on drawing SLR-PB-M-318, Sheet 1, Coordinates G8, post indicator valve 37B-12492 is indicated as in scope, and on drawing SLR-PB-M-318, Sheet 2, Coordinates G2, post indicator valve 37B-12320 is indicated as in scope. Post indicator valves 37B-12320 and 37B-12492 are included in the component type 'Valve Body' as identified in SLRA Table 2.3.3-14, Fire Protection System – Components Subject to Aging Management Review' and provided in SLRA Table 3.3.2-14, 'Fire Protection System – Summary of Aging Management Evaluation. As a result, drawing SLR-PB-M-318, Sheet 10 is revised to show the identified post indicating valves as in scope for license renewal in accordance with 10 CFR 54.4(a) and are subject to aging management review in accordance with 10 CFR 54.21(a)(1).

The staff finds the applicant's response to RAI 2.3.3.14-1 acceptable because the applicant clarified that the auxiliary boiler building fire suppression system performs no license renewal intended function for 10 CFR 54.4(a)(3) and is not required for compliance with 10 CFR 50.48. Therefore, the auxiliary boiler building fire suppression system is not within the scope of license renewal or subject to an AMR. In addition, the applicant clarified that the west side dewatering building water curtain at location H6 in drawing SLR PB 318, Sheet 1, has no license renewal intended function for 10 CFR 54.4(a)(3) and is not required for compliance with 10 CFR 50.48. Therefore, it is not within the scope of license renewal or subject to an AMR. Finally, the applicant clarified that the post indicator valves at locations E6 and G3 in drawing SLR PB 318, Sheet 10 are within the scope of license renewal in accordance with 10 CFR 54.4(a) and subject to an AMR. The applicant indicated that drawing SLR PB M 318, Sheet 10 is revised to show the identified post indicating valves as in scope for subsequent license renewal in accordance with 10 CFR 54.4(a) and are subject to an AMR.

In summary, the staff finds that the applicant addressed each item in response to the RAI 2.3.3.14-1 and adequately identified the fire protection system components within the scope of subsequent license renewal and subject to an AMR.

In RAI 2.3.3.14-2, the staff requested the applicant verify whether a pressure maintenance system or jockey pump is in the scope of subsequent license renewal and subject to an AMR. If it is excluded from the scope of license renewal and not subject to an AMR, the staff requests that the applicant provide justification for the exclusion.

In a May 23, 2019 letter, the applicant stated:

> The Peach Bottom Atomic Power Station Fire Protection system does not have "jockey pumps" included in the system design but utilizes the high-pressure lube water (HPLW) system pumps to maintain fire water system pressure. Connection of the high-pressure, low-flow HPLW system to the Fire Protection system maintains header pressure and prevents unnecessary operation of the credited electric motor driven and diesel driven fire pumps. The HPLW system maintains the fire system pressure at 150 psi. The electric motor driven fire pump starts when system pressure drops to 140 psi and the diesel driven fire pump starts at a system pressure of 130 psi. A check valve in the piping connecting the two systems is in scope for the Fire Protection system to provide mechanical isolation between the systems. The check valve, 37B-12338, is shown on SLR-PB-M-318, Sheet 3.
>
> The HPLW pumps are not in scope for SLR in accordance with 10 CFR 54.4(a) or subject to an aging management review in accordance with 10 CFR 54.21(a)(1). The justification for exclusion of the HPLW pumps is due to the fact that they are not credited in the PBAPS Fire Protection Plan or other CLB documents and do not perform a 10 CFR 54.4(a)(3) function in support of the commission's regulations for fire protection. The pumps are not credited for meeting any fire system hydraulic demand requirements. Fire system hydraulic requirements are met by the electric motor driven fire pump and diesel driven fire pump. The HPLW system pumps are shown on SLR-PB-M-317, Sheet 1.

The applicant's response clarified that a pressure maintenance system is installed to prevent false starts and maintain the main fire pump's life expectancy. The pressure maintenance system maintains system pressure while tolerating small fluctuations, so the main fire pump does not start until a fire is present. The pressure maintenance system prevents frequent starting of the main fire pumps by maintaining pressure in the fire water supply system.

The applicant indicated that the pressure maintenance function on the fire water system is provided by the high-pressure lube water system (HPLW) system at the PBAPS site in lieu of the jockey pump pressure maintenance device. The applicant further indicated that components in the HPLW system to the fire protection system maintain header pressure and prevent unnecessary operation of the credited electric motor-driven and diesel-driven fire pumps. The HPLW system maintains the fire system pressure at 150 psi. The electric motor-driven fire pump starts when system pressure drops to 140 psi and the diesel-driven fire pump starts at a system pressure of 130 psi. A check valve in the piping connecting the two systems is in scope of the fire protection system to provide mechanical isolation between the systems. The check valve, 37B 12338, is shown on SLR-PB-M-318, Sheet-3. The staff finds the applicant's response to RAI 2.3.3.12-2 concerning the pressure maintenance system or jockey pump is acceptable because the components in the HPLW system are included within the scope of subsequent license renewal and subject to an AMR in accordance with the requirements of 10 CFR 54.4(a) and 10 CFR 54.21(a)(1), respectively.

In RAI 2.3.3.14-3, the staff requested the applicant to verify whether the fire protection components listed below are within the scope of subsequent license renewal and whether they are subject to an AMR. The staff also requested justification for components excluded from the scope of subsequent license renewal and are not subject to an AMR:

- diesel engine jacket water heat exchanger and portions of the diesel fuel oil system and starting air system supplied by a vendor on a diesel generator skid including heat exchanger and muffler
- fire hose connections, hose racks
- flexible hoses
- standpipe risers
- restricting orifice, flow elements, metal flex connection
- seismic support for standpipes system piping
- floor drains for removal of fire water
- fire wraps
- radiant heat shields
- seismic gap covers
- structural steel fire proofing

In a May 23, 2019 letter, the applicant provided the results of the scoping and screening process for the fire protection system component types listed above. The applicant indicated that the components in the diesel engine fuel oil system and diesel engine muffler are included under the component type piping, piping components in SLRA Table 2.3.3-14 with AMR results in SLRA Table 3.3.2-14. The diesel engine starting air system and jacket water heat exchange system are subcomponents in the diesel-driven fire pump engine, which are integral to the active diesel engine assembly. The applicant indicated that the diesel engine starting air system and jacket water heat exchange system are not subject to an AMR. The staff confirmed that the diesel engine for diesel-driven fire pump subcomponents do not meet the AMR criteria of 10 CFR 54.21(a)(1)(i).

The fire pump diesel engines include various components necessary to support engine operation. Many of these components are either located internal to the engine or are physically mounted on the engine. These components are considered integral subcomponent parts of the active diesel engine assembly. Fire hose connections and standpipe risers are included under the component type piping, piping components in SLRA Table 2.3.3-14 with AMR results in SLRA Table 3.3.2-14. Hose racks are included under the component type hose stations in SLRA Table 2.3.3-14 with AMR results in SLRA Table 3.3.2-14. The applicant treated flexible hoses as short-lived active components and are replaced periodically; therefore, they are not subject to an AMR. Restricting orifices, flow elements are included under the component type flow, and metal flex connection is included under the component type flexible connection in SLRA Table 2.3.3-14 with AMR results in SLRA Table 3.3.2-14. The staff confirmed that the seismic support for standpipe system piping included under the component type supports for cable trays, conduit, HVAC ducts, tube track, instrument tubing, non-ASME Piping and Components: support members, welds, bolted connections, support anchorage to building structure in SLR system component supports in SLRA Table 2.4-4. The staff confirmed that the floor drains for removal of fire water are included under the component type piping, piping components in SLRA Table 2.3.3-19. Fire wraps are included under the component type fire barrier in SLRA Table 2.3.3-14 with AMR results in SLRA Table 3.3.2-14. There are no radiant heat shields associated with the fire protection system at PBAPS. Seismic gap covers are included under the component type fire barrier penetration seals in SLRA Table 2.3.3-14 with AMR results in SLRA Table 3.3.2-14. Structural steel fireproofing material is included under the component type fire barrier for steel components in SLRA Table 2.3.3-14 with AMR results in SLRA Table 3.3.2-14.

The staff finds that the applicant addressed and resolved each item in response to the RAI as discussed above and adequately identified the fire protection system components within the scope of subsequent license renewal and subject to an AMR as required by 10 CFR 54.4(a) and 10 CFR 54.21(a)(1), respectively.

2.3.3.14.3 Conclusion

Based on the staff's evaluation in SER Section 2.3.3.14.2 and on a review of the SLRA, UFSAR, license renewal boundary drawings, and RAI responses, the staff concludes that the applicant appropriately identified the fire protection system components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR, in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.15 Fuel Handling System

2.3.3.15.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.15 describes the fuel handling system components subject to an AMR and lists the license renewal boundary drawings that show the system boundaries. SLRA Table 2.3.3-15 provides a list of the component types subject to an AMR and their intended functions. SLRA Table 3.3.2-15 provides the results of the applicant's AMR for fuel handling system SCs.

2.3.3.15.2 Staff Evaluation

The staff evaluated the system functions described in the SLRA and UFSAR to verify that the applicant has included within the scope of license renewal 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 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 SRP-SLR Section 2.3, "Scoping and Screening Results: Mechanical Systems," the staff reviewed the following:

- SLRA Section 2.3.3.15
- SLRA Table 2.3.3-15
- UFSAR Sections 7.6 and 10.4

2.3.3.15.3 Conclusion

Based on the staff's evaluation in SER Section 2.3.3.15.2 and on a review of the SLRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the fuel handling system components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR, in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.16 Fuel Pool Cooling and Cleanup System

2.3.3.16.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.16 describes the fuel pool cooling and cleanup system components subject to an AMR and lists the license renewal boundary drawings that show the system boundaries. SLRA Table 2.3.3-16 provides a list of the component types subject to an AMR and their intended functions. SLRA Table 3.3.2-16 provides the results of the applicant's AMR for fuel pool cooling and cleanup system SCs.

2.3.3.16.2 Staff Evaluation

The staff evaluated the system functions described in the SLRA and UFSAR to verify that the applicant has included within the scope of license renewal 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 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 SRP-SLR Section 2.3, "Scoping and Screening Results: Mechanical Systems," the staff reviewed the following:

- SLRA Section 2.3.3.16
- SLRA Table 2.3.3-16
- UFSAR Section 10.5

2.3.3.16.3 Conclusion

Based on the staff's evaluation in SER Section 2.3.3.16.2 and on a review of the SLRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the fuel pool cooling and cleanup system components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR, in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.17 High Pressure Service Water System

2.3.3.17.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.17 describes the high pressure service water system components subject to an AMR and lists the license renewal boundary drawings that show the system boundaries.

SLRA Table 2.3.3-17 provides a list of the component types subject to an AMR and their intended functions. SLRA Table 3.3.2-17 provides the results of the applicant's AMR for high pressure service water system SCs.

2.3.3.17.2 Staff Evaluation

The staff evaluated the system functions described in the SLRA and UFSAR to verify that the applicant has included within the scope of license renewal 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 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 SRP-SLR Section 2.3, "Scoping and Screening Results: Mechanical Systems," the staff reviewed the following:

- SLRA Section 2.3.3.17
- SLRA Table 2.3.3-17
- UFSAR Section 10.7

2.3.3.17.3 Conclusion

Based on the staff's evaluation in SER Section 2.3.3.17.2 and on a review of the SLRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the high pressure service water system components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR, in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.18 Offgas and Recombiner System

2.3.3.18.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.18 describes the offgas and recombiner system components subject to an AMR and lists the license renewal boundary drawings that show the system boundaries. SLRA Table 2.3.3-18 provides a list of the component types subject to an AMR and their intended functions. SLRA Table 3.3.2-18 provides the results of the applicant's AMR for offgas and recombiner system SCs.

2.3.3.18.2 Staff Evaluation

The staff evaluated the system functions described in the SLRA and UFSAR to verify that the applicant has included within the scope of license renewal 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 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 SRP-SLR Section 2.3, "Scoping and Screening Results: Mechanical Systems," the staff reviewed the following:

- SLRA Section 2.3.3.18
- SLRA Table 2.3.3-18
- UFSAR Sections 9.4 and 11.4

2.3.3.18.3 Conclusion

Based on the staff's evaluation in SER Section 2.3.3.18.2 and on a review of the SLRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the offgas and recombiner system components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR, in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.19 Plant Equipment and Floor Drain System

2.3.3.19.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.19 describes the plant equipment and floor drain system components subject to an AMR and lists the license renewal boundary drawings that show the system boundaries. SLRA Table 2.3.3-19 provides a list of the component types subject to an AMR and their intended functions. SLRA Table 3.3.2-19 provides the results of the applicant's AMR for plant equipment and floor drain system SCs.

2.3.3.19.2 Staff Evaluation

The staff evaluated the system functions described in the SLRA and UFSAR to verify that the applicant has included within the scope of license renewal 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 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 SRP-SLR Section 2.3, "Scoping and Screening Results: Mechanical Systems," the staff reviewed the following:

- SLRA Section 2.3.3.19
- SLRA Table 2.3.3-19
- UFSAR Sections 9.2, 9.3, 9.4, 10.18, and 10.19

2.3.3.19.3 Conclusion

Based on the staff's evaluation in SER Section 2.3.3.19.2 and on a review of the SLRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the plant equipment and floor drain system components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR, in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.20 Post Accident Sampling System

2.3.3.20.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.20 describes the post-accident sampling system components subject to an AMR and lists the license renewal boundary drawings that show the system boundaries. SLRA Table 2.3.3-20 provides a list of the component types subject to an AMR and their intended functions. SLRA Table 3.3.2-20 provides the results of the applicant's AMR for post-accident sampling system SCs.

2.3.3.20.2 Staff Evaluation

The staff evaluated the system functions described in the SLRA and UFSAR to verify that the applicant has included within the scope of license renewal 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 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 SRP-SLR Section 2.3, "Scoping and Screening Results: Mechanical Systems," the staff reviewed the following:

- SLRA Section 2.3.3.20
- SLRA Table 2.3.3-20
- UFSAR Section 7.20.4.6

2.3.3.20.3 Conclusion

Based on the staff's evaluation in SER Section 2.3.3.20.2 and on a review of the SLRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the post-accident sampling system components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR, in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.21 Process Sampling System

2.3.3.21.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.21 describes the process sampling system components subject to an AMR and lists the license renewal boundary drawings that show the system boundaries. SLRA Table 2.3.3-21 provides a list of the component types subject to an AMR and their intended functions. SLRA Table 3.3.2-21 provides the results of the applicant's AMR for process sampling system SCs.

2.3.3.21.2 Staff Evaluation

The staff evaluated the system functions described in the SLRA and UFSAR to verify that the applicant has included within the scope of license renewal 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 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 SRP-SLR Section 2.3, "Scoping and Screening Results: Mechanical Systems," the staff reviewed the following:

- SLRA Section 2.3.3.21
- SLRA Table 2.3.3-21
- UFSAR Section 10.20

2.3.3.21.3 Conclusion

Based on the staff's evaluation in SER Section 2.3.3.21.2 and on a review of the SLRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the process sampling system components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR, in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.22 Pump Structure Ventilation System

2.3.3.22.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.22 describes the pump structure ventilation system components subject to an AMR and lists the license renewal boundary drawings that show the system boundaries. SLRA Table 2.3.3-22 provides a list of the component types subject to an AMR and their intended functions. SLRA Table 3.3.2-22 provides the results of the applicant's AMR for pump structure ventilation system SCs.

2.3.3.22.2 Staff Evaluation

The staff evaluated the system functions described in the SLRA and UFSAR to verify that the applicant has included within the scope of license renewal 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 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 SRP-SLR Section 2.3, "Scoping and Screening Results: Mechanical Systems," the staff reviewed the following:

- SLRA Section 2.3.3.22
- SLRA Table 2.3.3-22
- UFSAR Section 10.14

The staff's review determined additional information was necessary to complete the review of the applicant's scoping and screening results, which resulted in the issuance of RAI 2.3.3.22-1. The RAI and the applicant's responses are documented in ADAMS Accession No. ML19143A053.

In RAI 2.3.3.22-1, the staff identified that SLRA Table 2.3.3-22, "Pump Structure Ventilation System – Components Subject to Aging Management Review," did not show the component type "bird screens" with its intended function of "filter," as depicted on the miscellaneous buildings ventilation flow diagram. Specifically, the staff requested that the applicant describe how the aging management of components that prevent fouling of the ventilation inlet was addressed in the SLRA.

In its response, the applicant described changes to the SLRA and supporting information to clarify how the aging management of component types that perform a filtering function was addressed in the SLRA. Specifically, the applicant provided the following clarifications and revisions:

- Clarified that the bird screens are included in SLRA Table 3.5.2-12, "Miscellaneous Steel Summary of Aging Management Evaluation," for the component type "Structural Miscellaneous – Vents," with aluminum material, air – outdoor environment, and intended functions of direct flow and shelter and protection. The applicant also stated that the SLRA basis document PB-SSBD-SCRN, "Structures, Component and Commodity Types, With Active, Passive Determinations, and Intended Functions," includes bird screens in the definition of the component type "Structural Miscellaneous – Vent."
- Revised SLRA Table 2.4-12 and SLRA Table 3.5.2-12 to add the filter function to the "Structural Miscellaneous – Vents" component type.

The staff reviewed the applicant's modifications to SLRA Table 2.4-12 for conformance with the requirements of 10 CFR 54.4(a)(2) and 10 CFR 54.21(a)(1). The staff found that the applicant had included the bird screens, identified under the "Structural Miscellaneous – Vent" component type in SLRA Section 2.4.12, "Miscellaneous Steel," as within the scope of license renewal and subject to an aging management review, consistent with the requirements of 10 CFR 54.4(a)(2) and 10 CFR 54.21(a)(1).

2.3.3.22.3 Conclusion

Based on the staff's evaluation in SER Section 2.3.3.22.2 and on a review of the SLRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the pump structure ventilation system components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR, in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.23 Radiation Monitoring System

2.3.3.23.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.23 describes the radiation monitoring system components subject to an AMR and lists the license renewal boundary drawings that show the system boundaries. SLRA Table 2.3.3-23 provides a list of the component types subject to an AMR and their intended functions. SLRA Table 3.3.2-23 provides the results of the applicant's AMR for radiation monitoring system SCs.

2.3.3.23.2 Staff Evaluation

The staff evaluated the system functions described in the SLRA and UFSAR to verify that the applicant has included within the scope of license renewal 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 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 SRP-SLR Section 2.3, "Scoping and Screening Results: Mechanical Systems," the staff reviewed the following:

- SLRA Section 2.3.3.23
- SLRA Table 2.3.3-23
- UFSAR Sections 7.12 and 7.13

2.3.3.23.3 Conclusion

Based on the staff's evaluation in SER Section 2.3.3.23.2 and on a review of the SLRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the radiation monitoring system components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR, in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.24 Radwaste System

2.3.3.24.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.24 describes the radwaste system components subject to an AMR and lists the license renewal boundary drawings that show the system boundaries. SLRA Table 2.3.3-24 provides a list of the component types subject to an AMR and their intended functions. SLRA Table 3.3.2-24 provides the results of the applicant's AMR for radwaste system SCs.

2.3.3.24.2 Staff Evaluation

The staff evaluated the system functions described in the SLRA and UFSAR to verify that the applicant has included within the scope of license renewal 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 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 SRP-SLR Section 2.3, “Scoping and Screening Results: Mechanical Systems,” the staff reviewed the following:

- SLRA Section 2.3.3.24
- SLRA Table 2.3.3-24
- UFSAR Sections 9.2 and 9.3

2.3.3.24.3 Conclusion

Based on the staff’s evaluation in SER Section 2.3.3.24.2 and on a review of the SLRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the radwaste system components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR, in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.25 Reactor Building Closed Cooling Water System

2.3.3.25.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.25 describes the reactor building closed cooling water system components subject to an AMR and lists the license renewal boundary drawings that show the system boundaries. SLRA Table 2.3.3-25 provides a list of the component types subject to an AMR and their intended functions. SLRA Table 3.3.2-25 provides the results of the applicant’s AMR for reactor building closed cooling water system SCs.

2.3.3.25.2 Staff Evaluation

The staff evaluated the system functions described in the SLRA and UFSAR to verify that the applicant has included within the scope of license renewal 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 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 SRP-SLR Section 2.3, “Scoping and Screening Results: Mechanical Systems,” the staff reviewed the following:

- SLRA Section 2.3.3.25
- SLRA Table 2.3.3-25
- UFSAR Section 10.8

2.3.3.25.3 Conclusion

Based on the staff’s evaluation in SER Section 2.3.3.25.2 and on a review of the SLRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the reactor building closed cooling water system components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR, in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.26 Reactor Water Cleanup System

2.3.3.26.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.26 describes the reactor water cleanup system components subject to an AMR and lists the license renewal boundary drawings that show the system boundaries. SLRA Table 2.3.3-26 provides a list of the component types subject to an AMR and their intended functions. SLRA Table 3.3.2-26 provides the results of the applicant's AMR for reactor water cleanup system SCs.

2.3.3.26.2 Staff Evaluation

The staff evaluated the system functions described in the SLRA and UFSAR to verify that the applicant has included within the scope of license renewal 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 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 SRP-SLR Section 2.3, "Scoping and Screening Results: Mechanical Systems," the staff reviewed the following:

- SLRA Section 2.3.3.26
- SLRA Table 2.3.3-26
- UFSAR Section 4.9

2.3.3.26.3 Conclusion

Based on the staff's evaluation in SER Section 2.3.3.26.2 and on a review of the SLRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the reactor water cleanup system components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR, in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.27 Refueling Water Storage and Transfer System

2.3.3.27.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.27 describes the refueling water storage and transfer system components subject to an AMR and lists the license renewal boundary drawings that show the system boundaries. SLRA Table 2.3.3-27 provides a list of the component types subject to an AMR and their intended functions. SLRA Table 3.3.2-27 provides the results of the applicant's AMR for refueling water storage and transfer system SCs.

2.3.3.27.2 Staff Evaluation

The staff evaluated the system functions described in the SLRA and UFSAR to verify that the applicant has included within the scope of license renewal 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 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 SRP-SLR Section 2.3, "Scoping and Screening Results: Mechanical Systems," the staff reviewed the following:

- SLRA Section 2.3.3.27
- SLRA Table 2.3.3-27
- UFSAR Sections 10.3.4.2. and 10.5

2.3.3.27.3 Conclusion

Based on the staff's evaluation in SER Section 2.3.3.27.2 and on a review of the SLRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the refueling water storage and transfer system components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR, in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.28 Safety Grade Instrument Gas System

2.3.3.28.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.28 describes the safety grade instrument gas system components subject to an AMR and lists the license renewal boundary drawings that show the system boundaries. SLRA Table 2.3.3-28 provides a list of the component types subject to an AMR and their intended functions. SLRA Table 3.3.2-28 provides the results of the applicant's AMR for safety grade instrument gas system SCs.

2.3.3.28.2 Staff Evaluation

The staff evaluated the system functions described in the SLRA and UFSAR to verify that the applicant has included within the scope of license renewal 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 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 SRP-SLR Section 2.3, "Scoping and Screening Results: Mechanical Systems," the staff reviewed the following:

- SLRA Section 2.3.3.28
- SLRA Table 2.3.3-28
- UFSAR Sections 5.2.3.9 and 10.17

2.3.3.28.3 Conclusion

Based on the staff's evaluation in SER Section 2.3.3.28.2 and on a review of the SLRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the safety grade instrument gas system components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR, in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.29 Service Water System

2.3.3.29.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.29 describes the service water system components subject to an AMR and lists the license renewal boundary drawings that show the system boundaries. SLRA Table 2.3.3-29 provides a list of the component types subject to an AMR and their intended functions. SLRA Table 3.3.2-29 provides the results of the applicant's AMR for service water system SCs.

2.3.3.29.2 Staff Evaluation

The staff evaluated the system functions described in the SLRA and UFSAR to verify that the applicant has included within the scope of license renewal 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 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 SRP-SLR Section 2.3, "Scoping and Screening Results: Mechanical Systems," the staff reviewed the following:

- SLRA Section 2.3.3.29
- SLRA Table 2.3.3-29
- UFSAR Section 10.6

2.3.3.29.3 Conclusion

Based on the staff's evaluation in SER Section 2.3.3.29.2 and on a review of the SLRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the service water system components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR, in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.30 Standby Liquid Control System

2.3.3.30.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.30 describes the standby liquid control system components subject to an AMR and lists the license renewal boundary drawings that show the system boundaries. SLRA Table 2.3.3-30 provides a list of the component types subject to an AMR and their intended functions. SLRA Table 3.3.2-30 provides the results of the applicant's AMR for standby liquid control system SCs.

2.3.3.30.2 Staff Evaluation

The staff evaluated the system functions described in the SLRA and UFSAR to verify that the applicant has included within the scope of license renewal 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 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 SRP-SLR Section 2.3, "Scoping and Screening Results: Mechanical Systems," the staff reviewed the following:

- SLRA Section 2.3.3.30
- SLRA Table 2.3.3-30
- UFSAR Section 3.8

2.3.3.30.3 Conclusion

Based on the staff's evaluation in SER Section 2.3.3.30.2 and on a review of the SLRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the standby liquid control system components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR, in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.31 Suppression Pool Temperature Monitoring System

2.3.3.31.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.31 describes the suppression pool temperature monitoring system components subject to an AMR and lists the license renewal boundary drawings that show the system boundaries. SLRA Table 2.3.3-31 provides a list of the component types subject to an AMR and their intended functions. SLRA Table 3.3.2-31 provides the results of the applicant's AMR for suppression pool temperature monitoring system SCs.

2.3.3.31.2 Staff Evaluation

The staff evaluated the system functions described in the SLRA and UFSAR to verify that the applicant has included within the scope of license renewal 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 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 SRP-SLR Section 2.3, "Scoping and Screening Results: Mechanical Systems," the staff reviewed the following:

- SLRA Section 2.3.3.31
- SLRA Table 2.3.3-31
- UFSAR Section 7.20.4.7

2.3.3.31.3 Conclusion

Based on the staff's evaluation in SER Section 2.3.3.31.2 and on a review of the SLRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the suppression pool temperature monitoring system components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR, in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.32 Torus Water Cleanup System

2.3.3.32.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.32 describes the torus water cleanup system components subject to an AMR and lists the license renewal boundary drawings that show the system boundaries. SLRA Table 2.3.3-32 provides a list of the component types subject to an AMR and their intended functions. SLRA Table 3.3.2-32 provides the results of the applicant's AMR for torus water cleanup system SCs.

2.3.3.32.2 Staff Evaluation

The staff evaluated the system functions described in the SLRA and UFSAR to verify that the applicant has included within the scope of license renewal 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 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 SRP-SLR Section 2.3, "Scoping and Screening Results: Mechanical Systems," the staff reviewed the following:

- SLRA Section 2.3.3.32
- SLRA Table 2.3.3-32
- UFSAR Section 7.3.11

2.3.3.32.3 Conclusion

Based on the staff's evaluation in SER Section 2.3.3.32.2 and on a review of the SLRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the torus water cleanup system components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR, in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.33 Torus Water Storage and Transfer System

2.3.3.33.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.33 describes the torus water storage and transfer system components subject to an AMR and lists the license renewal boundary drawings that show the system boundaries. SLRA Table 2.3.3-33 provides a list of the component types subject to an AMR and their intended functions. SLRA Table 3.3.2-33 provides the results of the applicant's AMR for torus water storage and transfer system SCs.

2.3.3.33.2 Staff Evaluation

The staff evaluated the system functions described in the SLRA and UFSAR to verify that the applicant has included within the scope of license renewal 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 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 SRP-SLR Section 2.3, "Scoping and Screening Results: Mechanical Systems," the staff reviewed the following:

- SLRA Section 2.3.3.33
- SLRA Table 2.3.3-33
- UFSAR Section 10.19.3.5

2.3.3.33.3 Conclusion

Based on the staff's evaluation in SER Section 2.3.3.33.2 and on a review of the SLRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the torus water storage and transfer system components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR, in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.34 Traveling Water Screen System

2.3.3.34.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.34 describes the traveling water screen system components subject to an AMR and lists the license renewal boundary drawings that show the system boundaries. SLRA Table 2.3.3-34 provides a list of the component types subject to an AMR and their intended functions. SLRA Table 3.3.2-34 provides the results of the applicant's AMR for traveling water screen system SCs.

2.3.3.34.2 Staff Evaluation

The staff evaluated the system functions described in the SLRA and UFSAR to verify that the applicant has included within the scope of license renewal 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 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 SRP-SLR Section 2.3, "Scoping and Screening Results: Mechanical Systems," the staff reviewed the following:

- SLRA Section 2.3.3.34
- SLRA Table 2.3.3-34
- UFSAR Sections 10.6, 10.9, 11.6, and 12.2.14

2.3.3.34.3 Conclusion

Based on the staff's evaluation in SER Section 2.3.3.34.2 and on a review of the SLRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the traveling water screen system components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR, in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.35 Turbine Building Closed Cooling Water System

2.3.3.35.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.35 describes the turbine building closed cooling water system components subject to an AMR and lists the license renewal boundary drawings that show the system boundaries. SLRA Table 2.3.3-35 provides a list of the component types subject to an AMR and their intended functions. SLRA Table 3.3.2-35 provides the results of the applicant's AMR for turbine building closed cooling water system SCs.

2.3.3.35.2 Staff Evaluation

The staff evaluated the system functions described in the SLRA and UFSAR to verify that the applicant has included within the scope of license renewal 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 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 SRP-SLR Section 2.3, “Scoping and Screening Results: Mechanical Systems,” the staff reviewed the following:

- SLRA Section 2.3.3.35
- SLRA Table 2.3.3-35
- UFSAR Section 10.10

2.3.3.35.3 Conclusion

Based on the staff’s evaluation in SER Section 2.3.3.35.2 and on a review of the SLRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the turbine building closed cooling water system components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR, in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.36 Water Treatment System

2.3.3.36.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.36 describes the water treatment system components subject to an AMR and lists the license renewal boundary drawings that show the system boundaries. SLRA Table 2.3.3-36 provides a list of the component types subject to an AMR and their intended functions. SLRA Table 3.3.2-36 provides the results of the applicant’s AMR for water treatment system SCs.

2.3.3.36.2 Staff Evaluation

The staff evaluated the system functions described in the SLRA and UFSAR to verify that the applicant has included within the scope of license renewal 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 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 SRP-SLR Section 2.3, “Scoping and Screening Results: Mechanical Systems,” the staff reviewed the following:

- SLRA Section 2.3.3.36
- SLRA Table 2.3.3-36
- UFSAR Sections 10.16 and 10.18

2.3.3.36.3 Conclusion

Based on the staff’s evaluation in SER Section 2.3.3.36.2 and on a review of the SLRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the water treatment system components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR, in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.4 STEAM AND POWER CONVERSION SYSTEM

SLRA Section 2.3.4, “Steam and Power Conversion System,” identifies the steam and power conversion system SCs subject to an AMR for license renewal. The applicant described the supporting SCs of the steam and power conversion systems in the following SLRA sections:

- SLRA Section 2.3.4.1, “Condensate System”
- SLRA Section 2.3.4.2, “Condensate Storage System”
- SLRA Section 2.3.4.3, “Feedwater System”
- SLRA Section 2.3.4.4, “Main Condenser System”
- SLRA Section 2.3.4.5, “Main Steam System”

SER Sections 2.3.4.1–2.3.4.5 include the staff’s findings on its review of SLRA Sections 2.3.4.1–2.3.4.5, respectively.

2.3.4.1 Condensate System

2.3.4.1.1 Summary of Technical Information in the Application

SLRA Section 2.3.4.1 describes the condensate system components subject to an AMR and lists the license renewal boundary drawings that show the system boundaries. SLRA Table 2.3.4-1 provides a list of the component types subject to an AMR and their intended functions. SLRA Table 3.4.2-1 provides the results of the applicant’s AMR for condensate system SCs.

2.3.4.1.2 Staff Evaluation

The staff evaluated the system functions described in the SLRA and UFSAR to verify that the applicant has included within the scope of license renewal 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 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 SRP-SLR Section 2.3, “Scoping and Screening Results: Mechanical Systems,” the staff reviewed the following:

- SLRA Section 2.3.4.1
- SLRA Table 2.3.4-1
- UFSAR Sections 1.6.1.4.6, 1.6.1.4.7, 3.4.5.2, 11.7 and 11.8

2.3.4.1.3 Conclusion

Based on the staff’s evaluation in SER Section 2.3.4.1.2 and on a review of the SLRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the condensate system components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR, in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.4.2 Condensate Storage System

2.3.4.2.1 Summary of Technical Information in the Application

SLRA Section 2.3.4.2 describes the condensate storage system components subject to an AMR and lists the license renewal boundary drawings that show the system boundaries. SLRA Table 2.3.4-2 provides a list of the component types subject to an AMR and their intended functions. SLRA Table 3.4.2-2 provides the results of the applicant’s AMR for condensate storage system SCs.

2.3.4.2.2 Staff Evaluation

The staff evaluated the system functions described in the SLRA and UFSAR to verify that the applicant has included within the scope of license renewal 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 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 SRP-SLR Section 2.3, “Scoping and Screening Results: Mechanical Systems,” the staff reviewed the following:

- SLRA Section 2.3.4.2
- SLRA Table 2.3.4-2
- UFSAR Sections 3.4.5, 4.7, 6.4, 6.5.3, 7.4, 10.3, and 11.7

2.3.4.2.3 Conclusion

Based on the staff’s evaluation in SER Section 2.3.4.2.2 and on a review of the SLRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the condensate storage system components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR, in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.4.3 Feedwater System

2.3.4.3.1 Summary of Technical Information in the Application

SLRA Section 2.3.4.3 describes the feedwater system components subject to an AMR and lists the license renewal boundary drawings that show the system boundaries. SLRA Table 2.3.4-3 provides a list of the component types subject to an AMR and their intended functions. SLRA Table 3.4.2-3 provides the results of the applicant's AMR for feedwater system SCs.

2.3.4.3.2 Staff Evaluation

The staff evaluated the system functions described in the SLRA and UFSAR to verify that the applicant has included within the scope of license renewal 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 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 SRP-SLR Section 2.3, "Scoping and Screening Results: Mechanical Systems," the staff reviewed the following:

- SLRA Section 2.3.4.3
- SLRA Table 2.3.4-3
- UFSAR Sections 4.7, 4.11, 6.4.1, 7.3, 7.10, and 11.8

2.3.4.3.3 Conclusion

Based on the staff's evaluation in SER Section 2.3.4.3.2 and on a review of the SLRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the feedwater system components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR, in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.4.4 Main Condenser System

2.3.4.4.1 Summary of Technical Information in the Application

SLRA Section 2.3.4.4 describes the main condenser system components subject to an AMR and lists the license renewal boundary drawings that show the system boundaries. SLRA Table 2.3.4-4 provides a list of the component types subject to an AMR and their intended functions. SLRA Table 3.4.2-4 provides the results of the applicant's AMR for main condenser system SCs.

2.3.4.4.2 Staff Evaluation

The staff evaluated the system functions described in the SLRA and UFSAR to verify that the applicant has included within the scope of license renewal 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 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 SRP-SLR Section 2.3, "Scoping and Screening Results: Mechanical Systems," the staff reviewed the following:

- SLRA Section 2.3.4.4
- SLRA Table 2.3.4-4
- UFSAR Sections 11.3 and 14.9

2.3.4.4.3 Conclusion

Based on the staff's evaluation in SER Section 2.3.4.4.2 and on a review of the SLRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the main condenser system components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR, in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.4.5 Main Steam System

2.3.4.5.1 Summary of Technical Information in the Application

SLRA Section 2.3.4.5 describes the main steam system components subject to an AMR and lists the license renewal boundary drawings that show the system boundaries. SLRA Table 2.3.4-5 provides a list of the component types subject to an AMR and their intended functions. SLRA Table 3.4.2-5 provides the results of the applicant's AMR main steam system SCs.

2.3.4.5.2 Staff Evaluation

The staff evaluated the system functions described in the SLRA and UFSAR to verify that the applicant has included within the scope of license renewal 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 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 SRP-SLR Section 2.3, "Scoping and Screening Results: Mechanical Systems," the staff reviewed the following:

- SLRA Section 2.3.4.5
- SLRA Table 2.3.4-5
- UFSAR Sections 4.4, 4.5, 4.6, 4.10, 4.11, 6.4, and 7.4

2.3.4.5.3 Conclusion

Based on the staff's evaluation in SER Section 2.3.4.5.2 and on a review of the SLRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the main steam system components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately 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 structures and structural components (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 license renewal 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 structures and components 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 structures and structural components. The objective was to determine whether the applicant has identified, in accordance with 10 CFR 54.4, structures and structural components that meet the license renewal 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 license renewal. The staff reviewed relevant licensing-basis documents, including the UFSAR, for each structure to determine whether the applicant has omitted from the scope of license renewal components with intended functions delineated under 10 CFR 54.4(a). The staff also reviewed the licensing basis documents to determine whether the SLRA specified all intended functions delineated under 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 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). The staff issued RAIs as needed to resolve any omissions or discrepancies.

2.4.1.1 Summary of Technical Information in the Application

SLRA Sections 2.4.1 through 2.4.22, as listed below, describe the structures and structural components subject to an AMR and the boundaries of the structure. SLRA Tables 2.4-1 through 2.4-22 list the structures and structural component types subject to an AMR and their intended functions. SLRA Table 3.5.2-1 through 3.5.2-22 provide the results of the applicant's AMR for structure and structural components.

- Section 2.4.1, "Administration Building and Shop"
- Section 2.4.2, "Boiler House"
- Section 2.4.3, "Circulating Water Pump Structure"
- Section 2.4.4, "Component Supports"
- Section 2.4.5, "Containment Structure"

- Section 2.4.6, “Dewatering Building”
- Section 2.4.7, “Diesel Generator Building”
- Section 2.4.8, “Electrical and Instrumentation Enclosures and Raceways”
- Section 2.4.9, “Emergency Cooling Tower and Reservoir”
- Section 2.4.10, “Hazard Barriers and Elastomers”
- Section 2.4.11, “Insulation”
- Section 2.4.12, “Miscellaneous Steel”
- Section 2.4.13, “Nitrogen Storage Building”
- Section 2.4.14, “Outdoor Electric Switchgear, North Substation”
- Section 2.4.15, “Radwaste Building and Reactor Auxiliary Bay”
- Section 2.4.16, “Reactor Building”
- Section 2.4.17, “Recombiner Building”
- Section 2.4.18, “Stack”
- Section 2.4.19, “Station Blackout Structure and Foundations”
- Section 2.4.20, “Turbine Building and Main Control Room Complex”
- Section 2.4.21, “Watertight Dikes”
- Section 2.4.22 ,”Yard Structures (Manholes, Duct Banks, Valve Pits, etc.)”

2.4.1.2 Staff Evaluation

The staff evaluated the structure functions described in the SLRA and UFSAR to verify that the applicant has included within the scope of license renewal 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 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).

2.4.1.3 Conclusion

Based on the staff’s evaluation described in SER Section 2.4.1.2 and on its review of the SLRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant has appropriately identified the structure and structural components within the scope of subsequent license renewal, as required by 10 CFR 54.4(a). The staff also concludes that the applicant has adequately identified the passive, long-lived SCs 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 Controls

This section documents the staff’s review of the applicant’s scoping and screening results for electrical and instrumentation and controls (I&C) systems. Specifically, this section discusses electrical and I&C component commodity groups.

In accordance with the requirements of 10 CFR 54.21(a)(1), the applicant must list passive, long-lived SCs that are within the scope of license renewal 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 structures and components that meet the scoping criteria and that are subject to an AMR.

The staff's process for evaluation of the information in SLRA Section 2.5, "Scoping and Screening Results: Electrical," was the same for all electrical and I&C components. The objective was to determine whether the applicant had identified, in accordance with 10 CFR 54.4, components that appear to meet the license renewal scoping criteria. Similarly, the staff evaluated the applicant's screening results to verify that all passive, long-lived 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 the applicant had identified as being within the scope of license renewal. The staff reviewed relevant licensing basis documents, including the UFSAR, for each component to determine whether the applicant had omitted from the scope of license renewal components with intended functions delineated under 10 CFR 54.4(a). The staff also reviewed the licensing basis documents to determine whether the SLRA specified all intended functions delineated under 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 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 Table 2.5.2-1, "Electrical Commodities Subject to Aging Management Review," describes the electrical and I&C components 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 I&C system components.

2.5.2 Staff Evaluation

SLRA section 2.5.2 relates to scoping and screening of electrical and I&C system components subject to an aging management review (AMR) in accordance with 10 CFR 54.4 and 10 CFR 54.21. The staff evaluated the system functions described in the SLRA and UFSAR to verify that the applicant has included within the scope of license renewal 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 license renewal to verify that all passive and long-lived components were subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

Part 54.4(a) of 10 CFR requires a list of plant systems, structures, and components (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), Exelon must identify and list passive, long-lived SSCs within the scope of the subsequent license renewal and subject to an AMR. The Standard Review Plan (SRP), 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 license renewal. NEI 17-01 has been endorsed by NRC letter dated December 5, 2017 (ADAMS Accession No. ML17339A596).

The staff used the SRP-SLR and NEI 17-01 guidance to evaluate the methodology used by Exelon in performing the scoping and screening for the structures and components within the scope of the subsequent license renewal. 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 Instrumentation and Controls Systems,” and NEI 17-01. The staff determined 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).”

SLRA Section 2.5.1, “Electrical Systems,” and Subsection 2.5.2.5.7, “Switchyard Bus and Connections, Transmission Conductors, and Transmission Connectors,” state, in part, that both the offsite and onsite power systems are relied upon to meet the requirements of 10 CFR 50.63 (the SBO Rule) and include equipment that is required to cope with an SBO (e.g., alternate ac power sources), and the plant system portion of the offsite power system that is used to connect the plant to the offsite power source meeting the requirements under 10 CFR 54.4(a)(3). The boundaries for electric equipment for SBO are shown on SLRA Figure 2.1-2, “Peach Bottom SBO Alternate AC Source and Recovery Path Boundaries.”

The staff evaluated the system functions described in the SLRA and UFSAR to verify that the applicant had included within the scope of the subsequent license renewal all components with intended functions delineated under 10 CFR 54.4(a). SLRA Section 2.1.1, “Scoping Methodology – Introduction,” stated 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 subsequent license renewal. In addition, SLRA Section 2.1.3.4, “Scoping for Regulated Events,” states that all electrical equipment that support the requirements of 10 CFR 50.63 are also within the scope of subsequent license renewal.

The staff also reviewed those components that the applicant identified as within the scope of subsequent license renewal to verify that all passive and long-lived components were subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1). The staff also verified whether the applicant had omitted any passive and long-lived components subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

The applicant had grouped the electrical and I&C components determined to be within the scope of subsequent license renewal into component commodity groups. The applicant had applied the screening criteria in 10 CFR 54.21(a)(1)(i) and 10 CFR 54.21(a)(1)(ii) to this list of component commodity groups to identify those that perform their intended functions without moving parts or without a change in configuration or properties and to remove the component commodity groups that are subject to replacement based on a qualified life or specified time period.

SLRA Section 2.5.2.2 listed the following passive component and commodity groups that are subject to an AMR:

- cable connections (metallic parts)
- cable tie wraps
- insulated cables and connections not included in the EQ Program
- electrical and I&C penetration assemblies not included in the EQ Program
- fuse holders (not part of active equipment)
- high-voltage insulators (for SBO recovery)
- metal enclosed bus
- splices
- switchyard bus and connections (for SBO recovery)
- terminal blocks
- transmission conductors and connectors (for SBO recovery)
- uninsulated ground conductors
- wooden pole

In addition to the list above, SLRA notes that electrical and I&C components and commodities included in the EQ Program (10 CFR 50.49) are excluded because they have 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 eliminated cable tie-wraps from the electrical commodities subject to an AMR, stating that cable fasteners and tie-wraps are intended to be used for training cables, assembling wires or cables into neat bundles for ease of maintenance, and are not considered a cable support. The applicant further stated that electrical cable tie-wraps do not function as cable supports in raceway support analyses and their use is not credited in the seismic qualification of cable trays; therefore, cable tie-wraps have no SLR intended functions as defined in 10 CFR 54.4(a). Since cable tie-wraps do not have an SLR intended function, they are not subject to an AMR. Based on the 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 in the electrical commodities subject to an AMR, stating that this commodity group is comprised of grounding cable and associated connectors. Ground conductors are provided for equipment and personnel protection and do not perform an intended function for license renewal. Therefore, uninsulated ground conductors are not within the scope of license renewal and not subject to aging management review. Based on the review of this information, the staff finds that the exclusion of uninsulated ground conductors from the electric commodities subject to an AMR is acceptable.

As a result of the staff's review of the list of components subject to an AMR, the staff finds that the electrical components identified as being subject to an AMR were consistent with the SRP-SLR. The staff also finds that the applicant had included all 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 subsequent license renewal satisfies the requirements in 10 CFR 54.4(a). Therefore, the staff finds the applicant's scoping and screening for electrical systems to be acceptable.

2.5.3 Conclusion

The staff reviewed the SLRA and the UFSAR to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff found no such omissions. In addition, the staff's review determined whether the applicant failed to identify any components subject to an AMR. The staff found no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that Exelon has appropriately identified the electrical and instrumentation and controls systems components within the scope of the subsequent license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.6 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 concludes that the applicant has adequately identified those systems and components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

With respect to these matters, the staff concludes that there is reasonable assurance that if the NRC issues a subsequent renewed operating license for Peach Bottom Units 2 and 3, the applicant will continue to conduct the activities authorized by the renewed licenses in accordance with the CLB. The staff also concludes that any changes to the CLB made to comply with 10 CFR 54.29(a) are in accordance with the Atomic Energy Act of 1954, as amended, and in accordance with NRC regulations.

3 AGING MANAGEMENT REVIEW RESULTS

This section of the safety evaluation report (SER) contains the U.S. Nuclear Regulatory Commission (NRC) staff's evaluation of Exelon Generating Company, LLC's (Exelon or the applicant) aging management programs (AMPs) and aging management reviews (AMRs) for Peach Bottom Atomic Power Station (PBAPS) Units 2 and 3 (and referred to as PBAPS or PBAPS Units 2 and 3 thereafter).

Exelon describes these AMPs and AMRs in its subsequent license renewal application (SLRA) for PBAPS Units 2 and 3. SLRA Appendix B lists the 47 AMPs that Exelon will rely on to manage or monitor the aging of passive, long-lived structures and components (SCs). SLRA Section 3 provides the results of Exelon's AMRs for those systems and components identified in SLRA Section 2 as within the scope of license renewal and subject to an AMR.

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

(1) reactor vessel, internals, and reactor coolant system (SER Section 3.1)
(2) engineered safety features (SER Section 3.2)
(3) auxiliary systems (SER Section 3.3)
(4) steam and power conversion systems (SER Section 3.4)
(5) containment, structures, and component supports (SER Section 3.5)
(6) electrical and instrumentation and controls (SER Section 3.6)

3.0 Applicant's Use of the Generic Aging Lessons Learned Report for Subsequent License Renewal 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 (GALL-SLR Report) (Agencywide Documents Access and Management System (ADAMS) Accession Nos. ML17187A031 and ML17187A204), for certain programs and AMR items. The GALL-SLR Report provides summaries of generic AMPs that the staff has determined would be adequate to manage the effects of aging for related SCs subject to an AMR. If an applicant commits to implementing these staff-approved AMPs, the time, effort, and resources for SLRA review will be greatly reduced, thereby improving the efficiency and effectiveness of the review process.

- The GALL-SLR Report identifies the following:
  - structures, systems, and components (SSCs)
  - SC materials
  - environments to which the SCs are exposed
  - aging effects associated with the material and environment combinations
  - AMPs credited with managing or monitoring these aging effects
  - recommendations for further evaluation of certain material, environment, and aging effect combinations

3.0.1 Format of the Subsequent License Renewal Application

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 the Nuclear Energy Institute (NEI) 17-01, “Industry Guideline for Implementing the Requirements of 10 CFR *[Code of Federal Regulations]* Part 54 for Subsequent License Renewal,” dated March 2017 (ADAMS Accession No. ML17339A599), which the NRC endorsed as acceptable for Exelon to use in performing its AMRs and drafting its SLRA (ADAMS Accession No. ML18029A368).

The organization of SLRA Section 3 follows the recommendations of NEI 17-01 and parallels the section structure of SRP-SLR Chapter 3. SLRA Section 3 presents the results of Exelon’s AMR 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 its Table 1s, the applicant provided a summary of the alignment between the PBAPS Units 2 and 3 AMR results and the GALL-SLR Report AMR items. The applicant included a “discussion” column to document whether each of the AMR summary items in the Table 1 is consistent with the GALL-SLR Report or consistent with the GALL-SLR Report but uses a different AMP to manage aging effects, or whether the item is not applicable at PBAPS. Each Table 1 item provides a summary of 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 its 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. The Table 2 includes a column linking each AMR item to a Table 1 item.

3.0.2 Staff’s Review Process

The staff conducted the following three types of evaluations of Exelon’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 AMPs and AMR analyses are one acceptable method for managing the effects of aging, the staff did not re-evaluate those AMPs and AMRs that the staff 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 the item to determine consistency. In addition, the staff conducted either an

audit or a technical review of the applicant's technical justifications for the exceptions or the adequacy of the enhancements.

The SRP-SLR states that an applicant may take one or more exceptions to specific GALL-SLR Report AMP elements; however, any exception to the GALL-SLR Report AMP should be described and justified. Therefore, the staff considers exceptions as being portions of the GALL-SLR Report AMP that the applicant does not intend to implement.

In some cases, an applicant may choose an existing plant program that does not currently meet all the program elements defined in the GALL-SLR Report AMP. However, the applicant may make a commitment to enhance the existing program before the subsequent period of extended operation to satisfy the GALL-SLR Report AMP. Enhancements may expand but not reduce the scope of an AMP.

(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 verify conformance with 10 CFR 54.21(a)(3) requirements.

In addition to its SLRA review, the staff conducted an operating experience review audit from September 17–27, 2018, and an in-office regulatory audit from November 13, 2018–January 22, 2019, as detailed in the Audit Reports dated June 6, 2019 (ADAMS Accession No. ML19142A369), and September 24, 2019 (ADAMS Accession No. ML19205A206). These audits and reviews are designed to maximize the efficiency of the staff's SLRA review. The applicant can respond to questions, the staff can readily evaluate the applicant's responses, and the need for formal correspondence between the staff and the applicant can be reduced, resulting in a more efficient review.

These audits and technical reviews of the applicant's AMPs and AMRs determine whether 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 [current licensing basis] for the period of extended operation," as required by 10 CFR 54.21.

3.0.2.1 Review of AMPs

For those AMPs that the applicant claimed are consistent with the GALL-SLR Report AMPs, the staff conducted either an audit or a technical review to confirm that the applicant's AMPs are consistent with the GALL-SLR Report. For each AMP that has one or more deviations, the staff evaluated each deviation to determine whether the deviation is 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.1-1 of the SRP-SLR:

(1) "<u>scope of program</u>" – Scope of program includes the specific SCs subject to an AMR for SLR.

(2) "<u>preventive actions</u>" – Preventative actions should prevent or mitigate aging degradation.

(3) "<u>parameters monitored or inspected</u>" – Parameters monitored or inspected should be linked to the degradation of the particular SC intended function(s).

(4) “detection of aging effects” – 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 one-time inspections to ensure timely detection of aging effects.

(5) “monitoring and trending” – Monitoring and trending should provide predictability of the extent of degradation, as well as timely corrective or mitigative actions.

(6) “acceptance criteria” – Acceptance criteria, against which the need for corrective actions will be evaluated, should ensure that the SC intended function(s) are maintained under all current licensing basis (CLB) design conditions during the subsequent period of extended operation.

(7) “corrective actions” – Corrective actions, including root cause determination and prevention of recurrence, should be timely.

(8) “confirmation process” – Confirmation process should ensure that corrective actions have been completed and are effective.

(9) “administrative controls” – Administrative controls should provide for a formal review and approval.

(10) “operating experience” – Operating experience 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 managed adequately so that the SC-intended function(s) will be maintained during the subsequent period of extended operation. Operating experience 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 is effective in managing the aging effects for which it is credited. The AMP is either enhanced or new AMPs are developed, as appropriate, when it is determined through the evaluation of OE that the effects of aging may not be adequately managed.

Details of the staff’s audit evaluation of program elements 1 through 7 and 10 are documented in the Regulatory Audit Reports and summarized in SER Section 3.0.3.

The staff reviewed the applicant’s quality assurance (QA) program and documented its evaluations in SER Section 3.0.4. The staff’s evaluation of the QA program included an assessment of the “corrective actions,” “confirmation process,” and “administrative controls” program elements.

The staff reviewed the information regarding the “operating experience” program element and documented its evaluation in SER 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 identified by the applicant 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. Item numbers 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. The next column, “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 determined, on the basis of its review, whether 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 effect. 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 effect. 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 effect. 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 effect, 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 effect. 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 effect, 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 effect 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 effect.

3.0.2.3 Updated Final Safety Analysis Report Supplement

Consistent with the SRP-SLR for the AMRs and AMPs that it reviewed, the staff also reviewed the updated final safety analysis report (UFSAR) supplement, which summarizes the applicant's programs and activities for managing aging effects for the subsequent period of extended operation, as required by 10 CFR 54.21(d).

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 applicant responses to requests for additional information (RAIs).

During the regulatory audits, the staff examined the applicant's justifications, as documented in the audit summary report, to verify that the applicant's activities and programs are 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

SER 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 SER section that documents the staff's evaluation of the program.

Table 3.0-1 PBAPS Aging Management Programs

PBAPS Aging Management Program	SLRA Section(s)	New or Existing Aging Management Program	GALL-SLR Report Comparison (Final Staff Disposition)	Corresponding Aging Management Program in the GALL-SLR Report	Corresponding Section in this Safety Evaluation Report
ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	B.2.1.1	Existing	Consistent	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD (XI.MI)	3.0.3.1.1
Water Chemistry	B.2.1.2	Existing	Consistent with Exceptions or Enhancements	Water Chemistry (XI.M2)	3.0.3.2.1
Reactor Head Closure Stud Bolting	B.2.1.3	Existing	Consistent with Exceptions or Enhancements	Reactor Head Closure Stud Bolting (XI. M3)	3.0.3.2.2
BWR Vessel ID Attachment Welds	B.2.1.4	Existing	Consistent	BWR Vessel ID Attachment Welds (XI.M4)	3.0.3.1.2

PBAPS Aging Management Program	SLRA Section(s)	New or Existing Aging Management Program	GALL-SLR Report Comparison (Final Staff Disposition)	Corresponding Aging Management Program in the GALL-SLR Report	Corresponding Section in this Safety Evaluation Report
BWR Stress Corrosion Cracking	B.2.1.5	Existing	Consistent	BWR Stress Corrosion Cracking (XI.M7)	3.0.3.1.3
BWR Penetrations	B.2.1.6	Existing	Consistent	BWR Penetrations (XI.M8)	3.0.3.1.4
BWR Vessel Internals	B.2.1.7	Existing - Requ ires Enhancement	Consistent with Exceptions or Enhancements	BWR Vessel Internals (XI.M9)	3.0.3.2.3
Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)	B.2.1.8	New	Consistent	Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS) (XI.M12)	3.0.3.1.5.
Flow-Accelerated Corrosion	B.2.1.9	Existing - Requires Enhancement]	Consistent with Exceptions or Enhancements	Flow-Accelerated Corrosion (XI.M17)	3.0.3.2.4
Bolting Integrity	B.2.1.10	Existing - Requires Enhancement	Consistent with Exceptions or Enhancements	Bolting Integrity (XI.M18)	3.0.3.2.5
Open-Cycle Cooling Water System	B.2.1.11	Existing - Requires Enhancement	Consistent with Exceptions or Enhancements	Open-Cycle Cooling Water System (XI.M20)	3.0.3.2.6
Closed Treated Water Systems	B.2.1.12	Existing - Requires Enhancement	Consistent with Exceptions or Enhancements	Closed Treated Water Systems (XI.M21A)	3.0.3.2.7
Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems	B.2.1.13	Existing - Requires Enhancement	Consistent with Exceptions or Enhancements	Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems (XI.M23)	3.0.3.2.8
Compressed Air Monitoring	B.2.1.14	Existing - Requires Enhancement	Consistent with Exceptions or Enhancements	Compressed Air Monitoring (XI.M24)	3.0.3.2.9
BWR Reactor Water Cleanup System	B.2.1.15	Existing	Consistent	BWR Reactor Water Cleanup System (XI.M25)	3.0.3.1.6
Fire Protection	B.2.1.16	Existing - Requires Enhancement	Consistent with Exceptions or Enhancements	Fire Protection (XI.M26)	3.0.3.2.10
Fire Water System	B.2.1.17	Existing - Requires Enhancement	Consistent with Exceptions or Enhancements	Fire Water System (XI.M27)	3.0.3.2.11
Outdoor and Large Atmospheric Metallic Storage Tanks	B.2.1.18	Existing - Requires Enhancement	Consistent with Exceptions or Enhancements	Outdoor and Large Atmospheric Metallic Storage Tanks (XI.M29)	3.0.3.2.12
Fuel Oil Chemistry	B.2.1.19	Existing - Requires Enhancement	Consistent with Exceptions or Enhancements	Fuel Oil Chemistry (XI.M30)	3.0.3.2.13
Reactor Vessel Material Surveillance	B.2.1.20	Existing - Requires Enhancement	Consistent with Exceptions or Enhancements	Reactor Vessel Material Surveillance (XI.M31)	3.0.3.2.14

PBAPS Aging Management Program	SLRA Section(s)	New or Existing Aging Management Program	GALL-SLR Report Comparison (Final Staff Disposition)	Corresponding Aging Management Program in the GALL-SLR Report	Corresponding Section in this Safety Evaluation Report
One-Time Inspection	B.2.1.21	New	Consistent	One-Time Inspection (XI.M32)	3.0.3.1.7
Selective Leaching	B.2.1.22	New	Consistent	Selective Leaching (XI.M33)	3.0.3.1.8.
ASME Code Class 1 Small-Bore Piping	B.2.1.23	New	Consistent	ASME Code Class 1 Small-Bore Piping (XI.M35)	3.0.3.1.9
External Surfaces Monitoring of Mechanical Components	B.2.1.24	New	Consistent	External Surfaces Monitoring of Mechanical Components (XI.M36)	3.0.3.1.10
Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	B.2.1.25	New	Consistent	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (XI.M38)	3.0.3.1.11
Lubricating Oil Analysis	B.2.1.26	Existing	Consistent	Lubricating Oil Analysis (XI.M39)	3.0.3.1.12
Monitoring of Neutron-Absorbing Materials Other Than Boraflex	B.2.1.27	Existing	Consistent	Monitoring of Neutron-Absorbing Materials Other Than Boraflex (XI.M40)	3.0.3.1.13
Buried and Underground Piping and Tanks	B.2.1.28	Existing - Requires Enhancement	Consistent with Exceptions or Enhancements	Buried and Underground Piping and Tanks (XI.M41)	3.0.3.2.15
Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks	B.2.1.29	New	Consistent with Exceptions or Enhancements	Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks (XI.M42)	3.0.3.2.16
ASME Section XI, Subsection IWE	B.2.1.30	Existing - Requires Enhancement	Consistent with Exceptions or Enhancements	ASME Section XI, Subsection IWE (XI.SI)	3.0.3.2.17
ASME Section XI, Subsection IWF	B.2.1.31	Existing - Requires Enhancement	Consistent with Exceptions or Enhancements	ASME Section XI, Subsection IWF (XI.S3)	3.0.3.2.18
10 CFR Part 50, Appendix J	B.2.1.32	Existing	Consistent	10 CFR Part 50, Appendix J (XI.S4)	3.0.3.1.14
Masonry Walls	B.2.1.33	Existing - Requires Enhancement	Consistent with Exceptions or Enhancements	Masonry Walls (XI.S5)	3.0.3.2.19
Structures Monitoring	B.2.1.34	Existing - Requires Enhancement]	Consistent with Exceptions or Enhancements	Structures Monitoring (XI.S6)	3.0.3.2.20
Inspection of Water-Control Structures Associated with Nuclear Power Plants	B.2.1.35	Existing - Requires Enhancement]	Consistent with Exceptions or Enhancements	Inspection of Water-Control Structures Associated with Nuclear Power Plants (XI.S7)	3.0.3.2.21

PBAPS Aging Management Program	SLRA Section(s)	New or Existing Aging Management Program	GALL-SLR Report Comparison (Final Staff Disposition)	Corresponding Aging Management Program in the GALL-SLR Report	Corresponding Section in this Safety Evaluation Report
Protective Coating Monitoring and Maintenance	B.2.1.36	Existing - Requires Enhancement]	Consistent with Exceptions or Enhancements	Protective Coating Monitoring and Maintenance (XI.S8)	3.0.3.2.22
Electrical Insulation for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	B.2.1.37	Existing - Requires Enhancement]	Consistent with Exceptions or Enhancements	Electrical Insulation for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements (XI.E1)	3.0.3.2.23
Electrical Insulation for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits	B.2.1.38	Existing - Requires Enhancement]	Consistent with Exceptions or Enhancements	Electrical Insulation for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits (XI.E2)	3.0.3.2.24
Electrical Insulation for Inaccessible Medium-Voltage Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	B.2.1.39	Existing - Requires Enhancement]	Consistent with Exceptions or Enhancements	Electrical Insulation for Inaccessible Medium-Voltage Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements (XI.E3A)	3.0.3.2.25
Electrical Insulation for Inaccessible Instrument and Control Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	B.2.1.40	New	Consistent with Exceptions or Enhancements	Electrical Insulation for Inaccessible Instrument and Control Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements (XI.E3B)	3.0.3.2.26
Electrical Insulation for Inaccessible Low-Voltage Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	B.2.1.41	New	Consistent with Exceptions or Enhancements	Electrical Insulation for Inaccessible Low-Voltage Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements (XI.E3C)	3.0.3.2.27
Metal Enclosed Bus	B.2.1.42	New	Consistent	Metal Enclosed Bus (XI.E4)	3.0.3.1.15

PBAPS Aging Management Program	SLRA Section(s)	New or Existing Aging Management Program	GALL-SLR Report Comparison (Final Staff Disposition)	Corresponding Aging Management Program in the GALL-SLR Report	Corresponding Section in this Safety Evaluation Report
Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	B.2.1.43	New	Consistent	Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements (XI.E6)	3.0.3.1.16
Wooden Pole	B.2.2.1	Existing - Requires Enhancement	Not Consistent with or Not Addressed in the GALL-SLR Report	None. PBAPS Plant-Specific Program	3.0.3.3.1
Fatigue Monitoring	B.3.1.1	Existing - Requires Enhancement]	Consistent with Exceptions or Enhancements	Fatigue Monitoring (X.M1)	3.0.3.2.28
Neutron Fluence Monitoring	B.3.1.2	Existing - Requires Enhancement]	Consistent with Exceptions or Enhancements	Neutron Fluence Monitoring (X.M2)	3.0.3.2.29
Environmental Qualification of Electric Equipment	B.3.1.3	Existing-Requires Enhancement	Consistent with Exceptions or Enhancements	Environmental Qualification of Electric Equipment (X.E1)	3.0.3.2.30

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:

- ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD
- BWR Vessel ID Attachment Welds
- BWR Stress Corrosion Cracking
- BWR Penetrations
- Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)
- BWR Reactor Water Cleanup System
- One-Time Inspection
- Selective Leaching
- ASME Code Class 1 Small-Bore Piping
- External Surfaces Monitoring of Mechanical Components
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components
- Lubricating Oil Analysis
- Monitoring of Neutron-Absorbing Materials Other Than Boraflex
- 10 CFR Part 50, Appendix J

- Metal Enclosed Bus
- Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements

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, operating experience, and a review of the applicant's UFSAR supplement summary of the program.

3.0.3.1.1 ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD

SLRA Section B.2.1.1 describes the existing ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD, as consistent with GALL-SLR Report AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC and IWD."

Staff Evaluation. During its in-office audit (ADAMS Accession No. ML19205A206), the staff reviewed Exelon'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 element(s) of Exelon's program to the corresponding program elements of GALL-SLR Report AMP XI.M1.

Based on its audit, 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 Exelon claimed consistency with the GALL-SLR Report are consistent with the corresponding program elements of GALL-SLR Report AMP XI.M1. The staff finds that the AMP is adequate to manage the applicable aging effects.

Operating Experience. SLRA Section B.2.1.1 summarizes operating experience related to the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD. The staff evaluated operating experience information by reviewing the SLRA and conducting an audit. During the audit, the staff independently searched plant-specific operating experience information to determine whether any previously unknown or recurring aging effects were identified.

The staff did not identify any operating experience indicating that Exelon should modify its proposed program. Based on its audit and review of the SLRA, the staff finds that the conditions and operating experience at the plant are bounded by those for which the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD was evaluated.

UFSAR Supplement. SLRA Section A.2.1.1 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 Exelon committed to ongoing implementation of the existing ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD, 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 Exelon's ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program, the staff concludes that those program elements for which Exelon claimed consistency with the GALL-SLR Report are consistent. The staff concludes that Exelon 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 BWR Vessel ID Attachment Welds

SLRA Section B.2.1.4 describes the existing BWR Vessel ID Attachment Welds AMP as consistent with the GALL-SLR Report AMP XI.M4, "BWR Vessel ID Attachment Welds."

Staff Evaluation. During its in-office audit (ADAMS Accession No. ML19205A206), the staff reviewed Exelon's claim of consistency with the GALL-SLR Report. The staff compared the "scope of program," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements of Exelon's program to the corresponding program elements of the GALL-SLR Report AMP XI.M4. The staff notes that the GALL-SLR Report AMP XI.M4 states that the BWR Vessel ID Attachment Welds AMP is a condition monitoring program and has no preventive actions.

Based on its review of the SLRA, the staff finds that the "scope of program," "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 the GALL-SLR Report AMP XI.M4.

Review of License Renewal Applicant Action Items

In the staff safety evaluation for Topical Report Boiling Water Reactor Vessel Internals Project (BWRVIP)-48, "Vessel ID Attachment Weld Inspection and Flaw Evaluation Guidelines," (2004, non-public) the staff issued the following license renewal applicant action items on the report:

(1) The license renewal applicant is to verify that its plant is bounded by the BWRVIP-48 report, and to commit to programs described as necessary in this report to manage the effects of aging on the functionality of the bracket attachments during the subsequent period of extended operation.

(2) The license renewal applicant is to ensure that the programs and activities specified as necessary in the BWRVIP-48 report are summarily described in the UFSAR supplement.

(3) The license renewal applicant is to ensure that the inspection strategy described in the BWRVIP-48 report does not conflict or result in any changes needed to their technical specifications (TSs).

The staff reviewed Exelon's response, as documented in SLRA Appendix C, to the above license renewal applicant action items. The staff finds that Exelon has adequately addressed the above action items because the applicant verifies that its AMP is bounded by the NRC-approved BWRVIP-48-A report, and that there are no deviations from the inspection and evaluation recommendations within this report. Also, the applicant further states that no changes to TSs were needed to meet the requirements of this report. Finally, the applicant included a UFSAR supplement in SLRA Section A.2.1.4 to describe programs and activities for managing the effects of aging per this report.

Operating Experience. SLRA Section B.2.1.4 summarizes operating experience related to the BWR Vessel ID Attachment Welds AMP. The staff evaluated operating experience information by reviewing the SLRA and conducting an audit (ADAMS Accession No. ML19142A369). During the audit, the staff independently searched plant-specific operating experience information to determine whether any previously unknown or recurring aging effects were identified.

The staff did not identify any operating experience indicating that Exelon would need to modify its program beyond that proposed in the SLRA, or that there are additional aging effects requiring management beyond those claimed by the applicant as being applicable to the components.

Based on its audit and review of the SLRA, the staff finds that the conditions and operating experience at the plant are bounded by those for which the BWR Vessel ID Attachment Welds AMP was evaluated.

UFSAR Supplement. SLRA Section A.2.1.4 provides the UFSAR supplement for the BWR Vessel ID Attachment Welds AMP. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in the 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. On the basis of its review of Exelon's BWR Vessel ID Attachment Welds AMP, the staff concludes that those program elements for which Exelon claimed consistency with the GALL-SLR Report are consistent. The staff concludes that Exelon 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 BWR Stress Corrosion Cracking

SLRA Section B.2.1.5 describes the BWR Stress Corrosion Cracking program as consistent with the GALL-SLR Report AMP XI.M7, "BWR Stress Corrosion Cracking."

Staff Evaluation. During its in-office audit (ADAMS Accession No. ML19205A206), the staff reviewed Exelon'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 Exelon's program to the corresponding program elements of the GALL-SLR Report AMP XI.M7.

For the inspections of the welds in the program scope, the program implements NRC-approved BWRVIP-75-A, "BWR Vessel Internals Project Technical Basis for Revisions to the NRC's Generic Letter (GL) 88-01 Inspection Schedules." Exelon has decided to use normal water chemistry, and, therefore, the inspection schedules are consistent with criteria that is applicable to a boiling-water reactor (BWR) unit operating with normal water chemistry. The staff finds that the inspections in accordance with the BWRVIP-75-A report are consistent with the GALL-SLR Report AMP XI.M7. These inspections also provide reasonable assurance that the aging effects due to stress corrosion cracking (SCC) in the reactor coolant piping system will be adequately managed during the subsequent period of extended operation at PBAPS.

The staff conducted an audit to verify Exelon's claim of consistency with the GALL-SLR Report. 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 the GALL-SLR Report AMP XI.M7.

Operating Experience. SLRA Section B.2.1.5 summarizes operating experience related to the BWR Stress Corrosion Cracking program. The staff evaluated operating experience information by reviewing the SLRA and conducting an audit (ADAMS Accession No. ML19142A369). During the audit, the staff independently searched plant-specific operating experience information to determine whether any previously unknown or recurring aging effects were identified. The staff did not identify any operating experience indicating that Exelon should modify its proposed program.

Based on its audit and review of the SLRA, the staff finds that the conditions and operating experience at the plant are bounded by those for which the BWR Stress Corrosion Cracking program was evaluated.

UFSAR Supplement. SLRA Section A.2.1.5 provides the UFSAR supplement for the BWR Stress Corrosion Cracking program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in the 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. On the basis of its review of Exelon's BWR Stress Corrosion Cracking program, the staff concludes that those program elements for which Exelon claimed consistency with the GALL-SLR Report are consistent. The staff concludes that Exelon 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.

3.0.3.1.4 BWR Penetrations

SLRA Section B.2.1.6 describes the existing BWR Penetrations program as consistent with the GALL-SLR Report AMP XI.M8, "BWR Penetrations."

Staff Evaluation. During its in-office audit (ADAMS Accession No. ML19205A206), the staff reviewed Exelon'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 Exelon's program to the corresponding program elements of GALL-SLR Report AMP XI.M8.

The staff noted that Exelon is implementing normal water chemistry at PBAPS Units 2 and 3. Regarding the weld inspection criteria for the penetrations, Exelon is implementing the NRC-approved BWRVIP-27-A, "BWR Standby Liquid Control (SLC) System/Core Plate ΔP

Inspection and Flaw Evaluation Guidelines"; BWRVIP-47-A, "BWR Lower Plenum Inspection and Flaw Evaluation Guidelines"; and, BWRVIP-49-A, "Instrument Penetration Inspection and Flaw Evaluation Guidelines."

Exelon stated that in SLC nozzle to vessel weld, no leakage or cracking was identified during the system inspections. Inspections of control rod guide tubes (CRGT), control rod drive housing, and instrumentation penetrations revealed no cracking. In addition to the periodic inspections of the penetrations, the applicant's corrective action, trending, and monitoring activities provide reasonable assurance that if any emerging aging degradation were to be detected, the corrective actions would be expected to resolve the issue in a timely manner. The staff finds that the use of the inspection criteria specified in the aforementioned staff-approved BWRVIP reports provides reasonable assurance that the aging effects due to stress corrosion cracking and cyclic loading in the penetrations at PBAPS Units 2 and 3 will be adequately managed during the subsequent period of extended operation.

The staff conducted an audit to verify Exelon's claim of consistency with the GALL-SLR Report. 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 are consistent with the corresponding program elements of GALL-SLR Report AMP XI.M8.

Operating Experience. SLRA Section B.2.1.6 summarizes operating experience related to the BWR Penetrations. The staff evaluated operating experience information by reviewing the SLRA and conducting an audit (ADAMS Accession No. ML19142A369). During the audit, the staff independently searched plant-specific operating experience information to determine whether any previously unknown or recurring aging effects were identified. The staff did not identify any operating experience indicating that Exelon should modify its proposed program.

Based on its audit and review of the SLRA, the staff finds that the conditions and operating experience at the plant are bounded by those for which the AMP for BWR Penetrations was evaluated.

UFSAR Supplement. SLRA Section A.2.1.6 provides the UFSAR supplement for the BWR Penetrations 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. On the basis of its review of Exelon's BWR Penetrations program, the staff concludes that those program elements for which Exelon claimed consistency with the GALL-SLR Report are consistent. The staff concludes that Exelon 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.

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

SLRA Section B.2.18 describes the new 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)." Exelon amended this SLRA section by letters dated January 23, 2019, and February 11, 2019 (ADAMS Accession Nos. ML19023A015 and ML19042A131, respectively).

Staff Evaluation. During its in-office audit (ADAMS Accession No. ML19205A206), the staff reviewed Exelon'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 Exelon's program to the corresponding program elements of GALL-SLR Report AMP XI.M12.

The "detection of aging effects" program element of GALL-SLR Report AMP XI.M12 indicates that an applicant may select and use one of the following approaches to manage loss of fracture toughness due to thermal aging embrittlement: (a) qualified inspections such as enhanced visual inspections or qualified ultrasonic testing (UT) inspections, or (b) flaw tolerance evaluations.

In its amendments to the SLRA, dated January 23, 2019, and February 11, 2019, Exelon clarified that the program will use qualified inspections (such as enhanced visual or UT inspections) among the approaches described in the GALL-SLR Report. Exelon also indicated that the flaw tolerance evaluation option is not an approach included in the applicant's aging management program. The staff finds that the aging management using qualified enhanced visual or UT inspections is consistent with the guidance in GALL-SLR Report AMP XI.M12. The staff also finds that because the flaw tolerance evaluation option is not used in the program, there is no need for the staff to review a plant-specific flaw tolerance evaluation on the CASS components.

The staff conducted an audit to verify Exelon's claim of consistency with the GALL-SLR Report. Based on its review of the SLRA and amendments, 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.

Operating Experience. SLRA Section B.2.1.8 summarizes operating experience related to the Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS) program. The staff evaluated operating experience information by reviewing the SLRA and conducting an audit (ADAMS Accession No. ML19142A369). During the audit, the staff independently searched plant-specific operating experience information to determine whether any previously unknown or recurring aging effects were identified. The staff did not identify any operating experience indicating that Exelon should modify its proposed program.

Based on its audit and review of the SLRA, the staff finds that the conditions and operating experience at the plant are bounded by those for which the Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS) program was evaluated.

UFSAR Supplement. SLRA Section A.2.1.8, as amended by letters dated January 23, 2019, and February 11, 2019, provides the UFSAR supplement for the Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS) 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. On the basis of its review of Exelon's Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS) program, the staff concludes that those program elements for which Exelon claimed consistency with the GALL-SLR Report are consistent. The staff concludes that Exelon 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.

3.0.3.1.6 BWR Reactor Water Cleanup System

SLRA Section B.2.1.15 describes the existing BWR Reactor Water Cleanup System as consistent with GALL-SLR Report AMP XI.M25, "BWR Reactor Water Cleanup System."

Staff Evaluation. During its in-office audit (ADAMS Accession No. ML19205A206), the staff reviewed Exelon'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 Exelon's program to the corresponding program elements of GALL-SLR Report AMP XI.M25.

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 are consistent with the corresponding program elements of GALL-SLR Report AMP XI.M25. The staff finds that the AMP is adequate to manage the applicable aging effects.

Operating Experience. SLRA Section B.2.1.15 summarizes operating experience related to the BWR Reactor Water Cleanup System. The staff evaluated operating experience information by reviewing the SLRA and conducting an audit (ADAMS Accession No. ML19142A369). During the audit, the staff independently searched plant-specific operating experience information to determine whether any previously unknown or recurring aging effects were identified. The staff did not identify any operating experience indicating that Exelon should modify its proposed program.

Based on its audit and review of the SLRA, the staff finds that the conditions and operating experience at the plant are bounded by those for which the BWR Reactor Water Cleanup System was evaluated.

UFSAR Supplement. SLRA Section A.2.1.15 provides the UFSAR supplement for the BWR Reactor Water Cleanup System. 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 Exelon committed to ongoing implementation of the existing BWR Reactor Water Cleanup System 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 Exelon's BWR Reactor Water Cleanup System, the staff determined that those program elements for which Exelon claimed consistency with the

GALL-SLR Report are consistent. The staff concludes that Exelon 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 B.2.1.21 describes the new One-Time Inspection program of selected components as consistent with GALL-SLR Report AMP XI.M32, “One-Time Inspection.”

Staff Evaluation. During its in-office audit (ADAMS Accession No. ML19205A206), the staff reviewed Exelon’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 Exelon’s program to the corresponding program elements of GALL-SLR Report AMP XI.M32, “One-Time Inspection.”

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 are consistent with the corresponding program elements of GALL-SLR Report AMP XI.M32, “One-Time Inspection.” The staff finds that the One-Time Inspection AMP is adequate to manage the applicable aging effects because the program elements are consistent with the GALL-SLR Report AMP XI.M32, “One-Time Inspection.”

Operating Experience. SLRA Section B.2.1.21 summarizes operating experience related to the One-Time Inspection program. The staff evaluated operating experience information by reviewing the SLRA and conducting an audit (ADAMS Accession No. ML19142A369). During the audit, the staff independently searched plant-specific operating experience information to determine whether any previously unknown or recurring aging effects were identified. The staff did not identify any operating experience indicating that Exelon should modify its proposed program. Based on its audit and review of the SLRA, the staff finds that the conditions and operating experience at the plant are bounded by those for which the One-Time Inspection program was evaluated.

UFSAR Supplement. SLRA Section A.2.1.21 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 noted Exelon committed to implementing the new One-Time Inspection program no later than 10 years prior to the subsequent period of extended operation, and the one-time inspections will be performed within the 10 years prior to the subsequent period of extended operation, and no later than 6 months prior to the subsequent period of 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. On the basis of its review of Exelon's One-Time Inspection program, the staff concludes that those program elements for which Exelon claimed consistency with the GALL-SLR Report are consistent. The staff concludes that Exelon 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 Selective Leaching

SLRA Section B.2.1.22 describes the new Selective Leaching program as consistent with GALL-SLR Report AMP XI.M33, "Selective Leaching." Exelon amended this SLRA section by letters dated September 14, 2018, and May 2, 2019.

Staff Evaluation. During its in-office audit (ADAMS Accession No. ML19205A206), the staff reviewed Exelon'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 Exelon's program to the corresponding program elements of GALL-SLR Report AMP XI.M33.

As amended by letter dated September 14, 2018 (ADAMS Accession No. ML18257A143), Exelon revised SLRA Section B.2.1.22 to clarify that the provision regarding reducing the number of visual and mechanical inspections when additional destructive examinations are performed is applicable to both the one-time portion and the periodic portion of the Selective Leaching program. The staff finds Exelon's change acceptable because it is consistent with the "detection of aging effects" program element of GALL-SLR Report AMP XI.M33.

During its review of the "detection of aging effects" program element, the staff noted that visual/mechanical inspection quantities for each population comprises a 3 percent sample or a maximum of 8 components per unit. The staff reviewed NUREG-2221, "Technical Bases for Changes in the Subsequent License Renewal Guidance Documents NUREG-2191 and NUREG-2192," dated December 2017 (ADAMS Accession No. ML17362A126), and noted that the reduction in the number of visual/mechanical examinations from that in the previous version of AMP XI.M33 (i.e., the GALL-SLR Report, Revision 2, recommended a 20 percent sample or a maximum of 25 components) is based in part on the applicant's one-time inspections conducted for the initial period of extended operation. The staff reviewed the applicant's initial license renewal application and noted that only a single inspection for selective leaching was performed on a cast iron fire protection component. Although the applicant did not perform multiple selective leaching inspections prior to the initial period of extended operation, the staff finds the applicant's approach to use visual/mechanical inspection quantities of 3 percent or a maximum of eight components per unit acceptable because the sample size of the periodic destructive examination (i.e., at least one destructive examination for each of the periodic populations) being conducted at a frequency of every 10 years beginning 10 years prior to the subsequent period of extended operation (Commitment No. 22) provides the staff reasonable assurance that loss of material due to selective leaching will be detected prior to a loss of intended function.

For the "corrective actions" program element, the staff determined the need for additional information, which resulted in the issuance of an RAI. RAI B.2.1.22-1 and Exelon's response are documented in ADAMS Accession Nos. ML19108A427 and ML19143A053.

In its response, Exelon (a) stated that industry-proven technologies will not be used to screen for the existence of selective leaching on difficult-to-access surfaces; and (b) revised SLRA Section B.2.1.22 to state: "[i]f it is necessary to conduct inspections on difficult-to-access surfaces due to unacceptable inspection findings occurring within the same material and environment, the necessary steps to make these surfaces accessible will be taken so that direct visual inspections can be performed or so that they can be removed for destructive testing to detect selective leaching." The staff finds Exelon's response and changes to Section B.2.1.22 acceptable because performing visual and destructive examinations to detect selective leaching is consistent with GALL-SLR Report AMP XI.M33 recommendations.

The staff conducted an audit to verify the applicant's claim of consistency with the GALL-SLR Report. Based on its review of the SLRA, and Exelon's response to RAI B.2.1.22-1, 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 are consistent with the corresponding program elements of GALL-SLR Report AMP XI.M33.

Operating Experience. SLRA Section B.2.1.22 summarizes operating experience related to the Selective Leaching program. The staff evaluated operating experience information by reviewing the SLRA and conducting an audit (ADAMS Accession No. ML19029B121.) During the audit, the staff independently searched plant-specific operating experience information to determine whether any previously unknown or recurring aging effects were identified.

The staff did not identify any operating experience indicating that Exelon should modify its proposed program beyond the modifications already incorporated. Based on its audit and review of the SLRA, the staff finds that the conditions and operating experience at the plant are bounded by those for which the Selective Leaching program was evaluated.

UFSAR Supplement. SLRA Section A.2.1.22 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. The staff also noted that Exelon committed to implement the new Selective Leaching program 10 years prior to the subsequent period of extended operation for managing the effects of aging for applicable components (Commitment No. 22). 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 Exelon's Selective Leaching program, the staff concludes that those program elements for which Exelon claimed consistency with the GALL-SLR Report are consistent. The staff concludes that Exelon 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 ASME Code Class 1 Small-Bore Piping

SLRA Section B.2.1.23 describes the new condition monitoring 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 in-office audit (ADAMS Accession No. ML19205A206), the staff reviewed Exelon's AMP for consistency with the GALL-SLR Report. The staff compared program elements 1 through 7 of Exelon's program to the corresponding program elements of GALL-SLR Report AMP XI.M35.

Based on its audit, the staff finds that program elements 1 through 7 ("scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions") 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.

Operating Experience. SLRA Section B.2.1.23 summarizes operating experience related to the ASME Code Class 1 Small-Bore Piping program. Exelon stated that the ASME Code Class 1 Small-Bore Piping program will be effective in ensuring that the intended functions of the ASME Class 1 small-bore piping are maintained consistent with the CLB during the subsequent period of extended operation.

The staff reviewed operating experience information in the SLRA and during the audit. As discussed in the Audit Report (ADAMS Accession No. ML19142A369), the staff conducted an independent search of the plant operating experience information to determine whether: (a) any previously unknown or recurring aging effects were identified; and (b) in light of plant operating experience, Exelon's SLRA AMP can be adequate to manage the associated aging effects. The staff did not identify any operating experience that would indicate that Exelon should consider modifying its proposed program.

Based on its audit and review of the SLRA, the staff finds that the conditions and operating experience at the plant are bounded by those for which the ASME Code Class 1 Small-Bore Piping program was evaluated.

UFSAR Supplement. SLRA Section A.2.1.23 provides the UFSAR supplement for 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 noted that Exelon committed to ongoing implementation of the existing condition monitoring ASME Code Class 1 Small-Bore Piping 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 audit and review of Exelon's ASME Code Class 1 Small-Bore Piping program, the staff concludes that those program elements for which Exelon claimed consistency with the GALL-SLR Report are consistent. The staff concludes that Exelon 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).

3.0.3.1.10 External Surfaces Monitoring of Mechanical Components

SLRA Section B.2.1.24 states that the External Surfaces Monitoring of Mechanical Components program is a new program that will be consistent with the program elements in the GALL-SLR

Report AMP XI.M36, "External Surfaces Monitoring of Mechanical Components." Exelon amended this section by letter dated January 23, 2019 (ADAMS Accession No. ML19023A015).

Staff Evaluation. During its in-office audit (ADAMS Accession No. ML19205A206), the staff reviewed Exelon's claim of consistency with the GALL-SLR Report. The staff compared program elements of Exelon's program to the corresponding program elements of GALL-SLR Report AMP XI.M36.

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 for which Exelon claimed consistency with the GALL-SLR Report are consistent with the corresponding program elements of GALL-SLR Report AMP XI.M36.

Operating Experience. SLRA Section B.2.1.24 summarizes operating experience related to the External Surfaces Monitoring of Mechanical Components program. Although this is a new program, the SLRA included examples of plant-specific operating experience providing objective evidence that the program will be effective in assuring intended functions are maintained consistent with the CLB. The staff reviewed operating experience information in the SLRA and conducted an audit (ADAMS Accession No. ML19142A369)). As discussed in the Audit Report, the staff independently searched the plant operating experience information: (a) to identify examples of age-related degradation, as documented in the applicant's corrective action program database; and (b) to 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. Other than the information discussed below, the staff did not identify any operating experience to indicate that the proposed program would not be adequate to manage the associated aging effects.

After discussions during the audit about an operating experience report on a partially clogged room cooler air intake, Exelon amended the program by letter dated January 23, 2019. Exelon revised SLRA Table 3.2.1, Item 3.2.1-081; Table 3.2.2-2; Table 3.2.2-6; Section A.2.1.24; and Section B.2.1.24 to include reduction of heat transfer for room cooler air intake screens due to fouling by debris or other material. The staff reviewed these changes and found them acceptable because periodic inspections of the air intake screens can ensure that the associated aging effect is adequately managed.

UFSAR Supplement. SLRA Section A.2.1.24, as modified by letter dated January 23, 2019, provides the UFSAR supplement for the External Surfaces Monitoring of Mechanical Components program. The staff reviewed this UFSAR supplement description 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 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 audit and review of Exelon's External Surfaces Monitoring of Mechanical Components program, the staff concludes that those program elements for which Exelon claimed consistency with the GALL-SLR Report are consistent. The staff concludes that Exelon 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 Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components

SLRA Section B.2.1.25 describes the new Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program as consistent with GALL-SLR Report AMP XI.M38, “Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components.” Exelon amended this SLRA section by letter dated January 23, 2019.

Staff Evaluation. During its in-office audit (ADAMS Accession No. ML19205A206), the staff reviewed Exelon’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 Exelon’s program to the corresponding program elements of GALL-SLR Report AMP XI.M38.

For the “detection of aging effects” program element, the staff determined the need for additional information concerning why methods to detect cracking of titanium components exposed to raw water are not addressed in SLRA Sections A.2.1.25 and B.2.1.25. Exelon provided a supplement on January 23, 2019 (ADAMS Accession No. ML19023A015) to address the staff’s concern.

In its supplement, Exelon revised SLRA Sections A.2.1.25 and B.2.1.25 to reflect that visual (VT-1), surface, or volumetric examinations will be performed to detect cracking of titanium components exposed to raw water. The staff finds Exelon’s supplemental response acceptable because (a) using ASME Code Section XI VT-1 inspections or surfaces examinations to manage cracking is consistent with GALL-SLR Report AMP XI.M38; and (b) volumetric examinations are capable of detecting cracking.

The staff conducted an audit to verify Exelon’s claim of consistency with the GALL-SLR Report. Based on its review of the SLRA as amended by letter dated January 23, 2019, 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.M38.

Operating Experience. SLRA Section B.2.1.25 summarizes operating experience related to the Internal Surfaces in Miscellaneous Piping and Ducting Components program. The staff evaluated operating experience information by reviewing the SLRA and conducting an audit (ADAMS Accession No. ML19142A369). During the audit, the staff independently searched plant-specific operating experience information to determine whether any previously unknown or recurring aging effects were identified.

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

UFSAR Supplement. As amended by letter dated January 23, 2019, SLRA Section A.2.1.25 provides the UFSAR supplement for the 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 Exelon committed to implement the new Internal Surfaces in Miscellaneous Piping and Ducting Components program no later than 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, as amended by letter dated January 23, 2019, is an adequate summary description of the program.

Conclusion. On the basis of its review of Exelon's Internal Surfaces in Miscellaneous Piping and Ducting Components program, the staff concludes that those program elements for which Exelon claimed consistency with the GALL-SLR Report are consistent. The staff concludes that Exelon 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 Lubricating Oil Analysis

SLRA Section B.2.1.26 describes the existing Lubricating Oil Analysis program as consistent with GALL-SLR Report AMP XI.M39, "Lubricating Oil Analysis."

Staff Evaluation. During its in-office audit (ADAMS Accession No. ML19205A206), the staff reviewed Exelon'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 Exelon's program to the corresponding program elements of GALL-SLR Report AMP XI.M39.

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.M39

Operating Experience. SLRA Section B.2.1.26 summarizes operating experience related to the Lubricating Oil Analysis program. The staff evaluated operating experience information by reviewing the SLRA and conducting an audit (ADAMS Accession No. ML19142A369). During the audit, the staff independently searched plant-specific operating experience information to determine whether any previously unknown or recurring aging effects were identified. The staff did not identify any operating experience indicating that Exelon should modify its proposed program beyond that incorporated. Based on its audit and review of the SLRA the staff finds that the conditions and operating experience at the plant are bounded by those for which the Lubricating Oil Analysis program was evaluated.

UFSAR Supplement. SLRA Section A.2.1.26 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-01. The staff also noted that Exelon 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. On the basis of its audit and review of Exelon's Lubricating Oil Analysis program, the staff concludes that those program elements for which Exelon claimed consistency with the GALL-SLR Report are consistent. The staff concludes that Exelon 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).

3.0.3.1.13 Monitoring of Neutron-Absorbing Materials Other Than Boraflex

SLRA Section B.2.1.27 describes the existing Monitoring of Neutron-Absorbing Materials Other Than Boraflex program as consistent with GALL-SLR Report AMP XI.M40, "Monitoring of Neutron-Absorbing Materials Other Than Boraflex."

Staff Evaluation. During its in-office audit (ADAMS Accession No. ML19205A206), the staff reviewed Exelon'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 Exelon's program to the corresponding program elements of GALL-SLR Report AMP XI.M40. During the audit, and as confirmed by the applicant in its response to the request for clarification of information (RCI) B.2.1.27-1 (ADAMS Accession No. ML19133A179), the staff noted that the applicant procedures contain a requirement to trend coupon test results if projected degradation of the neutron-absorbing material cannot maintain the 5 percent subcriticality margin. The 5 percent subcriticality margin is specified in both 10 CFR 50.68(b)(2), which states the k-effective must not exceed 0.95, and in element 6, "Acceptance Criteria," of the GALL-SLR program.

Based on its audit and review of the SLRA, and review of Exelon's response to RCI B.2.1.27-1, 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 are consistent with the corresponding program elements of GALL-SLR Report AMP XI.M40. The staff also 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 associated with staff-identified differences are adequate to manage the applicable aging effects.

Operating Experience. SLRA Section B.2.1.2.7 summarizes operating experience related to the Monitoring of Neutron-Absorbing Materials Other Than Boraflex program. The staff evaluated operating experience information by reviewing the SLRA and conducting an audit (ADAMS Accession No. ML19142A369).

During the audit, the staff independently searched plant-specific operating experience information to determine whether any previously unknown or recurring aging effects were identified. The staff did not identify any operating experience indicating that Exelon should include any further modifications in its proposed program.

Based on its audit and review of the SLRA, the staff finds that the conditions and operating experience at the plant are bounded by those for which the Monitoring of Neutron-Absorbing Materials Other Than Boraflex program was evaluated.

UFSAR Supplement. SLRA Section A.2.1.27 provides the UFSAR supplement for the Monitoring of Neutron-Absorbing Materials Other Than Boraflex 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 Exelon committed to ongoing implementation of the existing Monitoring of Neutron-Absorbing Materials Other Than Boraflex 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 audit and review of Exelon's Monitoring of Neutron-Absorbing Materials Other Than Boraflex program, the staff concludes that those program elements for which Exelon claimed consistency with the GALL-SLR Report are consistent. The staff concludes that Exelon 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 10 CFR Part 50, Appendix J

SLRA Section B.2.1.32 describes the existing "10 CFR Part 50, Appendix J" AMP as consistent with GALL-SLR Report AMP XI.S4, "10 CFR Part 50, Appendix J."

Staff Evaluation. During its in-office audit (ADAMS Accession No. ML19205A206), the staff reviewed Exelon'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 Exelon's program to the corresponding program elements of GALL-SLR Report AMP XI.S4.

The staff conducted an audit to verify Exelon's claim of consistency with the GALL-SLR Report. 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 are consistent with the corresponding program elements of GALL-SLR Report AMP XI.S4.

Operating Experience. SLRA Section B.2.1.32 summarizes operating experience related to the "10 CFR Part 50, Appendix J" AMP. The staff evaluated operating experience information by reviewing the SLRA and conducting an audit (ADAMS Accession No. ML19142A369). During the audit, the staff independently searched plant-specific operating experience information to determine whether any previously unknown or recurring aging effects were identified.

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

UFSAR Supplement. SLRA Section A.2.1.32 provides the UFSAR supplement for the "10 CFR Part 50, Appendix J" 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 Exelon committed to ongoing implementation of the existing "10 CFR Part 50, Appendix J" 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. On the basis of its audit and review of Exelon's "10 CFR Part 50, Appendix J" AMP, the staff concludes that those program elements for which Exelon claimed consistency with the GALL-SLR Report are consistent. The staff concludes that Exelon 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 Metal Enclosed Bus

SLRA Section B.2.1.42 describes the new Metal Enclosed Bus program as consistent with GALL-SLR Report AMP XI.E4, "Metal Enclosed Bus." Exelon amended this SLRA section by letter dated May 23, 2019.

Staff Evaluation. During its in-office audit (ADAMS Accession No. ML19205A206), the staff reviewed Exelon'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 Exelon's program to the corresponding program elements of GALL-SLR Report AMP XI.E4.

The staff conducted an audit to verify Exelon's claim of consistency with the GALL-SLR Report. The staff noted that the SLRA stated that there are no gaskets, boots, and sealants as part of the external portions of the in-scope metal enclosed buses. The staff discussed this with Exelon staff and reviewed photos of the installation as well as arrangement drawings that Exelon provided. 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 B.2.1.42-1 and Exelon's response are documented in ADAMS Accession No. ML19143A053.

In its response, Exelon stated that elastomers will be added to the scope of the Metal Enclosed Bus AMP as well as the program basis document, implementing procedures, and work orders to include visual inspection of accessible elastomers for age-related degradation. Exelon revised SLRA Section 3.6.2.1.5, Table 3.6.1, item 3.6.1-011, Table 3.6.2-1, Appendix A Section A.2.1.42, and Appendix B Section B.2.1.42.

During its evaluation of Exelon's response to RAI B.2.1.42-1, the staff noted that elastomers will be included and addressed for proper age management in the proposed AMP. The staff finds Exelon's response and changes to the SLRA (Section 3.6.2.1.5, Table 3.6.1 item 3.6.1-011, Table 3.6.2-1, Appendix A Section A.2.1.42, and Appendix B Section B.2.1.42), as well as the program basis document and associated implementing procedures and work orders, acceptable because elastomer material age management is consistent with the recommendations of GALL-SLR Report AMP XI.E4.

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 are consistent with the corresponding program elements of GALL-SLR Report AMP XI.E4.

Operating Experience. SLRA Section B.2.1.42 summarizes operating experience related to the Metal Enclosed Bus program. The staff evaluated operating experience information by reviewing the SLRA and conducting an audit (ADAMS Accession No. ML19142A369). During the audit, the staff independently searched plant-specific operating experience information to determine whether any previously unknown or recurring aging effects were identified. The staff did not identify any operating experience indicating that Exelon should modify its proposed program.

Based on its audit and review of the SLRA, the staff finds that the conditions and operating experience at the plant are bounded by those for which the Metal Enclosed Bus program was evaluated.

UFSAR Supplement. SLRA Section A.2.1.42 provides the UFSAR supplement for the Metal Enclosed Bus program. The staff reviewed this UFSAR supplement description of the program and noted that the SLRA did not mention aging management of elastomers. The staff determined the need for additional information, which resulted in the issuance of an RAI. RAI B.2.1.42-1 and Exelon's response are documented in ADAMS Accession No. ML19143A053. In its response, Exelon revised Section A.2.1.14 to include age management of elastomers per the recommendation of the GALL-SLR Report.

During its evaluation of Exelon's response to RAI B.2.1.42-1, the staff noted that elastomers are included and addressed for proper age management in the proposed UFSAR supplement. The staff finds Exelon's response acceptable because the UFSAR supplement, as amended, is consistent with the recommended description in GALL-SLR Report Table XI-01. The staff also noted that Exelon committed (Commitment No. 42) to implement the new Metal Enclosed Bus program no later than 6 months prior to the subsequent period of extended operation for managing the effects of aging for applicable components.

Conclusion. On the basis of its review of Exelon's Metal Enclosed Bus program, the staff concludes that those program elements for which Exelon claimed consistency with the GALL-SLR Report are consistent. The staff concludes that Exelon 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 B.2.1.43 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 in-office audit (ADAMS Accession No. ML19205A206), the staff reviewed Exelon'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 Exelon's program to the corresponding program elements of GALL-SLR Report AMP XI.E6.

The staff conducted an audit to verify Exelon's claim of consistency with the GALL-SLR Report. 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 are consistent with the corresponding program elements of GALL-SLR Report AMP XI.E6.

<u>Operating Experience</u>. SLRA Section B.2.1.43 summarizes operating experience related to the Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program. The staff evaluated operating experience information by reviewing the SLRA and conducting an audit (ADAMS Accession No. ML19142A369). During the audit, the staff independently searched plant-specific operating experience information to determine whether any previously unknown or recurring aging effects were identified. The staff did not identify any operating experience indicating that Exelon should modify its proposed program.

Based on its audit and review of the SLRA, the staff finds that the conditions and operating experience at the plant are bounded by those for which the Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements was evaluated.

<u>UFSAR Supplement</u>. SLRA Section A.2.1.43 provides the UFSAR supplement for 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 Exelon committed (Commitment No. 43) to implement the Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program 6 months, 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.

<u>Conclusion</u>. On the basis of its review of Exelon's Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program, the staff concludes that those program elements for which Exelon claimed consistency with the GALL-SLR Report are consistent. The staff concludes that Exelon 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).

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

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:

- Water Chemistry
- Reactor Head Closure Stud Bolting
- BWR 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
- Outdoor and Large Atmospheric Metallic Storage Tanks
- Fuel Oil Chemistry
- Reactor Vessel Material Surveillance
- 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 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 Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits.
- Electrical Insulation for Inaccessible Medium-Voltage Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements
- Electrical Insulation for Inaccessible Instrument and Control 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
- Neutron Fluence Monitoring
- Environmental Qualification of Electric Equipment

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 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 Water Chemistry

SLRA Section B.2.1.2 states that the Water Chemistry program is an existing program consistent with the program elements in the GALL-SLR Report AMP XI.M2, "Water Chemistry," except for the exception identified in the SLRA.

Staff Evaluation. During its in-office audit (ADAMS Accession No. ML19205A206), the staff reviewed Exelon'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" elements of Exelon's program to the corresponding program elements of GALL-SLR Report AMP XI.M2.

During the audit, and as confirmed by the applicant (ADAMS Accession No. ML19133A179), the staff noted that applicant procedures require reactor coolant excess dissolved hydrogen levels to be at least 20 parts per billion (ppb) at greater than 10 percent reactor power and that the hydrogen water chemistry system is capable of being operational at reactor power levels as low as 5 percent.

The staff also reviewed the portions of the "scope of program" 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 is as follows.

Exception 1. SLRA Section B.2.1.2 includes an exception to the "scope of program" program element related to inclusion of treated water chemistry in the Auxiliary Steam System in the Water Chemistry program. The staff reviewed this exception against the corresponding program element in GALL-SLR Report AMP XI.M2 and finds it acceptable because: (a) managing aging effects of components exposed to treated water in the Auxiliary Steam System is consistent with the GALL-SLR Report; (b) the applicant proposed to use the One-Time Inspection program to verify the effectiveness of the Water Chemistry program in managing aging effects for these components; and (c) the applicant has proposed adequate water chemistry parameters for the Auxiliary Steam System.

Based on its audit and review of the SLRA, the staff finds that, with the above exception, 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. The staff also reviewed the exception and its justification and concludes that it is acceptable

Operating Experience. SLRA Section B.2.1.2 summarizes operating experience related to the Water Chemistry program. The staff evaluated operating experience information by reviewing the SLRA and conducting an audit (ADAMS Accession No. ML19142A369). During the audit, the staff independently searched plant-specific operating experience information to determine whether any previously unknown or recurring aging effects were identified. The staff did not identify any operating experience indicating that Exelon should modify its proposed program beyond that incorporated. Based on its audit and review of the SLRA, the staff finds that the conditions and operating experience at the plant are bounded by those for which the Water Chemistry program was evaluated.

UFSAR Supplement. SLRA Section A.2.1.2 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 Exelon committed to ongoing implementation of the existing 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 UFSAR supplement is an adequate summary description of the program.

Conclusion. On the basis of its audit and review of Exelon's Water Chemistry program, the staff concludes that those program elements for which Exelon claimed consistency with the GALL-SLR Report are consistent. In addition, the staff reviewed the exception and its justification, and the differences between Exelon's program and GALL-SLR Report AMP XI.M2, and concludes that the AMP with the exception and differences is adequate to manage the applicable aging effects. The staff concludes that Exelon 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

SLRA Section B.2.1.3 describes the existing Reactor Head Closure Stud Bolting program as consistent, with exceptions, with GALL-SLR Report AMP XI.M3, "Reactor Head Closure Stud Bolting."

Staff Evaluation. During its in-office audit (ADAMS Accession No. ML19205A206), the staff reviewed Exelon's claim of consistency with the GALL-SLR Report. The staff compared program elements 1 through 7 ("scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions") of Exelon's program to the corresponding program elements of GALL-SLR Report AMP XI.M3.

The staff also reviewed portions of the "preventive actions" and "corrective actions" 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 the exceptions is as follows.

Exception 1. SLRA Section B.2.1.3 includes an exception to the "preventive actions" program element. The GALL-SLR program recommends stud materials have an ultimate tensile strength less than 170 ksi (or yield strength less than 150 ksi) because these materials are known to be resistant to SCC. Exelon's program states that its stud bolting is considered high-strength steel and some of the studs may "marginally" exceed the 170 ksi criterion. Specifically, it states that "Only 12 of 89 ultimate tensile strength test results reported on the CMTRs [Certified Materials Test Reports] for the heats used for the Units 2 and 3 studs and nuts are greater than or equal to 170 ksi." Therefore, Exelon's program takes exception to this program element. Exelon's program also indicates that it performs volumetric examinations of stud bolting for cracking in accordance with the ASME Section XI, IWB, IWC and IWD program. It further states that its previous inspections have found no indication of cracking.

The staff reviewed this exception against the corresponding program element in GALL-SLR Report AMP XI.M3. The staff noted that, based on industry operating experience and research, bolting materials with ultimate tensile strength higher than the 170 ksi criterion may be susceptible to SCC degradation. The staff also noted that Exelon completed a review of site operating experience, including site condition reports, and did not find degradation that has impacted the intended functions of the studs. In addition, Exelon provided preventive measures in the program that (1) will ensure in its procurement of new bolting materials that the strength will meet the criterion, and (2) will exclude the use of molybdenum disulfate thread lubricants to inhibit SCC. Additionally, the volumetric examinations that are performed are capable of detecting degradation due to SCC. Based on its review, the staff finds this exception acceptable because (1) the bolting materials only marginally exceed the tensile strength criterion, (2) the inspections are capable of detecting cracking, and (3) previous inspections have found no indication of cracking.

Exception 2. SLRA Section B.2.1.3 also includes an exception to the "corrective actions" program element. Exelon's program states that its potential replacement reactor head closure studs and nuts already in the warehouse may slightly exceed the strength criteria. The SLRA further states that the program has implemented procurement requirements to ensure that future replacement studs are fabricated from bolting materials with actual measured yield strength less than 150 ksi, as well as requirements to preclude the use of sulfide-containing lubricant, as consistent with the GALL-SLR Report program guidance.

The staff reviewed this exception against the corresponding program element in GALL-SLR Report AMP XI.M3. The staff finds this exception acceptable because (1) the ultimate tensile strength only marginally exceeds the criterion, (2) volumetric inspections will be performed to detect any indication of cracking, and (3) Exelon has implemented procurement requirements in its program to ensure replacement studs are fabricated from bolting materials that meet the strength criterion.

Based on its audit, the staff finds that, with the above exceptions, program elements 1 through 7 for which Exelon 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 justification, and finds that the AMP, with the exceptions, is adequate to manage the applicable aging effects.

Operating Experience. SLRA Section B.2.1.3 summarizes operating experience related to the Reactor Head Closure Stud Bolting program. Exelon stated that the Reactor Head Closure Stud Bolting program will be effective in ensuring that intended functions will be maintained consistent with the CLB through the subsequent period of extended operation.

The staff reviewed operating experience information in the SLRA and during the audit. As discussed in the Audit Report (ADAMS Accession No. ML19142369), the staff conducted an independent search of the plant operating experience information to determine whether: (a) any previously unknown or recurring aging effects were identified; and (b) in light of plant operating experience, whether Exelon's SLRA AMP will be adequate to manage the associated aging effects. The staff did not identify any operating experience that would indicate that Exelon should consider modifying its proposed program.

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

UFSAR Supplement. SLRA Section A.2.1.3 provides the UFSAR supplement for the Reactor Head Closure Stud Bolting 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 Exelon committed to ongoing implementation of the existing Reactor Head Closure Stud Bolting 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 audit and review of Exelon's Reactor Head Closure Stud Bolting program, the staff determined that those program elements for which Exelon claimed consistency with the GALL-SLR Report are consistent. In addition, the staff reviewed the exceptions, and the justifications, and determined that the AMP with the exceptions is adequate to manage the applicable aging effects. The staff concludes that Exelon 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 BWR Vessels Internals

SLRA Section B.2.1.7 states that the BWR Vessel Internals AMP is an existing program with enhancements that will be consistent, with the program elements in the GALL-SLR Report AMP XI.M9, "BWR Vessel Internals," except for the exception identified in the SLRA.

Staff Evaluation. During its in-office audit (ADAMS Accession No. ML19205A206), the staff reviewed Exelon's claim of consistency with the GALL-SLR Report. The staff compared the "scope of program," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements of Exelon's program to the corresponding program elements of GALL-SLR Report AMP XI.M9. The staff notes that the GALL-SLR Report AMP XI.M9 states that the BWR Vessel Internals program is a condition monitoring program and has no preventive actions.

BWRVIP-76, Revision 1-A, dictates the performance of a component-specific flaw tolerance evaluation for core shroud welds with cumulative extent of cracking in excess of 30 percent of the weld circumference. Exelon identified two core shroud welds (Unit 3, welds H3 and H4), which had cumulative cracking in excess of 30 percent of the weld circumference. Although one of the cracks identified was through-wall, the majority of the cracking did not extend through-wall. Exelon performed a component-specific flaw evaluation for these welds by conservatively projecting flaw growth through-wall for all identified cracks and performing fracture mechanics and leakage evaluations assuming a 10-year reinspection interval. The applicant's evaluation concluded that the required structural margin is maintained in these welds for an inspection interval of 10 years. The staff reviewed the applicant's evaluation and determined that the flaw evaluation provides an acceptable basis for re-inspecting the shroud on a 10-year interval based on the following factors: (a) the flaw evaluation included limit load, linear elastic, and elastic plastic flaw evaluations of the cracks in the H3 and H4 welds using methods that are consistent with those approved in BWRVIP-76, Revision 1-A report or other staff-approved methods, such as those in Section XI of the ASME Code, (b) the flaw evaluation applied the bounding and proprietary flaw growth rates that were approved in the BWRVIP-76, Revision 1-A report, and (c) the flaw evaluation demonstrates that the flaws will be acceptable for service for a period of at least 10 years.

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 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 the three enhancements is as follows.

Exception 1. SLRA Section B.2.1.7 includes an exception to the "scope of program," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," and "acceptance criteria" program elements related to the steam dryer inspection requirements in BWRVIP-139-A (ADAMS Accession No. ML101270123). In this exception, Exelon stated that the inspection and evaluation guidelines in BWRVIP-139-A do not address the Westinghouse Nordic-design replacement steam dryer designs. Instead, the licensee proposes to manage the effects of aging for these steam dryers using the alternative guidelines in WCAP-17635-P, Revision 3 (ADAMS Accession No. ML14105A385 (proprietary)) and through implementation of an inspection program defined in License Conditions 2.C (15)(f), (g), and (h) of the renewed operating licensees. The staff finds this exception acceptable because the inspection of the replacement steam dryers is being adequately managed by the Renewed Facility Operating License Conditions 2.C(15)(f), (g), and (h).

Enhancement 1. This section addresses Confirmatory Item 3.0.3.2.3-1. SLRA Section B.2.1.7 includes an enhancement to the "scope of program" and "parameters monitored or inspected" program elements. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M9. Following discussion with NRC staff, by email dated October 7, 2019 (ADAMS Accession No. ML19280B255), the applicant proposed to revise this commitment as follows. The applicant proposes, in accordance with BWRVIP-25, Revision 1 (ADAMS Accession No. ML16273A475 (publicly available) and ML16273A476 (proprietary)) to install wedges or inspect core plate rim hold-down bolts for stress corrosion cracking, or demonstrate via analysis that the installation of wedges and inspections of the core plate rim hold-down bolts are not required. The NRC staff has reviewed this report with respect to the applicant's proposal and finds that it provides acceptable methods to mitigate stress corrosion cracking through the installation of wedges, the identification of stress corrosion cracking through inspection, or the provision of an evaluation that justifies the elimination of the requirements of the inspection of the core plate bolts.

The NRC staff also confirmed that PBAPS meets the limitation in BWRVIP-25, Revision 1 regarding the calculated fluence to which the core plate rim hold-down bolts will be exposed and, therefore, determined that PBAPS may use the analytical methods in BWRVIP-25, Revision 1. Based on this confirmation, the staff finds that, for application to the PBAPS licensing basis, the use of BWRVIP-25, Revision 1 provides acceptable means to mitigate, identify or assess stress corrosion cracking and that the applicant has identified appropriate actions that will be taken to manage the effects of aging during the subsequent period of extended operations. Therefore, the NRC staff finds that this proposed revised enhancement is acceptable.

On October 9, 2019 (ADAMS Accession No. ML19283A362), the applicant addressed Confirmatory Item 3.0.3.2.3-1 by amending the SLRA to include the following revised enhancement:

> In accordance with BWRVIP-25, Revision 1, install core plate wedges, or inspect core plate rim hold-down bolts for stress corrosion cracking, or demonstrate via analysis that the installation of wedges and inspections of the core plate rim hold-down bolts are not required, no later than six months prior to the second period of extended operation, or before the end of the last refueling outage prior to the second period of extended operation, whichever occurs later.

The applicant reflected this enhancement in a revision of SLRA UFSAR Supplement Section A.2.1.7 and a revision of Part 1 of Commitment No. 7 in SLRA UFSAR Supplement Table A.5, "Second License Renewal Commitment List." The staff finds the revised enhancement and commitment provides for adequate management of stress corrosion cracking in the core plate rim hold-down bolts because the applicant will either: (1) implement a modification that will use wedges to replace the core plate rim hold-down bolts as the load bearing components in the core plate assemblies, which will eliminate any potential aging issues in the core plate rim hold-down bolts, or (2) manage stress corrosion cracking (and even loss of preload) in the core plate rim hold bolts using the inspection or analytical methods defined in the BWRVIP-25, Revision 1 report. Confirmatory Item 3.0.3.2.3-1 is closed.

Enhancement 2. SLRA Section B.2.1.7 includes an enhancement to the "scope of program" and "parameters monitored or inspected" program elements. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M9 and finds it acceptable because when it is implemented the applicant will perform a VT-3 inspection of the jet pump inlet mixer and beam regions every refuel cycle after a fluence value of 1.3×10^{20} n/cm^2 (51 effective full power years (EFPY) for Unit 2, and 63 EFPY for Unit 3) is reached at the jet pump hold-down beam.

Enhancement 3. SLRA Section B.2.1.7 includes an enhancement to the "scope of program," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," and "acceptance criteria" program elements. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M9 and finds it acceptable because when it is implemented it will perform the steam dryer inspection program in accordance with WCAP-17635-P, which includes manufacturer's recommendations based on relevant operating experience and has acceptance criteria consistent with BWRVIP-139-A. The staff documented its review of Exelon's use of WCAP-17635-P at PBAPS in its safety evaluation dated May 15, 2014, regarding the Peach Bottom Units 2 and 3 extended power uprate application license amendment request (ADAMS Accession No. ML14132A285).

The staff conducted an in-office audit (ADAMS Accession No. ML19205A206) to verify Exelon's claim of consistency with the GALL-SLR Report. Based on its review of the SLRA, the staff finds that the "scope of program," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements for which Exelon claimed consistency with the GALL-SLR Report are consistent with the corresponding program elements of GALL-SLR Report AMP XI.M9. In addition, the staff reviewed the exception and its justification and concludes that it is acceptable. 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.

Review of License Renewal Applicant Action Items

The program document for the BWR Vessel Internals program explains that the scope of the aging management program (AMP) includes implementation of the methodologies identified in a number of NRC-approved technical reports issued by the BWRVIP. The safety evaluations for the technical reports included action items (AAIs) that were to be addressed in a BWR applicant's SLRA.

Exelon provided its responses to these AAIs in Appendix C of the SLRA. The staff confirmed that Exelon provided the appropriate responses to the AAIs that were issued concerning the following BWRVIP technical reports:

- BWRVIP-18, Revision 2-A, for core spray nozzles and internal core spray line components
- BWRVIP-25, Revision 1, for core plate assembly components
- BWRVIP-26-A for the top guide assembly components
- BWRVIP-27-A for standby liquid control line/core delta P line nozzles and portions of the lines internal to the reactor pressure vessel
- BWRVIP-38 for shroud support inspection and flaw evaluation guidelines
- BWRVIP-41, Revision 3, for jet pump assembly components
- BWRVIP-42-A for the low pressure coolant injection couplings
- BWRVIP-47-A for reactor vessel internal components located in the reactor pressure vessel lower plenum region
- BWRVIP-74-A for pressure-retaining components in the reactor pressure vessel
- BWRVIP-76, Revision 1-A, for the core shroud and core shroud welds.

The staff also confirmed that Exelon addressed the specific request in the AAIs. This includes Exelon's responses to the following types of AAIs that have been issued concerning the specific BWRVIP report methodologies:

- supporting information in relation to implementation of BWRVIP-defined inspections or evaluations of reactor vessel internal component specific locations
- evaluations of reactor vessel internal component-specific time-limited aging analyses (TLAAs)
- needed performance of supplemental flaw evaluations or expanded component-specific inspections
- needed UFSAR supplement information for describing programmatic bases used to implement specific BWRVIP guideline methodologies
- potential identification of TS changes needed to manage the effects of aging in reactor vessel internal component specific locations

For these AAIs, the staff found the AAI responses to be acceptable because Exelon had either

- included the applicable UFSAR supplement describing the applicable inspection or evaluation used to manage aging effects of applicable components addressed in the AAIs, or
- identified, included, and evaluated the applicable TLAA for the component in the SLRA, or
- demonstrated that the existing basis for managing the effects of aging in the RVI components is consistent with those defined in staff-approved BWRVIP reports and that the SLRA does not need to propose any amendments to the plant-specific technical specifications in order to manage the effects of aging during the period of extended operation, as might otherwise be required by the provisions of 10 CFR 54.22.

Operating Experience. SLRA Section B.2.1.7 summarizes operating experience related to the BWR Vessel Internals AMP. The staff evaluated operating experience information by reviewing the subsequent license renewal application (SLRA) and conducting an audit (ADAMS Accession No. ML19142A369). During the audit, the staff independently searched plant-specific operating experience information to determine whether any previously unknown or recurring aging effects were identified.

The staff did not identify any operating experience indicating that Exelon should modify its proposed program beyond that proposed in the SLRA, or that there are additional aging effects requiring management beyond those claimed by the applicant as being applicable to the components.

Based on its audit and review of the SLRA, the staff finds that the conditions and operating experience at the plant are bounded by those for which the BWR Vessel Internals AMP was evaluated.

UFSAR Supplement. SLRA Section A.2.1.7, as amended by letter dated October 9, 2019, provides the UFSAR supplement for the BWR Vessel Internals 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.

Conclusion. On the basis of its audit and review of Exelon's BWR Vessel Internals AMP, the staff concludes that those program elements for which Exelon claimed consistency with the GALL-SLR Report are consistent. In addition, the staff reviewed the exception and its justification and concludes that it is acceptable. 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 Exelon 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). The staff concludes that Exelon 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).

3.0.3.2.4 Flow-Accelerated Corrosion

SLRA Section B.2.1.9 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."

Staff Evaluation. During its in-office audit (ADAMS Accession No. ML19205A206), the staff reviewed Exelon'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 Exelon's program to the corresponding program elements of GALL-SLR Report AMP XI.M17. For the "scope of program" program element, the staff determined the need for additional information, which resulted in the issuance of RAI B.2.1.9-1. The staff's request and Exelon's response are documented in ADAMS Accession No. ML19122A289.

In its response, Exelon revised SLRA Section B.2.1.9 and stated that the governing implementation procedure for the Flow-Accelerated Corrosion program was recently revised in response to staff questions in 2014 for the Byron and Braidwood license renewal. The procedure revision added a paragraph to address software validation, verification, and documentation that will be annotated as a commitment for the SLR. The staff finds Exelon's response, including the changes to the SLRA and the implementation procedure, acceptable because the additional activities to validate and verify any changes to software used in the Flow-Accelerated Corrosion program will ensure that calculated wear rates and remaining component life are consistent with the methodology delineated in NSAC-202L, "Recommendations for an Effective Flow-Accelerated Corrosion Program."

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 this enhancement follows.

Enhancement 1. SLRA Section B.2.1.9 includes an enhancement to the "detection of aging effects" program element, which relates to ensuring that there are adequate bases for the continued exclusion of infrequently used systems from the program. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.M17 and finds it acceptable because ensuring that previous program exclusions remain valid, for infrequently used systems, will provide reasonable assurance that aging effects associated with these systems will continue to be adequately managed by the program.

Based on its audit and review of the response to RAI B.2.1.9-1, 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 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 it will make the AMP adequate to manage the applicable aging effects.

Operating Experience. SLRA Section B.2.1.9 summarizes operating experience related to the Flow-Accelerated Corrosion program. The staff evaluated operating experience information by reviewing the SLRA and conducting an audit (ADAMS Accession No. ML19142A369). During the audit, the staff independently searched plant-specific operating experience information to identify whether any unexpected or previously unknown age-related degradation occurred and to evaluate the need for program adjustments. The staff identified operating experience for which it determined the need for additional information, which resulted in the issuance of RAI B.1.2.9-2. The staff's request and Exelon's response are documented in ADAMS Accession No. ML19122A289.

In its response, Exelon summarized its review and validation process for the CHECWORKS models used by the Flow-Accelerated Corrosion program, including several independent verification activities. The response noted that, although legacy modeling errors have been identified in the initial CHECWORKS analytical models, these errors have not represented significant issues and there have been no instances in which legacy modeling errors caused a loss of system or component function. The staff finds Exelon's response acceptable because previous independent verifications of the program's analytical models provide reasonable assurance that structural integrity of piping within the scope of the program will be maintained.

Based on its audit, review of the SLRA, and review of Exelon's response to RAI B.2.1.9-2, the staff finds that the conditions and operating experience at the plant are bounded by those for which the Flow-Accelerated Corrosion program was evaluated.

UFSAR Supplement. SLRA Section A.2.1.9 provides the UFSAR supplement for the Flow-Accelerated 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 Exelon committed to enhance the program 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. On the basis of its audit and review of Exelon's Flow-Accelerated Corrosion program, the staff concludes that those program elements for which Exelon claimed consistency with the GALL-SLR Report are consistent. Also, the staff reviewed the enhancement and concludes 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 Exelon 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 B.2.1.10 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." Exelon amended this SLRA section by letter dated January 23, 2019.

Staff Evaluation. During its in-office audit (ADAMS Accession No. ML19205A206), the staff reviewed Exelon'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 Exelon's program to the corresponding program elements of GALL-SLR Report AMP XI.M18.

The staff also reviewed the portions of the “scope of program,” “preventive actions,” “detection of aging effects,” “acceptance criteria,” and “corrective actions” 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 the exception and nine enhancements is as follows.

Exception 1. SLRA Section B.2.1.10 includes an exception to the “scope of program” program element related to closure bolting on pressure-retaining components. The staff reviewed this exception against the corresponding Bolting Integrity program element in GALL-SLR Report AMP XI.M18 and finds it acceptable because: (1) the component, material, environment, and aging effects of the submerged mechanical bolts are equivalent to those of submerged pressure-retaining bolts managed under the GALL-SLR Report AMP XI.M18; (2) although the bolting on the submerged cooling water pump structure traveling screens is not pressure-retaining bolting, the applicant’s approach for detecting the aging effects of the submerged mechanical bolts is consistent with the recommendations in the GALL-SLR Report; and (3) the applicant’s intent to use sample-based visual inspections on a 10-year frequency as an alternate means of inspection (as stated in SLRA Enhancement 2 which is reviewed and found acceptable below) is adequate to manage the aging effects of loss of preload and loss of material for these submerged mechanical bolts.

Enhancement 1. SLRA Section B.2.1.10 includes an enhancement to the “detection of aging effects” and “acceptance criteria” program elements. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.M18 and finds it acceptable because the Bolting Integrity program will include inspection of 19 bolt heads and threads per unit every 10 years for the submerged closure bolts in the emergency service water, high pressure service water, and fire protection pumps, consistent with the recommendations in GALL-SLR Report AMP XI.M18.

Enhancement 2. SLRA Section B.2.1.10 includes an enhancement to the “detection of aging effects” and “acceptance criteria” program elements. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.M18 and finds it acceptable because the Bolting Integrity program will include inspection of 19 bolt heads and threads per unit on a 10-year frequency for the submerged bolts in the traveling screens of the circulating water pump structure, consistent with the recommendations in GALL-SLR Report AMP XI.M18.

Enhancement 3. SLRA Section B.2.1.10 includes an enhancement to the “detection of aging effects” and “acceptance criteria” program elements. 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, the Bolting Integrity program will: (1) include inspection of 19 bolt heads and threads per unit on a 10-year frequency for pressure-retaining bolting in systems that contain air or gas; and (2) include applying inspection techniques such as soap bubble testing, thermography testing, acoustic testing, or verifying bolting is hand tight consistent with the recommendations in GALL-SLR Report AMP XI.M18.

Enhancement 4. SLRA Section B.2.1.10 includes an enhancement to the “detection of aging effects” and “acceptance criteria” program elements. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.M18 and finds it acceptable because the Bolting Integrity program will: (1) include inspection of a minimum of 25 bolt heads and threads per unit on a 10-year frequency for pressure-retaining bolting in systems that contain air or gas; and (2) include applying inspection techniques such as soap bubble testing, thermography testing, acoustic testing, or verifying bolting is hand tight consistent with the recommendations in GALL-SLR Report AMP XI.M18.

Enhancement 5. SLRA Section B.2.1.10 includes an enhancement to the “detection of aging effects” program element. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report XI.M18 and finds it acceptable because the Bolting Integrity program site walkdown procedures will specify inspection parameters such as proper lightning and appropriate distances to adequately detect the associated aging effects consistent with the recommendations in GALL-SLR Report AMP XI.M18.

Enhancement 6. SLRA Section B.2.1.10 includes an enhancement to the “detection of aging effects” program element. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.M18 and finds it acceptable because, the AMPs guidance for repetitive tasks will be revised to specify inspection parameters such as proper lighting and appropriate inspection distances to adequately detect the associated aging effects in submerged closure bolting consistent with the recommendations in GALL-SLR Report AMP XI.M18.

Enhancement 7. SLRA Section B.2.1.10 includes an enhancement to the “corrective actions” program element. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report and finds it acceptable because the Bolting Integrity program corrective actions will include increased inspections of closure bolts and extent of condition analyses consistent with the recommendations in GALL-SLR Report AMP XI.M18 when sample-based inspections and subsequent inspections do not meet acceptance criteria.

Enhancement 8. SLRA Section B.2.1.10 includes an enhancement to the “detection of aging effects” program element. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.M18 and finds it acceptable the Bolting Integrity program will include volumetric examination of high-strength bolts consistent with the recommendations in GALL-SLR Report AMP XI.M18.

Enhancement 9. SLRA Section B.2.1.10 includes an enhancement to the “preventive actions” program element. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report and finds it acceptable because the Bolting Integrity program will include guidance for proper selection, installation, and storage of bolting material, as well as proper selection of lubricants consistent with the recommendations in the GALL-SLR Report.

Based on its audit and review of the SLRA and amendments, the staff finds that, with the above exception, 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.M18. The staff also reviewed the exception and its justification and concludes that it is acceptable. The staff reviewed the enhancements and finds that their implementation prior to the subsequent period of extended operation will make the AMP adequate to manage the applicable aging effects.

Operating Experience. SLRA Section B.1.1.10 summarizes the operating experience related to the Bolting Integrity program. The staff evaluated the operating experience information by reviewing the SLRA and conducting an audit (ADAMS Accession No. ML19142A369). During the audit, the staff independently searched plant-specific operating experience information to determine whether any previously unknown or recurring aging effects were identified. The staff did not identify any operating experience indicating Exelon should modify its proposed program. Based on its audit and review of the SLRA, the staff finds that the conditions and operating experience at the plant are bounded by those for which the Bolting Integrity program was evaluated.

UFSAR Supplement. SLRA Section A.2.1.10 provides the UFSAR supplement for the Bolting Integrity 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, as amended by letter dated January 23, 2019, is an adequate summary description of the program.

Conclusion. On the basis of its audit and review of Exelon's Bolting Integrity program, the staff concludes that those program elements for which Exelon claimed consistency with the GALL-SLR Report are consistent. The staff also reviewed the exception and its justifications and concludes that it is acceptable. The staff reviewed the enhancements and concludes 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 Exelon 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).

3.0.3.2.6 Open-Cycle Cooling Water System

SLRA Section B.2.1.11 states that the Open-Cycle Cooling Water System AMP is an existing program with an enhancement that will be consistent with the program elements in the GALL-SLR Report AMP XI.M20, "Open-Cycle Cooling Water System."

Staff Evaluation. During its in-office audit (ADAMS Accession No. ML19205A206), the staff reviewed Exelon'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 Exelon's program to the corresponding program elements of GALL-SLR Report AMP XI.M20.

The staff also reviewed the portions of the "corrective actions" program element associated with 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 is as follows.

Enhancement 1. SLRA Section B2.1.11 includes an enhancement to the "corrective actions" program element to perform additional inspections if acceptance criteria are not met. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M20 and finds it acceptable because, the program will require the inspection scope to be expanded when acceptance criteria are not met. The expanded scope would be either no fewer than five additional inspections 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. This scope expansion is consistent with GALL-SLR Report AMP XI.M20.

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 for which Exelon claimed consistency with the GALL-SLR Report are consistent with the corresponding program elements of GALL-SLR Report AMP XI.M20. In addition, the staff reviewed the enhancement associated with the “corrective actions” program element and finds that it will make the AMP adequate to manage the applicable aging effects.

Operating Experience. SLRA Section B.2.1.11 summarizes operating experience related to the Open-Cycle Cooling Water System program. The staff evaluated operating experience information by reviewing the SLRA and conducting an audit (ADAMS Accession No. ML19142A369). During the audit, the staff independently searched plant-specific operating experience information to determine whether any previously unknown or recurring aging effects were identified.

The staff did not identify any operating experience indicating that Exelon should modify its proposed program beyond that incorporated. Based on its audit and review of the SLRA, the staff finds that the conditions and operating experience at the plant are bounded by those for which the Open-Cycle Cooling Water System program was evaluated

UFSAR Supplement. SLRA Section A.2.1.11 provides the UFSAR supplement for the Open-Cycle Cooling Water System 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. On the basis of its audit and review of Exelon’s Open-Cycle Cooling Water System program, the staff concludes that those program elements for which Exelon claimed consistency with the GALL-SLR Report are consistent. Also, the staff reviewed the enhancement and concludes 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 Exelon 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 System

SLRA Section B.2.1.12 states that the Closed Treated Water Systems program is an existing program with an enhancement that will be consistent with the program elements in GALL-SLR Report AMP XI.M21A, “Closed Treated Water Systems,” apart from the exception identified in the SLRA.

Staff Evaluation. During its in-office audit (ADAMS Accession No. ML19205A206), the staff reviewed Exelon’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 Exelon’s program 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,” “acceptance criteria,” and “corrective actions” 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 the one exception and one enhancement follows.

Exception 1. SLRA Section B.2.1.12 includes an exception to the “parameters monitored or inspected” program element that relates to the use of EPRI 3002000590, “Closed Cooling Water Chemistry Guideline,” which is a more recent version of the EPRI guidance than the one specified in the GALL-SLR Report XI.M21A. The SLRA states that the specific water chemistry parameters, acceptance range, and sampling frequency from the more recent guidance remains unchanged from the previous version for the chemical treatment program at PBAPS. The staff reviewed this exception against the corresponding program element in GALL-SLR Report AMP XI.M21A and finds it acceptable because use of the more recent water chemistry guidance results in an equivalent program.

Enhancement 1. SLRA Section B.2.1.12 includes an enhancement to the “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” “acceptance criteria,” and “corrective actions” program elements for performing periodic inspections to verify the effectiveness of water chemistry control. The enhancement also includes provisions to project identified degradation until the next scheduled inspection and to expand the scope of inspections when degradation is identified. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M21A and finds it acceptable because following its implementation, the program will include the condition monitoring activities provided in the GALL-SLR Report program.

Based on its audit and review of the SLRA, the staff finds that, with the above exception, 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 Exelon claimed consistency with the GALL-SLR Report are consistent with the corresponding program elements of GALL-SLR Report AMP XI.M21A. The staff also reviewed the exception and its justification, and the enhancement and finds that the AMP is adequate to manage the applicable aging effects.

Operating Experience. SLRA Section B.2.1.12 summarizes operating experience related to the Closed Treated Water Systems program. The SLRA states that plant-specific operating experience provides objective evidence that the Closed Treated Water Systems program will effectively assure that the intended functions will be maintained consistent with the CLB for the subsequent period of extended operation.

The staff reviewed operating experience information in the SLRA and during the audit. As discussed in the Audit Report (ADAMS Accession No. ML19142A369) the staff conducted an independent search of the plant operating experience information 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. The staff did not identify any operating experience that would indicate that the proposed program would not be adequate to manage the associated aging effects. Based on its audit and review of the SLRA, the staff finds that the conditions and operating experience at the plant are bounded by those for which the Closed Treated Water Systems program was evaluated.

UFSAR Supplement. SLRA Section A.2.1.12 provides the UFSAR supplement for the Closed Treated Water 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 Exelon committed to enhance the program as described in SLRA Section A.5 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 audit and review of Exelon's Closed Treated Water Systems program, the staff concludes that those program elements for which Exelon claimed consistency with the GALL-SLR Report are consistent. The staff also reviewed the exception and its justification and concludes that it is acceptable. The staff reviewed the enhancement and finds 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 Exelon 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 B.2.1.13 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.M23, "Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems."

Staff Evaluation. During its in-office audit (ADAMS Accession No. ML19205A206), the staff reviewed Exelon'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 "confirmation process" program elements of Exelon's program to the corresponding program elements of GALL-SLR Report AMP XI.M23.

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

Enhancement 1. SLRA Section B.2.1.13 includes an enhancement to the "scope of program," "parameters monitored or inspected," and "detection of aging effects" program elements. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M23 and finds it acceptable because when the enhancement the program will be consistent with GALL-SLR Report AMP XI.M23 recommendations for performance of inspections of: (1) crane bridges, structural members, and structural components for the aging effects of loss of material, deformation or cracking due to corrosion or wear; and (2) bolted connections for the aging effects of loss of material, cracking, and indications of loss of preload.

Enhancement 2. SLRA Section B.2.1.13 includes an enhancement to the “monitoring and trending,” “corrective actions,” and “confirmation process” program elements. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M23 and finds it acceptable because the program will be consistent with GALL-SLR Report AMP XI.M23 recommendations to: (1) document deficiencies using plant-specific processes and procedures; and (2) address deficiencies in the applicant’s corrective action program.

Enhancement 3. SLRA Section B.2.3.13 includes an enhancement to the “acceptance criteria” and “corrective actions” program elements. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.M23 and finds it acceptable because the program will be consistent with GALL-SLR Report AMP XI.M23 recommendations to evaluate and repair visual indication of loss of material, deformation, cracking, and loss of bolting preload in accordance with applicable ASME B30 series standards.

The staff conducted an audit to verify the applicant’s claim of consistency with the GALL-SLR Report. Based on its review of the SLRA, the staff finds that the “scope of program,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” “acceptance criteria,” “corrective actions,” and “confirmation process” program elements for which Exelon claimed consistency with the GALL-SLR Report are consistent with the corresponding program elements of GALL-SLR Report AMP XI.M23. In addition, the staff reviewed the enhancements and finds that they will make the AMP adequate to manage the applicable aging effects.

Operating Experience. SLRA Section B.2.1.13 summarizes operating experience related to the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems program. The staff evaluated operating experience information by reviewing the SLRA and conducting an audit (ADAMS Accession No. ML19142A369). During the audit, the staff independently searched plant-specific operating experience information to determine whether any previously unknown or recurring aging effects were identified. The staff did not identify any operating experience indicating that Exelon should modify its proposed program beyond that incorporated during the development of the SLRA.

Based on its audit and review of the SLRA, the staff finds that the conditions and operating experience 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 Section A.2.1.13 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 implement the enhancements to the AMP 6 months prior to the subsequent period of extended operation as discussed in Section A.

The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. On the basis of its audit and review of Exelon’s Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems program, the staff concludes that those program elements for which Exelon 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 Exelon 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 B.2.1.14 states that the Compressed Air Monitoring program is an existing program with enhancements that will be consistent with the program elements in the GALL-SLR Report AMP XI.M24, “Compressed Air Monitoring.”

Staff Evaluation. During its in-office audit (ADAMS Accession No. ML19205A206), the staff reviewed Exelon’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 Exelon’s program to the corresponding program elements of GALL-SLR Report AMP XI.M24.

The staff also reviewed the portions of the “parameters monitored or inspected,” “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 these two enhancements follows.

Enhancement 1. SLRA Section B.2.1.14 includes an enhancement to the “detection of aging effects” and “monitoring and trending” program elements. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M24 and finds it acceptable because performing daily inspection of the nitrogen after dryer desiccant for signs of moisture is consistent with the recommendations of the GALL-SLR Report AMP XI.M24.

Enhancement 2. SLRA Section B.2.1.14 includes an enhancement to the “parameters monitored or inspected” and “detection of aging effects” program elements. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M24 and finds it acceptable because performing opportunistic visual inspections of component internal surfaces exposed to a dry air environment for signs of loss of material due to corrosion is consistent with the recommendations of the GALL-SLR Report AMP XI.M24.

Based on its audit, the staff finds that the “scope of program,” “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” and “acceptance criteria” program elements for which Exelon 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 enhancements associated with the “parameters monitored or inspected,” “detection of aging effects,” and “monitoring and trending” program elements and finds that they will make the AMP adequate to manage the applicable aging effects.

Operating Experience. SLRA Section B.2.1.14 summarizes operating experience related to the Compressed Air Monitoring program. The staff evaluated operating experience information by reviewing the SLRA and conducting an audit (ADAMS Accession No. ML19142A369). During the audit, the staff independently searched plant-specific operating experience information to determine whether any previously unknown or recurring aging effects were identified. The staff did not identify any operating experience indicating that Exelon should modify its proposed program beyond that incorporated. Based on its audit and review of the SLRA, the staff finds that the conditions and operating experience at the plant are bounded by those for which the Compressed Air Monitoring program was evaluated.

UFSAR Supplement. SLRA Section A.2.1.14 provides the UFSAR supplement for the Compressed Air Monitoring program. The staff reviewed this UFSAR supplement description of the program and determined that it is consistent with the recommended description in GALL-SLR Report Table XI-01. The staff also noted that Exelon committed to implementing the enhancements to the existing Compressed Air Monitoring program 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. On the basis of its audit and review of Exelon's Compressed Air Monitoring program, the staff concludes that those program elements for which Exelon claimed consistency with the GALL-SLR Report are consistent. Also, the staff reviewed the enhancements and concludes 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 Exelon 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).

3.0.3.2.10 Fire Protection

SLRA Section B.2.1.16 states that the Fire Protection program is an existing program with enhancements that will be consistent, with the program elements in the GALL-SLR Report AMP XI.M26, "Fire Protection."

Staff Evaluation. During its in-office audit (ADAMS Accession No. ML19205A206), the staff reviewed Exelon'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 Exelon's program to the corresponding program elements of GALL-SLR Report AMP XI.M26.

The staff also reviewed the portions of the "scope of program," "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 two enhancements follows.

Enhancement 1. SLRA Section B.2.1.16 includes an enhancement to the "scope of program," "parameters monitored or inspected," "detection of aging effects," and "acceptance criteria" program elements to perform periodic visual inspections every 18 months for identification of corrosion that may lead to loss of material on the external surfaces of the low pressure carbon dioxide fire suppression systems. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M26 and finds it acceptable because it will require visual inspections to manage the aging effects associated with the carbon dioxide fire suppression systems, which is consistent with GALL-SLR Report AMP XI.M26.

Enhancement 2. SLRA Section B.2.1.16 includes an enhancement to the “scope of program,” “parameters monitored or inspected,” “detection of aging effects,” and “acceptance criteria” program elements to perform periodic visual inspections of combustible liquid spill retaining curbs every 24 months. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M26 and finds it acceptable it will require visual inspections to manage cracking and loss of material of combustible liquid spill retaining curbs to prevent loss of intended function.

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 for which Exelon claimed consistency with the GALL-SLR Report are consistent with the corresponding program elements of GALL-SLR Report AMP XI.M26. In addition, the staff reviewed the enhancements associated with the “scope of program,” “parameters monitored or inspected,” “detection of aging effects,” and “acceptance criteria” program elements and finds that they will make the AMP adequate to manage the applicable aging effects.

Operating Experience. SLRA Section B.2.1.16 summarizes operating experience related to the Fire Protection program. The staff evaluated operating experience information by reviewing the SLRA and conducting an audit (ADAMS Accession No. ML19142A369). During the audit, the staff independently searched plant-specific operating experience information to determine whether any previously unknown or recurring aging effects were identified. The staff did not identify any operating experience indicating that Exelon should modify its proposed program. Based on its audit and review of the SLRA, the staff finds that the conditions and operating experience at the plant are bounded by those for which the Fire Protection program was evaluated.

UFSAR Supplement. SLRA Section A.2.1.16 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 that Exelon committed to implement the stated enhancements 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. On the basis of its audit and review of Exelon’s Fire Protection program, the staff concludes that those program elements for which Exelon 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 Exelon 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 B.2.1.17 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 exception identified in the SLRA. Exelon amended this SLRA section by letters dated January 23, 2019 (ADAMS Accession

No. ML019023A015); May 2, 2019 (ADAMS Accession No. ML19122A289); and May 30, 2019 (ADAMS Accession No. ML19150A297).

Staff Evaluation. During its in-office audit (ADAMS Accession No. ML19205A206), the staff reviewed Exelon'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 Exelon's program to the corresponding program elements of GALL-SLR Report AMP XI.M27.

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 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 20 exceptions and enhancements is as follows.

Exception 1. SLRA Section B.2.1.17 includes an exception to the "detection of aging effects" program element related to not conducting an air flow test through the auxiliary boiler foam chamber discharge nozzle. As stated in the SLRA: (a) the foam discharge nozzle is a large orifice and the system utilizes a deflector shield rather than being dependent on the nozzle to establish the spray discharge pattern; (b) the supply piping is dry and not wetted; (c) the fuel oil tank is permanently sealed; and (d) a one-time inspection of the auxiliary boiler fuel oil storage tank internal foam nozzle and deflector ensures proper configuration, orientation, and no indication of flow blockage.

The staff noted that the design configuration of the foam system results in it being less susceptible to flow blockage because: (a) the orifice is large and given an air environment in a sealed enclosure, flow blockage would not be expected to occur; and (b) the deflector shield used to distribute the foam is not susceptible to flow blockage as compared to a nozzle that would distribute the foam. The staff reviewed this exception against the corresponding program element in GALL-SLR Report AMP XI.M27 and finds it acceptable because: (a) the system is less susceptible to flow blockage; (b) a one-time inspection (see Enhancement No. 11) can verify that there is no evidence of flow blockage prior to the start of the subsequent period of extended operation; and (c) it is reasonable to assume that should the foam system actuate, the entry into the enclosure required to remove foam residue prior to replacing the fuel oil would include inspecting for flow blockage.

Exception 2. During its review of SLRA Section B.2.1.17, the staff identified a difference in the "detection of aging effects" program element affecting the "preventive actions" and "detection of aging effects" program elements. Specifically, the staff noted that the plant-specific procedures do not require that hydrant flushes be performed for at least a minute and that the hydrant barrel completely drain within 60 minutes. The staff determined the need for additional information, which resulted in the issuance of an RAI. RAI B.2.1.17-2 and Exelon's response are documented in ADAMS Accession No. ML19122A289.

In its response, Exelon added Enhancement No. 15 to the Fire Water System to include a minimum flow duration of 1 minute after the hydrant valve is fully open to assure adequate time is allowed to clear the fire water main of all foreign material. In regard to the hydrant barrel draining in 60 minutes, Exelon stated: (a) a review of completed tests since 2004 indicates that some hydrants have been found with standing water; (b) water found in hydrants is the result of either groundwater entering through the normally open drain port or a leaking hydrant valve that cannot completely drain; (c) the hydrant flush test procedure requires that the hydrant be checked for standing water and requires that if water is found, the water be pumped down to 3 ft [below the ground surface], which ensures the hydrant is drained below the frost line depth of approximately 30 inches; (d) a search of plant-specific operating experience since 2004 for freezing fire hydrants was performed and none were found; and (e) plant-specific operating experience, including many subfreezing conditions, has proven the current flush and drain method effective because there is no history of freezing hydrants at PBAPS.

During its evaluation of Exelon's response to RAI B.2.1.17-2, the staff noted that Exelon did not provide a technical basis for why fire hydrant water would not freeze during cold weather conditions. The staff finds Exelon's response and the inclusion of Enhancement No. 15 acceptable in part because the addition of minimum flush flow times is consistent with the GALL-SLR Report AMP XI.M27. However, Exelon's position that plant-specific operating experience is adequate to demonstrate that hydrants will not freeze lacked sufficient rigor to provide reasonable assurance that the intended function of a hydrant will be met during cold weather conditions. The staff determined the need for additional information, which resulted in Exelon revising its response to RAI B.2.1.17-2 as documented in ADAMS Accession No. ML19150A297. In its revised response, Exelon stated that: (a) water that is in a hydrant barrel below the frost line will not freeze because of heat provided by the earth below the frost line, which is supported by national standards for the installation of fire service mains and their appurtenances including fire hydrants; (b) national standards for fire piping, such as Section 10.4.2.1 of NFPA 24 and Section 3.3.9.1 of NFPA 25, only require that the hydrant isolation valve be installed below the frost line; and (c) the data from a hydrogeological study performed in 2018 for the PBAPS site indicated that the groundwater levels are below the frost line.

The staff independently reviewed the following:

- NFPA 24, "Standard for the Installation of Private Fire Service Mains and Their Appurtenances," Section 10.4.2.1, "Protection for Piping," which states that the top of the pipe shall be buried not less than 12 inches below the frost line for the locality.
- The 2011 edition NFPA 25, Section 3.3.9.1, and NFPA 24, Section 3.4.1.1, which state that the control valve for a dry barrel hydrant is located below the frost line.
- The Manual of Water Supply Practices, M17, "Fire Hydrants: Installation, Field Testing, and Maintenance," section titled, "Types of Dry-Barrel Hydrants," which states that the main valve is located below the normal frost line to protect the hydrant from freezing.

The staff reviewed the draining of fire hydrant barrels portion of the exception against the corresponding program element in GALL-SLR Report AMP XI.M27 and finds it acceptable because: (a) national consensus standards allow the hydrant control valve to be located just below the frost line because of heat provided from the earth below the frost line; (b) Exelon confirmed that groundwater levels (a potential source of backfilling of a hydrant barrel) are below the frost line; and (c) existing plant-specific procedures require draining of a barrel to below the frost line.

<u>*Enhancement 1*</u>. SLRA Section B.2.1.17 includes an enhancement to the "parameters monitored or inspected," "detection of aging effects," "acceptance criteria," and "corrective actions" program elements related to revising flow test procedures to include requirements to include acceptance criteria for inspector test flushes and wet pipe main drain tests, and corrective actions associated with not meeting the acceptance criteria. The staff determined the

need for additional information, which resulted in the issuance of an RAI. RAI B.2.1.17-1 and Exelon's response are documented in ADAMS Accession No. ML19122A289.

In its response, Exelon revised Enhancement No. 1 to state that additional tests are completed within the interval in which the original test was conducted and if acceptance criteria are not met during followup testing, an extent of condition and extent of cause analysis will be conducted to determine the further extent of tests. In addition, Exelon stated that there are 29 wet sprinkler systems within the scope of license renewal, including 20 wet sprinkler systems with alarm control valves that have 2-inch main drains and inspector test flush connections. Main drain tests are performed on all 20 with alarm control valves and 2-inch main drains. The nine wet sprinkler systems without alarm control valves have inspector test connections. Inspector test flushes are periodically performed, consistent with GALL-SLR Report AMP XI.M27, on all 29 wet sprinkler systems to verify there is no flow blockage due to fouling in the sprinkler system and fire water supply system. During the inspector test flushes, the nominal time from opening the test valve to control room alarm annunciation is recorded and compared to the test criterion. The basis for the one-minute test criterion is to provide adequate time to bound the variability in the test and still demonstrate water is flowing through the supply piping and sprinkler system and there is no flow blockage.

During the operating experience audit, the staff only noted one instance of a main drain test not meeting acceptance criteria. The staff reviewed this enhancement and RAI response against the corresponding program element in GALL-SLR Report AMP XI.M27 and finds it acceptable because: (a) the timing of additional tests and means to determine the scope of additional testing will be consistent with GALL-SLR Report AMP XI.M27; (b) based on its review of plant-specific operating experience, the staff did not identify an adverse trend in main drain test results; and (c) conducting main drain tests on 20 of 29 wet sprinkler systems during the subsequent period of extended operation exceeds the minimum sample size for sampling-based programs cited in the GALL-SLR Report (e.g., AMP XI.M38) and, as a result, the issue associated with the accuracy of trending of the inspector test flushes sufficient to detect potential flow blockage due to fouling is resolved.

Enhancement 2. SLRA Section B.2.1.17 includes an enhancement to the "parameters monitored or inspected," "detection of aging effects," and "acceptance criteria" program elements related to performing air flow tests for certain deluge systems. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M27 and finds it acceptable because it will be consistent with the frequency and test method of deluge systems recommended in AMP XI.M27 and NFPA 25, "Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems," Section 13.4.3.2.2.

Enhancement 3. SLRA Section B.2.1.17 includes an enhancement to the "parameters monitored or inspected" and "detection of aging effects" program elements related to increasing the frequency of air flow tests for the standby gas treatment and recombiner system deluge system. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M27 and finds it acceptable because it will be consistent with the frequency of testing of deluge systems recommended in AMP XI.M27 and NFPA 25 Section 13.4.3.2.2.

Enhancement 4. As amended by letter dated May 2, 2019, SLRA Section B.2.1.17 includes an enhancement to the "parameters monitored or inspected" and "detection of aging effects" program elements related to the frequency and inspection parameters for sprinkler inspections.

The staff determined the need for additional information, which resulted in the issuance of an RAI. RAI B.2.1.17-3 and Exelon's response are documented in ADAMS Accession No. ML19122A289.

In its response, Exelon revised Enhancement No. 4 to state, "[r]evise procedures to improve guidance for external visual inspections of the in scope sprinkler systems piping and sprinklers at least every two years to inspect for corrosion, loss of material, leaks, and proper sprinkler orientation. Corroded, leaking or damaged sprinklers shall be replaced." Exelon stated that there are approximately 1,400 sprinklers on wet sprinkler systems. A search of plant operating experience since 2004 identified five sprinklers on wet pipe sprinkler systems that were found to be leaking. The leaks were small (i.e., drops per minute), none exhibited corrosion, and, as a result, the leaking sprinklers did not adversely impact the ability of the sprinklers to perform their intended function.

The staff noted that Exelon revised its response to RAI B.2.1.17-3 by letter dated May 30, 2019 (ADAMS Accession No. ML19150A297) to remove reference to an engineering evaluation that will determine if a sprinkler exhibits sufficient corrosion that could impact the design function, in which case it would be replaced. The RAI response now states, "[i]f corroded sprinklers are identified during the inspection, the condition will be entered into the corrective action program and the sprinklers will be replaced."

The staff reviewed this enhancement and RAI response against the corresponding program element in GALL-SLR Report AMP XI.M27 and finds it acceptable because (a) a very low percentage of the 1400 sprinklers exhibited leakage; and (b) the intended function of the leaking sprinklers was not affected; and c) when implemented, it will be consistent with the frequency of inspections and inspection parameters recommended in AMP XI.M27 and NFPA 25, Section 5.2.1.1.

Enhancement 5. SLRA Section B.2.1.17 includes an enhancement to the "parameters monitored or inspected" and "detection of aging effects" program elements related to external visual inspection of above ground fire main 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 it will be consistent with the recommended frequency of external visual inspections recommended in AMP XI.M27.

Enhancement 6. As amended by Supplement No. 2 (ADAMS Accession No. ML19023A015) SLRA Section B.2.1.17 includes an enhancement to the "parameters monitored or inspected," "detection of aging effects," "acceptance criteria," and "corrective actions" program elements related to internal visual inspection parameters, methods, frequency, and corrective actions for sprinkler and 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 it will be consistent with the recommendations in AMP XI.M27 and NFPA 25 Section 14.2 related to the inspections of wet pipe sprinkler, pre-action sprinkler, and deluge systems.

Enhancement 7. SLRA Section B.2.1.17 includes an enhancement to the "parameters monitored or inspected" and "detection of aging effects" program elements related to performing a one-time inspection of original yard transformer deluge system piping that was not replaced during transformer replacements. 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 volumetric wall thickness measurements can provide insights into potential internal corrosion of fire water system piping.

Enhancement 8. SLRA Section B.2.1.17 includes an enhancement to the "detection of aging effects" program element related to inspections of the motor driven fire pump intake strainer. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M27 and finds it acceptable because conducting inspections of fire pump strainers is consistent with the recommendations in AMP XI.M27, Table XI.M27-1, "Fire Water System Inspection and Testing Recommendations."

Enhancement 9. SLRA Section B.2.1.17 includes an enhancement to the "detection of aging effects" program element related to frequency of performing flow tests at the most hydraulically limiting locations for each zone of the fire water system. 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 it will be consistent with flow testing recommendations in AMP XI.M27 and NFPA 25, Section 6.3.1.

Enhancement 10. SLRA Section B.2.1.17 includes an enhancement to the "detection of aging effects" program element related to flushing deluge system mainline supply 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 it will be consistent with the recommendation in AMP XI.M27 for flushing strainers after each system actuation.

Enhancement 11. SLRA Section B.2.1.17 includes an enhancement to the "detection of aging effects" program element related to performing a one-time inspection of the auxiliary boiler fuel oil storage tank internal foam nozzle and deflector to ensure proper configuration and orientation and no indication of flow blockage. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M27 and finds it acceptable because a one-time visual inspection can verify that there is no evidence of flow blockage prior to the start of the subsequent period of extended operation.

Enhancement 12. SLRA Section B.2.1.17 includes an enhancement to the "detection of aging effects" program element related to performing internal inspections of the auxiliary boiler oil storage tank foam system foam concentrate tank. 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 it will be consistent with AMP XI.M27 recommendations related to frequency of inspections.

Enhancement 13. SLRA Section B.2.1.17 includes an enhancement to the "detection of aging effects" program element related to revising testing procedures associated with the hydrogen seal oil and reactor building water curtain systems to ensure proper drainage of the piping after testing. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M27 and finds it acceptable because d the procedure changes can ensure that the piping will be dry and will thus minimize potential loss of material.

Enhancement 14. SLRA Section B.2.1.17 includes an enhancement to the "detection of aging effects" program element related to revising testing procedures associated with the transformer deluge systems to ensure proper drainage of the piping after 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 the procedure changes can ensure that the piping will be dry and will thus minimize potential loss of material.

Enhancement 15. As amended by letter dated May 2, 2019, SLRA Section B.2.1.17 includes an enhancement to the “preventive actions,” “parameters monitored or inspected,” and “detection of aging effects” program elements related to incorporating a minimum flow time into the fire hydrant flushing procedures. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M27 and finds it acceptable because the duration of hydrant flushing will be consistent with the AMP XI.M27.

Enhancement 16. As amended by letter dated May 2, 2019, SLRA Section B.2.1.17 includes an enhancement to the “parameters monitored or inspected,” “detection of aging effects,” “acceptance criteria,” and “corrective actions” program elements related to the interval between underground fire water main flow tests. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M27 and finds it acceptable as follows. Consistent with other conditions adverse to quality, the corrective action program will be used to “determine an increased test frequency when established test criteria is not met or when significant degraded trends that could adversely affect system intended function are identified.” In addition, the test frequency for underground fire water main flow tests will only be extended to 5 years when test results pass the established test criteria in accordance with NFPA 25.

Enhancement 17. As amended by letter dated May 2, 2019, SLRA Section B.2.1.17 includes an enhancement to the “corrective actions” program element related to performance of additional wall thickness measurements of fire water system piping when the baseline inspections do not meet acceptance criteria. In its response to RAI 3.3.2.2.7-1 (ADAMS Accession No. ML19122A289), Exelon stated that it would conduct five additional ultrasonic test inspections on fire water system piping for each pipe wall inspection that does not meet acceptance criteria. The staff noted that in its response, Exelon stated that a minimum of seven locations would be examined with frequency spanning 3 to 7 years depending on subsequent test results, degradation found, engineering evaluation, and pipe replacements. The staff reviewed this enhancement, as revised by the RAI response, against the criteria in SRP-SLR Section 3.3.2.2.7 and finds it acceptable because periodically conducting seven inspections and evaluating and trending the results can provide insights into the internal conditions of the fire water system piping. In addition, conducting five additional inspections when acceptance criteria are not met is consistent with corrective action recommendations in GALL-SLR Report AMP XI.M38, which can be used to manage internal aging effects.

Enhancement 18. As amended by letter dated May 2, 2019, SLRA Section B.2.1.17 includes an enhancement to the “monitoring and trending” program element related to applying mil tolerance input when determining corrosion rates. In its response to RAI 3.3.2.2.7-1 (ADAMS Accession No. ML19122A289), Exelon stated that it will use a mil tolerance of 12-1/2 percent for added conservatism when determining corrosion rates at new inspection locations if corrosion rates from other locations with nearly identical operating conditions, material, size, and configuration cannot be used. The staff reviewed this enhancement, as revised by the RAI response, and finds it acceptable because using corrosion rates from other locations with nearly identical operating conditions, material, size, and configuration or applying a 12-1/2 percent factor can result in reasonable actual or upper bound corrosion rates.

The staff conducted an audit to verify Exelon’s claim of consistency with the GALL-SLR Report. Based on its review of the SLRA, amendments, and Exelon’s responses to RAIs B.2.1.17-1, B.2.1.17-2, B.2.1.17-3, and 3.3.2.2.7-1, 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 Exelon claimed consistency with the GALL-SLR Report are consistent with the corresponding program elements of GALL-SLR Report AMP XI.M27, with the exception of staff-identified differences between Exelon's program and GALL-SLR Report XI.M27. The staff reviewed the exception and staff-identified difference and their justifications and concludes that they are acceptable. The staff reviewed the enhancements and finds that their implementation prior to the subsequent period of extended operation will make the AMP adequate to manage the applicable aging effects.

Operating Experience. SLRA Section B.2.1.17 summarizes operating experience related to the Fire Water System program. The staff evaluated operating experience information by reviewing the SLRA and conducting an audit (ADAMS Accession No. ML19142A369). During the audit, the staff independently searched plant-specific operating experience information to determine whether any previously unknown or recurring aging effects were identified. The staff identified operating experience for which it determined the need for additional information, which resulted in the issuance of an RAI. RAI B.2.1.17-4 and Exelon's response are documented in ADAMS Accession No. ML19122A289.

The staff's review of Exelon's changes to the Fire Water System program as a result of the decreasing trend of fire water pump flow testing results is documented in Enhancement No. 16.

The staff's evaluation of loss of material due to recurring internal corrosion in the fire water system is documented in SER Section 3.3.2.2.7. Based on its audit and review of the SLRA, and review of Exelon's response to RAI B.2.1.17-4, the staff finds that the conditions and operating experience at the plant are bounded by those for which the Fire Water System program was evaluated.

UFSAR Supplement. SLRA Section A.2.1.17, as amended by Supplement No. 2 (ADAMS Accession No. ML19023A015) provides the UFSAR supplement for the Fire Water System 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 Exelon committed to ongoing implementation of the existing Fire Water System 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 audit and review of Exelon's Fire Water System program, the staff concludes that those program elements for which Exelon claimed consistency with the GALL-SLR Report are consistent, with the exception of staff-identified difference (Exception No. 2) between Exelon's program and GALL-SLR Report AMP XI.M27. The staff reviewed the exception and staff-identified difference (Exception No. 2) and finds that they are acceptable. The staff reviewed the enhancements and concludes 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 Exelon 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 Outdoor and Large Atmospheric Metallic Storage Tanks

SLRA Section B.2.1.18 states that the Outdoor and Large Atmospheric Metallic Storage Tanks is an existing program with enhancements that will be consistent, with the program elements in the GALL-SLR Report AMP XI.M29, "Outdoor and Large Atmospheric Metallic Storage Tanks."

Staff Evaluation. During its in-office audit (ADAMS Accession No. ML19205A206), the staff reviewed Exelon'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 Exelon's program to the corresponding program elements of GALL-SLR Report AMP XI.M29.

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 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 B.2.1.18 includes an enhancement to the "parameters monitored or inspected" and "detection of aging effects" program elements to perform an inspection of the sealant at the perimeter of the condensate storage tanks and refueling water storage tank bases for signs of degradation every 2 years. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M29 and finds the enhancement acceptable because it will implement inspections that monitor sealant degradation and can provide additional assurance that potential loss of material and cracking is being adequately managed by the program.

Enhancement 2. SLRA Section B.2.1.18 includes an enhancement to the "monitoring and trending" program element to perform a pre-inspection review of the previous two inspections of internal tank coatings. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M42 (to manage aging effects of the internal coatings) and finds it acceptable because it will inform the inspections with previous operating experience and can ensure that degradation is adequately tracked and trended.

Enhancement 3. SLRA Section B.2.1.18 includes an enhancement to the "detection of aging effects" and "acceptance criteria" program elements to conduct training and qualification of individuals involved in internal coating or lining inspections. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M42 and finds it acceptable because it can ensure that individuals performing coatings/linings inspections on the subject tanks will be qualified in accordance with an ASTM standard endorsed by Regulatory Guide (RG) 1.54 (ADAMS Accession No. ML17031A288) and the individuals will therefore be able to appropriately identify coating/lining degradation.

Enhancement 4. SLRA Section B.2.1.18 includes an enhancement to the "detection of aging effects" and "monitoring and trending" program elements to perform volumetric inspections of the PBAPS Units 2 and 3 condensate storage tanks and refueling water storage tank bottoms at least once every 10 years during the subsequent period of extended operation and at least once during the 10-year period prior to the subsequent period of extended operation. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M29 and finds it acceptable because it can provide reasonable assurance that degradation of tank bottoms is identified and repaired, such that tank integrity is maintained and the subject tanks are able to perform their intended functions throughout the subsequent period of extended operation.

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 for which Exelon claimed consistency with the GALL-SLR Report are consistent with the corresponding program elements of GALL-SLR Report AMP XI.M29. In addition, the staff reviewed the enhancements associated with the "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," and "acceptance criteria" program elements and finds that they will make the AMP adequate to manage the applicable aging effects.

Operating Experience. SLRA Section B.2.1.18 summarizes operating experience related to the Outdoor and Large Atmospheric Metallic Storage Tanks. The staff evaluated operating experience information by reviewing the SLRA and conducting an audit (ADAMS Accession No. ML19142A369). During the audit, the staff independently searched plant-specific operating experience information to determine whether any previously unknown or recurring aging effects were identified. The staff did not identify any operating experience indicating that Exelon should modify its proposed program. Based on its review of the SLRA, the staff finds that the conditions and operating experience at the plant are bounded by those for which the Outdoor and Large Atmospheric Metallic Storage Tanks program was evaluated.

UFSAR Supplement. SLRA Section A.2.1.18 provides the UFSAR supplement for the Outdoor and Large Atmospheric Metallic Storage Tanks. 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 Exelon committed to ongoing implementation of the existing Outdoor and Large Atmospheric Metallic Storage Tanks program with enhancements 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 audit and review of Exelon's Outdoor and Large Atmospheric Metallic Storage Tanks program, the staff concludes that those program elements for which Exelon claimed consistency with the GALL-SLR Report are consistent. Also, the staff reviewed the enhancements and concludes 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 Exelon 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 Fuel Oil Chemistry

SLRA Section B.2.1.19 states that the Fuel Oil Chemistry 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."

<u>Staff Evaluation</u>. During its in-office audit (ADAMS Accession No. ML19205A206), the staff reviewed Exelon'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 Exelon's program to the corresponding program elements of GALL-SLR Report AMP XI.M30. For the "detection of aging effects," the staff determined the need for additional information, which resulted in the issuance of an RAI. RAI B.2.1.19-1 and Exelon's response are documented in ADAMS Accession Nos. ML18193A689, and ML19122A289.

In its response, Exelon stated that diesel generator fuel oil storage tanks 0A(B,C,D)T038 do not have low point drains. Each tank uses a transfer pump with suction piping that is vertically configured inside the tank that takes suction from 4 inches off the bottom of the tank. Prior to sampling, the transfer pump is run for 5 minutes to clear the volume of fuel oil from the transfer pump suction piping and ensure that the fuel oil sample is from the contents of the tank. Exelon also stated that the diesel generator transfer pump suction piping y-strainers include screens with 0.062-inch perforations that are installed to protect the pump from large foreign materials because the pump is required for diesel generator operability. The fuel oil analysis procedure utilizes a filter pore size of 3 microns. The staff finds Exelon's response acceptable because taking the sample from the diesel tanks after 5 minutes of running to clear out the fuel oil that is in the piping section of the transfer pump is consistent with the GALL-SLR Report AMP XI.M30. GALL-SLR Report AMP XI.M30 states that a sampling methodology that includes a representative sample from the lowest point in the tank may be used. Additionally, the staff recognizes that the y-strainers include screens with 0.062-inch perforations. The perforations are large enough to filter out harmful debris to protect the diesel generators without impacting the samples for analysis which uses a filter of 3 microns. The staff also notes that the plants' TSs require that the diesel generator fuel oil storage tanks be checked for standing water every 31 days. If water is found in the sample, then the condition would be entered into the corrective action program and analysis performed on the sample to determine the presence of microbes.

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 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 nine enhancements follows.

<u>*Enhancement 1*</u>. SLRA Section B.2.1.19 includes an enhancement to the "preventive actions," "parameters monitored or inspected," and "detection of aging effects" program elements to address periodic internal inspection of the diesel fire pump fuel oil storage tank and the diesel fire pump day tank. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M30 and finds it acceptable because it will be consistent with the recommendations of the GALL-SLR Report.

<u>*Enhancement 2*</u>. SLRA Section B.2.1.19 includes an enhancement to the "preventive actions" program element to address periodic removal of water collected at the bottom of the diesel fire pump fuel oil storage tank and the diesel fire pump day tank. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M30 and finds it acceptable because it will be consistent with the recommendations of the GALL-SLR Report.

<u>*Enhancement 3*</u>. SLRA Section B.2.1.19 includes an enhancement to the "parameters monitored or inspected" program element to address testing of new fuel oil for particulate

concentration and the levels of microbiological organisms for the diesel generator fuel oil day tanks, diesel generator fuel oil storage tanks, and diesel fire pump fuel oil storage tank. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M30 and finds it acceptable because it will be consistent with the recommendations of the GALL-SLR Report.

Enhancement 4. SLRA Section B.2.1.19 includes an enhancement to the “parameters monitored or inspected” and “detection of aging effects” program elements to address periodic sampling and analysis for water and sediment content, particulate concentration, and the levels of microbiological organisms for the diesel generator fuel oil day tanks. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M30 and finds it acceptable because it will be consistent with the recommendations of the GALL-SLR Report.

Enhancement 5. SLRA Section B.2.1.19 includes an enhancement to the “parameters monitored or inspected” and “detection of aging effects” program elements to address periodic sampling and analysis for water and sediment and the levels of microbiological organisms for the diesel generator fuel oil storage tanks. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M30 and finds it acceptable because it will be consistent with the recommendations of the GALL-SLR Report.

Enhancement 6. SLRA Section B.2.1.19 includes an enhancement to the “parameters monitored or inspected” and “detection of aging effects” program elements to address periodic sampling and analysis for particulate concentration and the levels of microbiological organisms for the diesel fire pump fuel oil storage tank and the diesel fire pump day tank. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M30 and finds it acceptable because it will be consistent with the recommendations of the GALL-SLR Report.

Enhancement 7. SLRA Section B.2.1.19 includes an enhancement to the “monitoring and trending” program element to address periodic trending of water and sediment content, particulate concentration, and the levels of microbiological organisms for all fuel oil tanks within the scope of the program. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M30 and finds it acceptable because it will be consistent with the recommendations of the GALL-SLR Report.

Enhancement 8. SLRA Section B.2.1.19 includes an enhancement to the “preventive actions” and “corrective actions” program elements to address the need for biocide or corrosion inhibitor addition if periodic testing indicates biological activity or evidence of corrosion. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M30 and finds it acceptable because it will be consistent with the recommendations of the GALL-SLR Report.

Enhancement 9. SLRA Section B.2.1.19 includes an enhancement to the “monitoring and trending” and “acceptance criteria” program elements to address any degradation identified during tank internal inspections against acceptance criteria to confirm that the timing of subsequent inspections will maintain the components’ intended function throughout the subsequent period of extended operation based on the projected rate of degradation. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M30 and finds it acceptable because it will be consistent with the recommendations of the GALL-SLR Report.

Based on its audit and review of the SLRA, and review of Exelon's responses to RAI B.2.1.19-1, 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 Exelon 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 they will make the AMP adequate to manage the applicable aging effects.

Operating Experience. SLRA Section B.2.1.19 summarizes operating experience related to the Fuel Oil Chemistry program. The staff evaluated operating experience information by reviewing the SLRA and conducting an audit (ADAMS Accession No. ML19142A369). During the audit, the staff independently searched plant-specific operating experience information to determine whether any previously unknown or recurring aging effects were identified.

The staff did not identify any operating experience indicating that Exelon should modify its proposed program beyond that incorporated. Based on its audit and review of the SLRA, and review of Exelon's response to RAI B.2.1.19-1, the staff finds that the conditions and operating experience at the plant are bounded by those for which the Fuel Oil Chemistry program was evaluated.

UFSAR Supplement. SLRA Section A.2.1.19 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 Exelon committed to ongoing implementation of the existing Fuel Oil Chemistry program with enhancements 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 audit and review of Exelon's Fuel Oil Chemistry program, the staff concludes that those program elements for which Exelon claimed consistency with the GALL-SLR Report are consistent. Also, the staff reviewed the enhancements and concludes 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 Exelon 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).

3.0.3.2.14 Reactor Vessel Material Surveillance

SLRA Section B.2.1.20 states that the Reactor Vessel Material Surveillance program is an existing program that, with an enhancement, will be consistent with the program elements in the GALL-SLR Report AMP XI.M31, "Reactor Vessel Material Surveillance."

Staff Evaluation. During its in-office audit (ADAMS Accession No. ML19205A206), the staff reviewed Exelon'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 Exelon’s program to the corresponding program elements of GALL-SLR Report AMP XI.M31.

The staff also reviewed the portions of the “scope of program,” “parameters monitored or inspected,” “detection of aging effects,” and “monitoring and trending” program elements associated with the AMP’s 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 programmatic enhancement follows.

Enhancement. SLRA Section B.2.1.20 includes the following enhancement to the “scope of program,” “parameters monitored or inspected,” “detection of aging effects,” and “monitoring and trending” program elements that call for the applicant to: (a) withdraw a reactor vessel surveillance capsule from each unit, (b) test these capsules, (c) submit a summary report for each capsule to the NRC, and (d) submit any changes to the Reactor Vessel Material Surveillance program to the NRC for review and approval. All of these activities were proposed by the applicant to be in accordance with the requirements in 10 CFR Part 50, Appendix H, and the guidance in GALL-SLR Report AMP XI.M31. Specifically, the applicant’s enhancement proposes to remove the 120º reconstituted capsule in PBAPS Unit 2, and the 120º capsule in PBAPS Unit 3 at 60-62 effective full power years (i.e., 60-62 EFPY).

The staff reviewed the limiting neutron fluence values (for 70 EPFY) that were provided for PBAPS Units 2 and 3 RPVs in SRLA Section 4.2.1, the removal times stated for the 120º capsules in the programmatic enhancement, and the lead factors (LFs) stated for the capsules to estimate what the neutron fluence exposures would be for the designated 120º capsules at the proposed times of capsule removal. The applicable criterion for the staff’s comparison is the program element criterion in GALL-SLR Report AMP XI.M31 that states a surveillance capsule has been removed or will be removed during the subsequent period of extended operation at a capsule fluence exposure between 1-2 times the limiting projected RPV fluence of interest at the end of the subsequent period of extended operation. For the assessment of the RPVs, this is the 1/4T location of the RPVs because that is the neutron fluence region of interest for the applicant’s evaluation of its RPV upper-shelf energy and pressure-temperature limit TLAAs. To meet this criterion for PBAPS Unit 2, the staff noted that the 120º reconstituted capsule in the unit would need to be removed a time when the capsule achieves a neutron fluence in the range of 1.54-3.08×10^{18} n/cm^2 (E > 1.0 MeV). Similarly, to meet this criterion for PBAPS Unit 3, the staff noted that the 120º capsule in the unit would need to be removed a time when the capsule achieves a neutron fluence in the range of 1.48-2.96×10^{18} n/cm^2 (E > 1.0 MeV).

Based on independent calculations performed by the staff, the staff noted that the 120º reconstituted capsule in BPAPS Unit 2 and the 120º capsule in PBAPS Unit 3 will be removed at times when the capsules achieve neutron fluence exposures in the range of approximately 1.7–1.9×10^{18} n/cm^2 (E > 1.0 MeV). The staff also noted that this demonstrates the capsules will achieve a fluence equivalent to 1-2 times the limiting neutron fluence of interest at the end of the subsequent period of extended operation because the capsule exposures (at the proposed times of capsule removal) will be within the allowable fluence ranges specified for the capsule withdrawals in the previous paragraph. Therefore, the staff confirmed that when the program and programmatic enhancement are implemented, the program will be both in compliance with the requirements in 10 CFR Part 50, Appendix H, and in conformance with the programmatic criteria defined for these types of AMPs in GALL-SLR Report AMP XI.M31.

The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M31 and finds it acceptable because the applicant's Reactor Vessel Materials Surveillance program will meet the requirements of 10 CFR Part 50, Appendix H, and will be consistent with the program element criteria defined for these types of AMPs in GALL-SLR Report AMP XI.M31, "Reactor Vessel Surveillance Monitoring."

Operating Experience. SLRA Section B.2.1.20 summarizes operating experience related to the Reactor Vessel Material Surveillance program. The staff evaluated operating experience information by reviewing the SLRA and conducting an audit (ADAMS Accession No. ML19142A369). During the staff's audit of the AMP the staff independently searched plant-specific operating experience information to determine whether any previously unknown or recurring aging effects were identified. The staff did not identify any additional aging effects beyond those already identified for applicable RPV components in the SLRA. This includes the applicant's identification that loss of fracture toughness due to neutron irradiation embrittlement is an applicable AERM for ferritic shell, nozzle, and weld components that are located in the beltline or extended beltline region of the RPV.

The staff also did not identify any evidence that the applicant was not implementing the Integrated Surveillance Program (ISP) in accordance with the methodology in EPRI Report No. BWRVIP-86, Revision 1-A. This includes the applicant's activities to incorporate applicable RPV surveillance data into the applicable RPV neutron embrittlement TLAA calculations, particularly for data derived from Charpy-impact tests of test specimens made from heats of materials matching those for the specific base metal or weld materials in the RPVs.

Based on its audit and review of the SLRA, the staff finds that the conditions and operating experience at the plant are bounded by those for which the Reactor Vessel Material Surveillance program was evaluated.

UFSAR Supplement. SLRA Section A.2.1.20 provides the UFSAR supplement for the Reactor Vessel Material Surveillance 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 the UFSAR supplement indicates that the current program for the AMP is based on implementation of the EPRI BWRVIP ISP for BWR reactor units, as modified by the plant-specific enhancement of the program defined in SLRA Section A.2.1.20.

The staff also noted that Exelon committed to remove a RPV surveillance capsule from each unit at approximately 60-62 EFPY for each unit, as reflected in the enhancement for the AMP, the UFSAR Supplement Section A.2.1.20, and Commitment No. 20 of the SLRA UFSAR Supplement Table A.5, "Second License Renewal Commitment List." The staff determined that the applicant's commitment and programmatic enhancement of the AMP are acceptable because the applicants proposed Reactor Vessel Surveillance program meets the regulatory requirements of Appendix H. The staff's basis for accepting the proposed enhancement of the AMP and UFSAR Supplement Table A.5, Commitment No. 20, is provided in the Enhancement subsection of this SER section.

Based on the staff's audit and review of information in UFSAR Supplement Section A.2.1.20 and UFSAR Commitment No. 20, the staff finds that the information in the UFSAR supplement provides an adequate summary description of the program.

Conclusion. On the basis of its review of Exelon's Reactor Vessel Materials Surveillance program, the staff concludes that those program elements for which Exelon claimed consistency with the GALL-SLR Report are consistent with those specified in GALL-SLR Report AMP XI.M31, "Reactor Vessel Materials Surveillance." Also, the staff reviewed the enhancement and commitment associated with the AMP and concluded that the additional withdrawal of capsules at 60–62 EPFY for each unit will make the AMP adequate to manage loss of fracture toughness due to neutron irradiation embrittlement in the RPV components during the subsequent period of extended operation. The staff concludes that Exelon 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 Buried and Underground Piping and Tanks

SLRA Section B.2.1.28 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."

Staff Evaluation. During its in-office audit (ADAMS Accession No. ML19205A206), the staff reviewed Exelon'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 Exelon's program to the corresponding program elements of GALL-SLR Report AMP XI.M41.

For the "preventive actions" and "detection of aging effects" program element, the staff determined the need for additional information, which resulted in the issuance of RAI B.2.1.28-1 (ADAMS Accession No. ML19108A427). The staff's evaluation of RAI B.2.1.28-1 is documented in Enhancement No.7 below.

For the "acceptance criteria" program element, the staff noted that Exelon's Buried and Underground Piping and Tanks program did not include the recommendation that for steel piping, when active microbiologically-influenced corrosion (MIC) has been identified or is probable, a polarized potential of -950 mV or more negative is recommended. During the audit, the staff noted that anaerobic sulfate reducing bacteria (SRB) were identified in 13 of 20 soil samples, which is an indicator of the potential for MIC. Although soil samples identified SRB in a majority of soil samples, the staff finds Exelon's proposal to not include the -950 mV recommendation for steel piping acceptable for the following reasons:

(a) in its response to RAI B.2.1.28-2 (ADAMS Accession No. ML19122A289), Exelon confirmed that operating experience has not identified instances of MIC on the external surfaces of buried steel piping or tanks;

(b) all 20 samples showed oxygen reducing potentials greater than 100 mV, indicating that the soil is sufficiently aerated so that it will not support sulfate reducers,

(c) soil samples did not show detectable levels of sulfide (i.e., an indicator of active SRB); and

(d) increasing the polarization from -850 mV to -950 mV increases the chances of exceeding the limiting critical potential to prevent coating damage (i.e., -1200 mV); therefore, increasing the cathodic protection polarization by 100 mV should only be used when MIC is identified or probable -- not in instance, like that here, when the potential for MIC is low).

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 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 seven enhancements follows.

Enhancement 1. SLRA Section B.2.1.28 includes an enhancement to the “parameters monitored or inspected” and “acceptance criteria” program elements related to manage cracking for buried stainless steel piping, utilizing a method that has been demonstrated to be capable of detecting cracking, whenever coatings are removed, exposing the base material. The staff reviewed this enhancement and finds it acceptable because Exelon’s approach to manage cracking for stainless steel piping is consistent with the “parameters monitored or inspected” and “acceptance criteria” program elements of GALL-SLR Report AMP XI.M41.

Enhancement 2. SLRA Section B.2.1.28 includes an enhancement to the “detection of aging effects” program element related to performing direct visual inspections of buried piping within the scope of license renewal in accordance with GALL-SLR Report AMP XI.M41, Table XI.M41-2, “Inspection of Buried and Underground Piping and Tanks,” during each 10-year period, beginning 10 years prior to the subsequent period of extended operation. The staff reviewed this enhancement and finds it acceptable because Exelon will perform direct visual inspections of buried piping within the scope of license renewal consistent with the “detection of aging effects” program element of GALL-SLR Report AMP XI.M41.

Enhancement 3. SLRA Section B.2.1.28 includes an enhancement to the “monitoring and trending,” “acceptance criteria,” and “corrective actions” program elements related to performing extent of condition inspections. The staff reviewed this enhancement and finds it is acceptable because Exelon will perform extent of condition consistent with the corresponding program elements in GALL-SLR Report AMP XI.M41.

Enhancement 4. SLRA Section B.2.1.28 includes an enhancement to the “preventive actions” and “monitoring and trending” program elements related to upgrading the existing cathodic protection system no later than 5 years prior to the subsequent period of extended operation in accordance with NACE SP0169-2007, “Control of External Corrosion on Underground or Submerged Metallic Piping Systems,” to ensure effective control of external corrosion of underground piping and tanks. The staff reviewed this enhancement and finds it acceptable because installing or refurbishing the cathodic protection system 5 years prior to the subsequent period of extended operation in accordance with NACE SP0169-2007 is consistent with GALL-SLR Report AMP XI.M41.

Enhancement 5. SLRA Section B.2.1.28 includes an enhancement to the “detection of aging effects” program element related to performing examinations of buried emergency diesel generator fuel oil tanks from the internal surface of the tank using volumetric techniques during each 10-year period, beginning 10 years prior to the subsequent period of extended operation.

The staff reviewed this enhancement and finds it acceptable because Exelon's approach to perform volumetric examinations of tanks from the internal surface is consistent with GALL-SLR Report AMP XI.M41.

Enhancement 6. SLRA Section B.2.1.28 includes an enhancement to the "preventive actions" program element related to performing annual system monitoring of the cathodic protection system to ensure effective protection of buried piping. The staff reviewed this enhancement and finds it acceptable because performing annual system monitoring of the cathodic protection system is consistent with GALL-SLR Report AMP XI.M41.

Enhancement 7. SLRA Section B.2.1.28 includes an enhancement to the "preventive actions" program element related to applying coating to buried portions of the 10-inch diameter stainless steel line from the torus dewatering tank to the condensate transfer pump suction line in accordance with approved station specifications, during the 10-year period prior to the subsequent period of extended operation. For this enhancement, the staff determined the need for additional information, which resulted in the issuance of an RAI. RAI B.2.1.28-1 and Exelon's May 2, 2019 responses are documented in ADAMS Accession Nos. ML19108A427, ML19122A289, and ML19163A222. The staff noted that the applicant's response to RAI B.2.1.28-1 was superseded by letter dated June 12, 2019 (ADAMS Accession No. ML19163A222).

In its response, Exelon stated the following: (a) the uncoated buried stainless steel segment totals approximately 44 inches in length; (b) there is approximately 270 ft of in-scope buried stainless steel piping at PBAPS; (c) all other in-scope buried stainless steel piping is coated in accordance with station specifications for external surface treatment of buried metallic pipe with either a coal tar based Somastic coating, coal tar enamel with felt wrap coating, or coal tar based tape coatings; and (d) two inspections of buried stainless steel will be conducted in the 10-year period prior to the subsequent period of extended operation. The staff finds Exelon's response acceptable for the following reasons: (a) two inspections of stainless steel will be conducted in the 10-year period prior to the subsequent period of extended operation, consistent with the GALL-SLR Report recommendations; (b) all other in-scope stainless steel piping is specified to be coated in accordance with the "preventive actions" program element of GALL-SLR Report AMP XI.M41; and (c) although Exelon did not address stress corrosion cracking (i.e., chlorides) in its response, the staff finds this acceptable because the uncoated stainless steel piping will be coated in the 50- to 60-year interval during which precoating inspections would detect indications of cracking.

The staff conducted an audit to verify Exelon's claim of consistency with the GALL-SLR Report. Based on its review of the SLRA, and review of Exelon's responses to RAI B.2.1.28-1 and RAI B.2.1.28-2, 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 Exelon claimed consistency with the GALL-SLR Report are consistent with the corresponding program elements of GALL-SLR Report AMP XI.M41. 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 they will make the AMP adequate to manage the applicable aging effects.

Operating Experience. SLRA Section B.2.1.28 summarizes operating experience related to the Buried and Underground Piping and Tanks program. The staff evaluated operating experience information by reviewing the SLRA and conducting an audit (ADAMS Accession

No. ML19142A369). During the audit, the staff independently searched plant-specific operating experience information to determine whether any previously unknown or recurring aging effects were identified.

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

<u>UFSAR Supplement</u>. SLRA Section A.2.1.28 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 Exelon committed (Commitment No. 10) to ongoing implementation of the existing Buried and Underground Piping and Tanks program with enhancements 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.

<u>Conclusion</u>. On the basis of its review of Exelon's Buried and Underground Piping and Tanks program, the staff concludes that those program elements for which Exelon 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 Exelon 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 Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks

SLRA Section B.2.1.29 states that the Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks program is a 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," except for the exceptions identified in the SLRA. Exelon amended this SLRA section by letter dated June 12, 2019.

<u>Staff Evaluation</u>. During its in-office audit (ADAMS Accession No. ML19205A206), the staff reviewed Exelon'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 Exelon's program to the corresponding program elements of GALL-SLR Report AMP XI.M42.

For the "scope of program" program element, the staff determined the need for additional information regarding why internally coated stainless steel piping and piping components were not included in SLRA Section B.2.1.29. Exelon provided a supplement on June 12, 2019 (ADAMS Accession No. ML19163A221), which revised SLRA Section B.2.1.29 to include internally coated stainless steel piping and piping components to the scope of the program. The staff finds Exelon's supplemental response acceptable because the revised SLRA Section B.2.1.29 identifies all material types within the scope of the program.

For the "scope of program" program element, the staff determined the need for additional information, which resulted in the issuance of an RAI. RAI B.2.1.29-1 and Exelon's response are documented in ADAMS Accession Nos. ML19108A427 and ML19122A289.

In its response, Exelon stated that no changes to SLRA Table 3.3.2-17, "High Pressure Service Water System," are required based on inspection of the unit 3 "D" residual heat removal (RHR) heat exchanger, which confirmed that coating was present on the waterbox as shown on the heat exchanger design drawing. The staff finds the applicant's response acceptable because the applicant confirmed that the carbon steel RHR heat exchanger tube side components depicted in SLRA Table 3.3.2-17 are internally coated.

During its review of the "detection of aging effects" program element, the staff noted that coatings inspectors are trained and qualified in accordance with ANSI N45.2.6, "Qualification of Inspections, Examinations, and Testing Personnel for Nuclear Power Plants." The staff noted that qualifications meeting the recommendations in RG 1.54, "Service Level I, II, and III Protective Coatings Applied to Nuclear Power Plants," are consistent with the staff's recommended actions to manage loss of coating integrity. The staff finds the training and qualification requirements acceptable because the use of ANSI N45.2.6 certification is an acceptable basis for qualifying coatings inspectors based on RG 1.54, June 1973, Section C.1, which endorses conformance to the ANSI N45.2 quality assurance standards.

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 B.2.1.29 includes an exception to the "detection of aging effects" program element related to not performing periodic inspections of concrete-lined ductile iron and gray cast iron fire system main loop buried piping. 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) based on the frequency, number, and multiple locations of flow tests that are conducted, flow blockage would be detected just as effectively as internal visual inspections periodically conducted on a portion of the piping in accordance with Table 4a, "Inspection Intervals for Internal Coatings/Linings for Tanks, Piping, Piping Components, and Heat Exchangers," of AMP XI.M42; and (b) the continuous monitoring and low-pressure alarm associated with the fire water system are effective means to detect potential through-wall flaws in the piping.

Exception 2. SLRA Section B.2.1.29 includes an exception to the "corrective actions" program element related to not repairing or replacing the high-pressure coolant injection (HPCI) system lube oil reservoir internal coating. 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 Safety Evaluation Report Related to the License Renewal of Fermi 2 (ADAMS Accession No. ML16190A241), the staff's review of EPRI TR-1007459, "Terry Turbine Maintenance Guide, HPCI Application," confirmed that it does not recommend recoating the HPCI turbine oil reservoir when degraded coatings are detected; and (b) Exelon stated in the subject exception that degraded coatings will be removed, providing reasonable assurance that flow blockage will not occur due to further degradation of degraded coatings.

The staff conducted an audit to verify Exelon's claim of consistency with the GALL-SLR Report. Based on its audit and review of the SLRA, and review of Exelon's response to RAI B.2.1.29-1, the staff finds that, with the above exceptions, 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 Exelon claimed consistency with the GALL-SLR Report are consistent with the corresponding program elements of GALL-SLR Report AMP XI.M42. 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.

Operating Experience. SLRA Section B.2.1.29 summarizes operating experience related to the Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks program. The staff evaluated operating experience information by reviewing the SLRA and conducting an audit (ADAMS Accession No. ML19142A369). During the audit, the staff independently searched plant-specific operating experience information to determine whether any previously unknown or recurring aging effects were identified.

The staff did not identify any operating experience indicating that Exelon should modify its proposed program beyond that incorporated. Based on its audit and review of the SLRA, the staff finds that the conditions and operating experience 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 A.2.1.29 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 against the recommended description for this type of program as described in GALL-SLR Report Table XI-01 and AMP XI.M42. The staff noted that GALL-SLR Report AMP XI.M42 states that an applicant may elect to manage the aging effects for internal coatings/linings in an alternative AMP if the UFSAR supplement for the Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks program provides a reference to the alternative AMP. However, during its review, the staff noted that the Outdoor and Large Atmospheric Metallic Storage Tanks program, which is used to manage internally coated condensate storage and refueling water storage tanks, is not referenced in SLRA Section A.2.1.29. Exelon provided a supplement on January 23, 2019 (ADAMS Accession No. ML19023A015), to address the staff's concern.

In the supplement, Exelon revised SLRA Section A.2.1.29 to state that aging management for the internally coated condensate storage and refueling water storage tanks is addressed in the Outdoor and Large Atmospheric Metallic Storage Tanks program and includes the applicable requirements for coating inspection from the Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks program. The staff finds Exelon's supplemental response acceptable because consistent with GALL-SLR Report AMP XI.M42, the UFSAR supplement for the Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks program provides a reference to the alternative AMP used to manage aging effects for internal coatings/linings. Therefore, the staff finds that the UFSAR supplement for the Internal Coatings/Linings for In-Scope Piping, Piping

Components, Heat Exchangers, and Tanks program is consistent with the corresponding program description in GALL-SLR Report Table XI-01 and AMP XI.M42.

The staff also noted that Exelon committed (Commitment No. 29) to implement the new Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks program 10 years prior to the subsequent period of extended operation for managing the effects of aging for applicable components. In addition, the staff noted that baseline inspections that may be required in the 10-year period prior to the subsequent period of extended operation will be completed 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, as amended by letter dated January 23, 2019, is an adequate summary description of the program.

Conclusion. On the basis of its audit and review of Exelon's Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks program, the staff concludes that those program elements for which Exelon claimed consistency with the GALL-SLR Report are consistent. The staff also reviewed the exception and its justification and concludes that it is acceptable. The staff concludes that Exelon 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 ASME Section XI, Subsection IWE

SLRA Section B.2.1.30 states that the ASME Section XI, Subsection IWE program is an existing program with enhancements and exception that will be consistent, with the program elements in the GALL-SLR Report AMP XI.S1, "ASME Section XI, Subsection IWE," except for the exceptions identified in the SLRA. Exelon amended this SLRA section by SLRA Supplement No. 2 dated January 23, 2019 (ADAMS Accession No. ML19023A015).

Staff Evaluation. During its in-office audit (ADAMS Accession No. ML19205A206), the staff reviewed Exelon'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 Exelon's program to the corresponding program elements of GALL-SLR Report AMP XI.S1.

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

Exception 1. SLRA Section B.2.1.30, as amended by SLRA Supplement No. 2, dated January 23, 2019, includes an exception to "parameters monitored or inspected" and "detection of aging effects" program elements related to not monitoring for cracking utilizing supplemental surface examination for drywell components, except high temperature mechanical penetrations, subject to cyclic loading with no CLB fatigue analysis. This exception applies to the following

PBAPS Units 2 and 3 primary containment structures and components (listed in SLRA Section 4.6) that were determined to have no existing CLB fatigue analysis or TLAAs: drywell shell, drywell head, drywell personnel airlock, drywell equipment hatches, drywell CRD removal hatch, electrical penetrations, and mechanical penetrations (except high temperature penetrations). As justification for the exception, SLRA Section B.2.1.30 states that the primary containment was designed per ASME Section III, 1965 edition with 1966 addenda, and that no fatigue analysis or exemption/waiver was required per this code year or original construction specifications as required by later code year editions. The SLRA further states that Exelon has performed an assessment that has shown that had the drywell been designed to ASME Section III, 1974 edition, it would have met the six criteria stipulated in Subsection NE-3222.4(d), “Vessels Not Requiring Analysis for Cyclic Operation.” The six criteria are associated with fatigue cycles evaluated through the end of the subsequent period of extended operation due to the following: (1) atmospheric-to-operating pressure cycle, (2) normal operation pressure fluctuation, (3) temperature difference – startup and shutdown, (4) temperature difference – normal operation, (5) temperature difference – dissimilar materials, and (6) mechanical loads. SLRA Section 3.5.2.2.1.5, as amended by SLRA Supplement No. 2, dated January 23, 2019, documents the bounding number for cycles for 80 years used in the evaluation and demonstrates how the six criteria stipulated in NE-3222.4(d) of the ASME Code Section III, 1974 edition, were satisfied. Exelon noted that the conclusions of the fatigue waiver assessment based on the 1974 code edition is applicable to the drywell design based on the 1965/66 edition/addenda code-of-record because the design values of material parameters used in the assessment were consistent between the code editions. Based on this code fatigue waiver assessment, Exelon concluded that the design evaluation for the specified drywell components accounts for an acceptable amount of fatigue for the subsequent period of extended operation, and therefore no supplemental surface examinations will be performed to detect cracking due to cyclic loading. As discussed further in the Enhancement No. 2 discussion, the high temperature mechanical penetrations, subject to cyclic loading with no CLB fatigue analysis, are not addressed by this exception and the accessible portions of the penetrations will be inspected for cracking.

The staff reviewed this exception against the corresponding program elements in GALL-SLR Report AMP XI.S1 and finds it acceptable because Exelon has by design analysis demonstrated that six fatigue waiver criteria stipulated in paragraph NE-3222.4(d), “Vessel Not Requiring Analysis for Cyclic Operation,” of the ASME Code Section III, Division 1, 1974 edition, are satisfied for the specified drywell components and are capable of withstanding the fatigue cycles expected through the end of the subsequent period of extended operation without any further fatigue evaluation for cyclic operation. Therefore, no supplemental surface examinations, recommended in GALL-SLR Report AMP XI.S1 for components without CLB fatigue analysis, are needed to manage the aging effect of cracking due to cyclic loading for these components.

Exception 2. SLRA Section B.2.1.30, as amended by SLRA Supplement No. 2, dated January 23, 2019, includes an exception to the “scope of program,” “parameters monitored or inspected,” “detection of aging effects,” and “acceptance criteria” program elements related to program scope expansion, inspection method and interval for managing the aging effect of flow blockage due to fouling for pump suction strainers (of the core spray system, high-pressure coolant injection (HPCI) system, reactor core isolation cooling (RCIC) system, and residual heat removal (RHR) system) located in the suppression pool (containment torus). Exelon noted that no GALL-SLR Report aging management review (AMR) items exist for managing this aging effect for these strainer components in the torus, and, as such, there is no AMP specified in the GALL-SLR Report to perform the aging management activities. Exelon noted that the ASME Section XI, Subsection IWE AMP was selected because the PBAPS’s containment inservice inspection requirements, described in the existing Augmented Inspection Program plan and procedures, will perform the aging management actions described below. Exelon further noted that the inspections are beyond the requirements of ASME Section XI, Subsection IWE. The plan requires visual inspection of 100 percent of the strainer assemblies each interval for general structural conditions, and one strainer module (screen) in the RHR System and one strainer module (screen) in the core spray system shall be inspected for debris and evidence of clogging during every other refueling outage. Further, the HPCI and RCIC strainers are inspected for debris and evidence of clogging every other refueling outage. The staff reviewed this exception and finds it acceptable because the existing containment augmented inspection plan and procedures include a program scope expansion that includes appropriate inspection, inspection method, and inspection interval to manage flow blockage due to fouling for the pump suction strainer components in the torus. The program can adequately manage the flow blockage aging effect for these components by performing visual inspections of the strainer elements to detect debris and evidence of clogging at a reasonable interval of every other refueling outage. The use of an exception is acceptable for program scope expansion, beyond that in the GALL-SLR Report AMP, based on the guidance in NEI 17-01 (ADAMS Accession No. ML17339A599), which the NRC staff endorsed on an interim basis by letter dated January 31, 2018 (ADAMS Accession No. ML18029A368), intended for use by the applicants that had notified the NRC of their intent to submit SLRAs before December 2019. For those applicants, including Exelon with the PBAPS SLRA, NEI 17-01 would be applicable for the entire period of extended operation. A future revision to RG 1.188 is expected to be submitted, the endorsement of which would end the interim basis for approving NEI 17-01.

Enhancement 1. SLRA Section B.2.1.30 includes an enhancement to the “parameters monitored or inspected” and “detection of aging effects” program elements related to monitoring of high temperature penetrations for cracking due to cyclic loading. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.S1 and finds it acceptable because interval to detect cracking of accessible portions of high temperature drywell mechanical penetrations, which is consistent with the recommendations of the GALL-SLR Report AMP XI.S1 to detect cracking in steel components subject to cyclic loading but that have no CLB fatigue or fatigue waiver analyses.

Enhancement 2. SLRA Section B.2.1.30, as amended by SLRA Supplement No. 2, dated January 23, 2019, includes an enhancement to the “preventive actions” program element related to maintaining bolting integrity. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.S1 and finds it acceptable because it will provide guidance for “preventive actions” for proper selection and storage of bolting and coating material and lubricants, and appropriate installation torque consistent with industry standards to provide reasonable assurance that bolting integrity is maintained, which is consistent with the recommendations of GALL-SLR Report AMP XI.S1.

Enhancement 3. SLRA Section B.2.1.30, as amended by SLRA Supplement No. 2, dated January 23, 2019, includes an enhancement to the “detection of aging effects” program element to conduct a one-time supplemental volumetric examination of the containment shell if triggered by plant-specific operating experience with containment shell corrosion initiating on the inaccessible side. 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, the program will include actions, sampling criteria, and statistical-based acceptance criteria consistent with GALL-SLR Report AMP XI.S1 recommendations to conduct a one-time supplemental volumetric examination of the containment metallic shell surfaces inaccessible from one side, if triggered by plant-specific operating experience of measurable corrosion initiated on the inaccessible side since the issuance of the first renewed license through the end of the subsequent period of extended operation. Based on the operating experience audit and the information in the SLRA, the staff notes that to date PBAPS has not identified operating experience of primary containment corrosion initiated from the inaccessible side; therefore, the triggering operating experience has not occurred to date.

The staff conducted an audit to verify Exelon's claim of consistency with the GALL-SLR Report. Based on its review of the SLRA, as amended by letter dated January 23, 2019, the staff finds that, with the above exceptions, program elements 1 through 7 for which Exelon claimed consistency with the GALL-SLR Report are consistent with the corresponding program elements of GALL-SLR Report AMP XI.S1. The staff also reviewed the exceptions and their justifications and concludes that they are acceptable. The staff reviewed the enhancements and finds that their implementation prior to the subsequent period of extended operation will make the AMP adequate to manage the applicable aging effects.

Operating Experience. SLRA Section B.2.1.30 summarizes operating experience related to Exelon's ASME Section XI, Subsection IWE AMP. The staff evaluated operating experience information by reviewing the SLRA and conducting an audit (ADAMS Accession No. ML19142A369). During the audit, the staff independently searched plant-specific operating experience information to determine whether any previously unknown or recurring aging effects were identified. The staff did not identify any operating experience indicating that Exelon should modify its proposed program beyond that incorporated during the development of the SLRA. Based on its audit and review of the SLRA, as amended by letter dated January 23, 2019, the staff finds that the conditions and operating experience at the plant are bounded by those for which the ASME Section XI, Subsection IWE program was evaluated in the GALL-SLR Report.

UFSAR Supplement. SLRA Section A.2.1.30, as amended by letter dated January 23, 2019, provides the UFSAR supplement for the ASME Section XI, Subsection IWE Aging Management program. The staff reviewed this UFSAR supplement description of the program and noted that with the enhancements it is consistent with the recommended description in GALL-SLR Report Table XI-01.

The staff also noted that Exelon committed to ongoing implementation of the existing ASME Section XI, Subsection IWE program with enhancements 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 by letter dated January 23, 2019, is an adequate summary description of the program.

Conclusion. On the basis of its audit and review of Exelon's ASME Section XI, Subsection IWE program, as amended by letter dated January 23, 2019, the staff concludes that those program elements for which Exelon claimed consistency with the GALL-SLR Report are consistent. The staff also reviewed the exception and its justification and concludes that it is acceptable. The staff reviewed the enhancements and finds 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 Exelon 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).

3.0.3.2.18 ASME Section XI, Subsection IWF

SLRA Section B.2.1.31 states that the ASME Section XI, Subsection IWF 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.” Exelon amended this SLRA section by letters dated February 11, 2019 (Supplement 3), and March 18, 2019 (Supplement 4).

Staff Evaluation. During its in-office audit (ADAMS Accession No. ML19205A206), the staff reviewed Exelon’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 Exelon’s program to the corresponding program elements of GALL-SLR Report AMP XI.S3.

The staff also reviewed the portions of the “scope of program,” “preventive actions,” “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 follows.

Enhancement 1. SLRA Section B.2.1.31 includes an enhancement to the “scope of program” program element. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.S3 and finds it acceptable because the program will require an evaluation to consider the acceptability of inaccessible areas of supports when conditions exist in accessible areas that could indicate the presence of, or result in degradation to, inaccessible areas of supports. This is consistent with the GALL-SLR Report recommendations in the “scope of program” program element in AMP XI.S3 for aging management for inaccessible areas.

Enhancement 2. SLRA Section B.2.1.31 includes an enhancement to the “detection of aging effects” program element. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.S3 and finds it acceptable because the program will include a one-time inspection of an additional 5 percent of supports within 5 years prior to entering the subsequent period of extended operation. This is consistent with the GALL-SLR Report recommendations in the “detection of aging effects” program element in AMP XI.S3 and will provide reasonable assurance that the aging of the inspected sample is representative of supports that are not in the inspection sample.

Enhancement 3. SLRA Section B.2.1.31 includes an enhancement to the “detection of aging effects” program element. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.S3 and finds it acceptable the program will including performing VT-3 examinations of all ASTM A490 bolting materials used for the reactor vessel support skirts and for the core spray pump supports once per 10-year interval during the subsequent period of extended operation; and volumetric examination comparable to that of ASME Section XI, Table IWB-2500-1, Examination Category B-G-1, of 12 ASTM A490 bolts at each of the reactor vessel support skirts, once per 10-year interval during the subsequent period of extended operation. This is consistent with the recommendations for “detection of aging” in GALL-SLR Report AMP XI.S3. In addition, the program will direct the expansion of scope for volumetric examinations if indications of unacceptable age-related degradation are identified, comparable to the methodology used in ASME Section IWF-2430.

In a letter dated February 11, 2019, Enhancement No. 3 above was supplemented to add information for program element 7, "corrective actions." The applicant stated that if the volumetric examination of these ASTM A490 bolts reveals conditions that do not meet the acceptance criteria, the program will enter the results into the corrective action program and extend the ASTM A490 bolt examination scope to include other ASTM A490 bolts used in similar joint configurations and subject to similar environment exposure conditions, which is comparable to the methodology used by the ASME Code Section IWF-2430 for IWF component supports. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.S3 and finds it acceptable because results that do not meet the acceptance criteria will be addressed in the applicant's corrective action program, consistent with the GALL-SLR Report AMP XI.S3.

Enhancement 4. SLRA Section B.2.1.31 includes an enhancement to the "preventive actions" program element, submitted in supplemental information by letter dated January 23, 2019. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.S3 and finds it acceptable because it will include requirements to adhere to recommendations for storage, lubricant selection, and bolting and coating material selection from the Research Council on Structural Connections (RCSC) publication, "Specification for Structural Joints Using High-Strength Bolts." This is consistent with the GALL-SLR Report recommendations for preventive actions to preclude age-related degradation of bolting.

Enhancement 5. SLRA Section B.2.1.31 includes an enhancement to the "detection of aging effects" program element, submitted in supplemental information by letter dated February 11, 2019 (ADAMS Accession No. ML19042A131). The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.S3 and finds it acceptable because the enhancement will require that if additional high-strength bolting is installed in IWF supports, volumetric examination will be performed for a sample of the bolting. This is consistent with the GALL-SLR Report recommendations in AMP XI.S3 for detection of cracking for high-strength bolting greater than 1 inch in diameter.

Enhancement 6. SLRA Section B.2.1.31 includes an enhancement to the "monitoring and trending" program element, submitted in supplemental information by letter dated February 11, 2019. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.S3 and finds it acceptable because the enhancement will ensure that if a support is repaired to as-new condition, the inspection sample is increased or modified to include another support that is representative of the remaining population of supports that were not repaired. This is consistent with the GALL-SLR Report recommendations for inspecting a representative sample population of supports.

The staff conducted an audit to verify Exelon's claim of consistency with the GALL-SLR Report. Based on its review of the SLRA and the amendment, dated February 11, 2019, 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 Exelon claimed consistency with the GALL-SLR Report are consistent with the corresponding program elements of GALL-SLR Report AMP XI.S3. In addition, the staff reviewed the enhancements associated with the "scope of program," "preventive actions," "detection of aging effects," "monitoring and trending," and "corrective actions" program elements and finds that the AMP will be adequate to manage the applicable aging effects.

By letter dated March 18, 2019, Exelon submitted a supplement to the SLRA that addressed the potential for a loss (or reduction) of fracture toughness due to irradiation embrittlement of reactor vessel (RV) support steel. Staff reviewed the analysis provided by the applicant which dispositioned the need for aging management of steel structures in the vicinity of the reactor. The staff's discussion of the applicant's submittal and evaluation of the aging effect is in SER Section 3.5.2.2.2.6.

Operating Experience. SLRA Section B.2.1.31 summarizes operating experience related to the ASME Section XI, Subsection IWF. The staff evaluated operating experience information by reviewing the SLRA and conducting an audit (ADAMS Accession No. ML19142A369). During the audit, the staff independently searched plant-specific operating experience information to determine whether any previously unknown or recurring aging effects were identified.

The staff did not identify any operating experience indicating that Exelon should modify its proposed program beyond that incorporated during the development of the SLRA. Based on its audit and review of the SLRA, the staff finds that the conditions and operating experience at the plant are bounded by those for which ASME Section XI, Subsection IWF was evaluated.

UFSAR Supplement. SLRA Section A.2.1.31 provides the UFSAR supplement for the ASME Section XI, Subsection IWF 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 Exelon committed (Commitment No. 31) to ongoing implementation of the existing ASME Section XI, Subsection IWF program for managing the effects of aging for applicable components during the subsequent period of extended operation. The staff also noted that Exelon committed (Commitment No. 31) to the enhancements stated in the SLRA and will implement them in accordance with the schedule listed in the enhancement.

The staff finds that the information in the UFSAR supplement, as amended by letter dated February 11, 2019, is an adequate summary description of the program.

Conclusion. On the basis of its review of Exelon's ASME Section XI, Subsection IWF program, the staff concludes that those program elements for which Exelon 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 Exelon 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 Masonry Walls

SLRA Section B.2.1.33 states that the Masonry Walls AMP is an existing program, with enhancements, that will be consistent with the program elements in the GALL-SLR Report AMP XI.S5, "Masonry Walls."

Staff Evaluation. During its in-office audit (ADAMS Accession No. ML19205A206), the staff reviewed Exelon'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 Exelon’s program to the corresponding program elements of GALL-SLR Report AMP XI.S5.

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

Enhancement 1. SLRA Section B.2.1.33 includes an enhancement to the “scope of program” program element. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.S5 and finds it acceptable because it will expand the scope of the program to address masonry walls in the additional structures determined to be in scope of subsequent license renewal.

The staff conducted an audit to verify Exelon’s claim of consistency with the GALL-SLR Report. 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 Exelon claimed consistency with the GALL-SLR Report are consistent with the corresponding program elements of GALL-SLR Report AMP XI.S5. In addition, the staff reviewed the enhancement associated with the “scope of program” program element and finds that, it will make the AMP adequate to manage the applicable aging effects.

Operating Experience. SLRA Section B.2.1.33 summarizes operating experience related to the Masonry Walls program. The staff evaluated operating experience information by reviewing the SLRA and conducting an audit (ADAMS Accession No. ML19142A369). During the audit, the staff independently searched plant-specific operating experience information to determine whether any previously unknown or recurring aging effects were identified. The staff did not identify any operating experience indicating that Exelon should modify its proposed program. Based on its audit and review of the SLRA, the staff finds that the conditions and operating experience at the plant are bounded by those for which the Masonry Walls program was evaluated.

UFSAR Supplement. SLRA Section A.2.1.33 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 also noted that Exelon committed to ongoing implementation of the existing Masonry Walls program with enhancement 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 audit and review of Exelon’s Masonry Walls AMP, the staff concludes that those program elements for which Exelon claimed consistency with the GALL-SLR Report are consistent. Also, the staff 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 Exelon 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 Structures Monitoring

SLRA Section B.2.1.34 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.” Exelon amended this SLRA section by letters dated January 23, 2019 (ADAMS Accession No. ML19023A015), and May 23, 2019 (ADAMS Accession No. ML19143A053).

Staff Evaluation. During its in-office audit (ADAMS Accession No. ML19205A206), the staff reviewed Exelon’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 “operating experience” program elements of Exelon’s program to the corresponding program elements of GALL-SLR Report AMP XI.S6.

For the “scope of program,” “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 B.2.1.34-1 and Exelon’s response are documented in ADAMS Accession No. ML19143A053.

In its response, Exelon revised SLRA Sections A.2.1.34, A.2.1.35, B.2.1.34, and B.2.1.35, and SLRA Appendix A, Commitment Nos. 34 and 35, to clarify that Enhancement No. 6 will either develop a new implementing procedure or revise an existing implementing procedure to address the aging management of inaccessible areas exposed to a potentially aggressive groundwater/soil environment. Exelon stated that the implementing actions will include, in part: (a) the monitoring of raw water/groundwater chemistry, on a frequency not to exceed 5 years, at locations that are representative of the groundwater in contact with structures that are within the scope of the subsequent license renewal; (b) when aggressive groundwater/soil is identified, performing focus inspections of accessible structural elements considered to be leading indicators, or of excavated concrete areas exposed to the aggressive groundwater/soil environment when there are no accessible areas that can be considered a leading indicator; and (c) using Tier 2 acceptance criteria from the American Concrete Institute (ACI) 349.3R to enter identified degraded conditions into the corrective action program. Exelon also stated that an initial groundwater testing and evaluation will be performed to develop a baseline engineering evaluation prior to the subsequent period of extended operation.

During its evaluation of Exelon’s response to RAI B.2.1.34-1, the staff noted that Exelon will implement plant-specific actions that are consistent with the GALL-SLR Report recommendations for managing concrete aging during the subsequent period of extended operation when exposed to an aggressive groundwater/soil environment. The staff finds Exelon’s response and changes to SLRA Sections A.2.1.34, A.2.1.35, B.2.1.34, and B.2.1.35, and SLRA Appendix A, Commitment Nos. 34 and 35, acceptable for the following reasons: (a) a review of plant-specific operating experience revealed that only specific locations at the site have indications of an aggressive/soil environment, and (b) the proposed actions are consistent with the GALL-SLR Report AMP XI.S6 recommendations to ensure that the aging effects are being detected for inaccessible concrete structural elements exposed to aggressive groundwater/soil environment.

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 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 13 enhancements follows.

Enhancement 1. SLRA Section B.2.1.34 includes an enhancement to the “scope of program” program element. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.S6 and finds it acceptable because when it will be consistent with the GALL-SLR Report recommendation to include all other structural components and commodities that are not covered by other structural AMPs as within the scope of the Structures Monitoring program.

Enhancement 2. SLRA Section B.2.1.34 includes an enhancement to the “scope of program” program element. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.S6 and finds it acceptable because it will be consistent with the GALL-SLR Report recommendation to include all other structures (i.e., administration building, boiler house, and dewatering building) that are not covered by other structural AMPs as within the scope of the Structures Monitoring program.

Enhancement 3. SLRA Section B.2.1.34 includes an enhancement to the “monitoring and trending” program element. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.S6 and finds it acceptable the AMP will be consistent with the GALL-SLR Report recommendation to ensure that a quantitative baseline inspection is established prior to the subsequent period of extended operation.

Enhancement 4. SLRA Section B.2.1.34 includes an enhancement to the “acceptance criteria” program element. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.S6 and finds it acceptable because it will be consistent with the GALL-SLR Report recommendation to ensure that quantitative acceptance criteria from Chapter 5 of the American Concrete Institute (ACI) 349.3R is used for concrete surface evaluations.

Enhancement 5. SLRA Section B.2.1.34 includes an enhancement to the “parameters monitored or inspected” program element. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.S6 and finds it acceptable because it will be consistent with the GALL-SLR Report recommendation to ensure that the program monitors the reduction in concrete anchor capacity due to local concrete degradation in concrete structures.

Enhancement 6. SLRA Section B.2.1.34, as amended by letter dated May 23, 2019, includes an enhancement to the “scope of program,” “parameters monitored or inspected,” and “detection of aging effects” program elements. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.S6 and finds it acceptable because it will be consistent with the GALL-SLR Report recommendation for sites with an aggressive groundwater/soil environment that the program ensure that plant-specific actions are implemented to manage concrete aging in inaccessible areas exposed to an aggressive groundwater/soil environment for the subsequent period of extended operation.

Enhancement 7. SLRA Section B.2.1.34 includes an enhancement to the “parameters monitored or inspected” and “detection of aging effects” program elements. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.S6 and finds it acceptable because it will be consistent with the GALL-SLR Report recommendation that the program ensure that identified through-wall leakage is monitored, trended, and evaluated for considering additional examination requirements or more frequent inspections.

Enhancement 8. SLRA Section B.2.1.34 includes an enhancement to the “parameters monitored or inspected” and “acceptance criteria” program elements. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.S6 and finds it acceptable because it will ensure that accessible sliding surfaces are monitored for loss of material due to wear or corrosion, and accumulation of debris or dirt using the acceptable criteria recommended by the GALL-SLR Report.

Enhancement 9. SLRA Section B.2.1.34 includes an enhancement to the “detection of aging effects” program element. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.S6 and finds it acceptable it will be consistent with the GALL-SLR Report recommendation that ensure that inaccessible areas are evaluated for acceptability when conditions exist in accessible areas that could indicate the presence of, or result in, degradation to such inaccessible areas.

Enhancement 10. SLRA Section B.2.1.34 includes an enhancement to the “parameters monitored or inspected,” “detection of aging effects,” and “acceptance criteria” program elements. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.S6 and finds it acceptable because it will be consistent with the GALL-SLR Report recommendation that the program ensure that (a) elastomeric vibration isolators and bearing pads are inspected for cracking, loss of material, and hardening using the acceptable criteria recommended by the GALL-SLR Report, and (b) visual inspection of elastomeric elements are supplemented with tactile inspection to detect hardening.

Enhancement 11. SLRA Section B.2.1.34 includes an enhancement to the “acceptance criteria” program element. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.S6 and finds it acceptable it will be consistent with the GALL-SLR Report recommendation that the program ensure that identified loose bolts and nuts during inspections are not acceptable unless accepted by an engineering evaluation.

Enhancement 12. SLRA Section B.2.1.34 includes an enhancement to the “parameters monitored or inspected” and “acceptance criteria” program elements. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.S6 and finds it acceptable because it will ensure that the program manages the aging effects for permanent shielding blankets so that their intended function(s) will be maintained during the subsequent period of extended operations.

Enhancement 13. SLRA Section B.2.1.34, as amended by letter dated January 23, 2019, includes an enhancement to the “preventive actions” program element. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.S6 and finds it acceptable because it will be consistent with the GALL-SLR Report recommendation to ensure that preventive actions, in accordance with applicable industry guidelines, are in place for the proper storage and selection of bolting material and lubricants, and that appropriate installation torque or tension is used to maintain adequate bolting integrity.

The staff conducted an audit to verify Exelon's claim of consistency with the GALL-SLR Report. Based on its review of the SLRA, amendments, and Exelon's response to RAI B.2.1.34-1, 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 Exelon claimed consistency with the GALL-SLR Report are consistent with the corresponding program elements of GALL-SLR Report AMP XI.S6. 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 they will make the AMP adequate to manage the applicable aging effects.

Operating Experience. SLRA Section B.2.1.34 summarizes operating experience related to the Structures Monitoring program. The staff evaluated operating experience information by reviewing the SLRA and conducting an audit (ADAMS Accession No. ML19142A369). During the audit, the staff independently searched plant-specific operating experience information to determine whether any previously unknown or recurring aging effects were identified. The staff did not identify any operating experience indicating that Exelon should modify its proposed program beyond that incorporated during the staff review of the SLRA. Based on its audit and review of the SLRA, the staff finds that the conditions and operating experience at the plant are bounded by those for which the Structures Monitoring program was evaluated.

UFSAR Supplement. SLRA Section A.2.1.34 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 Exelon committed (Commitment No. 34) 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 Exelon committed to implement the program enhancements by no later than 6 months prior to the subsequent period of extended operation, and to complete the baseline inspections by 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, as amended by letters dated January 23, 2019, and May 23, 2019, is an adequate summary description of the program.

Conclusion. On the basis of its audit and review of Exelon's Structures Monitoring program, the staff concludes that those program elements for which Exelon claimed consistency with the GALL-SLR Report are consistent. In addition, the staff reviewed the enhancements and concludes 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 Exelon 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 Inspection of Water Control Structures Associated with Nuclear Power Plants

SLRA Section B.2.1.35 states that the Inspection of Water Control Structures Associated with Nuclear Power Plants 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 supplemented this section of the SLRA by letter dated January 23, 2019.

Staff Evaluation. During its in-office audit (ADAMS Accession No. ML19205A206), the staff reviewed Exelon'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 Exelon's program to the corresponding program elements of GALL-SLR Report AMP XI.S7.

The staff also reviewed the portions of the "scope of program," "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 B.2.1.35 includes an enhancement to the "scope of program" program element. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.S7 and finds it acceptable because it will expand the scope of the program to address the sluice gates at the circulating water pump structure in the additional structures determined to be in scope of subsequent license renewal.

Enhancement 2. SLRA Section B.2.1.35 includes an enhancement to the "parameters monitored or inspected" program element. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.S7 and finds it acceptable because it will clarify parameters to be monitored and inspected at the emergency cooling tower and reservoir to include visual inspection for loss of material and reduction of heat transfer due to fouling for the cooling tower fill, and visual inspection of the drift eliminators. These inspections are consistent with the guidance in GALL-SLR Report AMP XI.S7.

Enhancement 3. SLRA Section B.2.1.35 includes an enhancement to the "parameters monitored or inspected" program element. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.S7 and finds it acceptable because it will monitor for reduction in concrete anchor capacity if local concrete degradation, such as cracking and loss of material, is identified. These inspections are consistent with the guidance in GALL-SLR Report AMP XI.S7.

Enhancement 4. SLRA Section B.2.1.35 includes an enhancement to the "parameters monitored or inspected" program element. The staff reviewed this enhancement against the corresponding program element "Concrete Technology and Codes" from the Portland Cement Association in GALL-SLR Report AMP XI.S7 and finds it acceptable because it will 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, and this is consistent with the guidance in GALL-SLR Report AMP XI.S7.

Enhancement 5. SLRA Section B.2.1.35 includes an enhancement to the "detection of aging effects" program element. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.S7 and finds it acceptable it will include provisions for special inspections following significant natural phenomena, such as large floods, hurricanes, tornadoes, or intense local rainfall as part of the guidelines for severe weather and natural disasters, and this is consistent with the guidance in GALL-SLR Report AMP XI.S7.

Enhancement 6. SLRA Section B.2.1.35 includes an enhancement to the “detection of aging effects” program element. In the response to the Structures Monitoring program RAI B.2.1.34-1 (ADAMS Accession No. ML19143A053), Exelon states that it will 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. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.S7 and finds it acceptable because it will monitor raw water and groundwater chemistry for pH, chlorides, and sulfates, on a frequency not to exceed 5 years and that accounts for seasonal variations. The evaluation of raw water and groundwater chemistry is consistent with the guidance in GALL-SLR Report AMP XI.S7.

Enhancement 7. SLRA Section B.2.1.35 includes an enhancement to the “detection of aging effects” program element. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.S7 and finds it acceptable it will monitor and trend through-wall groundwater leakage, infiltration volumes, and leakage water chemistry for signs of concrete or steel reinforcement degradation. The enhancement will develop additional engineering evaluations that 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, it will consider water chemistry analysis, including pH, along with mineral, chloride, sulfate, and iron content in the water. This is consistent with the guidance in GALL-SLR Report AMP XI.S7.

Enhancement 8. SLRA Section B.2.1.35 includes an enhancement to the “detection of aging effects” program element. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.S7 and finds it acceptable because it will evaluate the acceptability of inaccessible areas when conditions exist in accessible areas that could indicate the presence of, or result in, degradation to such inaccessible areas. This is consistent with the guidance in GALL-SLR Report AMP XI.S7.

Enhancement 9. SLRA Section B.2.1.35 includes an enhancement to the “detection of aging effects” program element. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.S7 and finds it acceptable because it will document the concrete conditions of submerged concrete structures. This is consistent with the guidance in GALL-SLR Report AMP XI.S7.

Enhancement 10. SLRA Section B.2.1.35 includes an enhancement to the “detection of aging effects” program element. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.S7 and finds it acceptable because it will specify a 6-year frequency for the inspection of the submerged portions of the traveling screen bays to match the inspection frequency of the submerged portions of the circulating water pump structure bays. This is consistent with the guidance in GALL-SLR Report AMP XI.S7.

Enhancement 11. SLRA Section B.2.1.35 includes an enhancement to the “monitoring and trending” program element. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.S7 and finds it acceptable because it will perform inspections under the enhanced program in order to establish quantitative baseline inspection data prior to the subsequent period of extended operation This is consistent with the guidance in GALL-SLR Report AMP XI.S7.

Enhancement 12. SLRA Section B.2.1.35 includes an enhancement to the “acceptance criteria” program element. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.S7 and finds it acceptable because it will provide evaluation criteria for structural concrete using quantitative second tier criteria of Chapter 5 in ACI 349.3R. This is consistent with the guidance in GALL-SLR Report AMP XI.S7.

Enhancement 13. SLRA Section B.2.1.35 includes an enhancement to the "acceptance criteria" program element. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.S7 and finds it acceptable it will clarify that loose bolts and nuts, and cracked bolts, are not acceptable unless accepted by engineering evaluations. This is consistent with the guidance in GALL-SLR Report AMP XI.S7.

Enhancement 14. SLRA Section B.2.1.35, as amended by letter dated January 23, 2019, includes an enhancement to the "preventive actions" program element. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.S7 and finds it acceptable because it will be consistent with the GALL-SLR Report recommendation to include preventive actions, in accordance with applicable industry guidelines, for the proper storage and selection of bolting material and lubricants, and the use of appropriate installation torque or tension to maintain adequate bolting integrity.

The staff conducted an audit to verify Exelon's claim of consistency with the GALL-SLR Report. 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 Exelon 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 "scope of program," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," and "acceptance criteria" program elements and finds that they will make the AMP adequate to manage the applicable aging effects.

Operating Experience. SLRA Section B.2.1.35 summarizes operating experience related to the Inspection of Water Control Structures Associated with Nuclear Power Plants. The staff evaluated operating experience information by reviewing the SLRA and conducting an audit (ADAMS Accession No. ML19142A369). During the audit the staff independently searched plant-specific operating experience information to determine whether any previously unknown or recurring aging effects were identified. The staff did not identify any operating experience indicating that Exelon should modify its proposed program. Based on its audit and review of the SLRA, the staff finds that the conditions and operating experience at the plant are bounded by those for which the Inspection of Water Control Structures Associated with Nuclear Power Plants program was evaluated.

UFSAR Supplement. SLRA Section A.2.1.35 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 Exelon committed to ongoing implementation of the existing Water Control Structures Associated with Nuclear Power Plants program with enhancements 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 audit and review of Exelon's Inspection of Water Control Structures Associated with Nuclear Power Plants AMP, the staff concludes that those program elements for which Exelon claimed consistency with the GALL-SLR Report are consistent. Also, the staff reviewed the enhancements and concluded that implementation prior to the subsequent period of extended operation will make the AMP adequate to manage the applicable aging effects. The staff concludes that Exelon 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 Protective Coating Monitoring and Maintenance

SLRA Section B.2.1.36 describes the existing Protective Coating Monitoring and Maintenance program as an existing program with enhancements that will be consistent with GALL-SLR Report AMP XI.S8, “Protective Coating Monitoring and Maintenance.” Exelon amended this SLRA section by letter dated May 2, 2019.

<u>Staff Evaluation</u>. During its in-office audit (ADAMS Accession No. ML19205A206), the staff reviewed Exelon’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 Exelon’s program to the corresponding program elements of GALL-SLR Report AMP XI.S8.

For the “detection of aging effects” and “monitoring and trending” program elements, as well as the UFSAR supplement, the staff determined the need for additional information, which resulted in the issuance of RAIs. RAIs B.2.1.36-1, B.2.1.36-2, B.2.1.36-3, and B.2.1.36-4, and Exelon’s responses are documented in ADAMS Accession Nos. ML19066A320 and ML19122A289.

In its response to RAI B.2.1.36-1, Exelon stated that Service Level I coatings inspectors will be certified to ANSI N45.2.6, Level II or Level III inspectors, and revised SLRA Appendix A, Section A.2.1.36, and Appendix B, Section B.2.1.36. SLRA Appendix A, Section A.5, Commitment No. 36 was also revised.

During its evaluation of Exelon’s response to RAI B.2.1.36-1, the staff noted that ASTM D7108 recommends coating inspectors to be certified to ANSI N45.2.6 Level III. The staff finds Exelon’s response and changes to SLRA Appendix A, Section A.2.1.36, Section A.5, Commitment No. 36, and SLRA Appendix B, Section B.2.1.36, acceptable because the proposed certification level for the coatings inspectors is consistent with the guidance in ASTM D7108, the recommended standard for establishing qualifications for a nuclear coatings specialist. ASTM D7108 is referenced in ASTM 5163-08, which is referenced by the GALL-SLR Report, Section XI.S8.

In its response to RAI B.2.1.36-2, Exelon stated that the coating inspection frequency of every other refueling outage (nominally 4 years) is based upon the coating condition found during inspections. In addition, Exelon also stated that the torus immersion areas have recently been recoated for each unit and the coatings were documented to be in good condition during recent inspections.

In its response to RAI B.2.1.36-3, Exelon stated that the design-basis accident (DBA) loss-of-coolant accident (LOCA) has been found to generate the greatest amount of debris that would impact the emergency core cooling system performance, the safety relief valves (SRVs) are not utilized in this accident scenario, and, as a result, the coating on the discharge piping of the SRVs remains qualified during the DBA LOCA. Exelon also stated that should there be an SRV lift, the qualification of the coating associated with that SRV would be considered unqualified and added to the unqualified coatings log.

During its evaluation of Exelon's response to RAI B.2.1.36-3, the staff noted that Exelon evaluated the remaining allowance for unqualified coatings during an SRV lift event. The allowance for unqualified coating in the PBAPS Unit 2 primary containment is 715 lbs, whereas the SRV lift would increase the total amount of unqualified coatings from 510 to 522 lbs. The staff finds Exelon's response acceptable because acceptable margin exists for allowable unqualified coatings during both the DBA LOCA and an SRV lift event.

In its response to RAI B.2.1.36-4, Exelon revised SLRA Appendix A, Section A.2.1.36, and Appendix B, Section B.2.1.36, to reference RG 1.54.

During its evaluation of Exelon's response to RAI B.2.1.36-4, the staff noted that the GALL-SLR Report recommends the UFSAR supplement for AMP XI.S8, "Protective Coating Monitoring and Maintenance," program reference RG 1.54. The staff finds Exelon's response and changes to the proposed UFSAR supplement in SLRA Appendix A, Section A.2.1.36, and SLRA Appendix B, Section B.2.1.36, acceptable because these sections now reference RG 1.54, which is consistent with GALL-SLR Report AMP XI.S8 and Table XI-01.

The staff also reviewed the portions of the "detection of aging effects," program element associated with an 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 is as follows.

Enhancement 1. SLRA Section B.2.1.36 includes an enhancement to the "detection of aging effects," program element. This enhancement is discussed in RAI B.2.1.36-1 above. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.S8 and finds it acceptable because it will be consistent with the GALL-SLR, Section XI.S8, as described in the evaluation of RAI B.2.1.36-1 above.

Based on its audit and review of the SLRA, and review of Exelon's responses to RAIs B.2.1.36-1, B.2.1.36-2, B.2.1.36-3, and B.2.1.36-4, 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.S8.

Operating Experience. SLRA Section B.2.1.36 summarizes operating experience related to the Protective Coating Monitoring and Maintenance program. The staff evaluated operating experience information by reviewing the SLRA and conducting an audit (ADAMS Accession No. ML19142A3639). During the audit, the staff independently searched plant-specific operating experience information to determine whether any previously unknown or recurring aging effects were identified. The staff did not identify any operating experience indicating that Exelon should modify its proposed program beyond that incorporated. Based on its audit and review of the SLRA, the staff finds that the conditions and operating experience at the plant are bounded by those for which the Protective Coating Monitoring and Maintenance program was evaluated.

UFSAR Supplement. SLRA Section A.2.1.36 provides the UFSAR supplement for the Protective Coating Monitoring and Maintenance 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 not consistent with the staff guidance.

The staff determined the need for additional information regarding the UFSAR supplement, which resulted in the issuance of RAI B.2.1.36-4 described above. As a result of RAI B.2.1.36-4, the applicant amended Appendix A, Section A.2.1.36-4, to reference RG 1.54, which is consistent with GALL-SLR Report, Table XI-01.

Therefore, the UFSAR supplement for the Protective Coating Monitoring and Maintenance program is consistent with the corresponding program description in GALL-SLR Report Table XI-01.

The staff also noted that Exelon 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 (Commitment No. 36). The staff also noted that Exelon committed to enhance the program to use certified coating inspections to inspect Service Level I coatings. This enhancement will be implemented 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 letter dated May 2, 2019, is an adequate summary description of the program.

Conclusion. On the basis of its audit and review of Exelon's Protective Coating Monitoring and Maintenance program, the staff concludes that those program elements for which Exelon claimed consistency with the GALL-SLR Report are consistent. The staff reviewed the enhancement and finds 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 Exelon 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).

3.0.3.2.23 Electrical Insulation for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements

SLRA Section B.2.1.37 states that the Electrical Insulation for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements is an existing program with enhancements that will be consistent with the program elements in the GALL-SLR Report AMP XI.E1, "Electrical Insulation for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements."

Staff Evaluation. During its in-office audit (ADAMS Accession No. ML19205A206), the staff reviewed Exelon'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 Exelon's program to the corresponding program elements of GALL-SLR Report AMP XI.E1.

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 the two enhancements follows.

Enhancement 1. SLRA Section B.2.1.37 includes an enhancement to the "detection of aging effects" program element. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.E1 and finds it acceptable because it will be consistent with GALL-SLR Report AMP XI.E1.

Enhancement 2. SLRA Section B.2.1.37 includes an enhancement to the "parameters monitored or inspected" and "detection of aging effects" program elements. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.E1 and finds it acceptable because it will be consistent with GALL-SLR Report AMP XI.E1.

The staff conducted an audit to verify Exelon's claim of consistency with the GALL-SLR Report. Based on its 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 Exelon 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 "parameters monitored or inspected" and "detection of aging effects" program elements and finds that, they will make the AMP adequate to manage the applicable aging effects.

Operating Experience. SLRA Section B.2.1.37 summarizes operating experience related to the Electrical Insulation for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements. The staff evaluated operating experience information by reviewing the SLRA and conducting an audit (ADAMS Accession No. ML19142A369). During the audit, the staff independently searched plant-specific operating experience information to determine whether any previously unknown or recurring aging effects were identified.

The staff did not identify any operating experience indicating that Exelon should modify its proposed program. Based on its audit and review of the SLRA, the staff finds that the conditions and operating experience 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 was evaluated.

UFSAR Supplement. SLRA Section A.2.1.37 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 Exelon committed (Commitment No. 37). to ongoing implementation of the existing Electrical Insulation for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program with enhancements 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 audit and review of Exelon'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 Exelon 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 Exelon 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).

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

SLRA Section B.2.1.38 states that the Electrical Insulation for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits is an existing program with enhancements that will be consistent with the program elements in the 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."

Staff Evaluation. During its in-office audit (ADAMS Accession No. ML19205A206), the staff reviewed Exelon'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 Exelon's program to the corresponding program elements of GALL-SLR Report AMP XI.E2.

The staff also reviewed the portions of the "scope of program," "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 two enhancements follows.

Enhancement 1. SLRA Section B.2.1.38 includes an enhancement to the "scope of program," "parameters monitored or inspected," and "acceptance criteria" program elements. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.E2 and finds it acceptable because it will be consistent with GALL-SLR Report AMP XI.E2.

Enhancement 2. SLRA Section B.2.1.38 includes an enhancement to the "detection of aging effects" and "monitoring and trending" program elements. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.E2 and finds it acceptable because it will be consistent with GALL-SLR Report AMP XI.E2.

The staff conducted an audit to verify Exelon's claim of consistency with the GALL-SLR Report. Based on its 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 Exelon claimed consistency with the GALL-SLR Report are consistent with the corresponding program elements of GALL-SLR Report AMP XI.E2. In addition, the staff reviewed the enhancements associated with the "scope of program," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," and "acceptance criteria" program elements and finds that they will make the AMP adequate to manage the applicable aging effects.

Operating Experience. SLRA Section B.2.1.38 summarizes operating experience related to the Electrical Insulation for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits. The staff evaluated operating experience information by reviewing the SLRA and conducting an audit (ADAMS Accession No. ML19142A369). During the audit, the staff independently searched plant-specific operating experience information to determine whether any previously unknown or recurring aging effects were identified.

The staff did not identify any operating experience indicating that Exelon should modify its proposed program. Based on its audit and review of the SLRA, the staff finds that the conditions and operating experience 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 Used in Instrumentation Circuits was evaluated.

UFSAR Supplement. SLRA Section A.2.1.38 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 Exelon committed (Commitment No. 38) to ongoing implementation of the existing Electrical Insulation for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used In Instrumentation Circuits program with enhancements 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 audit and review of Exelon'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 Exelon 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 Exelon 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).

3.0.3.2.25 Electrical Insulation for Inaccessible Medium-Voltage Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements

SLRA Section B.2.1.39 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 with enhancements that will be consistent with GALL-SLR Report AMP XI.E3A, "Electrical Insulation for Inaccessible Medium-Voltage Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements," except for the exceptions identified in the SLRA.

Staff Evaluation. During its in-office audit (ADAMS Accession No. ML19205A206), the staff reviewed Exelon'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 Exelon's program to the corresponding program elements of GALL-SLR Report AMP XI.E3A.

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

Exception 1. SLRA Section B.2.1.39 includes an exception to the "preventive actions" program element related to periodic actions to prevent inaccessible medium-voltage power cables from being exposed to significant moisture. Exelon proposed to inspect manholes with level monitoring and alarms that result in consistent and timely subsequent pump out of accumulated water prior to wetting or submergence of cables, at least once every 5 years, as supported by plant operating experience. GALL-SLR Report AMP XI.E3A recommends inspection of manholes for water accumulation at least once annually.

Exception 2. SLRA Section B.2.1.39 includes an exception to the "preventive actions" program element related to inspection of manholes following event-driven occurrences such as heavy rain, rapid thawing of ice and snow, or flooding. Exelon proposed to inspect manholes with level monitoring and alarms that would result in consistent and subsequent pump out of accumulated water prior to wetting or submergence of cables, following event-driven occurrences when level monitoring indicates water is accumulating. GALL-SLR Report AMP XI.E3A recommends inspection of water accumulation manholes following event-driven occurrences.

The staff issued RAI B.2.1.39-1 (ADAMS Accession No. ML19108A427) to obtain information necessary to determine if the exception will satisfy the criteria of 10 CFR 54.21(a)(3). Specifically, the staff requested Exelon to describe the level monitoring system and provide industry operating experience with these systems. The staff also requested Exelon to describe how the level monitoring systems are monitored for proper functioning and reliability. Exelon provided its response to the staff's RAI, in a letter dated May 2, 2019 (ADAMS Accession No. ML19122A289).

The staff finds Exelon's response acceptable because the SmartCover system is used to continuously monitor for water accumulation in manholes. If water is present and reaches the setpoint for alarm or a problem exists with a transmitter, Exelon will enter the condition into the corrective action program and will perform follow-up actions to inspect the manhole, pump out any accumulated water, and initiate additional corrective actions as needed. The SmartCover systems are widely used in water and wastewater facilities. Exelon has reviewed industry and PBAPS operating experience for the SmartCover manhole level monitoring systems and found no adverse plant-specific or industry operating experience for the SmartCover level monitoring equipment. The level transmitters' float-less design and continuous monitoring system, with alarms, are self-monitoring and do not require periodic preventive maintenance. Exelon did not identify any reliability issue for the SmartCover manhole level monitoring system at PBAPS and will continue to open and inspect manholes every 5 years, coincident with Structures Monitoring program inspections. The staff finds that there is no need to perform annual inspections for manholes that have the installed level monitoring and alarm system and where there has been a timely response to level alarms. Manholes with level monitoring and alarms, and timely pump out, prevent water accumulation from wetting or submerging cables. There is no adverse plant specific or industry operating experience for the level monitoring equipment installed at PBAPS. Therefore, the staff finds that the exception to GALL Report AMP XI.E3A, which would allow inspection of manholes every 5 years, acceptable. Additionally, because of the level transmitters' continuous monitoring and alarms, there is no need for event-driven inspections. Therefore, the staff finds that the exception to GALL Report AMP XI.E3A, allowing inspection for water accumulation after event-driven occurrences when level monitoring indicates water is accumulating, acceptable.

Enhancements. SLRA Section B.2.1.39 includes enhancements to the "scope of program," "preventive actions," "parameters monitored or inspected," and 'detection of aging effects" program elements. The staff reviewed these enhancements against the corresponding program elements in GALL-SLR Report AMP XI.E3A and finds them acceptable because, periodic testing of circuits and periodic condition monitoring of manholes will make these program elements consistent with those in GALL-SLR Report AMP XI.E3A.

The staff conducted an audit to verify Exelon's claim of consistency with the GALL-SLR Report. Based on its review of the SLRA, the staff finds that, with the above exceptions, 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 Exelon claimed consistency with the GALL-SLR Report are consistent with the corresponding program elements of GALL-SLR Report AMP XI.E3A. The staff also reviewed the exceptions associated with the "preventive actions" program element and their justifications and finds that they are acceptable. In addition, the staff reviewed the enhancements associated with the "scope of program," "parameters monitored or inspected," and "detections of aging effects" program elements and finds that they will make the AMP adequate to manage the applicable aging effects.

Operating Experience. SLRA Section B.2.1.39 summarizes operating experience related to the Electrical Insulation for Inaccessible Medium-Voltage Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program. The staff evaluated operating experience information by reviewing the SLRA and conducting an audit (ADAMS Accession No. ML19142A369). During the audit, the staff independently searched plant-specific operating experience information to determine whether any previously unknown or recurring aging effects were identified. The staff did not identify any operating experience indicating that Exelon should modify its proposed program. Based on its audit and review of the SLRA, the staff finds that the conditions and operating experience 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 A.2.1.39 provides the UFSAR supplement for 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 Exelon committed (Commitment No. 39) to implement the Electrical Insulation for Inaccessible Medium-Voltage Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program with enhancements 6 months, 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. On the basis of its review of Exelon'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 Exelon claimed consistency with the GALL-SLR Report are consistent. In addition, the staff reviewed the exceptions and their justifications and concludes that they are acceptable. 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 Exelon 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 Instrument and Control Cables Not Subject to 10 CFR 50.49 Environmental Qualifications Requirements

SLRA Section B.2.1.40 states the Electrical Insulation for Inaccessible Instrument and Control Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program is a new program that will be 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," except for the exceptions identified in the SLRA.

Staff Evaluation. During its audit (ADAMS Accession No. ML19205A206), the staff reviewed Exelon'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.

The staff also reviewed the portion of the "preventive actions" program element 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 exceptions follows.

Exception 1. SLRA Section B.2.1.40 includes an exception to "preventive actions" program element. This exception related to periodic actions to prevent inaccessible instrument and control cables from being exposed to significant moisture. Exelon proposed to inspect manholes with level monitoring and alarms that result in consistent and subsequent pump out of accumulated water prior to wetting or submergence of cables, at least once every five years, as supported by plant operating experience. GALL-SLR Report AMP XI.E3B recommends inspection of manholes for water accumulation at least once annually.

Exception 2. SLRA Section B.2.1.40 includes an exception to "preventive actions" program element. This exception related to inspection of manholes following event driven occurrences such as heavy rain, rapid thawing of ice and snow, or flooding. Exelon proposed to inspect manholes with level monitoring and alarms that result in consistent and subsequent pump out of accumulated water prior to wetting or submergence of cables, following event-driven occurrences when level monitoring indicates water is accumulating. GALL-SLR Report AMP XI.E3B recommends inspection for water accumulation manholes following event-driven occurrences.

The staff issued RAI B.2.1.40-1 (ADAMS Accession No. ML19108A427) to obtain the information necessary to determine if the exception will satisfy the criteria of 10 CFR 54.21(a)(3). Specifically, the staff requested Exelon to describe the level monitoring system and provide industry operating experience with these systems. The staff also requested Exelon to describe how the level monitoring systems are monitored for proper functioning and reliability. Exelon responded to the RAI in a letter dated May 2, 2019 (ADAMS Accession No. ML19122A289).

The staff finds Exelon's response acceptable because the SmartCover system is used to continuously monitor for water accumulation in manholes. If water is present and reaches the setpoint for alarm or a problem exists with a transmitter, Exelon will enter the condition into the corrective action program and will perform follow-up actions to inspect the manhole, pump out any accumulated water, and initiate additional corrective actions as needed. The SmartCover systems are widely used in water and wastewater facilities. Exelon has reviewed industry and PBAPS operating experience for the SmartCover manhole level monitoring systems and found no adverse plant specific or industry operating experience for the SmartCover level monitoring equipment. The level transmitters' float-less design and continuous monitoring system, with alarms, are self-monitoring and do not require periodic preventive maintenance. Exelon did not identify any reliability issue for SmartCover manhole level monitoring system at PBAPS and will continue to open and inspect manholes every five years, coincident with Structure Monitoring program inspections. The staff finds that there is no need to perform annual inspections for manholes that have the installed level monitoring and alarm system and where there has been a timely response to level alarms. Manholes with level monitoring and alarms, and timely pump out, prevent water accumulation from wetting or submerging cables. There is no adverse plant specific or industry operating experience for the level monitoring equipment installed at PBAPS. Therefore, the staff finds that the exception to GALL Report AMP XI.E3B, which would allow inspection of manholes every five years, acceptable. Additionally, because of the level transmitters' continuous monitoring and alarms, there is no need for event-driven inspections. Therefore, the staff finds that the exception to GALL Report AMP XI.E3B, allowing inspection for water accumulation after event-driven occurrences when level monitoring indicates water is accumulating, acceptable.

The staff conducted an audit to verify Exelon's claim of consistency with the GALL-SLR Report. Based on a review of the SLRA, the staff finds that, with the above exceptions, 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 Exelon claimed consistency with the GALL-SLR Report are consistent with the corresponding program elements of GALL-SLR Report AMP XI.E3B. In addition, the staff reviewed the exceptions and their justifications and concludes that the AMP, with the exceptions, is adequate to manage the applicable aging effects.

Operating Experience. SLRA Section B.2.1.40 summarizes operating experience related to the Electrical Insulation for Inaccessible Instrument and Control Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program. The staff evaluated operating experience information by reviewing the SLRA and conducting an audit (ADAMS Accession No. ML19142A369). During the audit, the staff independently searched plant-specific operating experience information to determine whether any previously unknown or recurring aging effects were identified. The staff did not identify any operating experience indicating that Exelon should modify its proposed program. Based on its audit and review of the SLRA, the staff finds that the conditions and operating experience 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 A.2.1.40 provides the UFSAR supplement for 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 Exelon committed (Commitment No. 40) to implement the Electrical Insulation for Inaccessible Instrument and Control Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program six months, 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. On the basis of its review of Exelon'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 Exelon claimed consistency with the GALL-SLR Report are consistent. In addition, the staff reviewed the exceptions and their justifications and concludes that the AMP, with the exceptions, is adequate to manage the applicable aging effects. The staff concludes that Exelon 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).

3.0.3.2.27 Electrical Insulation for Inaccessible Low-Voltage Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements

SLRA Section B.2.1.41 states the Electrical Insulation for Inaccessible Low-Voltage Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program is a new program that will be consistent with GALL-SLR Report AMP XI.E3C, "Electrical Insulation for Inaccessible Low-Voltage Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements," except for the exceptions identified in the SLRA.

Staff Evaluation. During its in-office audit (ADAMS Accession No. ML19205A206), the staff reviewed Exelon'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 Exelon's program to the corresponding program elements of GALL-SLR Report AMP XI.E3C.

The staff also reviewed the portion of the "preventive actions" program element 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 exceptions follows.

Exception 1. SLRA Section B.2.1.41 includes an exception to the "preventive actions" program element. This exception is related to periodic actions to prevent inaccessible low-voltage power cables from being exposed to significant moisture. Exelon proposed to inspect manholes with level monitoring and alarms that result in consistent and subsequent pump out of accumulated water prior to wetting or submergence of cables, at least once every 5 years, as supported by plant operating experience. GALL-SLR Report AMP XI.E3C recommends inspection of manholes for water accumulation at least once annually.

Exception 2. SLRA Section B.2.1.41 includes an exception to the "preventive actions" program element. This exception related to inspection of manholes following event-driven occurrences such as heavy rain, rapid thawing of ice and snow, or flooding. Exelon proposed to inspect manholes with level monitoring and alarms that result in consistent and subsequent pump out of accumulated water prior to wetting or submergence of cables, following event-driven occurrences when level monitoring indicates water is accumulating. The GALL-SLR Report AMP XI.E3C recommends inspection for water accumulation in manholes following event-driven occurrences.

The staff issued RAI B.2.1.41-1 (ADAMS Accession No. ML19108A427) to obtain the information necessary to determine if the exception will satisfy the criteria of 10 CFR 54.21(a)(3). Specifically, the staff requested Exelon to describe the level monitoring system and provide industry operating experience with these systems. The staff also requested Exelon to describe how the level monitoring systems are monitored for proper functioning and reliability. Exelon provided its response to the staff's RAI, in a letter dated May 2, 2019 (ADAMS Accession No. ML19122A289).

The staff finds Exelon's response acceptable because the SmartCover system is used to continuously monitor for water accumulation in manholes. If water is present and reaches the setpoint for alarm or a problem exists with a transmitter, Exelon will enter the condition into the corrective action program and will perform follow-up actions to inspect the manhole, pump out any accumulated water, and initiate additional corrective actions as needed. The SmartCover systems are widely used in water and wastewater facilities. Exelon has reviewed industry and PBAPS operating experience for the SmartCover manhole level monitoring systems and found no adverse plant-specific or industry operating experience for the SmartCover level monitoring equipment. The level transmitters' float-less design and continuous monitoring system, with alarms, are self-monitoring and do not require periodic preventive maintenance. Exelon did not identify any reliability issue for the SmartCover manhole level monitoring system at PBAPS and will continue to open and inspect manholes every 5 years, coincident with Structures Monitoring program inspections. The staff finds that there is no need to perform annual inspections for manholes that have the installed level monitoring and alarm system and where there has been a timely response to level alarms. Manholes with level monitoring and alarms, and timely pump out, prevent water accumulation from wetting or submerging cables. There is no adverse plant specific or industry operating experience for the level monitoring equipment installed at PBAPS. Therefore, the staff finds that the exception to GALL Report AMP XI.E3C, which would allow inspection of manholes every five years, acceptable. Additionally, because of the level transmitters' continuous monitoring and alarms, there is no need for event-driven inspections. Therefore, the staff finds that the exception to GALL Report AMP XI.E3C, allowing inspection for water accumulation after event-driven occurrences when level monitoring indicates water is accumulating, acceptable.

The staff conducted an audit to verify Exelon's claim of consistency with the GALL-SLR Report. 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 Exelon 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 "preventive actions" program element and their justifications and concludes that the AMP, with the exceptions, is adequate to manage the applicable aging effects.

Operating Experience. SLRA Section B.2.1.41 summarizes operating experience related to the Electrical Insulation for Inaccessible Low-Voltage Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program. The staff evaluated operating experience information by reviewing the SLRA and conducting an audit (ADAMS Accession No. ML19142A369). During the audit, the staff independently searched plant-specific operating experience information to determine whether any previously unknown or recurring aging effects were identified. The staff did not identify any operating experience indicating that Exelon should modify its proposed program. Based on its audit and review of the SLRA, the staff finds that the conditions and operating experience 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 A.2.1.41 provides the UFSAR supplement for 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 Exelon committed (Commitment No. 41) to implement the Electrical Insulation for Inaccessible Low-Voltage Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program with enhancements 6 months, 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. On the basis of its audit and review of Exelon'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 Exelon claimed consistency with the GALL-SLR Report are consistent. In addition, the staff reviewed the exceptions and their justifications and concludes that the AMP, with the exceptions, is adequate to manage the applicable aging effects. The staff concludes that Exelon 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).

3.0.3.2.28 Fatigue Monitoring

SLRA Section B.3.1.1 states that the Fatigue Monitoring AMP is an existing program with enhancements that will be consistent with the program elements in the GALL-SLR Report AMP X.M1, “Fatigue Monitoring.”

Staff Evaluation. During its in-office audit (ADAMS Accession No. ML19205A206), the staff reviewed Exelon’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 Exelon’s program to 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,” 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 four enhancements follows.

Enhancement 1. SLRA Section B.3.1.1 includes an enhancement to the “scope of program” program element related to updating the SI:FatiguePro™ software to include the calculation and tracking of environmentally assisted fatigue (EAF). The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP X.M1 and finds it acceptable because the calculation and tracking of EAF will be performed in accordance with NUREG/CR-6909 (ADAMS Accession No. ML16319A004) and consistent with the “scope of program,” program element of GALL-SLR Report AMP X.M1.

Enhancement 2. SLRA Section B.3.1.1 includes an enhancement to the “scope of program” and “monitoring and trending,” program elements related to updating the fatigue analyses and monitored component locations when applicable. The enhancement will ensure that updates are made based on operating experience, plant modifications, inspection findings, changes to transient definitions, and unanticipated newly discovered fatigue loading events. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP X.M1 and finds it acceptable because the “scope of program” and “monitoring and trending” program elements will be consistent with GALL-SLR Report AMP X.M1.

Enhancement 3. SLRA Section B.3.1.1 includes an enhancement to the “parameters monitored or inspected,” “detection of aging effects,” and “monitoring and trending” program elements related to revising procedures to require the periodic validation of chemistry parameters that are used as inputs for calculating the environmental adjustment factor (F_{en}). The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP X.M1 and finds it acceptable because it will validate environmental parameters that contribute to F_{en} values and be consistent with the “parameters monitored or inspected,” “detection of aging effects,” and “monitoring and trending” program elements of GALL-SLR Report AMP X.M1.

Enhancement 4. SLRA Section B.3.1.1 includes an enhancement to the “acceptance criteria” program element related to High Energy Line Break (HELB). The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP X.M1 and finds it acceptable because it will add additional acceptance criteria for exclusion locations and it will be consistent with the “acceptance criteria” program element of GALL-SLR Report AMP X.M1.

The staff conducted an audit to verify the applicant's claim of consistency with the GALL-SLR Report. 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 Exelon claimed consistency with the GALL-SLR Report are consistent with the corresponding program elements of GALL-SLR Report AMP XM1. In addition, the staff reviewed the enhancements associated with the "scope of program," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," and "acceptance criteria" program elements and finds that they will make the AMP adequate to manage the applicable aging effects.

Operating Experience. SLRA Section B.3.1.1 summarizes operating experience related to the Fatigue Monitoring AMP. The staff evaluated operating experience information by reviewing the SLRA and conducting an audit (ADAMS Accession No. ML19142A369). During the audit, the staff independently searched plant-specific operating experience information to determine whether any previously unknown or recurring aging effects were identified.

The staff did not identify any operating experience indicating that Exelon should modify its proposed program beyond that incorporated. Based on its audit and review of the SLRA, the staff finds that the conditions and operating experience at the plant are bounded by those for which the Fatigue Monitoring AMP was evaluated.

UFSAR Supplement. SLRA Section A.3.1.1 provides the UFSAR supplement for the Fatigue Monitoring 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 X-01. The staff also noted that Exelon committed (Commitment No. 45) to implement the four enhancements 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. On the basis of its audit and review of Exelon's Fatigue Monitoring AMP, the staff concludes that those program elements for which Exelon claimed consistency with the GALL-SLR Report are consistent with the GALL-SLR Report AMP X.M1, "Fatigue Monitoring." 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 Exelon 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 Neutron Fluence Monitoring

SLRA Section B.3.1.2 states that the Neutron Fluence Monitoring program is an existing program that with an enhancement will be consistent with the program elements in the GALL-SLR Report AMP X.M2, "Neutron Fluence Monitoring."

Staff Evaluation. During its in-office audit (ADAMS Accession No. ML19205A206), the staff reviewed Exelon'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 Exelon's program to the corresponding program elements of GALL-SLR Report AMP X.M2.

The staff also reviewed the portions of the "preventive actions," "detection of aging effects," and "monitoring and trending" 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 B.3.1.2 includes an enhancement to the "preventive actions," "detection of aging effects," and monitoring and trending" program elements. The applicant's enhancement calls for the applicant to perform periodic monitoring of the neutron fluences for evaluated reactor pressure vessel (RPV) and reactor vessel internal (RVI) components every refueling cycle to ensure that the neutron fluence projections used to support the RPV neutron irradiation embrittlement analyses (i.e., TLAAs, pressure-temperature limits) and RVI aging effect assessments remain bounding with respect to actual plant operating conditions. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP X.M2 and finds it acceptable because it will make the program's criteria for implementing neutron fluence monitoring activities consistent with those related to neutron fluence monitoring in the corresponding program elements of GALL-SLR Report AMP X.M2.

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 for which Exelon claimed consistency with the GALL-SLR Report are consistent with the corresponding program elements of GALL-SLR Report AMP X.M2. In addition, the staff reviewed the enhancement associated with the "preventive actions," "detection of aging effects," and "monitoring and trending" program elements and finds that it will make the AMP adequate to manage the applicable aging effects.

Operating Experience. SLRA Section B.3.1.2 summarizes operating experience related to the Neutron Fluence Monitoring program. The staff evaluated operating experience information by reviewing the SLRA and conducting an audit (ADAMS Accession No. ML19142A369). The staff determined that the applicant cited specific plant-specific or generic operating experience events that prompted the applicant to redefine the program and call for implementation of more frequent RPV and RVI neutron fluence monitoring reviews. Specifically, the staff noted that the program was redefined to call for periodic neutron fluence monitoring reviews every refueling cycle. The staff did not identify any operating experience indicating that Exelon should modify its proposed program beyond the programmatic criteria already incorporated into the program (with the appropriate enhancement) by the applicant and defined consistent with the corresponding program elements in GALL-SLR Report AMP X.M2, "Neutron Fluence Monitoring."

Based on its audit and review of the SLRA, the staff finds that the conditions and operating experience at the plant are bounded by those for which the Neutron Fluence Monitoring program was evaluated.

UFSAR Supplement. SLRA Section A.3.1.2 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 X-01.

The staff also noted that, in UFSAR Supplement Table A.5, Exelon committed (Commitment No. 46) to perform periodic monitoring of the neutron fluences for evaluated reactor pressure vessel (RPV) and reactor vessel internal (RVI) components every refueling cycle to ensure that the neutron fluence projections used to support the RPV neutron irradiation embrittlement analyses (i.e., TLAAs, pressure-temperature limits) and RVI component-specific aging effect assessments remain bounding with respect to actual plant operating conditions. The applicant also committed to implement this enhancement at least 6 months prior to entering into the subsequent period of extended operation. The staff has evaluated this commitment (i.e., enhancement) and has determined that it is acceptable because it will make the program's criteria for implementing neutron fluence monitoring activities consistent with those related to neutron fluence monitoring in the corresponding program elements of GALL-SLR Report AMP X.M2.

The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. On the basis of its audit and review of Exelon's Neutron Fluence Monitoring program, the staff concludes that those program elements for which Exelon claimed consistency with the GALL-SLR Report are consistent with the corresponding program elements defined in GALL-SLR Report AMP X.M2, "Neutron Fluence Monitoring." In addition, the staff reviewed the proposed enhancement of the AMP 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 Exelon has demonstrated that the impacts of neutron irradiation embrittlement or other neutron fluence-influenced aging effects on the RPV and RVI components will be adequately managed so that their 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).

3.0.3.2.30 Environmental Qualification of Electric Equipment

SLRA Section B.3.1.3 states that the Environmental Qualification [EQ] of Electric Equipment program 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 in-office audit (ADAMS Accession No. ML19205A206), the staff reviewed Exelon'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 Exelon's program to the corresponding program elements of 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 these enhancements follows.

Enhancement. SLRA Section B.3.1.3 includes enhancements to the “detection of aging effects” and “corrective actions” program elements. The enhancements of the existing EQ program add visual inspection of the accessible, passive EQ equipment located in adverse localized environments at least once every 10 years with the first inspection to be performed prior to the subsequent period of extended operation. The enhancements to the existing EQ program also establish acceptance criteria for the visual inspections of accessible, passive EQ equipment located in adverse localized environments. The staff reviewed these enhancements against the corresponding program elements in GALL-SLR Report AMP X.E1 and finds it acceptable because it will be consistent with GALL-SLR Report AMP X.E1.

The staff conducted an audit to verify Exelon’s claim of consistency with the GALL-SLR Report. 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 Exelon claimed consistency with the GALL-SLR Report are consistent with the corresponding program elements of GALL-SLR Report AMP X.E1. In addition, the staff reviewed the enhancement associated with the “detection of aging effects” and “corrective actions” program elements and finds that they will make the AMP adequate to manage the applicable aging effects.

Operating Experience. SLRA Section B.3.1.3 summarizes operating experience related to the Environmental Qualification of Electric Equipment. Exelon stated that the operating experience relative to Environmental Qualification of Electric Equipment AMP found that many aspects of the current Environmental Qualification Activities program are robust. A self-identified deficiency in scheduling replacement activities in the work management system was resolved using the corrective action program. Appropriate guidance for evaluation, repair, or replacement is provided for locations where degradation is found. Periodic assessments of the Environmental Qualification of Electric Equipment AMP are performed to identify the areas that need improvement to maintain the quality performance of the program. The program is informed and enhanced when necessary through the systematic and ongoing review of both plant-specific and industry operating experience.

The staff evaluated operating experience information by reviewing the SLRA and conducting an audit (ADAMS Accession No. ML19142A369). During the audit, the staff independently searched plant-specific operating experience information to determine whether any previously unknown or recurring aging effects were identified.

The staff did not identify any operating experience that would indicate that Exelon should consider modifying its proposed program. Based on its audit and review of the SLRA, the staff finds that the conditions and operating experience at the plant are bounded by those for which the Environmental Qualification of Electric Equipment program was evaluated.

UFSAR Supplement. SLRA Section A.3.1.3 provides the UFSAR supplement for the Environmental Qualification 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 noted that Exelon committed to ongoing implementation of the existing Environmental Qualification of Electric Equipment program for managing the effects of aging for applicable components during the subsequent period of extended operation. The staff also noted that Exelon committed (Commitment No. 47) to implement the enhancement to the program no later than 6 months prior to the subsequent period of extended operation. New visual inspections of accessible, passive EQ equipment located in adverse localized environment will be completed 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. On the basis of its audit and review of Exelon's Environmental Qualification of Electric Equipment program, the staff concludes that those program elements for which Exelon claimed consistency with the GALL-SLR Report are consistent. Also, the staff reviewed the enhancement and confirmed 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 Exelon 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:

- Wooden Pole

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.

3.0.3.3.1 Wooden Pole

SLRA Section B.2.2.1 describes the existing Wooden Pole program as plant-specific. Exelon stated that the program manages the aging effects associated with the in-scope wooden pole that is adjacent to the Susquehanna Substation. Exelon also stated that the program manages loss of material and change in material properties by conducting periodic inspections in accordance with corporate specifications of the wooden pole within the scope of the program.

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" 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 Exelon program manages aging effects through the effective incorporation of these program elements. The staff's evaluation of each of these elements follows.

Scope of the Program. SLRA Section B.2.2.1 states that the program inspects the in-scope wooden pole that is adjacent to the Susquehanna Substation. Exelon also stated that the wooden pole provides structural support for the conductors connecting the substation to the submarine cable for the alternate AC power for PBAPS's station blackout (SBO) coping period.

The staff reviewed Exelon's "scope of program" program element against the criteria in SRP-SLR Section A.1.2.3.1, which states the scope of the program should include the specific structures and components that the program manages.

The staff finds Exelon's "scope of program" program element to be adequate because it satisfies the criterion defined in SRP-SLR Section A.1.2.3.1 and, therefore, the staff finds it acceptable.

Preventive Actions. SLRA Section B.2.2.1 states that this AMP is a condition monitoring activity. There are no preventive or mitigative actions associated with this AMP.

The staff reviewed Exelon's "preventive actions" program element against the criteria in SRP-SLR Section A.1.2.3.2, which states some condition or performance monitoring programs do not rely on preventive actions and thus, this information need not be provided.

The staff finds Exelon's "preventive actions" program element to be adequate because it satisfies the criterion defined in SRP-SLR Section A.1.2.3.2. and, therefore, the staff finds it acceptable.

Parameters Monitored or Inspected. SLRA Section B.2.2.1 states that the wooden pole in the scope of this program is inspected for loss of material due to animal, insect, and moisture damage, and for change in material properties due to moisture damage using a standard wooden pole inspection specification. Parameters inspected typically evaluate shell rot, decay pockets, heart rot, rotten butt, cracked or broken arms or braces, mechanical damage, ground line decay, and split tops.

The staff reviewed Exelon's "parameters monitored or inspected" program element against the criteria in SRP-SLR Section A.1.2.3.3, which states for a condition monitoring program the parameter monitored or inspected should be capable of detecting the presence and extent of aging effects.

The staff finds Exelon's "parameters monitored or inspected" program element to be adequate because the proposed parameters align with the industry guidance for wooden pole inspection and are capable of detecting applicable aging effects. Therefore, the staff finds it acceptable.

Detection of Aging Effects. SLRA Section B.2.2.1 states that the Wooden Pole AMP detects aging effects prior to the loss of the wooden pole's intended function to provide structural support to in-scope electrical conductors. This AMP is based on performing wooden pole inspections in accordance with standard specifications. Exelon also stated that the wooden pole is monitored via visual inspections, sounding, and, if required, boring and excavating activities. The inspections of the wooden pole are performed every 10 years by a qualified inspector. This AMP employs industry standardized practices to perform condition monitoring and subsequent corrective actions. There is no national standard for inspecting poles; however, industry experience over several decades indicates that a 10-year inspection interval is adequate.

The staff reviewed Exelon's "detection of aging effects" program element against the criteria in SRP-SLR Section A.1.2.3.4, which states for condition monitoring programs the method or technique (such as visual, volumetric, or surface inspection), frequency, and timing of inspections may be linked to plant-specific or industry-wide operating experience. The discussion provides justification (including codes and standards referenced) that the technique and frequency are adequate to detect the aging effects before a loss of structure and component (SC) intended function.

The staff finds Exelon's "detection of aging effects" program element to be adequate because it employs visual inspection techniques and includes guidance for additional boring and excavation inspections if visual inspections indicate degradation, an approach which aligns with industry standard inspection techniques. This approach aligns with the industry standard inspection techniques and, therefore, the staff finds it acceptable.

Monitoring and Trending. SLRA Section B.2.2.1 states that the wooden pole is inspected at 10-year intervals. Exelon stated that occurrences of degradation (e.g., shell rot, decay pockets, heart rot, rotten butt, cracked or broken arms or braces, mechanical damage) that may limit the life of the pole, or which require immediate attention in the interest of safety, will be recorded and reported using the corrective action program. Exelon also stated that these periodic actions are sufficient to predict the extent of degradation so that timely corrective or mitigative actions are possible. Inspection results are evaluated against acceptance criteria that ensure the intended function of the pole is maintained until the next scheduled inspection, or required repair or replacement is performed based upon associated procedural guidance.

The staff reviewed Exelon's "monitoring and trending" program element against the criteria in SRP-SLR Section A.1.2.3.5, which states for periodic programs, where practical, identified degradation is projected until the next scheduled inspection. The results are evaluated against acceptance criteria to confirm that the timing of subsequent inspections maintains the components' intended function throughout the subsequent period of extended operation based on the projected rate of degradation.

The staff finds Exelon's "monitoring and trending" program element to be adequate because it satisfies the criterion defined in SRP-SLR Section A.1.2.3.5 and, therefore, the staff finds it acceptable.

Acceptance Criteria. SLRA Section B.2.2.1 states that the acceptance criteria are provided in the specification for inspection of wooden poles. An approved wooden pole maintenance contractor experienced in the inspection, treatment, and reinforcement of wooden poles performs the pole inspection. The inspector, through a combination of visual, sounding, boring, and excavation activities, determines the condition of the pole. Exelon noted that this program does not project observed degradation to the end of the subsequent period of extended operation and it is implemented on a periodic basis. Exelon also stated that the results of the inspection determine if the wooden pole is acceptable as is or in need of repair or replacement, assuring that the wooden pole will continue to perform its intended function until the next periodic inspection. This program's acceptance criteria are not directly related to or directly taken from the PBAPS CLB, codes and standards endorsed by NRC regulations, or NRC-endorsed technical or topical reports but are instead aligned with industry standards.

The staff reviewed Exelon's "acceptance criteria" program element against the criteria in SRP-SLR Section A.1.2.3.6, which states that quantitative and qualitative acceptance criteria and its basis should be described. Acceptance criteria for observed degradation during current inspections, which do permit degradation, are based on maintaining the intended function under all CLB design loads. The staff noted that qualified inspectors inspect the poles and will determine acceptability based on a combination of qualitative and quantitative acceptance criteria, including extent of decay, identified cavities, and remaining sound shell thickness.

The staff finds Exelon's "acceptance criteria" program element to be adequate because qualified inspectors review the pole against industry standard acceptance criteria and the element satisfies the criterion defined in SRP-SLR Section A.1.2.3.6. and, therefore, the staff finds it acceptable.

Corrective Actions. SLRA Section B.2.2.1 states that the Quality Assurance (QA) program implements the requirements of 10 CFR Part 50, Appendix B, and 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 elements of corrective action, confirmation process, and administrative controls and is applicable to the safety-related and nonsafety-related systems, structures, and components (SSCs), and commodity groups that are subject to an AMR, in accordance with Exelon's Quality Assurance (QA) Topical Report and corrective action program. Exelon also stated that if an inspection identifies a degraded condition, corrective actions (e.g., treatment, reinforcement, or replacement) are taken to restore the structural integrity of a degraded pole. The program will be enhanced to initiate a condition report within the corrective action program to document and evaluate the unacceptable conditions in accordance with plant administrative procedures, including identification of causes and extent of condition.

The staff reviewed Exelon's "corrective actions" program element against the criteria in SRP-SLR Section A.1.2.3.7, which states results that do not meet the acceptance criteria are addressed in the applicant's corrective action program under those specific portions of the QA program that are used to meet Criterion XVI, "Corrective Action," of 10 CFR Part 50, Appendix B. Appendix A.2 describes how an applicant may apply its 10 CFR Part 50, Appendix B, QA program to fulfill the corrective actions element of this AMP for both safety-related and nonsafety-related SCs within the scope of this program.

The SRP-SLR also stated that actions to be taken when the acceptance criteria are not met should be described in appropriate detail or referenced to source documents. Corrective actions, including cause evaluations, root cause determination, and prevention of recurrence should be timely. For monitored programmatic parameters that fail to meet defined acceptance criteria or standards, corrective action is taken prior to a loss of intended function of the affected SC.

The staff also reviewed the portions of the "corrective actions" 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 follows:

Enhancement 1. SLRA Section B.2.2.1 includes an enhancement to the "corrective actions" program element. In this enhancement, the applicant stated that the program will be enhanced to initiate a condition report within the corrective action program to document and evaluate the unacceptable conditions in accordance with plant administrative procedures, including identification of causes and extent of condition.

The staff reviewed this enhancement against the criteria in SRP-SLR Section A.1.2.3.7 and finds it acceptable because the applicant's program will be consistent with the recommendations in SRP-SLR, such that necessary and appropriate corrective actions associated with the wooden pole will be taken to ensure that the integrity of the wooden pole is maintained.

The staff finds Exelon's "corrective actions" program element to be adequate because it satisfies the criterion defined in SRP-SLR Section A.1.2.3.7 and, therefore, the staff finds it acceptable.

Operating Experience. SLRA Section B.2.2.1 summarizes operating experience related to the Wooden Pole AMP. The staff evaluated operating experience information by reviewing the SLRA against the acceptance criteria in SRP-SLR Section A.1.2.3.10 and conducting an audit (ADAMS Accession No. ML19142A369). The staff did not identify any operating experience indicating that Exelon should modify its proposed program beyond that incorporated during the development of the SLRA. Based on its audit and review of the SLRA, the staff finds that the conditions and operating experience at the plant are bounded by those for which the wooden pole was evaluated.

UFSAR Supplement. SLRA Section A.2.2.1 provides the UFSAR supplement for the Wooden Pole 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 Exelon committed (Commitment No. 44) to ongoing implementation of the existing Wooden Pole program with enhancements 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. The staff reviewed this enhancement against the criteria in SRP-SLR Section A.1.2.3.7 and finds it acceptable because the applicant's program will be consistent with the recommendations in SRP-SLR, such that necessary and appropriate corrective actions associated with the wooden pole will be taken to ensure that the integrity of the wooden pole is maintained. On the basis of its audit and review of Exelon's Wooden Pole program, the staff concludes that Exelon 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 license renewal applicants to demonstrate that for structures and components 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. NUREG-2192, "Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants" (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 quality assurance 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:

(7) Corrective Actions—Corrective actions, including root cause determination and prevention of recurrence, should be timely.

(8) Confirmation Process—Confirmation process should ensure that corrective actions have been completed and are effective.

(9) Administrative Controls—Administrative controls should provide a formal review and approval process.

NUREG-2192, “Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants” (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 structures, systems, and components are subject to the quality assurance requirements of 10 CFR Part 50 Appendix B. Additionally, for nonsafety-related structures and components 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 quality assurance attributes of AMPs:

- Safety-related structures and components are subject to 10 CFR Part 50 Appendix B requirements, which are adequate to address all quality-related aspects of an AMP [aging management program] consistent with the CLB [current licensing basis] of the facility for the subsequent period of extended operation.
- For nonsafety-related structures and components that are subject to an aging management review, an applicant has the option to expand the scope of its 10 CFR Part 50 Appendix B program to include these SCs [structures and components] 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, the 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 RLSB-1 (Appendix A.1 of this SRP-SLR).

3.0.4.1 Summary of Technical Information in Application

SLRA Appendix A, “Final Safety Analysis Report Supplement,” Section A.1.5, “Quality Assurance Program and Administrative Controls,” and SLRA Appendix B, “Aging Management Programs,” Section B.1.3, “Quality Assurance Program and Administrative Controls,” describe the elements of corrective action, confirmation process, and administrative controls that are applied to the AMPs for both safety-related and nonsafety-related components.

SLRA Appendix A, Section A.1.5, states:

> The Quality Assurance Program implements the requirements of 10 CFR 50, Appendix B, and is consistent with the summary in Appendix A.2, “Quality Assurance for Aging Management Programs (Branch Technical Position IQMB-1)” of NUREG-2192. The Quality Assurance Program includes the elements of corrective action, confirmation process, and administrative controls,

> and is applicable to the safety-related and nonsafety-related systems, structures, and components (SSCs) that are subject to Aging Management Review (AMR).

SLRA Appendix B, Section B.1.3, states:

> The Quality Assurance Program implements the requirements of 10 CFR 50, Appendix B, and is consistent with the summary in Appendix A.2, "Quality Assurance for Aging Management Programs (Branch Technical Position IQMB-1)" of NUREG-2192. The Quality Assurance Program includes the elements of corrective action, confirmation process, and administrative controls, and is applicable to the safety-related and nonsafety-related systems, structures, components (SSCs), and commodity groups that are subject to AMR.

3.0.4.2 Staff Evaluation

The staff reviewed SLRA Appendix A, Section A.1.5, and Appendix B, Section B.1.3, which describe how the applicant's existing quality assurance program includes the quality assurance-related elements (corrective action, confirmation process, and administrative controls) for AMPs, consistent with the staff's guidance described in Branch Technical Position IQMB-1. The staff also reviewed a sample of the applicant's AMP basis documents and confirmed that the AMPs implement the corrective action program, confirmation processes, and administrative controls as described in the SLRA. Based on its review, the staff determined that the quality attributes presented in the AMP basis documents and the associated AMPs are consistent with the staff's position regarding quality assurance for aging management.

3.0.4.3 Conclusion

On the basis of the staff's review of SLRA Appendix A, Section A.1.5, and SLRA Appendix B, Section B.1.3, and the AMP basis documents, the staff finds that the quality assurance attributes presented in the AMP basis documents and the associated AMPs are consistent with SRP-SLR, Branch Technical Position RLSB-1, and that the quality assurance attributes will be maintained such that the licensee will adequately manage aging in a way that maintains intended function(s) consistent with the CLB for the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3).

3.0.5 Operating Experience for Aging Management Programs

3.0.5.1 Summary of Technical Information in the Application

SLRA Appendix A, "Updated Final Safety Analysis Report Supplement," Section A.1.6, "Operating Experience," and SLRA Appendix B, "Aging Management Programs," Section B.1.4, "Operating Experience," describe the consideration of operating experience for aging management programs (AMPs). SLRA Sections A.1.6 and B.1.4 state that the applicant does a systematic review of plant-specific and industry operating experience concerning aging management and age-related degradation to ensure that the subsequent license renewal AMPs will be effective in managing the aging effects for which they are credited. The SLRA states that operating experience 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 structures and components (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. NUREG-2192, “Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants – Final Report (SRP-SLR),” Appendix A.4, “Operating Experience for Aging Management Programs,” states that the systematic review of plant-specific and industry operating experience, 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 operating experience that the effects of aging may not be adequately managed. AMPs should be informed by the review of operating experience on an ongoing basis, regardless of the AMP’s implementation schedule.

3.0.5.2.2 Consideration of Future Operating Experience

The staff reviewed SLRA Sections A.1.6 and B.1.4 to determine how the applicant will use future operating experience to ensure that the AMPs are effective. The staff evaluated the applicant’s operating experience review activities, as described in the SLRA. The staff’s evaluations with respect to these SRP-SLR sections follow in SER Sections 3.0.5.2.3 and 3.0.5.2.4, respectively.

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 operating experience concerning age-related degradation and aging management during the term of a renewed operating license. The acceptable programs are those relied on to meet the requirements of Appendix B to 10 CFR Part 50 and Item I.C.5, “Procedures for Feedback of Operating Experience to Plant Staff,” in NUREG-0737, “Clarification of TMI Action Plan Requirements,” dated November 1980 (ADAMS Accession No. ML051400209), as incorporated into the licensee’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 operating experience program should rely on active participation in the Institute of Nuclear Power Operations (INPO) operating experience program (formerly the INPO Significant Event Evaluation and Information Network (SEE IN) program endorsed in GL 82-04, “Use of INPO SEE IN Program,” dated March 9, 1982).

SLRA Sections A.1.6 and B.1.4 state that the applicant uses its operating experience program to systematically capture and review operating experience from plant-specific and industry sources. The applicant stated that the operating experience program meets the requirements of NUREG-0737. The applicant further states that the operating experience program interfaces and relies on active participation in the INPO operating experience program. Based on this information, the staff determined that the applicant’s operating experience 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 Operating Experience Related to Aging. SRP-SLR Section A.4.2 states that the programs and procedures relied on to meet the requirements of Appendix B to 10 CFR Part 50 and NUREG-0737, Item I.C.5, should not preclude the consideration of operating experience on age-related degradation and aging management.

SLRA Sections A.1.6 and B.1.4 state that operating experience from plant-specific and industry sources are systematically captured and reviewed on an ongoing basis in accordance with the quality assurance (QA) program, which is consistent with Appendix B to 10 CFR Part 50, and the operating experience program, which is consistent with NUREG-0737, Item I.C.5. Sections A.1.6 and B.1.4 state that the ongoing evaluation of operating experience included a review of corrective actions resulting in program enhancements. The SLRA states that trending reports, program health reports, assessments, and corrective action 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 QA program, the corrective action program, and the operating experience program would not preclude consideration of age-related operating experience, 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 Appendix B to 10 CFR Part 50 to include nonsafety-related SCs.

SLRA Appendix A, “Final Safety Analysis Report Supplement,” Section A.1.5, “Quality Assurance Program and Administrative Controls,” and SLRA Appendix B, “Aging Management Programs,” Section B.1.3, “Quality Assurance Program and Administrative Controls,” 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. SER Section 3.0.4 documents the staff’s evaluation of SLRA Sections A.1.5 and B.1.3 relative to the application of the QA program to nonsafety-related SSCs.

Consideration of Guidance Documents as Industry Operating Experience. 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 operating experience and evaluated accordingly.

SLRA Sections A.1.6 and B.1.4 state that the sources of external operating experience include the INPO operating experience 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 operating experience for impacts to its aging management activities, which includes sources that the staff considers to be the primary sources of external operating experience information. Based on the completion of the staff’s review and the consistency of consideration of guidance documents as industry operating experience with the guidance in SRP-SLR, Section A.4.2, the staff finds it acceptable.

Screening of Incoming Operating Experience. SRP-SLR Section A.4.2 states that all incoming plant-specific and industry operating experience should be screened to determine whether it involves age-related degradation or impacts to aging management activities.

SLRA Sections A.1.6 and B.1.4 state that internal and external operating experience is captured and systematically reviewed on an ongoing basis and that the operating experience program provides for evaluation of the effectiveness of their self-assessment process for each AMP described in the UFSAR supplement. Site-specific and industry operating experience items 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 operating experience review processes will include screening of all new operating experience to identify and evaluate items that have the potential to impact the aging management activities. Based on the completion of the staff's review and the consistency of screening of incoming operating experience with the guidance in SRP-SLR, Section A.4.2, the staff finds it acceptable.

Identification of Operating Experience Related to Aging. SRP-SLR Section A.4.2 states that coding should be used within the plant corrective action program to identify operating experience 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 Sections A.1.6 and B.1.4 state that the corrective action program identifies either plant-specific operating experience related to aging or industry operating experience 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 operating experience related to aging with the guidance in SRP-SLR, Section A.4.2, the staff finds it acceptable.

Information Considered in Operating Experience Evaluations. SRP-SLR Section A.4.2 states that operating experience identified as involving aging should receive further evaluation based on consideration of 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 action program to either enhance the AMPs or develop and implement new AMPs if an operating experience evaluation finds that the effects of aging may not be adequately managed.

SLRA Sections A.1.6 and B.1.4 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 operating experience includes the assessment of appropriate information to determine potential impacts to the aging management activities. The staff also determined that the applicant's operating experience program, in conjunction with the corrective action program, would implement any changes necessary to manage the effects of aging, as determined through its operating experience evaluations. Therefore, the staff finds that the information considered in the applicant's operating experience evaluations and use of the operating experience program and corrective action 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 action 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 Section B.1.4 states internal operating experience includes event investigations, trending reports, and lessons learned from in-house events as captured in program health reports, program assessments, and in the 10 CFR Part 50, Appendix B corrective action program. In addition, SLRA Section B.1.4 states that AMPs are either enhanced or new AMPs developed, as appropriate, when it is determined through the evaluation of operating experience that the effects of aging may not be adequately managed. SLRA Section B.1.4 states that the operating experience program also meets the requirements of NEI 14-12, "Aging Management Program Effectiveness," for periodic program assessments. In addition, SLRA Section B.1.4 states that AMP and operating experience 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 operating experience with the guidance in SRP-SLR, Section A.4.2, the staff finds it 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 operating experience. 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 Section A.1.6 states that the operating experience program provides for training to those responsible for activities including screening, evaluating, and communicating operating experience items related to aging management and aging-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 finds it acceptable.

Reporting Operating Experience to the Industry. SRP-SLR Section A.4.2 states that guidelines should be established for reporting plant-specific operating experience on age-related degradation and aging management to the industry.

Based on the completion of the staff's review and the consistency of the applicant's reporting operating experience to the industry with the guidance in SRP-SLR, Section 4.2, the staff finds it acceptable.

Schedule for Implementing the Operating Experience Review Activities. SRP-SLR Section A.4.2 states that the operating experience review activities should be implemented on an ongoing basis throughout the term of a renewed license.

Sections A.1.6 and B.1.4 state that the applicant's self-assessment process provides for periodic evaluation of the effectiveness of this operating experience program described in the UFSAR supplement. SLRA Sections A.1.6 and B.1.4 state that the operating experience program will be implemented on an ongoing basis throughout the terms of the renewed licenses. SLRA Section A.1.6 provides the UFSAR supplement summary description of the applicant's enhanced programmatic activities for ongoing review of the operating experience. On issuance of the 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 operating experience review activities accordingly.

The staff finds the implementation schedule acceptable because the applicant will implement the operating experience review activities on an ongoing basis throughout the term of the renewed operating licenses.

Based on its review of the SLRA, the staff determined that the applicant's programmatic activities for the ongoing review of operating experience are acceptable for (a) the systematic review of plant-specific and industry operating experience to ensure that the 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 development of new AMPs when it is determined through the evaluation of operating experience that the effects of aging may not be adequately managed. Based on its review, the staff determined that the applicant's operating experience review activities are consistent with the guidance in SRP-SLR, Section A.4.2.

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 operating experience are acceptable for (a) the systematic review of plant-specific and industry operating experience to ensure that the 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 development of new AMPs when it is determined through the evaluation of operating experience that the effects of aging may not be adequately managed. Based on the staff's review and the consistency of the applicant's operating experience review activities with the guidance in SRP-SLR, Section 4.2, the staff finds the applicant's programmatic activities for the ongoing review of operating experience acceptable.

3.0.5.3 UFSAR Supplement

In accordance with 10 CFR 54.21(d), the UFSAR supplement must contain a summary description of the programs and activities for managing the effects of aging. SLRA Section A.1.6 provides the UFSAR supplement summary description of the applicant's programmatic activities for the ongoing review of operating experience that will ensure that plant-specific and industry operating experience related to aging management will be used effectively.

The staff reviewed SLRA Section A.1.6 and found that the summary description of the ongoing evaluation of operating experience related to aging management will consider (a) SSCs,

(b) materials, (c) environments, (d) aging effects, (e) aging mechanisms, and (f) AMPs, and that procedures will be revised to specify these evaluations.

Based on its review, the staff determined that the content of the applicant's summary description is consistent with the example and also is sufficiently comprehensive to describe the applicant's programmatic activities for evaluating operating experience to maintain the effectiveness of the AMPs. Therefore, the staff finds the applicant's UFSAR supplement summary description adequate.

3.0.5.4 Conclusion

Based on its review of the applicant's programmatic activities for the ongoing review of operating experience, the staff finds that the applicant has demonstrated that operating experience 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 concludes that it provides an adequate summary description, as required by 10 CFR 54.21(d).

3.1 Aging Management of Reactor Vessel, 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 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 Evaluations for the Reactor Vessel, Internals, and Reactor Coolant System," is a summary comparison of the applicant's AMRs with those evaluated 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. For AMR items that the staff found to be consistent with the GALL-SLR Report (and no SER section is referenced), the staff determined that no additional evaluation or request for additional information was necessary and finds the items acceptable based on the GALL-SLR Report review of the 10 program elements. For AMR items that required additional evaluation (such as responses to requests for additional information), the staff's evaluation is documented in sections 3.1.2.1.2 through 3.1.2.1.4 below.

Table 3.1-1 Staff Evaluation for Reactor Vessel, Internals, and Reactor Coolant System Components in the GALL-SLR Report

Component Group (SRP-SLR Item No.)	Staff Evaluation
3.1.1-001	Consistent with the GALL-SLR Report (see SER Section 3.1.2.2.1)
3.1.1-002	Not applicable to BWRs (See Section 3.1.2.1.1)
3.1.1-003	Consistent with the GALL-SLR Report (see SER Section 3.1.2.2.1)
3.1.1-004	Consistent with the GALL-SLR Report (see SER Section 3.1.2.2.1)
3.1.1-005	Not applicable to BWRs (see SER Section 3.1.2.1.1)

Component Group (SRP-SLR Item No.)	Staff Evaluation
3.1.1-006	Consistent with the GALL-SLR Report (see SER Section 3.1.2.2.1)
3.1.1-007	Consistent with the GALL-SLR Report (see SER Section 3.1.2.2.1)
3.1.1-008	Not applicable to BWRs (See Section 3.1.2.1.1)
3.1.1-009	Not applicable to BWRs (See Section 3.1.2.1.1)
3.1.1-010	Not applicable to BWRs (See Section 3.1.2.1.1)
3.1.1-011	Consistent with the GALL-SLR Report (see SER Section 3.1.2.2.1)
3.1.1-012	Not applicable to BWRs (See Section 3.1.2.2.1 and 3.1.2.2.2)
3.1.1-013	Consistent with the GALL-SLR Report (see SER Section 3.1.2.2.3, item 1)
3.1.1-014	Consistent with the GALL-SLR Report (see SER Section 3.1.2.2.3, item 2)
3.1.1-015	Not applicable to BWRs (See Section 3.1.2.2.3)
3.1.1-016	Consistent with the GALL-SLR Report (see SER Section 3.1.2.2.4, item 1)
3.1.1-017	Not applicable to PBAPS (see SER Section 3.1.2.2.4, item 2)
3.1.1-018	Not applicable to BWRs (See Section 3.1.2.2.5)
3.1.1-019	Not applicable to BWRs (See Section 3.1.2.2.6)
3.1.1-020	Not applicable to BWRs (See Section 3.1.2.2.1 and 3.1.2.2.6)
3.1.1-021	Not applicable to PBAPS (See Section 3.1.2.2.1 and 3.1.2.2.7)
3.1.1-022	Not applicable to BWRs (See 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 BWRs (See Section 3.1.2.2.11)
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 BWRs (See Section 3.1.2.2.9)
3.1.1-029	Consistent with the GALL-SLR Report (see SER Section 3.1.2.2.12)
3.1.1-030	Consistent with the GALL-SLR Report
3.1.1-031	Not applicable to PBAPS (See Section 3.1.2.1.1)
3.1.1-032	Not applicable to BWRs (See Section 3.1.2.1.1)
3.1.1-033	Not applicable to BWRs (See Section 3.1.2.1.1)
3.1.1-034	Not applicable to BWRs (See Section 3.1.2.1.1)
3.1.1-035	Not applicable to BWRs (See Section 3.1.2.1.1)
3.1.1-036	Not applicable to BWRs (See Section 3.1.2.1.1)
3.1.1-037	Not applicable to BWRs (See Section 3.1.2.1.1)
3.1.1-038	Consistent with the GALL-SLR Report
3.1.1-039	Consistent with the GALL-SLR Report
3.1.1-040	Not applicable to BWRs (See Section 3.1.2.2.1)
3.1.1-040a	Not applicable to BWRs (See Section 3.1.2.2.1)
3.1.1-041	Consistent with the GALL-SLR Report (see SER Section 3.1.2.2.12)
3.1.1-042	Not applicable to BWRs (See Section 3.1.2.1.1)
3.1.1-043	Consistent with the GALL-SLR Report (see SER Section 3.1.2.2.2)
3.1.1-044	Not applicable to BWRs (See Section 3.1.2.1.1)
3.1.1-045	Not applicable to BWRs (See Section 3.1.2.1.1)
3.1.1-046	Not applicable to BWRs (See Section 3.1.2.1.1)
3.1.1-047	Not applicable to BWRs (See Section 3.1.2.1.1)
3.1.1-048	Not applicable to BWRs (See Section 3.1.2.1.1)
3.1.1-049	Not applicable to BWRs (See Section 3.1.2.1.1)

Component Group (SRP-SLR Item No.)	Staff Evaluation
3.1.1-050	Consistent with the GALL-SLR Report
3.1.1-051a	Not applicable to BWRs (See Section 3.1.2.2.9)
3.1.1-051b	Not applicable to BWRs (See Section 3.1.2.2.9)
3.1.1-052a	Not applicable to BWRs (See Section 3.1.2.2.9)
3.1.1-052b	Not applicable to BWRs (See Section 3.1.2.2.9)
3.1.1-052c	Not applicable to BWRs (See Section 3.1.2.2.9)
3.1.1-053a	Not applicable to BWRs (See Section 3.1.2.2.9)
3.1.1-053b	Not applicable to BWRs (See Section 3.1.2.2.9)
3.1.1-053c	Not applicable to BWRs (See Section 3.1.2.2.9)
3.1.1-054	Not applicable to BWRs (See Section 3.1.2.2.1)
3.1.1-055a	Not applicable to BWRs (See Section 3.1.2.2.9)
3.1.1-055b	Not applicable to BWRs (See Section 3.1.2.2.9)
3.1.1-055c	Not applicable to BWRs (See Section 3.1.2.2.9)
3.1.1-056a	Not applicable to BWRs (See Section 3.1.2.2.9)
3.1.1-056b	Not applicable to BWRs (See Section 3.1.2.2.9)
3.1.1-056c	Not applicable to BWRs (See 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	Not applicable to BWRs (See Section 3.1.2.2.9)
3.1.1-058b	Not applicable to BWRs (See Section 3.1.2.2.9)
3.1.1-059a	Not applicable to BWRs (See Section 3.1.2.2.9)
3.1.1-059b	Not applicable to BWRs (See Section 3.1.2.2.9)
3.1.1-059c	Not applicable to BWRs (See Section 3.1.2.2.9)
3.1.1-060	Consistent with the GALL-SLR Report (see SER Section 3.1.2.1.2)
3.1.1-061	Not applicable to BWRs (See Section 3.1.2.1.1)
3.1.1-062	Consistent with the GALL-SLR Report
3.1.1-063	Consistent with the GALL-SLR Report
3.1.1-064	Not applicable to BWRs (See Section 3.1.2.1.1)
3.1.1-065	Not applicable to BWRs (See Section 3.1.2.1.1)
3.1.1-066	Not applicable to BWRs (See Section 3.1.2.1.1)
3.1.1-067	Consistent with the GALL-SLR Report
3.1.1-068	Not applicable to BWRs (See Section 3.1.2.1.1)
3.1.1-069	Not applicable to BWRs (See Section 3.1.2.1.1)
3.1.1-070	Not applicable to BWRs (See Section 3.1.2.1.1)
3.1.1-071	Not applicable to BWRs (See Section 3.1.2.1.1)
3.1.1-072	Not applicable to BWRs (See Section 3.1.2.1.1)
3.1.1-073	Not applicable to BWRs (See Section 3.1.2.1.1)
3.1.1-074	Not applicable to BWRs (See Section 3.1.2.1.1)
3.1.1-075	Not applicable to BWRs (See Section 3.1.2.1.1)
3.1.1-076	Not applicable to BWRs (See Section 3.1.2.1.1)
3.1.1-077	Not applicable to BWRs (See Section 3.1.2.1.1)
3.1.1-078	Not applicable to BWRs (See Section 3.1.2.1.1)
3.1.1-079	Consistent with the GALL-SLR Report
3.1.1-080	Not applicable to BWRs (See Section 3.1.2.1.1)
3.1.1-081	Not applicable to BWRs (See Section 3.1.2.1.1)
3.1.1-082	Not applicable to BWRs (See Section 3.1.2.1.1)

Component Group (SRP-SLR Item No.)	Staff Evaluation
3.1.1-083	Not applicable to BWRs (See Section 3.1.2.1.1)
3.1.1-084	Consistent with the GALL-SLR Report
3.1.1-085	Consistent with the GALL-SLR Report
3.1.1-086	Not applicable to BWRs (See Section 3.1.2.1.1)
3.1.1-087	Not applicable to BWRs (See Section 3.1.2.1.1)
3.1.1-088	Not applicable to BWRs (See Section 3.1.2.1.1)
3.1.1-089	Not applicable to BWRs (See Section 3.1.2.1.1)
3.1.1-090	Not applicable to BWRs (See Section 3.1.2.1.1)
3.1.1-091	Consistent with the GALL-SLR Report
3.1.1-092	Not applicable to BWRs (See Section 3.1.2.1.1)
3.1.1-093	Not applicable to BWRs (See Section 3.1.2.1.1)
3.1.1-094	Consistent with the GALL-SLR Report
3.1.1-095	Consistent with the GALL-SLR Report
3.1.1-096	Consistent with the GALL-SLR Report
3.1.1-097	Consistent with the GALL-SLR Report
3.1.1-098	Consistent with the GALL-SLR Report
3.1.1-099	Consistent with the GALL-SLR Report (see SER Section 3.1.2.2.13)
3.1.1-100	Consistent with the GALL-SLR Report
3.1.1-101	Consistent with the GALL-SLR Report
3.1.1-102	Consistent with the GALL-SLR Report
3.1.1-103	Consistent with the GALL-SLR Report (see SER Section 3.1.2.2.12)
3.1.1-104	Consistent with the GALL-SLR Report
3.1.1-105	Not applicable to PBAPS (see SER Sections 3.1.2.1.1 and 3.1.2.2.15)
3.1.1-106	Not applicable to PBAPS (see SER Section 3.1.2.1.1)
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	Consistent with the GALL-SLR Report (see SER Section 3.1.2.1.2)
3.1.1-111	Not applicable to BWRs (see SER Section 3.1.2.1.1)
3.1.1-112	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.1.1-113	Consistent with the GALL-SLR Report
3.1.1-114	Consistent with the GALL-SLR Report
3.1.1-115	Not applicable to PBAPS (see SER Section 3.1.2.1.1 and 3.1.2.2.15)
3.1.1-116	Not applicable to BWRs (See SER Sections 3.1.2.1.1 and 3.1.2.2.10)
3.1.1-117	Not applicable to BWRs (See SER Sections 3.1.2.1.1 and 3.1.2.2.10)
3.1.1-118	Not applicable to BWRs (See SER Sections 3.1.2.1.1 and 3.1.2.2.9)
3.1.1-119	Not applicable to BWRs (See SER Sections 3.1.2.1.1 and 3.1.2.2.9)
3.1.1-120	Consistent with the GALL-SLR Report (see SER Section 3.1.2.2.14)
3.1.1-121	Consistent with the GALL-SLR Report
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	Not applicable to BWRs (See Section 3.1.2.2.1)
3.1.1-126	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.1.1-127	Not applicable to BWRs (See Section 3.1.2.2.1)

Component Group (SRP-SLR Item No.)	Staff Evaluation
3.1.1-128	Consistent with the GALL-SLR Report
3.1.1-129	Not applicable to PBAPS (See Section 3.1.2.2.1)
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	Consistent with the GALL-SLR Report
3.1.1-134	Not used. Addressed by 3.3.1-182.
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 SER Section 3.1.2.2.16)
3.1.1-137	Consistent with the GALL-SLR Report (see SER Section 3.3.2.1.12)
3.1.1-138	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.1.1-139	Not applicable to BWRs (see SER Sections 3.1.2.1.1 and 3.1.2.2.6)

The staff's review of component groups, as described in SER Section 3.0.2.2, is summarized in the following three sections:

(1) SER Section 3.1.2.1 discusses AMR results for components that the applicant states are either not applicable to PBAPS 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. The remaining subsections in SER Section 3.1.2.1 document the review of components that required additional information or otherwise require explanation.

(2) SER Section 3.1.2.2 discusses AMR results for which the GALL-SLR Report and SRP-SLR recommend further evaluation.

(3) SER 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; 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.

Additionally, Section 3.1.2.1.1 documents the staff's review of AMR items that the applicant determined to not be applicable or not used.

3.1.2.1.1 Aging Management Review Results Identified as Not Applicable or Not Used

For Table 1 items 3.1.1-017, 3.1.1-021, 3.1.1-031, 3.1.1-105, 3.1.1-106, 3.1.1-115, and 3.1.1-129, Exelon claimed that they were not applicable to PBAPS. The staff reviewed the SLRA and UFSAR and confirmed that the combination of aging effect, material, and environment represented by the Table 1 item does not exist at the site. Therefore, there are no AMR results that are applicable for these items or the items require no aging management.

SLRA Table 3.1.1 items 3.1-1-002, 3.1-1-005, 3.1-1-008, 3.1-1-009, 3.1-1-010, 3.1-1-012, 3.1-1-015, 3.1.1-017, 3.1-1-018, 3.1-1-019, 3.1-1-020, 3.1-1-021, 3.1-1-022, 3.1-1-025, 3.1-1-028, 3.1.1-.031,3.1-1-032, 3.1-1-033, 3.1-1-034, 3.1-1-035, 3.1-1-036, 3.1-1-037, 3.1-1-040, 3.1-1-040a, 3.1-1-042, 3.1-1-044, 3.1-1-045, 3.1-1-046, 3.1-1-047, 3.1-1-048, 3.1-1-049, 3.1-1-051a, 3.1-1-051b, 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, 3.1-1-055a, 3.1-1-055b, 3.1-1-055c, 3.1-1-056a, 3.1-1-056b, 3.1-1-056c, 3.1-1-058a, 3.1-1-058b, 3.1-1-059a, 3.1-1-059b, 3.1-1-059c, 3.1-1-061, 3.1-1-064, 3.1-1-065, 3.1-1-066, 3.1-1-068, 3.1-1-069, 3.1-1-070, 3.1-1-071, 3.1-1-072, 3.1-1-073, 3.1-1-074, 3.1-1-075, 3.1-1-076, 3.1-1-077, 3.1-1-078, 3.1-1-080, 3.1-1-081, 3.1-1-082, 3.1-1-083, 3.1-1-086, 3.1-1-087, 3.1-1-088, 3.1-1-089, 3.1-1-090, 3.1-1-092, 3.1-1-093, 3.1-1-105, 3.1-1-106, 3.1-1-111, 3.1-1-115, 3.1-1-116, 3.1-1-117, 3.1-1-118, 3.1-1-119, 3.1-1-125, 3.1-1-127, 3.1-1-129, and 3.1-1-139 have been identified as not being applicable to the SLRA. The staff reviewed and confirmed these AMR items are not applicable to PBAPS because these items are applicable only to PWRs.

SLRA Table 3.1.1 item 3.1.1-134 is not used. Item 3.3.1-182 is used instead. The staff reviewed and confirmed this alternate item is acceptable because it adequately addresses the relevant aging effects.

3.1.2.1.2 Wall Thinning Due to Erosion

SLRA Tables 3.1.2-1, 3.1.2-3, 3.2.2-3, 3.2.2-5, 3.3.2-26, 3.4.2-3, 3.4.2-4, and 3.4.2-5 include AMR items associated with Table 1 items 3.1.1-060, 3.1.1-110, 3.2.1-065, 3.3.1-126, and 3.4.1-060 that address wall thinning for steel and stainless steel piping components exposed to raw water, steam, treated water, treated water greater than 140 °F, and treated water greater than 200 °F. During its review of components associated with these AMR items for which Exelon cited generic note A, the staff noted that the SLRA credits the Flow-Accelerated Corrosion program to manage the aging effect in two different treated water environments (greater than 140 °F and greater than 200 °F) as opposed to the one environment described in the associated GALL-SLR Report item, reactor coolant, which is treated water, without a temperature designation. The staff finds that this difference between the GALL-SLR Report and the SLRA is insignificant because the aging effect being managed and the credited AMP would be the same for either temperature environment. The staff finds that Exelon’s proposal to use AMR items 3.1.1-060, 3.1.1-110, 3.2.1-065, 3.3.1-126, and 3.4.1-060 in the cited environments is 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, as recommended in the GALL-SLR Report, for the RCS components and provides information concerning how it will manage the applicable aging effects. The staff reviewed the applicant’s evaluation of component groups of which the GALL-SLR Report recommends further evaluation 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 states that TLAAs are evaluated in accordance with 10 CFR 54.21(c)(1) and that the TLAAs for evaluating cumulative fatigue damage or cracking due to fatigue or cyclic loading in reactor coolant system components or reactor vessel internals are addressed in SLRA Section 4.3, Subsections 4.3.1, 4.3.2, 4.3.3, 4.3.5, 4.3.6, 4.3.7, or 4.3.8. This is consistent with SRP-SLR Section 3.1.2.2.1 and is, therefore, acceptable. The staff's evaluations of these TLAAs are documented in SER Sections 4.3.1, 4.3.2, 4.3.3, 4.3.5, 4.3.6, 4.3.7, and 4.3.8.

3.1.2.2.2 Loss of Material due to General, Pitting, and Crevice Corrosion

SLRA Section 3.1.2.2.2.1 associated with SLRA Table 3.1.1, AMR item 3.1.1-012, addresses loss of material due to general, pitting, and crevice corrosion in the steel PWR steam generators upper and lower shell and transition cone exposed to secondary feedwater and steam. Exelon stated that this item is not applicable. The staff evaluated Exelon's claim against the criteria of SRP-SLR Section 3.1.2.2.2.1 and finds it acceptable because the item is only applicable to PWR steam generators.

SLRA Section 3.1.2.2.2.2 associated with SLRA Table 3.1.1, AMR item 3.1.1-012, addresses loss of material due to general, pitting, and crevice corrosion in the steel PWR steam generator shell assembly exposed to secondary feedwater and steam. Exelon stated that this item is not applicable. The staff evaluated Exelon's claim against the criteria of SRP-SLR Section 3.1.2.2.2.2 and finds it acceptable because the item is only applicable to PWR steam generators.

SLRA Table 3.1.1, AMR item 3.1.1-043, addresses loss of material due to pitting, crevice corrosion in stainless steel and nickel alloy reactor vessel internals exposed to reactor coolant. For the SLRA Table 2 AMR items that cite generic note E, the SLRA credits the BWR Vessel Internals to manage the aging effect for reactor vessel internals components such as core shroud, core plate access hole cover, core plate, core shroud support structure, core plate bolts, core spray lines, spargers, core spray rings, spray nozzles, thermal sleeves, core spray sparger nozzle, jet pump assemblies, fuel supports, control rod drive assemblies, instrumentation, steam dryers, and top guide. The AMR items cite plant-specific note 6, which states, "The BWR Vessel (B.2.1.7) program is substituted to manage the aging effect(s) applicable to this component type, material, and environment combination."

Based on its review of components associated with AMR item 3.1.1-043 for which Exelon cited generic note E, the staff finds Exelon's proposal to manage the effects of aging using the BWR Vessel Internals acceptable because (1) the program includes inspection and flaw evaluation in conformance with the guidelines of applicable staff-approved BWRVIP reports and ASME Code Section XI and (2) the staff has confirmed that the program will be capable of detecting and managing any loss of material that may occur in the reactor vessel internal components as a result of a pitting or crevice corrosion mechanism.

3.1.2.2.3 Loss of Fracture Toughness due to Neutron Irradiation Embrittlement

Item 1. SLR Section 3.1.2.2.3, item 1, states that TLAAs are evaluated in accordance with 10 CFR 54.21(c)(1) and that the evaluation of the TLAAs for assessing neutron irradiation embrittlement in ferritic reactor pressure vessel (RPV) components with neutron fluence exposures more than 1×10^{17} n/cm^2 (E > 1 MeV) are given in SLRA Section 4.2. This is consistent with SRP-SLR Section 3.1.2.2.3, item 1, and is, therefore, acceptable. The staff's evaluations regarding the neutron embrittlement TLAAs for the RPV components are documented in SER Section 4.2, Subsection 4.2.1.1, and Subsections 4.2.2-4.2.7.

Item 2. SLRA Section 3.1.2.2.3.2, associated with SLRA Table 3.1.1 AMR item 3.1.1-014, addresses loss of fracture toughness due to neutron irradiation embrittlement in steel reactor pressure vessel beltline shell, nozzle, and weld components exposed to a reactor coolant with neutron flux environment, which will be managed by the Neutron Fluence Monitoring program (SLRA AMP B.3.1.2) and the Reactor Vessel Material Surveillance program (SLRA AMP B.2.1.20). The staff reviewed Exelon's proposal against the criteria in SRP-SLR Section 3.1.2.2.3, item 2.

The staff confirmed that the applicant's AMR basis is consistent with the criteria in SRP-SLR Section 3.1.2.2.3, item 2, which indicate that the Neutron Fluence Monitoring and Reactor Vessel Material Surveillance programs may be used in combination with one another to manage loss of fracture toughness due to neutron irradiation embrittlement in these components. In its review of components associated with AMR item 3.1.1-014, the staff finds that Exelon has met the further evaluation criteria. The staff also finds that Exelon's proposal to manage the effects of aging using the Neutron Fluence Monitoring program and the Reactor Vessel Material Surveillance program is acceptable because this is consistent with the acceptance criteria in SRP-SLR Section 3.1.2.2.3, item 2, and the AMR bases in SRP-SLR Table 3.1-1, item 014, and GALL-SLR Report AMR item IV.A1-227.

Based on the programs identified, the staff concludes that Exelon's programs meet the acceptance criteria defined in SRP-SLR Section 3.1.2.2.3, item 2. For those AMR items associated with SLRA Section 3.1.2.2.3, item 2, the staff concludes that the SLRA is consistent with the GALL-SLR Report and that Exelon 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 3.1.2.2.3.3, associated with SLRA Table 3.1.1 AMR item 3.1.1-015, addresses loss of fracture toughness for Babcock & Wilcox (B&W) reactor internals exposed to neutron flux, which will be managed by the B&W Owners Group Report BAW-2248. The staff reviewed Exelon's proposal against the criteria in SRP-SLR Section 3.1.2.2.3.3.

In its review of components associated with AMR item 3.1.1-015, the staff finds this item is not applicable to Exelon's programs because it is applicable to PWRs only.

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, associated with SLRA Table 3.1.1, item 3.1.1-016, addresses cracking for stainless steel or nickel alloy reactor vessel top head enclosure flange leak detection line exposed to uncontrolled indoor air, which will be managed by the One-Time Inspection program. The staff reviewed Exelon's proposal against the criteria in SRP-SLR Section 3.1.2.2.4, item 1.

In its review of components associated with item 3.1.1-016, the staff finds that Exelon has met the further evaluation criteria, and Exelon's proposal to manage the effects of aging using the One-Time Inspection program is acceptable because a one-time inspection to verify that cracking does not occur in the associated components is consistent with the approach discussed in SRP-SLR Section 3.1.2.2.4, item 1.

Based on the program identified, the staff concludes that Exelon's program meets SRP-SLR Section 3.1.2.2.4, item 1. For those items associated with item 1 of SLRA Section 3.1.2.2.4, the staff concludes that the SLRA is consistent with the GALL-SLR Report and that Exelon 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 3.1.2.2.4.2 associated with SLRA Table 3.1.1, item 3.1.1-017, addresses cracking due to SCC and IGSCC that could occur in stainless steel (SS) BWR isolation condenser components exposed to reactor coolant. Exelon stated that this item is not applicable. The staff evaluated Exelon's claim against the criteria of SRP-SLR Section 3.1.2.2.4.2 and finds it acceptable because a review of the PBAPS Units 2 and 3 UFSAR confirmed that the PBAPS design does not include a BWR isolation condenser.

3.1.2.2.5 Crack Growth Due to Cyclic Loading

SLRA Section 3.1.2.2.5, associated with SLRA Table 3.1.1, AMR item 3.1.1-018, addresses crack growth due to cyclic loading for reactor pressure vessel shell forgings clad with stainless steel using a high heat input welding process. Exelon stated that this item is not applicable. The staff reviewed Exelon's proposal against the criteria in SRP-SLR Section 3.1.2.2.5 and finds it acceptable because: (a) SRP-SLR Section 3.1.2.2.5 and the corresponding AMR item (i.e., AMR item 18 in SRP-SLR Table 3.1-1) are only applicable to PWR-designed reactors, and (b) the UFSAR identifies that the reactors at the PBAPS facility are boiling water reactor designs.

3.1.2.2.6 Cracking Due to Stress Corrosion Cracking

Item 1. SLRA Section 3.1.2.2.6.1 associated with SLRA Table 3.1.1, AMR item 3.1.1-019, addresses cracking due to SCC in PWR stainless steel bottom-mounted instrument guide tubes exposed to reactor coolant. Exelon stated that this item is not applicable. The staff evaluated Exelon's claim against the criteria of SRP-SLR Section 3.1.2.2.6.1 and finds it acceptable because the item is only applicable to PWRs and PBAPS is a BWR plant.

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 stress corrosion cracking in Class 1 PWR cast austenitic stainless steel (CASS) reactor coolant system piping and piping components exposed to reactor coolant. Exelon stated that this item is not applicable because the PBAPS is a BWR plant. The staff evaluated Exelon's claim against the criteria in SRP-SLR Section 3.1.2.2.6, item 2, and finds it acceptable because the item is only applicable to PWR plants and PBAPS is a BWR plant.

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 stress corrosion cracking of stainless steel or nickel alloy reactor vessel flange leak detection lines of PWR light-water facilities. This item is applicable to PWRs only, and therefore is not used for PBAPS which is a BWR plant.

3.1.2.2.7 Cracking Due to Cyclic Loading

SLRA Section 3.1.2.2.7 associated with SLRA Table 3.1.1, AMR item 3.1.1-021, addresses cracking due to cyclic loading that could occur in steel and stainless steel BWR isolation condenser components exposed to reactor coolant. Exelon stated that this item is not applicable. The staff evaluated Exelon's claim against the criteria in SRP-SLR Section 3.1.2.2.7 and finds it acceptable because review of the PBAPS Units 2 and 3 UFSAR confirmed that the PBAPS design does not include a BWR isolation condenser.

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 feedwater impingement plates and supports exposed to secondary feedwater. Exelon stated that this item is not applicable. The staff evaluated Exelon's claim against the criteria in SRP-SLR Section 3.1.2.2.8 and finds it acceptable because both PBAPS Units 2 and 3 are BWRs and do not have any steam generators.

3.1.2.2.9 Aging Management of Pressurized-Water Reactor Vessel Internals

SLRA Section 3.1.2.2.9, associated with SLRA Table 3.1.1, AMR items 3.1.1-028, -051a, -051b, -052a, -052b, -052c, -053a, -053b, -053c, -055a, -055b, -055c, -056a, -056b, -056c, -058a, -058b, -059a, -059b, -059c, -118, -119, addresses the aging management of PWR vessel internals, which will be managed by the Electric Power Research Institute (EPRI) MRP-227-A guidelines. The staff reviewed Exelon's proposal against the criteria in SRP-SLR Section 3.1.2.2.9.

In its review of components associated with AMR items 3.1.1-028, -051a, -051b, -052a, -052b, -052c, -053a, -053b, -053c, -055a, -055b, -055c, -056a, -056b, -056c, -058a, -058b, -059a, -059b, -059c, -118, -119, the staff finds these items are not applicable to Exelon's programs because they are applicable to PWRs only.

Based on the programs identified, the staff concludes that SRP-SLR Section 3.1.2.2.9 criteria are not applicable to Exelon's programs. For those AMR items associated with SLRA Section 3.1.2.2.9 (items 3.1.1-028, -051a, -051b, -052a, -052b, -052c, -053a, -053b, -053c, -055a, -055b, -055c, -056a, -056b, -056c, -058a, -058b, -059a, -059b, -059c, -118, -119), the staff that these items are not applicable to Exelon's programs since they are applicable to PWRs only.

3.1.2.2.10 Loss of Material Due to Wear

SLRA Section 3.1.2.2.10, associated with SLRA Table 3.1.1 AMR items 3.1.1-116 and -117, addresses loss of material due to wear for nickel alloy and stainless steel control rod drive head penetration nozzles and thermal sleeves, which will be managed by a plant-specific AMP. The staff reviewed Exelon's proposal against the criteria in SRP-SLR Section 3.1.2.2.10.

In its review of components associated with AMR items 3.1.1-116 and -117, the staff finds these items are not applicable to Exelon's programs because they are applicable to PWRs only.

3.1.2.2.11 Cracking Due to Primary Water Stress Corrosion Cracking

Item 1. SLRA Section 3.1.2.2.11, associated with SLRA Table 3.1.1, AMR item 3.1.1-025, addresses cracking for steam generator divider plate assemblies exposed to secondary feedwater. Exelon stated that this item is not applicable. The staff evaluated Exelon's claim against the criteria in SRP-SLR Section 3.1.2.2.11, item 1, and finds it acceptable because both PBAPS units are BWRs and do not have any steam generators.

Item 2. SLRA Section 3.1.2.2.11, associated with SLRA Table 3.1.1, AMR item 3.1.1-025, addresses cracking for steam generator tube-to-tubesheet welds exposed to reactor coolant. Exelon stated that this item is not applicable. The staff evaluated Exelon's claim against the criteria in SRP-SLR Section 3.1.2.2.11, item 2, and finds it acceptable because both PBAPS units are BWRs and do not have any steam generators.

3.1.2.2.12 Cracking Due to Irradiation-Assisted Stress Corrosion Cracking

SLRA Section 3.1.2.2.12, associated with SLRA Table 3.1., AMR items 3.1.1-029, -041, and -103, addresses irradiation-assisted stress corrosion cracking (IASCC) for stainless steel and nickel alloy reactor vessel internal components exposed to reactor coolant with neutron flux, which will be managed by the BWR Vessel Internals program (SLRA AMP B.2.1.7 and the Water Chemistry program (SLRA AMP B.2.1.2). The staff reviewed Exelon's proposal against the criteria in SRP-SLR Section 3.1.2.2.12.

In its review of components associated with AMR items 3.1.1-029, -041, and -103, the staff finds that Exelon has met the further evaluation criteria, and Exelon's proposal to manage the effects of aging using the BWR Vessel Internals AMP is acceptable because: (a) the AMR basis is consistent with the acceptance criteria defined in SRP-SLR Section 3.1.2.2.12 and with AMR items 29, 41, and 103 in SRP-SLR Table 3.1-1, (b) Exelon's BWR Vessel Internals program will implement specific staff-approved augmented inspection methodologies of the EPRI BWRVIP to manage cracking due to IASCC in the reactor internals during the subsequent period of extended operation, (c) Exelon's Water Chemistry program is designed to minimize the concentrations of corrosive impurities that may be present in the reactor coolant and to mitigate the impacts that IASCC or other corrosive aging mechanisms may have on the structural integrity of the components during the subsequent period of extended operation, and (d) Exelon's programmatic basis is consistent with programmatic criteria referenced and defined for these types of AMPs in GALL-SLR Report AMP XI.M9, "BWR Vessel Internals," and GALL-SLR Report AMP XI.M2, "Water Chemistry."

Based on the programs identified, the staff concludes that Exelon's programs meet SRP-SLR Section 3.1.2.2.12 criteria. For those AMR items associated with SLRA Section 3.1.2.2.12 (items 3.1.1-029, -041, and -103), the staff concludes that the SLRA is consistent with the GALL-SLR Report and that Exelon 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).

3.1.2.2.13 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 AMR item 3.1.1-099, addresses loss of fracture toughness due to neutron irradiation or thermal aging embrittlement for stainless steel and nickel alloy reactor vessel internal components exposed to reactor coolant with neutron flux, which will be managed by the BWR Vessel Internals program (SLRA Section B.2.1.7). The staff reviewed Exelon's proposal against the criteria in SRP-SLR Section 3.1.2.2.13.

In its review of components associated with AMR item 3.1.1-099, the staff finds that Exelon has met the further evaluation criteria, and Exelon's proposal to manage the effects of aging using the BWR Vessel Internals AMP is acceptable because: (a) the AMR basis is consistent with the acceptance criteria defined in SRP-SLR Section 3.1.2.2.13 and with AMR item 99 in SRP-SLR Table 3.1-1, (b) Exelon's BWR Vessel Internals program will implement specific staff-approved augmented inspection methodologies issued by the EPRI BWRVIP to manage the impacts that loss of fracture toughness may have on the intended functions of the components during the subsequent period of extended operation, and (c) the applicant's programmatic basis is consistent with programmatic criteria referenced and defined for these types of AMPs in GALL-SLR Report AMP XI.M9, "BWR Vessel Internals."

Based on the programs identified, the staff concludes that Exelon's programs meet SRP-SLR Section 3.1.2.2.13 criteria. For those AMR items associated with SLRA Section 3.1.2.2.13 (item 3.1.1-099), the staff concludes that the SLRA is consistent with the GALL-SLR Report and that Exelon 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).

3.1.2.2.14 Loss of Preload Due to Thermal or Irradiation-Enhanced Stress Relaxation or Stress Corrosion Cracking

SLRA Section 3.1.2.2.14, as amended in the applicant's letter of October 9, 2019 (ADAMS Accession No. ML19283A362) and associated with SLRA Table 3.1.1 AMR item 3.1.1-120, addresses loss of preload due to thermal or irradiation-enhanced stress relaxation for stainless steel core plate rim hold-down bolts exposed to reactor coolant with neutron flux. The related AMR Item in SRLA Table 3.1.2-1 that references SLRA Item 3.1.1-120 and GALL-SLR AMR Item IV.B1.R-420 using the BWR Vessel Internals Program is subject to NEI Generic Note B. As described in Section 3.0.2.2, "Review of AMR Results," Generic Note B states that the AMP takes one or more exceptions to the GALL-SLR Report AMP. For these components, the applicable AMP is SLRA AMP B.2.1.7, "BWR Vessel Internals Program and the applicable TLAA is the plant-specific TLAA for the core plate rim hold-down bolts in SLRA Section 4.2.9. The staff reviewed Exelon's proposal against the criteria in SRP-SLR Section 3.1.2.2.14.

In its letter dated October 9, 2019, the applicant amended SLRA Section 3.1.2.2.14 to include an updated SLRA enhancement for managing aging in the core plate rim hold-down bolts:

> The BWR Vessel Internals (B.2.1.7) program is enhanced in accordance with BWRVIP-25, Revision 1 to install core plate wedges, or inspect core plate rim hold-down bolts for stress corrosion cracking, or demonstrate via analysis that the installation of wedges and inspections of the core plate rim hold-down bolts are not required, no later than six months prior to the second period of extended operation, or before the end of the last refueling outage prior to the second period of extended operation, whichever occurs later.

In its review of components associated with AMR item 3.1.1-120, the staff noted that loss of preload could potentially be induced in the core plate rim hold-down bolts by either a thermal or irradiation-enhanced stress relaxation mechanism or by a stress corrosion cracking mechanism.

The staff also noted that the BWR Vessel Internals program currently takes a deviation from the inspection protocols for core plate rim hold-down bolts in EPRI Report BWRVIP-25-A because the inspections are impractical for implementation. The staff noted that the applicant states that the deviation will be in place until revised BWRVIP guidance for the bolts or some other alternative for aging management is approved by the NRC. However, the staff also noted that the applicant appropriately addressed loss of preload in the bolts through the plant-specific TLAA that has been provided and evaluated in SLRA Section 4.2.9, “Core Plate Rim Hold-down Bolt Loss of Preload Analysis.” The staff has determined that the current existing TLAA provides an adequate, alternate basis for managing loss of preload in the core plate rim hold-down bolts during the subsequent period of extended operation; given the existing deviation from the BWRVIP-25-A methodology, the staff notes that this is in lieu of performing any inspections of the bolts for evidence of preload loss at this time.

Alternatively, the staff finds that if the applicant revises the CLB to include implementation of the revised guidance in the BWRVIP-25, Revision 1, report, the applicant may use either the inspection methods defined in the report to manage loss of preload and irradiation-assisted stress corrosion cracking in the core plate rim hold-down bolts during the subsequent period of extended operation, or the generic analytical TLAA methodology defined in the report to demonstrate that the amount of preload loss in the core plate rim hold-down bolts will remain at acceptable levels during the subsequent period of extended operation. Additional details are provided in the staff’s evaluation of Enhancement 1 in SLRA AMP B.2.1.7, “BWR Vessel Internals Program,” as documented in SER section 3.0.3.2.3.

Based on the staff’s review, the staff concludes that the TLAA proposed in SRLA Section 4.2.9 provides an acceptable alternative basis for addressing the aging management matters raised in SRP-SLR Section 3.1.2.2.14 and for managing loss of preload in the core plate rim hold-down bolts during the subsequent period of extended operation, as required by the provisions in 10 CFR 54.21(a)(3). The staff’s evaluation of the applicable TLAA for the core plate rim hold-down bolts is given in SER Section 4.2.9. The staff’s evaluation of the BWR Vessel Internals Program is documented in SER Section 3.0.3.2.3.

3.1.2.2.15 Loss of Material Due to General, Crevice or Pitting Corrosion and Cracking Due to Stress Corrosion Cracking

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 applicable aging effects for steel or stainless steel piping and piping components exposed to concrete. Exelon stated that these items are not applicable. The staff evaluated Exelon’s claim and finds it acceptable because the staff confirmed that Exelon’s SLRA does not have any AMR results that are applicable for these items. The staff also reviewed the UFSAR and did not identify any in-scope steel or stainless steel components located in the reactor coolant system exposed to concrete that would be susceptible to water intrusion.

3.1.2.2.16 Loss of Material Due to Pitting and Crevice Corrosion in Stainless Steel and Nickel Alloys

SLRA Section 3.1.2.2.16, associated with SLRA Table 3.1.1 AMR item 3.1.1-136, evaluates the loss of material due to pitting and crevice corrosion in stainless steel and nickel alloy piping, piping components exposed to air and condensation. The staff reviewed Exelon’s proposal against the criteria in SRP-SLR Section 3.1.2.2.16. The staff noted that in the SLRA Section 3.1.2.2.16, Exelon stated that plant-specific operating experience associated with stainless steel and nickel alloy piping, and piping components, in the Reactor Vessel, Internals, and Reactor Coolant System was evaluated to determine if prolonged exposure to uncontrolled indoor air or condensation had resulted in loss of material, due to pitting or crevice corrosion. Loss of material was not identified as an aging effect at PBAPS for the stainless steel and nickel alloy components in these environments, or as a result of transportable halogens, indicating that these environments do not contain sufficient halides (e.g., chlorides) in the presence of moisture to result in loss of material. Accordingly, Exelon is proposing to implement the One-Time Inspection (B.2.1.21) program to demonstrate that the loss of material aging effect does not occur in stainless steel and nickel alloy piping, and piping components, exposed to uncontrolled indoor air or condensation in the Reactor Vessel, Internals, and Reactor Coolant System. Exelon stated that deficiencies will be documented in accordance with 10 CFR Part 50, Appendix B, "Corrective Action Program," and that the One-Time Inspection (B.2.1.21) program is described in Appendix B.

In its review of components associated with AMR item 3.1.1-136, the staff finds that Exelon has met the further evaluation criteria, and Exelon's proposal to manage the effects of aging using the One-Time Inspection program is acceptable because its operating experience does not identify any loss of material due to pitting or crevice corrosion in stainless steel and nickel alloy piping, and piping components, in the Reactor Vessel, Internals, and Reactor Coolant System, or as a result of transportable halogens, indicating that these environments do not contain sufficient halides (e.g., chlorides) in the presence of moisture to result in loss of material. Based on the program identified, the staff concludes that Exelon's program meets SRP-SLR Section 3.1.2.2.16 criteria. For those AMR items associated with SLRA Section 3.1.2.2.16, the staff concludes that the SLRA is consistent with the GALL-SLR Report and that Exelon 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).

3.1.2.2.17 Quality Assurance for Aging Management of Nonsafety-Related Components

SER Section 3.0.4 documents the staff's evaluation of the applicant's QA program.

3.1.2.2.18 Ongoing Review of Operating Experience

SER Section 3.0.5 documents the staff's evaluation of the applicant's ongoing review of operating experience.

3.1.2.3 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 3.1.2-1 through 3.1.2-4 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.

3.1.2.3.1 Reactor Pressure Vessel (RPV) Component External Surfaces Exposed to Uncontrolled Indoor Air

Components citing item 3.1.1-124 in SLRA Table 3.1.2-1 state that loss of material for steel components exposed to uncontrolled indoor air is not applicable and no AMP is proposed. The AMR items cite generic note I and plant-specific note 9. SLRA Table 3.1.1, item 3.1.1-124, explains that external surfaces of components in the reactor vessel, internals, and reactor coolant system during both operation and shutdown are normally above the dewpoint temperature. Consequently, loss of material due to general pitting or crevice corrosion will not occur because there will be no wetting from condensation.

The staff reviewed the associated items in the SLRA to confirm this aging effect is not applicable for this component, material, and environment combination. The staff finds Exelon's proposal of no AMP acceptable because loss of material caused by external corrosion from accumulation of moisture on reactor pressure vessel components is unlikely at the normal operating temperatures of these components inside containment.

<u>Jet Pump Assembly (Thermal Sleeve Inlet Headers, Riser Brace Arms, Hold-down Beams, and Auxiliary Wedges) Exposed to Reactor Coolant and Neutron Flux</u>

SLRA Table 3.1.2-1 states that the loss of material due to wear in jet pump assembly thermal sleeve inlet headers, riser brace arms, hold-down beams, and auxiliary wedges that are made from X-750 Nickel-based alloy materials and are exposed to a reactor coolant with neutron flux environment will be managed by the BWR Vessel Internals program (SRLA AMP B.2.1.7). The AMR items cite generic note H, for which Exelon has identified loss of material due to wear is an applicable AERM for the components. The AMR items also cite plant-specific note 7, which states that the BWR Vessel Internals program is used to manage loss of material due to wear in the specified components.

The staff finds Exelon's proposal to manage loss of material due to wear acceptable because the BWR Vessel Internals program performs augmented inspections of jet pump assembly components through implementation of the NRC-approved methodology in EPRI Report No. BWRVIP-41 (as approved in the NRC's safety evaluation report of June 5, 2001 (ADAMS Accession No. ML011570460)), and because the EPRI methods implement visual inspection and evaluation techniques that are capable of detecting and monitoring for evidence wear that may be occurring in the components.

3.1.2.3.2 Fuel Assemblies Exposed to a Reactor Coolant with Neutron Flux Environment

SLRA Table 3.1.2-4 includes a plant-specific aging management review (AMR) item for the fuel assemblies that are included with the reactor pressure vessels and are exposed to a reactor coolant with neutron flux environment. The AMR item cites plant-specific note 1. In this plant-specific note, the applicant stated that the fuel assemblies are subject to replacement in accordance with the applicant core re-loading process and are therefore considered to be short-lived components. The applicant stated that the fuel assemblies are not subject to aging management.

The staff reviewed the associated item against the regulatory provisions at 10 CFR 54.21(a)(1) to confirm that the fuel assemblies do not need to be within the scope of an AMR. The staff noted that 10 CFR 54.21(a)(1) identifies, in part, that passive components do not need to be included within the scope of an AMR if the components are subject to replacement on a specified time period or qualified life (i.e., if the passive components are considered to be short-lived components). The staff noted that the applicant's fuel assemblies are considered to be short-lived components because they are replaced in accordance with the applicant's core reloading process, which calls for the fuel assemblies to be replaced on a one-third core offload schedule (i.e., one-third of the assemblies being replaced each refueling outage). Therefore, the staff finds Exelon's conclusion to be acceptable, and that the fuel assemblies do not need to be within the scope of an AMR because the fuel assemblies are being replaced on a specified time period.

3.1.2.3.3 Nickel Alloy Reactor Vessel Internal (RVI) Instrumentation Exposed to Internal Gas

SLRA Table 3.1.2-1 states that for nickel-alloy RVI instrumentation exposed to an internal gas environment, there are no aging effects and no AMP is proposed. The AMR item cites generic note G. The AMR item also cites plant-specific note 10, which states that the nickel alloy RVI instrumentation exposed to an internal nitrogen gas environment are not assessed in the GALL-SLR Report and that nickel alloy components do not have any aging effects in gas environments.

The staff reviewed the associated item for the instrumentation to confirm that there are no aging effects for the applicable component, material, and environment combination. The staff noted that the nitrogen gas environment creates a benign, inert environment for the components that is designed to preclude initiation of aging effects for the component surfaces exposed to the gas. Therefore, the staff finds Exelon's proposal acceptable because the instrumentation is exposed to a nitrogen gas environment, which creates benign, inert conditions for the component surfaces exposed to the gas and is designed to preclude the initiation of applicable aging effects in the components.

3.1.2.3.4 Carbon Steel or Low-Alloy Steel Reactor Pressure Vessel (RPV) Main Steam Nozzles Exposed to a Steam Environment

SLRA Table 3.1.2-1 states that loss of material due to pitting or crevice corrosion in carbon or low-alloy steel RPV main steam nozzles exposed to a steam environment will be managed using a plant-specific time-limited aging analysis (TLAA). The AMR item cites generic note H for which Exelon has identified loss of material due to pitting or crevice corrosion as an applicable aging effect and aging mechanisms for the nozzles. The AMR item also cites plant-specific note 11, which states that the plant-specific TLAA for the RPV main steam nozzles is included and evaluated in SLRA Section 4.7.

The staff noted that the applicant includes the plant-specific TLAA for the RPV main steam nozzles in SLRA Section 4.7.2 and has projected the TLAA to the end of the subsequent period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii). The staff finds Exelon's plant-specific AMR basis to be acceptable because: (a) SRP-SLR Section 1.2 identifies that TLAAs may be used as a basis for demonstrating adequate aging management in accordance with the requirement in 10 CFR 54.21(a)(3), and (b) the applicant has appropriately included its plant-specific TLAA for the main steam in SLRA Section 4.7.2. The staff evaluates the plant-specific TLAA for the RPV main steam nozzles and the applicant's basis for dispositioning the TLAA in accordance with 10 CFR 54.21(c)(1)(ii) in SER Section 4.7.2.

3.1.2.3.5 Stainless Steel and Nickel Alloy RVI Mechanical Joint Components Exposed to a Reactor Coolant with Neutron Flux Environment

SLRA Table 3.1.2-1, as amended in the applicant's letter of September 14, 2018 (ADAMS Accession No. ML18257A143), states that loss of preload due to thermal or irradiation-enhanced stress relaxation in specific RVI mechanical joint components will be managed using a plant-specific time-limited aging analysis (TLAA). The AMR items apply to the following fastened joint components that are made from either stainless steel or X-750 nickel alloy materials and are exposed to a reactor coolant with neutron flux environment: (a) jet pump auxiliary spring wedge assemblies, (b) jet pump slip joint clamps, (c) jet pump riser clamps, and (d) the PBAPS Unit 3-specific core spray repair hardware bolting. The AMR items cite generic note H for which Exelon has identified loss of preload due to thermal or irradiation-enhanced stress relaxation as an applicable aging effect and aging mechanisms for the components. The AMR item also cites either plant-specific note 4 or 5, which state that the plant-specific TLAAs for the components are included and evaluated in SLRA Section 4.2.

In the applicant's letter of September 14, 2018, the applicant amended SLRA Table 3.1.2-1 to delete an analogous AMR item for the jet pump oversized wedges from the scope of the SLRA. The applicant stated that the jet pump oversized wedges were procured for the units, but clarified that the oversized wedges had yet to be installed as a modification of the jet pump assemblies in either unit. The staff finds that the applicant has provided an acceptable basis for deleting the AMR item for the jet pump oversized wedges from the scope of the SLRA because the components: (a) have yet to be installed in the current plant designs, and (b) do not serve a license renewal intended function and do not need to be included within the scope of the SLRA. The staff also finds that any associated time-dependent preload analysis for the oversized wedges would not need to be identified as a TLAA for the SLRA because the over-sized wedges are not currently within the scope of the SRLA, and therefore the analysis does not conform to Criterion 1 for defining TLAAs in 10 CFR 54.3(a).[1]

For the other specified RVI mechanical joint components, the staff confirmed that the applicant includes the TLAAs for the components in the following subsections of SLRA Section 4.2:

- SLRA Section 4.2.10 for the jet pump slip joint clamps
- SLRA Section 4.2.11 for the jet pump auxiliary spring wedge assemblies
- SLRA Section 4.2.12 for the jet pump riser clamps
- SLRA Section 4.2.15 for the PBAPS Unit 3 core spray repair hardware bolting

The staff noted that the applicant has projected these TLAAs to the end of the subsequent period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii). The staff finds Exelon's plant-specific AMR basis to be acceptable because: (a) SRP-SLR Section 1.2 identifies that TLAAs may be used as a basis for demonstrating adequate aging management in accordance with the requirement in 10 CFR 54.21(a)(3), and (b) the applicant has appropriately included its TLAAs for the specified RVI mechanical joint components in applicable subsections of SLRA Section 4.2. The staff evaluates these TLAAs and the applicant's bases for dispositioning the TLAAs in accordance with 10 CFR 54.21(c)(1)(ii) in SER Sections 4.2.10, 4.2.11, 4.2.12, and 4.2.15, respectively.

[1] The provisions of 10 CFR 54.3(a) and the contents of SER Section 4.1 both define the six criteria in 10 CFR 54.3(a) that must be met to define a given plant analysis as a TLAA. To meet Criterion 1 for defining TLAAs in 10 CFR 54.3(a), the system, structure, or component evaluated in the analysis must be within the scope of the SLRA.

3.1.2.3.6 Carbon Steel RPV Feedwater Nozzles Exposed to Reactor Coolant

SLRA Table 3.1.2-1 states that cracking due to cyclic loading in carbon steel RPV feedwater nozzles exposed to an internal reactor coolant environment will be managed using a plant-specific time-limited aging analysis (TLAA). The AMR item cites generic note H for which Exelon has identified cracking due to cyclic loading as an applicable aging effect and aging mechanisms for the nozzles. The AMR item also cites plant-specific note 8, which states that the plant-specific TLAA for the RPV feedwater nozzles is included and evaluated in SLRA Section 4.7.

The staff confirmed that the applicant includes the plant-specific TLAA for the RPV feedwater nozzles in SLRA Section 4.7.3 and has projected the TLAA to the end of the subsequent period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii). The staff finds Exelon’s proposal to manage cracking due to cyclic loading in the RPV feedwater nozzles acceptable because: (a) SRP-SLR Section 1.2 identifies that TLAAs may be used as a basis for demonstrating adequate aging management in accordance with the requirement in 10 CFR 54.21(a)(3), and (b) the applicant has appropriately included its plant-specific TLAA for the RPV feedwater nozzles in SLRA Section 4.7.3. The staff evaluates the plant-specific TLAA for the RPV feedwater nozzles and the applicant’s basis for dispositioning the TLAA in accordance with 10 CFR 54.21(c)(1)(ii) in SER Section 4.7.3.

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 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 Evaluations for the Engineered Safety Features,” is a summary comparison of the applicant’s AMRs with those evaluated in the GALL-SLR Report for the engineered safety features 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. For AMR items that the staff found to be consistent with the GALL-SLR Report (and no SER section is referenced), the staff determined that no additional evaluation or request for additional information was necessary and finds the items acceptable based on the GALL-SLR Report review of the 10 program elements. For AMR items that required additional evaluation (such as responses to requests for additional information), the staff’s evaluation is documented in sections 3.2.2.1.2 through 3.2.2.1.5 below.

Table 3.2-1 Staff Evaluation for Engineered Safety Features Components in the GALL-SLR Report

Component Group (SRP-SLR Item No.)	Staff Evaluation
3.2.1-001	Consistent with the GALL-SLR Report (see SER 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

Component Group (SRP-SLR Item No.)	Staff Evaluation
3.2.1-004	Consistent with the GALL-SLR Report (see SER Section 3.2.2.2.2)
3.2.1-005	Not applicable to BWRs (See SER Section 3.2.2.1.1)
3.2.1-006	Consistent with the GALL-SLR Report (see SER Section 3.2.2.2.3)
3.2.1-007	Consistent with the GALL-SLR Report (see SER Section 3.2.2.2.4)
3.2.1-008	Not applicable to BWRs (See SER Section 3.2.2.1.1)
3.2.1-009	Not applicable to BWRs (See SER Section 3.2.2.1.1)
3.2.1-010	Consistent with the GALL-SLR Report (see SER Section 3.2.2.1.2)
3.2.1-011	Consistent with the GALL-SLR Report
3.2.1-012	Not used. Addressed by item 3.1.1-062.
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	Consistent with the GALL-SLR Report
3.2.1-017	Not applicable to PBAPS (See SER Section 3.2.2.1.1)
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	Not applicable to BWRs (See SER Section 3.2.2.1.1)
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	Not applicable to PBAPS (See SER Section 3.2.2.1.1)
3.2.1-024	Not applicable to BWRs (See SER Section 3.2.2.1.1)
3.2.1-025	Not applicable to PBAPS
3.2.1-026	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.2.1-027	Not applicable to PBAPS
3.2.1-028	Not applicable to PBAPS
3.2.1-029	Consistent with the GALL-SLR Report
3.2.1-030	Not applicable to PBAPS
3.2.1-031	Consistent with the GALL-SLR Report
3.2.1-032	Not applicable to PBAPS
3.2.1-033	Not applicable to PBAPS
3.2.1-034	Consistent with the GALL-SLR Report
3.2.1-035	Not applicable to BWRs (See SER Section 3.2.2.1.1)
3.2.1-036	Not applicable to BWRs (See SER Section 3.2.2.1.1)
3.2.1-037	Not applicable to PBAPS (See SER Section 3.2.2.1.1)
3.2.1-038	Consistent with the GALL-SLR Report
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	Consistent with the GALL-SLR Report (see SER Section 3.2.2.2.10)
3.2.1-043	Consistent with the GALL-SLR Report
3.2.1-044	Not applicable to PBAPS (See SER Section 3.2.2.1.1)
3.2.1-045	Not applicable to BWRs (See SER Section 3.2.2.1.1)
3.2.1-046	Consistent with the GALL-SLR Report
3.2.1-047	Not applicable to BWRs (see SER Section 3.2.2.1.1)

Component Group (SRP-SLR Item No.)	Staff Evaluation
3.2.1-048	Consistent with the GALL-SLR Report (see SER 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	Consistent with the GALL-SLR Report
3.2.1-052	Consistent with the GALL-SLR Report
3.2.1-053	Not applicable to PBAPS (See SER Section 3.2.2.1.1)
3.2.1-053a	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.2.1-054	Not used. Addressed by 3.1.1-097.
3.2.1-055	Not used. Addressed by 3.1.1-052 (see SER Section 3.2.2.2.9).
3.2.1-056	Not applicable to PBAPS (see SER Section 3.2.2.2.10)
3.2.1-057	Consistent with the GALL-SLR Report (See SER Section 3.2.2.1.3 and 3.3.2.1.12)
3.2.1-058	Not applicable to BWRs (See SER Section 3.2.2.1.1)
3.2.1-059	Not applicable to PBAPS (See SER Section 3.2.2.1.1)
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 PBAPS (See SER Section 3.2.2.1.1)
3.2.1-063	Consistent with the GALL-SLR Report
3.2.1-064	Consistent with the GALL-SLR Report
3.2.1-065	Consistent with the GALL-SLR Report (see SER Section 3.2.2.1.5)
3.2.1-066	Consistent with GALL-SLR Report (see Section 3.2.2.2.7)
3.2.1-067	Not applicable to PBAPS (See SER Section 3.2.2.1.1)
3.2.1-068	Not applicable to PBAPS (See SER Section 3.2.2.1.1)
3.2.1-069	Consistent with the GALL-SLR Report
3.2.1-070	Not applicable to PBAPS (See SER Section 3.2.2.1.1)
3.2.1-071	Not applicable to PBAPS (See SER Section 3.2.2.1.1)
3.2.1-072	Not applicable to PBAPS (See SER Section 3.2.2.1.1)
3.2.1-073	Consistent with the GALL-SLR Report
3.2.1-074	Not applicable to PBAPS (See SER Section 3.2.2.1.1)
3.2.1-075	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.2.1-076	Consistent with the GALL-SLR Report
3.2.1-077	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.2.1-078	Not used (see SER Section 3.2.2.1.1)
3.2.1-079	Consistent with the GALL-SLR Report
3.2.1-080	Not applicable to PBAPS (see SER Section 3.2.2.2.4)
3.2.1-081	Consistent with GALL-SLR Report. (see SER Section 3.2.2.1.4)
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	Not used. Addressed by 3.3.1-182.
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 PBAPS (see SER Section 3.2.2.2.9)

Component Group (SRP-SLR Item No.)	Staff Evaluation
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 PBAPS (See SER Section 3.2.2.1.1)
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 PBAPS (See SER Section 3.2.2.1.1)
3.2.1-099	Not applicable to PBAPS (see SER Section 3.2.2.2.2)
3.2.1-100	Not applicable to PBAPS (see SER Section 3.2.2.2.8)
3.2.1-101	Consistent with the GALL-SLR Report (see SER Section 3.2.2.2.8)
3.2.1-102	Not applicable to PBAPS (see SER Section 3.2.2.2.8)
3.2.1-103	Not applicable to PBAPS (see SER Section 3.2.2.2.4)
3.2.1-104	Not applicable to PBAPS (See SER Section 3.2.2.1.1)
3.2.1-105	Not applicable to PBAPS (see SER Section 3.2.2.2.10)
3.2.1-106	Not applicable to PBAPS (see SER Section 3.2.2.2.2)
3.2.1-107	Consistent with the GALL-SLR Report (see SER Section 3.2.2.2.2)
3.2.1-108	Consistent with the GALL-SLR Report (see SER Section 3.2.2.2.4)
3.2.1-109	Not applicable to PBAPS (see SER Section 3.2.2.2.8)
3.2.1-110	Not applicable to PBAPS (see SER Section 3.2.2.2.8)
3.2.1-111	Not applicable to PBAPS (see SER Section 3.2.2.2.10)
3.2.1-112	Not applicable to PBAPS (see SER 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	Consistent with the GALL-SLR Report
3.2.1-115	Not applicable to PBAPS (See SER Section 3.2.2.1.1)
3.2.1-116	Not applicable to PBAPS (See SER Section 3.2.2.1.1)
3.2.1-117	Not applicable to PBAPS (See SER Section 3.2.2.1.1)
3.2.1-118	Not applicable to PBAPS (See SER Section 3.2.2.1.1)
3.2.1-119	Not applicable to PBAPS (see SER Section 3.2.2.2.10)
3.2.1-120	Not applicable to PBAPS (See SER Section 3.2.2.1.1)
3.2.1-121	Not applicable to PBAPS (see SER Section 3.2.2.2.10)
3.2.1-122	Consistent with the GALL-SLR Report
3.2.1-123	Not applicable to PBAPS (See SER Section 3.2.2.1.1)
3.2.1-124	Not applicable to PBAPS (See SER Section 3.2.2.1.1)
3.2.1-125	Not applicable to PBAPS (See SER Section 3.2.2.1.1)
3.2.1-126	Not applicable to PBAPS (See SER Section 3.2.2.1.1)
3.2.1-127	Not applicable to PBAPS (See SER Section 3.2.2.1.1)
3.2.1-128	Not applicable to PBAPS (See SER Section 3.2.2.1.1)
3.2.1-129	Not applicable to PBAPS (See SER Section 3.2.2.1.1)
3.2.1-130	Consistent with the GALL-SLR Report
3.2.1-131	Not applicable to PBAPS (See SER Section 3.2.2.1.1)
3.2.1-132	Not applicable to PBAPS (See SER Section 3.2.2.1.1)
3.2.1-133	Not applicable to PBAPS (See SER Section 3.2.2.1.1)
3.2.1-134	Not applicable to PBAPS (See SER Section 3.2.2.1.1)

The staff's review of component groups, as described in SER Section 3.0.2.2, is summarized in the following three sections:

(1) SER Section 3.2.2.1 discusses AMR results for components that the applicant states are either not applicable to PBAPS 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.

(2) SER Section 3.2.2.2 discusses AMR results for which the GALL-SLR Report and SRP-SLR recommend further evaluation.

(3) SER 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 3.2.2-8 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.

Additionally, SER 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

Exelon claimed that the following SLRA Table 3.2-1 items were not applicable to PBAPS: 3.2-1-017, 3.2-1-023, 3.2-1-025, 3.2-1-027, 3.2-1-028, 3.2-1-030, 3.2-1-032, 3.2-1-033, 3.2-1-037, 3.2-1-044, 3.2-1-053, 3.2-1-056, 3.2-1-059, 3.2-1-062, 3.2-1-067, 3.2-1-068, 3.2-1-070, 3.2-1-071, 3.2.1-072, 3.2.1-074, 3.2-1.080, 3.2.1-091, 3.2.1-096, 3.2.1-098, 3.2.1-099, 3.2.1-100, 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, 3.2-1-115, 3.2-1-116, 3.2-1-117, 3.2-1-118, 3.2-1-119, 3.2-1-120, 3.2-1-121, 3.2-1-123, 3.2-1-124, 3.2-1-125, 3.2-1-126, 3.2-1-127, 3.2-1-128, 3.2-1-129, 3.2-1-131, 3.2-1-132, 3.2-1-133, and 3.2-1-134. The staff reviewed the SLRA and UFSAR and confirmed that the particular combination of aging effect, material, and environment represented by the AMR item does not exist at the site, and therefore, Exelon's SLRA does not have any AMR results that are applicable for these items or the items require no aging management

Exelon identified the following items as not being applicable to the SLRA: items 3.2-1-005, 3.2-1-008, 3.2-1-009, 3.2-1-020, 3.2-1-024, 3.2-1-035, 3.2-1-036, 3.2-1-045, 3.2-1-047, and 3.2-1-058 have been identified as not being applicable to the SLRA. The staff reviewed and confirmed these AMR items are not applicable to the SLRA because these items are applicable only to PWRs.

Items 3.2.1-012 and 3.2.1-087 are not used and are addressed by items 3.1.1-062 and 3.3.1-182, respectively. Item 3.2-1-054 is not used and is addressed by item 3.1.1-097. Items 3.2-1-055 and 3.2.1-078 are not used and are both addressed by item 3.2.1-052. The staff reviewed and confirmed these alternate items are acceptable because they adequately address the relevant aging effects.

3.2.2.1.2 Loss of Fracture Toughness Due to Thermal Aging Embrittlement

SLRA Table 3.2.1, AMR item 3.2.1-010, addresses loss of fracture toughness due to thermal aging embrittlement for cast austenitic stainless steel (CASS) piping, piping components exposed to treated borated water and treated water at temperatures greater than 250 °C (482 °F). For the SLRA Table 2 AMR item that cites generic note E and AMR item 3.2.1-010, the SLRA credits the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program to manage the aging effect for the CASS valve body in SLRA Table 3.3.2-26.

Based on its review of components associated with AMR item 3.2.1-010 for which Exelon cited generic note E, the staff finds Exelon's proposal to manage the effects of aging using the SLRA ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program acceptable because: (1) GALL-SLR Report AMP XI.M12, "Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)," indicates that the scope of the program does not include aging management for CASS valve bodies based on the adequacy of the existing ASME Code Section XI inspection requirements; and (2) the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program, which the applicant credits, implements the inservice inspection requirements (such as visual, surface, and volumetric examination requirements) for the valve body in accordance with ASME Code Section XI as incorporated by reference in 10 CFR 50.55a.

3.2.2.1.3 No Aging Effect

SLRA Table 3.2.1, AMR item 3.2.1-057, states that there are no aging effects requiring management for copper-alloy piping and piping components exposed to air, condensation, or gas. During its review of components associated with AMR item 3.2.1-057 for which Exelon cited generic notes A and C, the staff noted that the SLRA states there are no aging effects for copper alloy greater than 15 percent zinc piping, piping components, heat exchanger tubes, and spray nozzles exposed to air-indoor uncontrolled or condensation.

For copper-alloy components with greater than 15 percent zinc that cite SLRA item 3.2.1-057, the staff determined the need for additional information, which resulted in the issuance of an RAI. See SER Section 3.3.2.1.12 for the staff's evaluation of responses to RAIs 3.3.2.1.1-1 and 3.3.2.1.1-1a for item 3.1.1-137.

3.2.2.1.4 Reduction of Heat Transfer due to Fouling

SLRA Table 3.2.1, item 3.2.1-081, addresses reduction of heat transfer due to fouling for steel and other metallic heat exchanger tubes exposed to air or condensation. As a result of discussions during the staff's in-office audit, regarding plant-specific operating experience for a partially clogged room cooler air intake, Exelon revised SLRA Tables 3.2.2-2 and 3.2.2-6 by adding item 3.2.1-081. This changed the discussion section for this AMR item from "Not Applicable" to "Consistent with NUREG-2191." The staff's evaluation of the associated changes to the SLRA is documented in the operating experience discussion, SER Section 3.0.3.1.10.

3.2.2.1.5 Wall Thinning Due to Erosion

The staff's evaluation for metallic piping components exposed to steam, which is being managed for wall thinning by the Flow-Accelerated Corrosion program through AMR item 3.2.1-065, is documented in SER Section 3.1.2.1.2. As discussed in that section, the applicant's approach was found to be acceptable.

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, as recommended in the GALL-SLR Report, for the engineered safety features components and provides information concerning how it will manage the applicable aging effects. The staff reviewed the applicant's evaluation of component groups of which the GALL-SLR Report recommends further evaluation, 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 states that TLAAs are evaluated in accordance with 10 CFR 54.21(c)(1) and that the TLAA for evaluating cumulative fatigue damage or cracking due to fatigue or cyclic loading in emergency safety feature system piping and piping components is addressed in SLRA Section 4.3, Subsection 4.3.4. This is consistent with SRP-SLR Section 3.2.2.2.1 and is, therefore, acceptable. The staff's evaluation of this TLAA is documented in SER Section 4.3.4.

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, and 3.2.1-107, addresses loss of material due to pitting or crevice corrosion for stainless steel and nickel alloy piping, piping components, and tanks; and insulated piping, piping components, and tanks exposed to air or condensation, which will be managed by the One-Time Inspection program. The staff reviewed Exelon's proposal against the criteria in SRP-SLR Section 3.2.2.2.2.

Exelon stated that the engineered safety features systems contain no: (a) stainless steel or nickel alloy piping, piping components, or tanks exposed to air-outdoor or air-indoor controlled; (b) nickel alloy tanks; (c) insulated nickel alloy piping, piping components, or tanks; and (d) insulated stainless steel piping, piping components, or tanks exposed to air-indoor controlled, air-indoor uncontrolled, or air-outdoor. The staff evaluated Exelon's claim and finds it acceptable based on a review of the UFSAR and SLRA related to these component, material, and environment combinations.

In its review of components associated with AMR items 3.2.1-004, 3.2.1-048, and 3.2.1-107, the staff finds that Exelon has met the further evaluation criteria, and Exelon's proposal to manage the effects of aging using the One-Time Inspection program is acceptable for the following reasons: (a) loss of material has not been identified as an aging effect by Exelon for stainless steel or nickel alloy components in these environments; (b) use of the One-Time Inspection program can demonstrate that loss of material due to pitting and crevice corrosion does not occur at a rate that affects the intended function of the components, which is consistent with SRP-SLR Section 3.2.2.2.2; and (c) the visual inspections can be capable of detecting loss of material.

Based on the program identified, the staff concludes that Exelon's program meets 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 Exelon 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 3.2.2.2.2, associated with SLRA Table 3.2.1 AMR items 3.2.1-099, 3.2.1-106, and 3.2.1-112, addresses loss of material due to pitting or crevice corrosion for stainless steel and nickel alloy components exposed to air, condensation, raw water, waste water, or the underground environment. Exelon stated that these items are not applicable. The staff evaluated Exelon's claim and finds it acceptable because based on a review of the UFSAR, there are no stainless steel or nickel alloy tanks or stainless steel or nickel alloy underground piping, piping components, or tanks in the engineered safety features systems.

3.2.2.2.3 Loss of Material Due to General Corrosion and Flow Blockage Due to Fouling

SLRA Section 3.2.2.2.3, associated with SLRA Table 3.2.1 AMR item 3.2.1-006, addresses loss of material due to general, pitting and crevice corrosion, and flow blockage due to fouling, for metallic drywell and suppression chamber spray nozzles exposed to air–indoor uncontrolled and condensation environments, which will be managed by the One-Time Inspection program. The staff reviewed Exelon's proposal against the criteria in SRP-SLR Section 3.2.2.2.3.

The staff noted that the PBAPS Units 2 and 3 drywell and suppression chamber spray nozzles within the Residual Heat Removal System are copper alloy with greater than 15 percent zinc and are exposed internally to a condensation environment. The applicant stated that loss of material is not an aging effect for copper alloys in a condensation environment. The staff reviewed the ASM Handbook, Volume 13B, "Corrosion: Materials, Corrosion of Copper and Copper Alloys," which states in Table 3 that copper alloys with greater than 15 percent zinc provide excellent corrosion resistance to industrial, marine, and rural atmospheric environments. The Residual Heat Removal System contains carbon steel piping sections downstream of the inboard primary containment motor-operated isolation valves, which extend to the drywell and suppression chamber spray nozzles. These sections are normally dry and subject to wetting, and they are periodically wetted only during transient or accident conditions that require drywell or suppression chamber spray operation. Since the upstream piping is carbon steel, flow blockage due to fouling is an applicable aging effect for the spray nozzles. In its review of components associated with AMR item 3.2.1-006, the staff finds that Exelon has met the further evaluation criteria, and Exelon's proposal to manage the aging effects using the One-Time Inspection program is acceptable because the One-Time Inspection program is designed to verify the effectiveness of an AMP that is designed to prevent or minimize aging that could cause the loss of an intended function during the subsequent period of extended operation.

Based on the program identified, the staff concludes that Exelon's program meets SRP-SLR Section 3.2.2.2.3, item 3.2.1-006. For those AMR items associated with SLRA Section 3.2.2.2.3, the staff concludes that the SLRA is consistent with the GALL-SLR Report and that Exelon 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).

3.2.2.2.4 Cracking Due to Stress Corrosion Cracking in Stainless Steel 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 stress corrosion cracking for stainless steel piping, piping components, or tanks; and insulated stainless steel piping, piping components, or tanks exposed to air or condensation, which will be managed by the One-Time Inspection program. The staff reviewed Exelon's proposal against the criteria in SRP-SLR Section 3.2.2.2.4.

Exelon stated that the engineered safety features systems contain no: (a) stainless steel piping, piping components, or tanks exposed to air-outdoor or air-indoor controlled; and (b) insulated stainless steel tanks, piping or piping components exposed to air-indoor controlled, air-indoor uncontrolled, or air-outdoor in the engineered safety features systems. The staff evaluated Exelon's claim and finds it acceptable based on a review of the UFSAR and SLRA related to these component, material, and environment combinations.

In SLRA Section 3.2.2.2.4, Exelon stated that cracking has not been identified as an aging effect for stainless steel components exposed to air or condensation, or because of transportable halogens. During its audit of plant-specific operating experience, the staff noted that in 2011, a high-pressure coolant injection (HPCI) sensing line failure resulted from chloride-contaminated material in contact with the stainless steel tubing. The apparent cause evaluation, corrective action (the items were replaced), and follow-on extent of condition inspections revealed that: (a) the stress corrosion cracking occurred due to contact with a chlorine-based thermoplastic that was not authorized by plant-specific design requirements for the system; (b) the plastic material was removed and the tubing in contact with the material was replaced; and (c) an extent of condition for both the HPCI and the reactor core isolation cooling tubing did not reveal any other instances of use of this material. During the audit, the staff searched for other potential plant-specific operating experience associated with loss of material or cracking of stainless steel components exposed to air or condensation and did not find any related to environmentally induced failure. Based on the staff's review of the plant-specific documents associated with the HPCI sensing line failure and the audit of plant-specific operating experience, the staff concludes that the applicant's claim is reasonable.

The staff noted that some items associated with AMR item 3.2.1-007, in SLRA Table 3.1.2-1, cite cracking due to intergranular stress corrosion cracking as an additional applicable aging mechanism whereas SRP-SLR Section 3.2.2.2.4 only cites stress corrosion cracking. For the purposes of inspecting these components, cracking due to intergranular stress corrosion cracking can be considered as a subset of stress corrosion cracking. In its review of components associated with AMR items 3.2.1-007 and 3.2.1-108, the staff finds that Exelon has met the further evaluation criteria, and Exelon's proposal to manage the effects of aging using the One-Time Inspection program is acceptable for the following reasons: (a) cracking has not been identified as an aging effect by Exelon for stainless steel components in these environments, except for the one example of plant-specific operating experience described above; (b) use of the One-Time Inspection program can demonstrate that cracking due to stress corrosion cracking or intergranular stress corrosion cracking does not occur at a rate that affects the intended function of the components, which is consistent with SRP-SLR Section 3.2.2.2.4; and (c) the inspections consistent with GALL-SLR Report AMP XI.M32 (e.g., surface examination, VT-1) can be capable of detecting cracking.

Based on the program identified, the staff concludes that Exelon's program meets 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 SLRA is consistent with the GALL-SLR Report and that Exelon 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 3.2.2.2.4, associated with SLRA Table 3.2.1, AMR items 3.2.1-080 and 3.2.1-103, addresses cracking due to stress corrosion cracking for stainless steel components exposed to air or condensation or the underground environment. Exelon stated that these items are not applicable. The staff evaluated Exelon's claim and finds it acceptable because based on a review of the UFSAR, there are no stainless steel tanks within the scope of GALL-SLR Report AMP XI.M29, "Outdoor and Large Atmospheric Metallic Storage Tanks," or stainless steel underground piping, piping components, or tanks in the engineered safety features systems.

3.2.2.2.5 Quality Assurance for Aging Management of Nonsafety-Related Components

SER Section 3.0.4 documents the staff's evaluation of the applicant's QA program.

3.2.2.2.6 Ongoing Review of Operating Experience

SER Section 3.0.5 documents the staff's evaluation of the applicant's ongoing review of operating experience.

3.2.2.2.7 Loss of Material Due to Recurring Internal Corrosion

SLRA Section 3.2.2.2.7, associated with SLRA Table 3.2.1, item 3.2.1-066, addresses loss of material due to recurring internal corrosion in metallic components exposed to raw water or waste water in engineered safety features systems. Exelon proposed to manage this aging effect/mechanism with the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program.

The staff reviewed Exelon's proposal against the criteria in SRP-SLR Section 3.2.2.2.7 for the components associated with item 3.2.1-066. The staff finds that Exelon has met the further evaluation criteria and its proposal to manage the associated aging effects using the above cited program is acceptable because the program includes periodic inspections that can identify loss of material for the associated room cooler drip pans or clogging of the drain lines prior to the loss of intended function. In addition, the staff did not identify any further examples of recurring internal corrosion in engineered safety features systems during its independent review of the plant-specific operating experience database. Exelon 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).

3.2.2.2.8 Cracking Due to Stress Corrosion Cracking in Aluminum Alloys

SLRA Section 3.2.2.2.8, associated with SLRA Table 3.2.1 AMR item 3.2.1-101, addresses cracking due to stress corrosion cracking for aluminum alloy piping, piping components, or tanks exposed to an external environment of air or condensation, which will be managed by the

One-Time Inspection program. The staff reviewed Exelon's proposal against the criteria in SRP-SLR Section 3.2.2.2.8.

Exelon stated that the engineered safety features systems contain no aluminum alloy tanks, piping, or piping components exposed to the air-indoor controlled, air-outdoor, or condensation external environments in the engineered safety features systems. The staff evaluated Exelon's claim and finds it acceptable based on a review of the UFSAR and SLRA related to these component, material, and environment combinations.

In its review of components associated with AMR item 3.2.1-101, the staff finds that Exelon has met the further evaluation criteria, and Exelon's proposal to manage the effects of aging using the One-Time Inspection program is acceptable for the following reasons: (a) cracking has not been identified as an aging effect by Exelon for aluminum alloy components in these environments; (b) use of the One-Time Inspection program can demonstrate that cracking due to stress corrosion cracking does not occur at a rate that affects the intended function of the components, which is consistent with SRP-SLR Section 3.2.2.2.8; and (c) the inspections consistent with GALL-SLR Report AMP XI.M32 (e.g., surface examination, VT-1) can be capable of detecting cracking.

Based on the program identified, the staff concludes that Exelon's program meets SRP-SLR Section 3.2.2.2.8 criteria. For those AMR items associated with SLRA Section 3.2.2.2.8, the staff concludes that the SLRA is consistent with the GALL-SLR Report and that Exelon 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 3.2.2.2.8, associated with SLRA Table 3.2.1, AMR items 3.2.1-100, 3.2.1-102, 3.2.1-109, and 3.2.1-110, addresses cracking due to stress corrosion cracking for aluminum alloy components exposed to air, condensation, soil, concrete, raw water, waste water, or the underground environment, collectively. Exelon stated that these items are not applicable. The staff evaluated Exelon's claim and finds it acceptable because based on a review of the UFSAR and SLRA, there are no aluminum alloy tanks, piping, or piping components exposed to an internal environment of air, condensation, soil, concrete, raw water, or waste water; or insulated or underground piping, piping components, or tanks in the engineered safety features systems.

3.2.2.2.9 Loss of Material Due to General, Crevice, or Pitting Corrosion and Cracking Due to Stress Corrosion Cracking

SLRA Section 3.2.2.2.9, associated with SLRA Table 3.2.1, AMR item 3.2.1-055, addresses loss of material for steel piping components exposed to concrete, which will be managed by the Buried and Underground Piping and Tanks program. In lieu of using AMR item 3.2.1-055, the SLRA cites item 3.2.1-052 to manage aging effects for these items. The staff reviewed Exelon's proposal against the criteria in SRP-SLR Section 3.2.2.2.9.

SLRA Section 3.2.2.2.9 states that for steel piping exposed to concrete in the standby gas treatment system, loss of material will be managed by the Buried and Underground Piping program because the piping could be exposed to groundwater. In its review of components associated with AMR item 3.2.1-052, the staff finds that Exelon has met the further evaluation criteria, and Exelon's proposal to manage the effects of aging using the Buried and Underground Piping and Tanks program is acceptable because the periodic visual inspections conducted for the program can be capable of detecting concrete degradation that could lead to susceptibility of loss of material in steel piping exposed to concrete.

Based on the program identified, the staff concludes that Exelon's program meets SRP-SLR Section 3.2.2.2.9 criteria. 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 Exelon 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 3.2.2.2.9, associated with SLRA Table 3.2.1, AMR item 3.2.1-091, addresses applicable aging effects for stainless steel piping and piping components exposed to concrete. Exelon stated that this item is not applicable. The staff evaluated Exelon's claim and finds it acceptable because the staff did not identify any in-scope stainless steel components located in the engineered safety features systems exposed to concrete that would be susceptible to water intrusion during its review of the UFSAR.

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 item 3.2.1-042, addresses loss of material due to pitting or crevice corrosion for aluminum alloy piping, piping components, and tanks exposed to air or condensation, which will be managed by the One-Time Inspection program. The staff reviewed Exelon's proposal against the criteria in SRP-SLR Section 3.2.2.2.10.

Exelon stated that the engineered safety features systems contain no aluminum alloy tanks or aluminum alloy piping or piping components exposed to the air-indoor controlled, air-outdoor, or condensation external environments in the engineered safety features systems. The staff evaluated Exelon's claim and finds it acceptable based on a review of the UFSAR and SLRA related to these component, material, and environment combinations.

In its review of components associated with AMR item 3.2.1-042, the staff finds that Exelon has met the further evaluation criteria, and Exelon's proposal to manage the effects of aging using the One-Time Inspection program is acceptable for the following reasons: (a) loss of material has not been identified as an aging effect by Exelon for aluminum alloy components in these environments; (b) use of the One-Time Inspection program can demonstrate that loss of material due to pitting and crevice corrosion does not occur at a rate that affects the intended function of the components, which is consistent with SRP-SLR Section 3.2.2.2.10; and (c) the visual inspections can be capable of detecting loss of material.

Based on the program identified, the staff concludes that Exelon's program meets SRP-SLR Section 3.2.2.2.10 criteria. For those AMR items associated with SLRA Section 3.2.2.2.10, the staff concludes that the SLRA is consistent with the GALL-SLR Report and that Exelon 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 3.2.2.2.10, associated with SLRA Table 3.2.1, AMR items 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 or crevice corrosion for aluminum alloy components exposed to air, condensation, raw water, waste water, or the underground environment. Exelon stated that these items are not applicable. The staff evaluated Exelon's claim and finds it acceptable because based on a review of the UFSAR and SLRA, there are no aluminum alloy piping, piping components, or tanks exposed to air, condensation, raw water, or waste water; underground piping, piping components, or tanks; insulated piping, piping components, or tanks in the engineered safety features systems.

3.2.2.3 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 3.2.2-1 through 3.2.2-8 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.

3.2.2.3.1 Core Spray System

<u>Stainless Steel Suction Strainers Located in Torus and Exposed to Treated Water</u>

SLRA Tables 3.2.2-2, 3.2.2-3, 3.2.2-5, and 3.2.2-6 state that the aging effect of flow blockage due to fouling for stainless steel strainer elements exposed to treated water (external) will be managed by the SLRA AMP ASME Section XI, Subsection IWE. The AMR items cite generic note H, for which Exelon has identified flow blockage due to fouling as an additional aging effect. The AMR items cite plant-specific note 3 (for SLRA Table 3.2.2-5) or note 5 (for SLRA Tables 3.2.2-2, 3.2.2-3, and 3.2.2-6), which each state "Flow blockage due to fouling in the Emergency Containment Cooling System (ECCS) suction strainers will be managed by the ASME Section XI, Subsection IWE (B.2.1.30) program, which includes periodic inspections for sludge accumulation on the torus floor and ensures that the sludge accumulation rate does not exceed the design basis assumptions for design, fabrication, and testing of the strainers."

The staff noted that SLRA Section B.2.1.30, as amended by SLRA Supplement No. 2 dated January 23, 2019, included an exception to the scope of the PBAPS ASME Section XI, Subsection IWE AMP to include managing the aging effect of flow blockage due to fouling for the pump suction strainers located in the suppression pool (torus), for which no existing GALL-SLR Report items or AMP exist. The staff noted that visual inspections of the suction strainer are performed as part of PBAPS's containment inservice inspection requirements described in the Augmented Inspection Program Plan and procedures, which is an inspection performed at PBAPS, beyond the requirements of ASME Section XI. The plan requires visual inspection of 100 percent of the strainer assemblies each interval for general structural condition, and one strainer module (screen) in the RHR System and one strainer module (screen) in the core spray system for debris and evidence of clogging during every other refueling outage. Further, the HPCI and RCIC strainers are inspected for debris and evidence of clogging every other refueling outage. The staff evaluation of the acceptability of the exception is documented in SER Section 3.0.3.2.17. The staff finds Exelon's proposal to manage the flow blockage aging effect due to fouling acceptable because the PBAPS ASME

Section XI, Subsection IWE AMP includes visual inspections of the strainers for debris and evidence of clogging every other refueling outage, which provides a reasonable inspection method and interval for adequately managing the aging effect.

Aluminum Alloy Heat Exchangers Exposed to Condensation (External)

The aluminum core spray pump room cooler fins are addressed by item 3.3.1-254 and are discussed in SER Section 3.3.2.3.8.

3.2.2.3.2 High Pressure Coolant Injection System

Internally Coated Carbon Steel Blower Housings and Tanks Exposed to Condensation

SLRA Table 3.2.2-3 states that loss of material and loss of coating integrity for internally coated carbon steel blower housings and tanks exposed to condensation will be managed by the Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks 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 Exelon constitute all of the applicable aging effects for this component, material, and environment description. Based on its review of the GALL-SLR Report items E-401 and E-414, which state that internally coated carbon steel exposed to more aggressive environments (e.g., raw water) are susceptible to loss of material and loss of coating integrity, the staff finds that Exelon 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 that internally coated carbon steel components are managed for loss of material and loss of coating integrity in raw water environments using the Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks program. The staff finds Exelon's proposal to manage the effects of aging acceptable because raw water is more aggressive than condensation; therefore, Exelon's proposal to manage the effects of aging is bounded by GALL-SLR Report recommendations.

Stainless Steel Suction Strainers Exposed to Treated Water

The staff's evaluation for stainless steel strainer elements exposed to treated water (external), which will be managed for flow blockage due to fouling by the ASME Section XI, Subsection IWE AMP and are associated with generic note H, is documented in SER Section 3.2.2.3.1.

3.2.2.3.3 Reactor Core Isolation Cooling System - Summary of Aging Management Evaluation - SLRA Table 3.2.2-5"

Zinc Piping, Piping Components Exposed Internally to Lubricating Oil

SLRA Table 3.2.2-5 states that loss of material due to pitting, crevice corrosion for zinc piping and piping components exposed to lubricating oil will be managed by the Lubricating Oil Analysis program and the One-Time Inspection program. The AMR item cites generic note G.

The staff reviewed the associated items in the SLRA and considered whether the aging effects proposed by Exelon constitute all of the applicable aging effects for this component, material, and environment description. The staff noted that the GALL-SLR Report does not address zinc piping, piping components, and piping elements exposed to lubricating oil and loss of material as the aging effect. However, based on its review of the ASM Handbook Volume 13B, 2005, "Corrosion of Zinc and Zinc Alloys," which states that loss of material in the form of pitting and crevice corrosion may occur in this environment, the staff finds that the applicant has identified all credible aging effects for this component, material, and environment combination.

The staff finds Exelon's proposal to manage loss of material for zinc piping and piping components using the Lubricating Oil Analysis program acceptable because it is capable of detecting and minimizing contaminants in a lubricating oil environment. Additionally, the One-Time Inspection program will be used to verify the system-wide effectiveness of the Lubricating Oil Analysis program such that significant degradation does not occur and that the component's intended function is maintained.

<u>Stainless Steel Suction Strainers Exposed to Treated Water</u>

The staff's evaluation for stainless steel strainer elements exposed to treated water (external), which will be managed for flow blockage due to fouling by the ASME Section XI, Subsection IWE AMP and are associated with generic note H, is documented in SER Section 3.2.2.3.1.

3.2.2.3.4 Residual Heat Removal System - Summary of Aging Management Evaluation - SLRA Table 3.2.2-6"

<u>Stainless Steel Suction Strainers Exposed to Treated Water</u>

The staff's evaluation for stainless steel strainer elements exposed to treated water (external), which will be managed for flow blockage due to fouling by the ASME Section XI, Subsection IWE AMP, and are associated with generic note H, is documented in SER Section 3.2.2.3.1.

<u>Aluminum Alloy Heat Exchangers Exposed to Condensation (External)</u>

The residual heat removal pump room cooler fins are addressed by item 3.3.1-254 and are discussed in SER Section 3.3.2.3.8.

3.2.2.3.5 Standby Gas Treatment System - Summary of Aging Management Evaluation - SLRA Table 3.2.2-8

<u>Elastomer Flexible Connections Exposed to Condensation</u>

SLRA Tables 3.2.2-008, 3.3.2-003, 3.3.2-007, 3.3.2-009, and 3.3.2-022 state that loss of material due to wear for elastomer flexible connections exposed to condensation will be managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program. The AMR items cite generic note G, "Environment not in NUREG-2191 for this component and material."

The staff reviewed the associated items in the SLRA and considered whether the aging effects proposed by Exelon constitute all of the applicable aging effects for this component, material, and environment description. The staff noted that the applicant addressed hardening or loss of strength due to elastomer degradation for this component, material, and environment combination in other AMR items. Because the GALL-SLR Report states that elastomer flexible connections exposed to air and condensation are susceptible to loss of material due to wear and hardening or loss of strength due to elastomer degradation, the staff finds that Exelon has identified all applicable aging effects for this component, material, and environment combination.

The staff finds Exelon's proposal to manage the effects of aging acceptable because (a) the opportunistic visual inspections conducted by the Internal Surfaces in Miscellaneous Piping and Ducting Components program, with a representative sample of components inspected at least once every 10 years, are capable of detecting loss of material due to wear prior to the loss of the component's intended function; and (b) hardening or loss of strength due to elastomer degradation is appropriately being managed using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program.

Zinc Valve Bodies Exposed Internally to Condensation

SLRA Table 3.2.2-8 states that loss of material for zinc valve bodies exposed internally to condensation will be managed by the One-Time Inspection program. The AMR item cites generic note G and plant-specific note 2. The plant-specific note 2 states, "The One-Time Inspection (B.2.1.21) program is used to manage the aging effect(s) applicable to this component type, material, and environment combination."

The staff reviewed the associated items in the SLRA and considered whether the aging effects proposed by Exelon constitute all the applicable aging effects for this component, material, and environment description. The staff noted that the GALL-SLR Report does not address loss of material in zinc valve bodies exposed to condensation and states that there is no AERM for zinc exposed to uncontrolled air, which includes condensation. Based on review of the ASM Handbook Volume 13B, 2005, "Corrosion of Zinc and Zinc Alloys," which states zinc corrosion rates in atmospheric environments varies from approximately 0.1 μm/yr (0.004 mil/yr) to as high as 10 μm/yr (0.4 mil/yr), the staff finds that Exelon has identified all credible aging effects for this component, material, and environment combination. The staff finds Exelon's proposal to manage the effects of aging with the One-Time Inspection program acceptable because the expected corrosion rate of zinc valve bodies exposed to condensation are low enough that loss of material is unlikely to cause a loss of intended function.

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 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 Evaluations for the Auxiliary Systems," is a summary comparison of PBAPS AMRs with those evaluated 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. For AMR items that the staff found to be consistent with the GALL-SLR Report (and no SER section is referenced), the staff determined that no additional evaluation or request for additional information was necessary and finds the items acceptable based on the GALL-SLR Report review of the 10 program elements. For AMR items that required additional evaluation (such as responses to requests for additional information), the staff's evaluation is documented in sections 3.3.2.1.2 through 3.3.2.1.14 below.

Table 3.3-1 Staff Evaluation for Auxiliary Systems Components in the GALL-SLR Report

Component Group (SRP-SLR Item No.)	Staff Evaluation
3.3.1-001	Consistent with the GALL-SLR Report (see SER Section 3.3.2.2.1)
3.3.1-002	Consistent with the GALL-SLR Report (see SER Section 3.3.2.2.1)
3.3.1-003	Not applicable to BWRs (see SER Section 3.3.2.1.1 and 3.3.2.2.2)
3.3.1-003a	Not applicable to BWRs (see SER Section 3.3.2.1.1 and 3.3.2.2.2)
3.3.1-004	Consistent with the GALL-SLR Report (see SER 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 SER Section 3.3.2.2.4)
3.3.1-007	Not applicable to BWRs (see SER Section 3.3.2.1.1)
3.3.1-008	Not applicable to BWRs (see SER Section 3.3.2.1.1)
3.3.1-009	Not applicable to BWRs (see SER Section 3.3.2.1.1)
3.3.1-010	Not applicable to PBAPS (see SER Section 3.3.2.1.1)
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
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	Consistent with the GALL-SLR Report
3.3.1-017	Not applicable to PBAPS (see SER Section 3.3.2.1.1)
3.3.1-018	Not applicable to PBAPS (see SER Section 3.3.2.1.1)
3.3.1-019	Consistent with the GALL-SLR Report
3.3.1-020	Consistent with the GALL-SLR Report
3.3.1-021	Consistent with the GALL-SLR Report
3.3.1-022	Consistent with the GALL-SLR Report
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 used (see SER Section 3.3.2.1.1)
3.3.1-027	Not applicable to PBAPS (see SER Section 3.3.2.1.1)
3.3.1-028	Not applicable to BWRs (see SER Sections 3.3.2.1.1 and 3.3.2.2.1)
3.3.1-029	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-030	Consistent with the GALL-SLR Report (See SER Section 3.3.2.1.4)
3.3.1-030a	Not applicable to PBAPS (see SER Section 3.3.2.1.1)
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

Component Group (SRP-SLR Item No.)	Staff Evaluation
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 (See SER Section 3.3.2.1.9)
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	Consistent with the GALL-SLR Report
3.3.1-048	Consistent with the GALL-SLR Report
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 PBAPS (see SER Section 3.3.2.1.1)
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 (See SER Sections 3.3.2.1.3)
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
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 (see SER Section 3.3.2.1.10)
3.3.1-065	Not used (see SER Section 3.3.2.1.1)
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	Consistent with the GALL-SLR Report
3.3.1-070	Consistent with the GALL-SLR Report
3.3.1-071	Consistent with the GALL-SLR Report
3.3.1-072	Consistent with the GALL-SLR Report
3.3.1-073	Consistent with the GALL-SLR Report (See SER Section 3.3.2.1.2)
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

Component Group (SRP-SLR Item No.)	Staff Evaluation
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 (see SER Sections 3.3.2.1.10)
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 (See SER Section 3.3.2.1.10)
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	Not applicable to PBAPS (see SER Sections 3.3.2.1.1.and 3.3.2.2.4)
3.3.1-094a	Not applicable to PBAPS (see SER Sections 3.3.2.1.1 and 3.3.2.2.3)
3.3.1-095	Consistent with the GALL-SLR Report (see SER Section 3.3.2.1.10)
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 (See SER Section 3.3.2.1.7)
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 (See SER Section 3.3.2.1.9)
3.3.1-100	Consistent with the GALL-SLR Report (See SER Section 3.3.2.1.9)
3.3.1-101	Not applicable to PBAPS (see SER Section 3.3.2.1.1)
3.3.1-102	Consistent with the GALL-SLR Report
3.3.1-103	Not applicable to PBAPS (see SER Section 3.3.2.1.1)
3.3.1-104	Not applicable to PBAPS (see SER Section 3.3.2.1.1)
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	Partially not applicable. Applicable materials use 3.3.1-107.
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	Partially not applicable. Applicable materials use 3.3.1-016.
3.3.1-111	Not applicable to PBAPS (see SER Section 3.3.2.1.1)
3.3.1-112	Consistent with the GALL-SLR Report (see SER 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 (See SER Section 3.3.2.1.12)
3.3.1-115	Not applicable to PBAPS
3.3.1-116	Consistent with the GALL-SLR Report
3.3.1-117	Consistent with the GALL-SLR Report

Component Group (SRP-SLR Item No.)	Staff Evaluation
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	Consistent with the GALL-SLR Report
3.3.1-123	Not applicable to PBAPS (see SER Section 3.3.2.1.1)
3.3.1-124	Not applicable to PBAPS (see SER Section 3.3.2.1.1)
3.3.1-125	Consistent with the GALL-SLR Report
3.3.1-126	Consistent with the GALL-SLR Report (see SER Section 3.2.2.1.14)
3.3.1-127	Consistent with the GALL-SLR Report (see SER Section 3.2.2.2.7)
3.3.1-128	Consistent with the GALL-SLR Report
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 (see SER Section 3.3.2.1.10)
3.3.1-131	Consistent with the GALL-SLR Report
3.3.1-132	Consistent with the GALL-SLR Report
3.3.1-133	Not applicable to PBAPS (see SER Section 3.3.2.1.1)
3.3.1-134	Consistent with the GALL-SLR Report (See SER Sections 3.3.2.1.10 and 3.3.2.1.6)
3.3.1-135	Consistent with the GALL-SLR Report
3.3.1-136	Consistent with the GALL-SLR Report
3.3.1-137	Consistent with the GALL-SLR Report (See SER Sections 3.3.2.1.9)
3.3.1-138	Consistent with the GALL-SLR Report (See SER Section 3.3.2.1.6)
3.3.1-139	Consistent with the GALL-SLR Report (See SER Section 3.3.2.1.6)
3.3.1-140	Consistent with the GALL-SLR
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	Not applicable to PBAPS (see SER Sections 3.3.2.2.1 and 3.3.2.2.3)
3.3.1-147	Not applicable to PBAPS (see SER Section 3.3.2.1.1)
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 PBAPS (see SER Section 3.3.2.1.1)
3.3.1-150	Consistent with the GALL-SLR Report (See SER Section 3.3.2.1.2)
3.3.1-151	Not applicable to PBAPS (see SER Section 3.3.2.1.1)
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	Not applicable to PBAPS (see SER Section 3.3.2.1.1)
3.3.1-156	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-157	Consistent with the GALL-SLR Report
3.3.1-158	Not applicable to PBAPS (see SER Section 3.3.2.1.1)
3.3.1-159	Not applicable to PBAPS (see SER Section 3.3.2.1.1)
3.3.1-160	Consistent with the GALL-SLR Report (See SER Section 3.3.2.1.3)
3.3.1-161	Not applicable to PBAPS (see SER Section 3.3.2.1.1)
3.3.1-162	This item number is not used in the SRP-SLR or the GALL-SLR Report

Component Group (SRP-SLR Item No.)	Staff Evaluation
3.3.1-163	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	Not applicable to PBAPS (see SER Section 3.3.2.1.1)
3.3.1-167	Consistent with the GALL-SRP
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 PBAPS (see SER Section 3.3.2.1.1)
3.3.1-170	Not applicable to PBAPS (see SER Section 3.3.2.1.1)
3.3.1-171	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-172	Consistent with the GALL-SRP (see SER Section 3.3.2.1.13)
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 PBAPS
3.3.1-176	Not applicable to PBAPS
3.3.1-177	Not applicable to PBAPS
3.3.1-178	Not applicable to PBAPS
3.3.1-179	Consistent with the GALL-SRP 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 PBAPS (see SER Section 3.3.2.1.1)
3.3.1-182	Consistent with the GALL-SRP Report
3.3.1-183	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-184	Not applicable to PBAPS (see SER Section 3.3.2.1.1)
3.3.1-185	Not applicable to PBAPS (see SER Section 3.3.2.1.1)
3.3.1-186	Not applicable to PBAPS (see SER Sections 3.3.2.1.1 and 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 SER 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 PBAPS (see SER Sections 3.3.2.1.1 and 3.3.2.2.8)
3.3.1-193	Consistent with the GALL-SLR Report (See SER Section 3.3.2.1.5)
3.3.1-194	Not applicable to PBAPS (see SER Section 3.3.2.1.1)
3.3.1-195	Not applicable to PBAPS (see SER Section 3.3.2.1.1)
3.3.1-196	Not applicable to PBAPS (see SER Section 3.3.2.1.1)
3.3.1-197	Consistent with the GALL-SLR Report
3.3.1-198	Consistent with the GALL-SLR Report
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
3.3.1-202	Not used (see SER Section 3.3.2.2.9)
3.3.1-203	Consistent with the GALL-SLR Report
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 SER 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

Component Group (SRP-SLR Item No.)	Staff Evaluation
3.3.1-208	Not applicable to PBAPS (see SER Section 3.3.2.1.1)
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 PBAPS (see SER Section 3.3.2.1.1)
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 PBAPS (see SER Section 3.3.2.1.1)
3.3.1-215	Not applicable to PBAPS (see SER Section 3.3.2.1.1)
3.3.1-216	Not applicable to PBAPS (see SER Section 3.3.2.1.1)
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 PBAPS (see SER Section 3.3.2.1.1)
3.3.1-219	Not applicable to PBAPS (see SER Section 3.3.2.1.1)
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 SER Section 3.3.2.2.4)
3.3.1-223	Not applicable to PBAPS (see SER Sections 3.3.2.1.1 and 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 PBAPS (see SER Section 3.3.2.1.1)
3.3.1-227	Not applicable to PBAPS (see SER Section 3.2.2.2.10)
3.3.1-228	Not applicable to PBAPS (see SER Sections 3.3.2.1.1 and 3.3.2.2.4)
3.3.1-229	Not applicable to PBAPS (see SER Section 3.3.2.1.1)
3.3.1-230	Not applicable to PBAPS (see SER Section 3.3.2.1.1)
3.3.1-231	Not applicable to PBAPS (see SER Section 3.3.2.2.3)
3.3.1-232	Consistent with the GALL-SLR Report (see SER Section 3.3.2.2.4)
3.3.1-233	Not applicable to PBAPS (see SER Section 3.3.2.2.8)
3.3.1-234	Consistent with the GALL-SLR Report (see SER Section 3.3.2.2.10)
3.3.1-235	Consistent with the GALL-SLR Report
3.3.1-236	Not applicable to PBAPS (see SER Section 3.3.2.1.1)
3.3.1-237	Consistent with the GALL-SLR Report (See SER Section 3.3.2.1.12)
3.3.1-238	Not applicable to PBAPS (see SER Section 3.3.2.1.1)
3.3.1-239	Not applicable to PBAPS (see SER Section 3.3.2.1.1)
3.3.1-240	Not applicable to PBAPS (see SER Section 3.3.2.2.10)
3.3.1-241	Consistent with the GALL-SLR Report (see SER Section 3.3.2.2.4)
3.3.1-242	Consistent with the GALL-SLR Report (see SER 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	Consistent with the GALL-SLR Report
3.3.1-245	Not applicable to PBAPS (see SERs Sections 3.3.2.1.1 and 3.3.2.2.10)
3.3.1-246	Not applicable to PBAPS (see SERs Sections 3.3.1.1 and 3.3.2.2.4)
3.3.1-247	Not applicable to PBAPS (see SERs Sections 3.3.1.1 and 3.3.2.2.10)
3.3.1-248	Not applicable to PBAPS (see SER Section 3.3.2.1.1)
3.3.1-249	Consistent with the GALL-SLR Report
3.3.1-250	Not applicable to PBAPS (see SER Section 3.3.2.1.1)
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 PBAPS (see SER Section 3.3.2.1.1)

Component Group (SRP-SLR Item No.)	Staff Evaluation
3.3.1-253	Consistent with the GALL-SLR Report (See SER Section 3.3.2.1.11)
3.3.1-254	Not applicable to PBAPS (see SER Sections 3.3.1.1 and 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 used. Addressed by 3.3.1-085 and 3.3.1-091 (see SER Sections 3.3.2.1.1 and 3.3.2.1.10)
3.3.1-259	Not applicable to PBAPS (see SER Section 3.3.2.1.1)
3.3.1-260	Consistent with the GALL-SLR Report
3.3.1-261	Not applicable to PBAPS (see SER Section 3.3.2.1.1)
3.3.1-262	Not used. Addressed by 3.3.1-237 (see SER Section 3.3.2.1.1)
3.3.1-263	Partially not applicable. Partially addressed by 3.3.1-150, 3.3.1-253, and 3.3.1-119.

The staff's review of component groups, as described in SER Section 3.0.2.2, is summarized in the following three sections:

(1) SER Section 3.3.2.1 discusses AMR results for components that the applicant states are either not applicable to PBAPS 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 or not used, and documents any RAIs issued and the staff's conclusions.

(2) SER Section 3.3.2.2 discusses AMR results for which the GALL-SLR Report and SRP-SLR recommend further evaluation.

(3) SER 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 (A-D, plus not used or not applicable)

The following subsections document the staff's review of AMR results listed in SLRA Tables 3.3.2-1 through 3.3.2-36 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.

Additionally, SER 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

Exelon claimed that the following SLRA Table 3.3.1 items were not applicable to PBAPS: 3.3.1-010, 3.3.1-017, 3.3.1-018, 3.3.1-027, 3.3.1-030a, 3.3.1-051, 3.3.1-094, 3.3.1-094a, 3.3.1-101, 3.3.1-103, 3.3.1-104, 3.3.1-111, 3.3.1-115, 3.3.1-123, 3.3.1-124, 3.3.1-133, 3.3.1-146, 3.3.1-147, 3.3.1-149, 3.3.1-151, 3.3.1-155, 3.3.1-158, 3.3.1-159, 3.3.1-161, 3.3.1-166, 3.3.1-169, 3.3.1-170, 3.3.1-175, 3.3.1-176, 3.3.1-177, 3.3.1-178, 3.3.1-181, 3.3.1-184, 3.3.1-185, 3.3.1-186, 3.3.1-192, 3.3.1-194, 3.3.1-195, 3.3.1-196, 3.3.1-208, 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, 3.3.1-233, 3.3.1-236, 3.3.1-238, 3.3.1-239, 3.3.1-240, 3.3.1-245, 3.3.1-246, 3.3.1-247, 3.3.1-248, 3.3.1-250, 3.3.1-252, 3.3.1-254, 3.3.1-258, 3.3.1-259, and 3.3.1-261. The staff reviewed the SLRA and UFSAR and confirmed that the particular combination of aging effect, material, and environment represented by the AMR item does not exist at the site.

Exelon identified the following items as not being applicable to the SLRA: 3.3.1-003, 3.3.1-003a, 3.3.1-007, 3.3.1-008, 3.3.1-009, and 3.3.1-028. The staff reviewed and confirmed these AMR items are not applicable to PBAPS because these items are applicable only to PWRs and PBAPS is a BWR.

Items 3.3.1-026 (addressed by 3.3.1-203), 3.3.1-065 (addressed by 3.3.1-025), 3.3.1-202 (addressed by 3.3.2.2.9), 3.3.1-258 (addressed by 3.3.1-085 and 3.3.1-091) and 3.3.1-262 (addressed by 3.3.1-237) are not used. Items 3.3.1-108 (addressed by 3.3.1-107), 3.3.1-110 (addressed by item 3.3.1-016), and 3.3.1-263 (addressed by 3.3.1-150, 3.3.1-253, and 3.3.1-119) are partially not applicable and partially not used. The portions that are not used are addressed by other items. The staff reviewed and confirmed these alternate items are acceptable because they adequately address the relevant aging effects.

For SLRA Table 3.3.1, item 3.3.1-026, the applicant claimed that the corresponding items in the GALL-SLR Report are not applicable because they are addressed by SLRA Table 3.3.1, item 3.3.1-203. The staff reviewed the SLRA and confirmed that the aging effects will be addressed by the cited SLRA Table 3.3.1 item. Therefore, the staff finds the applicant's proposal acceptable.

SLRA Table 3.3.1, item 3.3.1-065, addresses managing loss of material and flow blockage due to fouling for aluminum piping and piping components exposed to raw water, treated water, or raw water (potable). Exelon stated that this item is not used and that this component, material, environment, and aging effect combination is addressed in item 3.3.1-025. The staff evaluated Exelon's claim and finds it acceptable because the applicant's AMR results do not include any component, material, environment, and aging effect combinations that would be applicable to Table 1 item 3.3.1-065.

For SLRA Table 3.3.1, item 3.3.1-262, Exelon claimed that the corresponding item in the GALL-SLR Report is not applicable because either there are no corresponding components exposed to closed cooling water, or they are addressed by another SLRA Table 1 item for components exposed to treated water. The staff reviewed the SLRA and the UFSAR and confirmed that the aging effects will be addressed by another SLRA Table 1 item (3.3.1-237) or there are no applicable components. Therefore, the staff finds Exelon's proposed approach acceptable.

3.3.2.1.2 Cracking and Loss of Material

SLRA Table 3.3.1, item 3.3.1-073, addresses cracking and loss of material for concrete piping and piping components exposed to outdoor air. For the corresponding 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 the cooling tower ceramic tile fill exposed to outdoor air. The AMR items cite plant-specific note 2, which states the ceramic tile (vitrified clay fill) in an outdoor air and raw water environment is considered similar to concrete, concrete cylinder piping, or asbestos cement in a raw water or outdoor air environment.

Based on its review of components associated with item 3.3.1-073 for which Exelon cited generic note E, the staff finds Exelon's proposal to manage the effects of aging using the Inspection of Water-Control Structures Associated with Nuclear Power Plants program acceptable because the program includes periodic visual inspections and cleaning that can identify cracking, loss of material, and flow blockage and provide reasonable assurance that the intended function of the ceramic tiles will be maintained during the subsequent period of extended operation.

SLRA Table 3.3.1, item 3.3.1-150, addresses cracking, blistering, and loss of material for fiberglass piping and piping components exposed to air. For the corresponding SLRA Table 2 AMR item that cites 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 fiberglass hazard barriers.

Based on its review of components associated with item 3.3.1-150 for which Exelon cited generic note E, the staff finds Exelon's proposal to manage the effects of aging using the Inspection of Water-Control Structures Associated with Nuclear Power Plants program acceptable because the program includes periodic visual inspections that can identify cracking, blistering, and loss of material and provide reasonable assurance that the intended function of the hazard barriers will be maintained during the subsequent period of extended operation.

3.3.2.1.3 Cracking Due to Stress Corrosion Cracking

SLRA Table 3.3.1, item 3.3.1-160, addresses cracking for copper alloy with greater than 15 percent zinc piping, piping components, and heat exchanger components exposed to closed-cycle cooling water, raw water, and waste water. 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 copper alloy with greater than 15 percent zinc sluice gate metal components exposed to raw water. The AMR items cite plant-specific note 1, which states that the Inspection of Water-Control Structures Associated with Nuclear Power Plants program is substituted to manage the applicable aging effects for this component type, material, and environment combination.

Based on its review of components associated with items 3.3.1-160 for which Exelon cited generic note E, the staff finds Exelon's proposal to manage the effects of aging using the Inspection of Water-Control Structures Associated with Nuclear Power Plants program acceptable because the program includes periodic visual inspections that can identify cracking and provide reasonable assurance that the intended function of the metallic sluice gate components will be maintained during the subsequent period of extended operation.

SLRA Table 3.3.1, AMR item 3.3.1-057 addresses hardening, loss of strength, and shrinkage for elastomer fire barrier penetration seals exposed to air and condensation. During its review of components associated with AMR item 3.3.1-057 for which Exelon cited generic note A, the staff noted that the SLRA credits the Fire Protection program to manage the aging effects for elastomer fire barrier penetration seals exposed to uncontrolled indoor air.

For the items in SLRA Table 3.3.2-14 stating that hardening and loss of strength for elastomer fire barrier penetration seals exposed to uncontrolled indoor air will be managed by the Fire Protection program, the staff determined the need for additional information. The staff held a clarification call with Exelon on July 10, 2019. Exelon's supplement in response to the call is documented in ADAMS Accession No. ML19193A006.

In its response, Exelon revised SLRA Table 3.3.2-14 to include shrinkage as an applicable aging effect for elastomer fire barrier penetration seals exposed to uncontrolled indoor air. The staff finds Exelon's response and changes to SLRA Table 3.3.2-14 acceptable because it revised the item in Table 3.3.2-14, associated with SLRA Table 3.3.1, AMR item 3.3.1-057 and generic note A, to include hardening, loss of strength, and shrinkage as applicable aging effects to be managed by the Fire Protection program. The identification of these aging effects is consistent with GALL-SLR Report AMP XI.M26.

Based on its review of components associated with AMR item 3.3.1-057 for which Exelon cited generic note A, the staff finds Exelon's proposal to manage the effects of aging using the Fire Protection program acceptable because it is consistent with GALL-SLR Report AMR item A-19.

3.3.2.1.4 Cracking, Loss of Material, and Flow Blockage

SLRA Table 3.3.1, item 3.3.1-030, addresses cracking, loss of material, and flow blockage for concrete exposed to raw water. 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 cooling tower fill ceramic tiles exposed to raw water. The AMR items cite plant-specific note 2, which states that the ceramic tile (vitrified clay fill) in an outdoor raw water environment is considered similar to concrete, concrete cylinder piping, or asbestos cement in a raw water environment.

Based on its review of components associated with item 3.3.1-030 for which Exelon cited generic note E, the staff finds Exelon's proposal to manage the effects of aging using the Inspection of Water-Control Structures Associated with Nuclear Power Plants program acceptable because the program includes periodic visual inspections and cleaning activities that can identify cracking, loss of material, and flow blockage for the cooling tower fill and provide reasonable assurance that the intended function of the ceramic tiles will be maintained during the subsequent period of extended operation.

3.3.2.1.5 Long-Term Loss of Material due to General Corrosion

SLRA Table 3.3.1, item 3.3.1-193, addresses long-term loss of material due to general corrosion for carbon and low alloy steel bolting exposed externally to waste water in the Plant Equipment and Floor Drain System. For the SLRA Table 2 AMR item in SLRA Table 3.3.2-19 associated with item 3.3.1-193 that cites generic note E, the SLRA credits the Bolting Integrity AMP to manage the aging effect for closure bolting exposed externally to waste water. The AMR item cites plant-specific note 1, which states, "The Bolting Integrity (B.2.1.10) program is substituted to manage the aging effect(s) applicable to this component type, material, and environment."

Based on its review of components associated with AMR item 3.3.1-193, for which Exelon cited generic note E, the staff finds Exelon's proposal to manage the effects of aging using the Bolting Integrity AMP acceptable because this existing condition monitoring program manages aging for loss of preload, cracking, and loss of material in safety-related and nonsafety-related closure bolting on pressure-retaining components.

3.3.2.1.6 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, Crevice Corrosion, or Microbiologically-Influenced Corrosion

SLRA Table 3.3.1, AMR items 3.3.1-138 and 3.3.1-139, address any type 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, or waste water that will be managed for: (a) loss of coating or lining integrity due to blistering, cracking, flaking, peeling, delamination, rusting, or physical damage (item 3.3.1-138); and (b) loss of material due to general, pitting, crevice corrosion, or microbiologically-influenced corrosion (MIC) (item 3.3.1-139). For the SLRA Table 2 AMR items that cite generic note E, the SLRA credits the Outdoor and Large Atmospheric Metallic Storage Tanks and Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components programs to manage the aging effects for internally coated carbon steel tanks exposed to treated water and raw water. The staff's evaluation of each of these programs to manage the effects of aging follows.

Outdoor and Large Atmospheric Metallic Storage Tanks program. The staff noted that GALL-SLR Report AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks," states that an applicant may elect to manage the aging effects for internal coatings/linings for in-scope piping, piping components, heat exchangers, and tanks with an alternative AMP as long as: (a) the recommendations of GALL-SLR Report AMP XI.M42 are incorporated into the alternative program; (b) exceptions or enhancements associated with the Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks program are included in the alternative AMP; and (c) the UFSAR supplement for the Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks program is included in the SLRA with a reference to the alternative AMP.

Based on its review of components associated with AMR items 3.3.1-138 and 3.3.1-139 for which Exelon cited generic note E, the staff finds Exelon's proposal to manage the effects of aging using the Outdoor and Large Atmospheric Metallic Storage Tanks program acceptable for the following reasons: (a) the activities to manage the aging effects for internal coatings are consistent with the recommendations in GALL-SLR Report AMP XI.M42; (b) the exceptions associated with the Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks program are not applicable to the subject tanks; and (c) as amended by letter dated January 23, 2019 (ADAMS Accession No. ML19023A015), SLRA Section A.2.1.29, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks," was revised to include a reference to the Outdoor and Large Atmospheric Metallic Storage Tanks program.

Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program. The staff notes 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) internal environment would not promote microbiologically-influenced corrosion (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 Exelon cited generic note E, the staff finds Exelon's proposal to manage the effects of aging using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components 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 tanks is leakage boundary; (c) the internal environments of these tanks do not contain chemical compounds that could cause accelerated corrosion; (d) these tanks are not subject to galvanic corrosion; (e) as documented in SLRA Section B.2.1.25, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," these tanks do not credit the internal coating; and (f) the internal environment for the radwaste building personnel decontamination hot water heater tank is potable raw water that is treated with a biocide (i.e., chlorine); therefore, the internal environment would not promote MIC of the base metal.

However, for SLRA AMR items 3.3.1-138 and 3.3.1-139 that cited a treated water environment, the staff determined the need for additional information for why the treated water environment for internally coated carbon steel tanks would not promote MIC of the base metal, which resulted in the issuance of an RAI. RAI B.2.1.29-2 and Exelon's response are documented in ADAMS Accession Nos. ML19108A427 and ML19122A289, respectively.

In its response, Exelon stated: (a) "the specific sources of treated water for these tanks are reactor water from the RWCU [reactor water cleanup] system and condensate from the condensate storage tanks;" (b) the sources of water for these tanks maintain limits for chlorides and sulfates at 10 ppb; (c) the tanks communicate with the service air system, which supplies clean filtered air and contains no potential sources of contamination; (d) "the RWCU regenerative heat exchangers contain reactor water as the process fluid on both sides of the tubes;" (e) "the RWCU non-regenerative heat exchangers are cooled by the reactor building closed cooling water system, which is a closed loop system that is treated with corrosion inhibitors and is monitored and treated for microbiological growth;" and (f) "operating experience has not revealed evidence of MIC occurring in these tanks or in any other components in treated water systems."

The staff finds Exelon's response acceptable for the following reasons: (a) as document in NUREG-2221, "Technical Bases for Changes in the Subsequent License Renewal Guidance Documents NUREG-2191 and NUREG-2192," MIC is not likely in treated water systems where sulfates and chlorides are less than 150 ppb; (b) the tanks do not communicate with raw or waste water systems that have the potential to contaminate treated water systems; and (c) plant-specific operating experience has not identified MIC in any components in treated water systems at PBAPS.

3.3.2.1.7 Loss of Material

SLRA Table 3.3.1, item 3.3.1-096b, addresses loss of material for steel heat exchanger components exposed to condensation. For the corresponding SLRA Table 2 AMR item that cites generic note E, the SLRA credits the Inspection of Internal Surfaces in Miscellaneous

Piping and Ducting program to manage the aging effects for heat exchanger components exposed to condensation.

Based on its review of components associated with item 3.3.1-96b for which Exelon cited generic note E, the staff finds Exelon's proposal to manage the effects of aging using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting program acceptable because the program includes periodic visual inspections that can identify loss of material and can provide reasonable assurance that the intended function of the heat exchanger components will be maintained during the subsequent period of extended operation.

3.3.2.1.8 Loss of Material and Long-Term Loss of Material

In SLRA Table 3.3.2-30, the applicant stated that carbon steel piping, piping components, and pump casings exposed to sodium pentaborate solution will be managed for loss of material and long-term loss of material by the Water Chemistry and One-Time Inspection programs. The AMR items cite generic note G, "Environment not in NUREG-2191 for this component and material." The AMR items cite plant-specific note 4, which states "[t]he Water Chemistry (B.2.1.2) program manages the aging effects on Standby Liquid Control (SLC) system components subject to the sodium pentaborate environment by monitoring and controlling SLC poison storage tank treated water chemistry. Aging effects on carbon steel exposed to a sodium pentaborate environment are established using a treated water environment."

The staff reviewed the associated items in the SLRA and considered whether the aging effects proposed by the applicant constitute all of the credible aging effects for this component, material, and environment description. The GALL-SLR Report states that carbon steel components typically are not susceptible to stress corrosion cracking and are mainly susceptible to loss of material. Based on its review of the GALL-SLR Report, the staff finds that the applicant has identified all credible aging effects for this component, material, and environment combination.

As discussed above, the applicant stated in plant-specific note 4 to the AMR items that the SLC poison storage tank treated water chemistry will be controlled by the Water Chemistry program. Additionally, the staff reviewed the following reports:

- NUREG/CR-6001, "Aging Assessment of BWR Standby Liquid Control Systems," dated August 17, 1992, was focused on corrosion of stainless steel components and how corrosion of the SLC System compared to corrosion of the Spent Fuel Pool System, which also contains boric acid in a liquid environment at similar temperatures and pressures. The study concluded that the pH of the SLC System varied with temperature, but was generally greater than 6.8 pH, which resulted in a less aggressive environment than the Spent Fuel Pool System.
- EPRI Report 1010639, "Non-Class 1 Mechanical Implementation Guideline and Mechanical Tools," Revision 4, which discusses borated water in BWR SLC systems and how the sodium pentaborate decahydrate used in the SLC system results in a pH in the range of 6.8-8.5, which is less aggressive than boric acid when concentrated.
- EPRI Report 1000975, "Boric Acid Corrosion Guidebook," Revision 1, which gives corrosion rates of carbon and low-alloy steel, in various concentrations of aerated boric acid solutions, to be generally low (0.05-1.1 mm/year (0.002-0.045 inch/year)), when the temperature was below 60°C (140°F).

The staff finds the applicant's proposal to manage the effects of aging acceptable because the Water Chemistry program monitors and controls the concentration of deleterious species in the water storage tanks that provide water to the SLC system that contains the sodium pentaborate solution. Additionally, the staff finds Exelon's proposal to manage the effects of aging with the One-Time Inspection program acceptable because the expected corrosion rate of carbon steel piping, piping components, and pump casings exposed internally to a sodium pentaborate solution are low enough that loss of material is unlikely to cause a loss of intended function

3.3.2.1.9 Loss of Material due to General, Pitting, Crevice Corrosion, and Microbiologically-Influenced Corrosion

SLRA Table 3.3.1, item 3.3.1-034, addresses loss of material for copper-alloy piping and piping components exposed to raw water. 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 copper alloy with greater than 15 percent zinc sluice gate metal components exposed to raw water. The AMR items cite plant-specific note 1, which states that the Inspection of Water-Control Structures Associated with Nuclear Power Plants program is substituted to manage the applicable aging effects for this component type, material, and environment combination.

Based on its review of components associated with item 3.3.1-034 for which Exelon cited generic note E, the staff finds Exelon's proposal to manage the effects of aging using the Inspection of Water-Control Structures Associated with Nuclear Power Plants program acceptable because the program includes periodic visual inspections that can identify loss of material and provide reasonable assurance that the intended function of these metallic sluice gate components will be maintained during the subsequent period of extended operation.

SLRA Table 3.3.1, AMR item 3.3.1-137, addresses loss of material due to general, pitting, crevice corrosion, and microbiologically-influenced corrosion for steel, stainless steel, and aluminum tanks exposed to treated water, raw water, and waste water. For the SLRA Table 2 AMR items that cite generic note E, the SLRA credits the ASME Section XI, Subsection IWF and Structures Monitoring programs to manage the aging effects for carbon steel, galvanized steel, low alloy steel, and stainless steel component supports and carbon steel hazard barriers/elastomers. The AMR items cite plant-specific notes 3 and 5 which state: (a) the ASME Section XI, Subsection IWF program is substituted to manage the aging effects applicable to this component type, material, and environment combination; and (b) the Structures Monitoring program is substituted to manage the aging effects applicable to this component type, material, and environment combination.

For SLRA AMR item 3.3.1-137, the staff determined the need for additional information related to inspecting underwater supports members and structural components by the ASME Section XI, Subsection IWF program and the Structures Monitoring program, respectively. The staff held a clarification call with Exelon on July 10, 2019. Exelon's response to the call is documented in Supplement No. 8 (ADAMS Accession No. ML19206A180).

In its supplement, Exelon revised SLRA Appendix B, Section B.2.1.31, "ASME Section XI, Subsection IWF" and Section B.2.1.34, "Structures Monitoring," to state that support members and structural components located underwater will not be accessible for evaluation with the same level of visual acuity as support members above water and inspections will be implemented to establish the condition of these structures by using divers or by dewatering.

During its evaluation of Exelon's response, the staff noted that the conditions for inspection will be established such that support members below water can be evaluated with an adequate level of visual acuity. The staff finds Exelon's response and changes to SLRA Sections B.2.1.31 and B.2.1.34 acceptable because the use of divers or dewatering provides reasonable assurance that the aging effects for underwater support members and structural components will be managed by the ASME Section XI, Subsection IWF program and Structures Monitoring program, respectively.

Based on its review of components associated with AMR items 3.3.1-137 for which Exelon cited generic note E, the staff finds Exelon's proposal to manage the effects of aging using the ASME Section XI, Subsection IWF and Structures Monitoring programs acceptable because the visual examinations performed for each program will be able to identify degradation before there is a loss of intended function. In addition, inspections will be performed with frequencies determined in accordance with the ASME Section XI, Subsection IWF IWF-2500-1 and RG 1.160, which are consistent with GALL-SLR Report AMP XI.S3, "ASME Section XI, Subsection IWF" and AMP XI.S6, "Structures Monitoring," respectively. Therefore, the staff finds that Exelon 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 Table 3.3.1, AMR items 3.3.1-099 and 3.3.1-100, addresses loss of material for copper alloy with 15 percent zinc or less, and stainless steel piping, piping components, and valve bodies exposed to lubricating 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 effects for copper alloy with 15 percent zinc or less and stainless steel piping, piping components, and valve bodies.

Based on its review of components associated with AMR items 3.3.1-099 and 3.3.1-100 for which Exelon cited generic note E, the staff finds Exelon's proposal to manage the effects of aging using the Internal Surfaces in Miscellaneous Piping and Ducting Components program acceptable because the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components AMP performs periodic inspections on a representative sample of 20 percent of each population or a maximum of 25 components per population. The staff also noted that the applicant stated, "the lube oil system components are the only components in the copper/lube oil and stainless steel/lube oil populations. Therefore, these components will be inspected periodically during the second period of extended operation and their condition will be assessed directly."

For SLRA AMR items 3.3.1-099, and 3.3.1-100 the staff determined the need for additional information, which resulted in the issuance of an RAI. RAI B.2.1.26-1 and Exelon's response are documented in ADAMS Accession No. ML19122A289.

In its response, Exelon stated that the preventive measures of the Lubricating Oil Analysis program would not be effective to manage aging of these components because lube oil for these compressors is not in the scope of the activities performed under the Lubricating Oil AMP. Exelon also stated that the lube oil system components described above are the only components in the copper/lube oil and stainless steel/lube oil populations. The staff finds Exelon's response acceptable because the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program performs periodic inspections on a representative sample of each population and is capable of detecting loss of material. The staff also noted that the system components in question are the only components in the copper/lube oil and stainless steel/lube oil population and will be inspected periodically by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program.

Based on its review of components associated with AMR items 3.3.1-099 and 3.3.1-100 for which Exelon cited generic note E, the staff finds Exelon'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 uses periodic visual inspections and can detect loss of material for these components.

3.3.2.1.10 Loss of Material Due to General, Pitting, Crevice Corrosion and Microbiologically-influenced Corrosion; Flow Blockage Due to Fouling

SLRA Table 3.3.1, AMR item 3.3.1-91, addresses loss of material due to general, pitting, crevice corrosion, and MIC; and flow blockage due to fouling for steel piping, piping components, heat exchanger components, and tanks exposed to waste water. For the SLRA Table 2 AMR items that cite generic note E, the SLRA credits the External Surfaces Monitoring of Mechanical Components program to manage loss of material for carbon steel drip pans exposed to waste water.

Based on its review of components associated with AMR item 3.3.1-91 for which Exelon cited generic note E, the staff finds Exelon's proposal to manage the effects of aging using the External Surfaces Monitoring of Mechanical Components program acceptable because (a) the license renewal intended function of the drip pans is leakage boundary; therefore, flow blockage due to fouling is not an applicable AERM; (b) periodic visual inspections of component surfaces at least once per refueling outage are sufficient to identify the potential for corrosion; and (c) managing loss of material for the external surfaces of steel components exposed to waste water using the External Surfaces Monitoring of Mechanical Components program is consistent with SRP-SLR Table 3.3-1, item 135.

SLRA Table 3.3.1, AMR item 3.3.1-064 addresses loss of material due to pitting, crevice corrosion, and MIC, and flow blockage due to fouling for steel and copper alloy piping and piping components exposed to raw water, treated water, or raw water (potable). During its review of components associated with AMR item number 3.3.1-064 for which Exelon cited generic note B, the staff noted that the SLRA credits the Fire Water System program to manage loss of material and flow blockage due to fouling for copper alloy with greater than 15 percent zinc hydrants, piping, and piping components.

For SLRA AMR item 3.3.1-064, the staff determined the need for additional information, which resulted in the issuance of an RAI. See the staff's evaluation of the response to RAIs 3.3.2.1.1-1 and 3.3.2.1.1-1a in SER section 3.3.2.1.12 for item 3.1.1-137 related to managing cracking for copper alloy with greater than 15 percent zinc hydrants, piping, and piping components in the fire water system.

SLRA Table 3.3.1, items 3.3.1-085, 3.3.1-091, 3.3.1-095, and 3.3.1-258, address components where flow blockage due to fouling is an applicable AERM in a waste water internal environment. During its review of components associated with (a) AMR items 3.3.1-85, 3.3.1-91, 3.3.1-95, and 3.3.1-258; (b) a pressure boundary intended function; and (c) a waste water internal environment, the staff noted that flow blockage due to fouling is not included as an AERM. The staff determined the need for additional information to determine why flow blockage due to fouling is not an applicable aging effect for the subject components. Exelon provided a supplement on January 23, 2019 (ADAMS Accession No. ML19023A015) to address the staff's concern.

In its supplement, Exelon revised SLRA Table 3.3.2-12 to reflect that a waste water internal environment is not applicable for copper alloy with 15 percent zinc or less valve bodies. In addition, Exelon revised SLRA Sections 3.2.2.1.4, 3.3.2.1.19, A.2.1.25, and B.2.1.25; and SLRA Tables 3.2.2-2, 3.2.2-4, 3.2.2-6, 3.3.1, and 3.3.2-19 to include flow blockage due to fouling as an AERM for components associated with (a) AMR items 3.3.1-85, 3.3.1-91, 3.3.1-95, and 3.3.1-258; (b) a pressure boundary intended function; and (c) a waste water internal environment. Item 3.3.1-258 is not used. The AERM are being managed by 3.3.1-085 and 3.3.1-091. The staff finds Exelon's supplemental response acceptable because (a) flow blockage due to fouling is no longer an applicable AERM for copper alloy with 15 percent zinc or less valve bodies in SLRA Table 3.3.2-12; and (b) all other components are appropriately being managed for flow blockage due to fouling.

SLRA Table 3.3.1, AMR item 3.3.1-130 addresses loss of material due to pitting, crevice corrosion, and MIC, and flow blockage due to fouling for metallic sprinklers exposed to air, condensation, raw water, treated water, or raw water (potable). During its review of components associated with AMR item number 3.3.1-130 for which Exelon cited generic notes B and D, the staff noted that the SLRA credits the Fire water System program to manage the aging effect for copper alloy with greater than 15 percent zinc sprinklers, piping, and piping components. For SLRA AMR item 3.3.1-130, the staff determined the need for additional information, which resulted in the issuance of an RAI. See the staff's evaluation of the response to RAIs 3.3.2.1.1-1 and 3.3.2.1.1-1a for item 3.1.1-137 related to managing cracking for copper alloy with greater than 15 percent zinc piping and piping components in the fire water system.

SLRA Table 3.3.1, AMR item 3.3.1-134, addresses loss of material and flow blockage due to fouling for steel, stainless steel, and copper-alloy piping, piping components, and heat exchanger components exposed to raw water (for components not covered by NRC GL 89-13, "Service Water System Problems Affecting Safety-Related Equipment"). During its review of components associated with AMR item 3.3.1-134 for which Exelon cited generic note A, the staff noted that the traveling screens with a filtration intended function in SLRA Table 3.3.2-34 are not being managed for flow blockage due to fouling. The staff determined the need for additional information to determine why flow blockage due to fouling is not an applicable aging effect for the subject components. Exelon provided a supplement on January 23, 2019 (ADAMS Accession No. ML19023A015), to address the staff's concern.

In its supplement, Exelon revised SLRA Sections 3.3.2.1.34, A.2.1.25, and B.2.1.25; and SLRA Table 3.3.2-34 to include flow blockage due to fouling as an AERM for the traveling screens with a filtration intended function. The staff finds Exelon's supplemental response acceptable because the traveling screens with a filtration intended function in SLRA Table 3.3.2-34 are now appropriately being managed for flow blockage due to fouling.

3.3.2.1.11 Loss of Material Due to Wear

SLRA Table 3.3.1, AMR item 3.3.1-253, addresses loss of material due to wear for polyvinyl chloride (PVC) piping and piping components exposed to raw water, raw water (potable), treated water, and waste water. For the SLRA Table 2 AMR item that cites generic note E, the SLRA credits the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program to manage the aging effect for PVC tanks exposed to treated water. The staff finds Exelon's proposal to manage the effects of aging using the Internal Surfaces in Miscellaneous Piping and Ducting Components acceptable because managing loss of material due to wear for PVC components exposed to treated water using the Internal Surfaces in Miscellaneous Piping and Ducting Components is consistent with GALL-SLR item 3.3.1-253.

3.3.2.1.12 No Aging Effect

SLRA Table 3.1.1, AMR item 3.1.1-137, states that there are no aging effects requiring management for copper-alloy piping and piping components exposed to air, condensation, or gas. During its review of components associated with AMR item 3.1.1-137 for which Exelon cited generic notes A and C, the staff noted that the SLRA states that there are no aging effects for copper alloy (with greater than 15 percent zinc) piping and piping components exposed to air-indoor uncontrolled, bronze bolts exposed to air-indoor uncontrolled or air-outdoor, and brass bolts exposed to air-indoor uncontrolled. The staff noted that brass bolts exposed to an air-indoor uncontrolled environment also cite items 3.5.1-087 and 3.5.1-088 for loss of preload as an aging effect. In addition, during its review of components made of copper alloy with greater than 15 percent zinc, including some citing AMR items 3.2.1-057 and 3.3.1-114, the staff noted that the SLRA did not include cracking due to SCC as an AERM in some air, condensation, raw water, and waste water environments.

For SLRA AMR items 3.1.1-137, 3.2.1-057, and 3.3.1-114, the staff determined the need for additional information, which resulted in the issuance of an RAI. RAI 3.3.2.1.1-1 and Exelon's response are documented in ADAMS Accession No. ML19122A289.

In its response, Exelon stated that cracking of copper alloy with greater than 15 percent zinc is a cited aging effect requiring management for: (a) insulated components exposed to condensation in the chilled water system and domestic water system because the insulation is assumed to contain contaminants that could leach out onto the copper-alloy component due to moisture under the insulation; and (b) components in the circulating water pump structure (SLRA Table 3.5.2-3), emergency cooling water system (SLRA Table 3.3.2-11), emergency service water system (SLRA Table 3.3.2-13), and service water system (SLRA Table 3.3.2-29) exposed to raw water due to chemicals used for macrobiological control, which contain ammonia or ammonium compounds.

Exelon also stated that: (a) cracking due to SCC is not cited as an AERM (other than as cited above) for copper alloy with greater than 15 percent zinc components exposed to air-indoor uncontrolled, air–outdoor, air–dry, treated water, waste water and certain applications in the condensation and raw water environments; (b) plant-specific operating experience for the past 10 years did not identify any instances of aging effects due to exposure to ammonia or ammonium compounds; and (c) for five of the following environments, "ammonia or ammonium compounds are not assumed to be present." A summary of Exelon's bases are as follows.

- Air-indoor uncontrolled: leakage from packing, gaskets, seals, and o-rings, that might contain trace amounts of ammonia or ammonium compounds, onto components is not required to be considered when determining aging effects requiring management. Exelon stated that this position is supported by NUREG-2221, Table 3-2, "SRP-SLR Chapter 2, Scoping and Screening, Differences from SRP-LR, Revision 2 and Their Technical Bases."

- Air-outdoor: "[a]lthough chemicals containing ammonia or ammonium compounds may be stored onsite (e.g., chemicals used for macrobiological control) or at offsite facilities, spills are event driven and ammonia or ammonium compounds are not assumed to be present in outdoor air for the determination of aging effects."
- Air-dry: "[u]se of this term is only associated with internal air environments located downstream of the compressed air system air dryers and filters." "[A]mmonium compounds are not assumed to be present in dry air for the determination of aging effects."
- Treated water: the treated water used in reactor grade water, condensate storage water, demineralized storage water, and torus water do not normally include ammonia or ammonium compounds. "[w]ater chemistry excursions that have the potential to produce ammonia are event driven (e.g., unexpected increase in zinc injection flow, resin intrusion event) and ammonia or ammonium compounds are not assumed to be present for the determination of aging effects." . . . "Although ammonia or ammonium compounds can be used in auxiliary boilers as a boiler feedwater pH controlling chemical, PBAPS does not use boiler feedwater pH controlling chemicals."
- Waste water: "[w]aste water normally is not expected to contain ammonia or ammonium compounds. Although chemicals containing ammonia or ammonium compounds may be stored onsite (e.g., chemicals used for macrobiological control), spills are event driven and ammonia or ammonium compounds are not assumed to be present in waste water for the determination of aging effects."
- Condensation: "cracking due to SCC is not cited as an aging effect requiring management for copper alloy with greater than 15 percent zinc components in this environment of condensation."
- Raw Water (other than open-cycle cooling water): neither the domestic water or fire protection system operate with chemicals which contain ammonia or ammonium compounds.

During its evaluation of Exelon's response to RAI 3.3.2.1.1-1, the staff noted that Exelon's interpretation of NUREG-2221, Table 3-2, was not consistent with staff-issued documents associated with subsequent license renewal and the use of the term "not assumed to be present" is ambiguous. The staff determined the need for additional information, which resulted in the issuance of an RAI. RAI 3.3.2.1.1-1a and Exelon's response are documented in ADAMS Accession No. ML19157A009.

In its response, Exelon stated that cracking will be managed for copper alloy with greater than 15 percent zinc components exposed to an air-indoor uncontrolled. Exelon amended SLRA Table 3.4.1 item 3.4.1-106 and Tables 3.1.2-3, 3.2.2-2, 3.2.2-3, 3.2.2-4, 3.2.2-5, 3.2.2-6, 3.2.2-8, 3.3.2-1, 3.3.2-2, 3.3.2-3, 3.3.2-7, 3.3.2-9, 3.3.2-12, 3.3.2-14, 3.3.2-20, 3.3.2-21, 3.3.2-22, 3.3.2-24, 3.3.2-25, 3.3.2-28, 3.3.2-29, 3.3.2-35, and 3.5.2-4 to cite cracking as an applicable aging effect and either the External Surfaces Monitoring of Mechanical Components, ASME Section XI, Subsection IWF, or Structures Monitoring program to manage cracking. Exelon also stated that potential sources of ammonia or ammonium compounds are not present in the air-outdoor, air-dry, treated water, waste water, and certain condensation environments that can impact copper alloy with greater than 15 percent zinc components.

SLRA Table 3.4.1, AMR item 3.4.1-106, addresses cracking due to stress corrosion cracking for copper alloy with greater than 15 percent zinc components exposed to air or condensation. For the SLRA Table 2 AMR items that cite generic note E, the SLRA credits the ASME Section XI, Subsection IWF, or Structures Monitoring program to manage the aging effect for brass bolting. Based on its review of components associated with AMR item 3.4.1-106 for which Exelon cited generic note E, the staff finds Exelon's proposal to manage the effects of aging using the ASME Section XI, Subsection IWF, or Structures Monitoring program acceptable because the periodic visual inspections can be capable of detecting cracking consistent with GALL-SLR Report items T-36b and T-37b.

The staff finds Exelon's response and changes to the above SLRA Tables acceptable as follows:

- Cracking will be managed for copper alloy greater than 15 percent zinc components for: (a) insulated components in the chilled water system and domestic water system exposed to condensation; (b) components in the circulating water pump structure (SLRA Table 3.5.2-3), emergency cooling water system (SLRA Table 3.3.2-11), emergency service water system (SLRA Table 3.3.2-13), and service water system (SLRA Table 3.3.2-29) exposed to raw water; and (c) components exposed to air-indoor uncontrolled. The cited program can be capable of detecting cracking during periodic inspections.
- Potential sources of ammonia or ammonium compounds are not present in the air-outdoor, air-dry, treated water, waste water, and certain condensation environments that can impact copper alloy with greater than 15 percent zinc components.

The staff noted that, although brass bolts cite item 3.1.1-137, indicating that there are no aging effects requiring management, loss of preload is cited as an AERM through SLRA Table 3.5.1, items 3.5.1-087 and 3.5.1-088.

During its review, the staff noted that SLRA Table 3.5.2-3 states that bronze bolting for hatches and plugs exposed to air-indoor uncontrolled and air-outdoor, citing item 3.1.1-137, have no aging effects and no recommended AMP. As amended by Supplement No. 2 (ADAMS Accession No. ML19023A015), Exelon revised SLRA Table 3.5.2-3 to state that loss of preload will be managed by the Structures Monitoring program. Exelon also revised SLRA Table 3.5.1, item 3.5.1-088, and SLRA Section B.2.1.34 to cite bronze as an applicable material. The staff finds the applicant's proposal acceptable because it is consistent with GALL-SLR Report item TP-261.

SLRA Table 3.3.1, AMR item 3.3.1-237, states that there are no aging effects for titanium (ASTM Grades 1, 2, 7, 9, 11, or 12) heat exchanger components other than tubes, piping, and piping components exposed to treated water. During its review of components associated with AMR item 3.3.1-237 for which Exelon cited generic note A, the staff noted that the SLRA did not cite the specific grade of titanium. As amended by Supplement No. 2 (ADAMS Accession No. ML19023A015), Exelon revised SLRA Tables 3.3.2-13 and 3.3.2-21 to cite plant-specific note 2, which states that piping and piping components citing item 3.3.1-237 are constructed of grade 2 titanium.

Based on its review of components associated with AMR item 3.3.1-237 for which Exelon cited generic note A, the staff finds Exelon's proposal that there are no aging effects for grade 2 titanium piping and piping components exposed to treated water acceptable because it is consistent with the GALL-SLR Report item A-766. The staff finds that Exelon 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).

3.3.2.1.13 Reduction of Impact Strength

SLRA Table 3.3.1, item 3.3.1-172, addresses reduction of impact strength for PVC piping and piping components exposed to outdoor air. For the corresponding SLRA Table 2 AMR item that cites 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 cooling tower drift eliminators exposed to outdoor air.

Based on its review of components associated with item 3.3.1-172 for which Exelon cited generic note E, the staff finds Exelon's proposal to manage the effects of aging using the Inspection of Water-Control Structures Associated with Nuclear Power Plants program acceptable because the program includes periodic visual inspections that can identify indications of impact strength reduction and provide reasonable assurance that the intended function of the drift eliminators will be maintained during the subsequent period of extended operation.

3.3.2.1.14 Wall Thinning Due to Erosion

The staff's evaluation for metallic piping components exposed to treated water greater than 140 °F and treated water greater than 200 °F, which is being managed for wall thinning by the Flow-Accelerated Corrosion program through AMR item 3.3.1-126, is documented in SER Section 3.1.2.1.2.

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, as recommended in the GALL-SLR Report, for the auxiliary systems 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 3.3.2.2. The following subsections document the staff's review.

3.3.2.2.1 Cumulative Fatigue Damage

SLRA Section 3.3.2.2.1 states that TLAAs are evaluated in accordance with 10 CFR 54.21(c)(1) and that the TLAA for evaluating cumulative fatigue damage or cracking due to fatigue or cyclic loading in the plant's cranes is addressed in SLRA Section 4.7.1. This is consistent with SRP-SLR Section 3.3.2.2.1 and is, therefore, acceptable. The staff's evaluation of this TLAA is documented in SER Section 4.7.1.

The applicant also states that the TLAA for evaluating cumulative fatigue damage or cracking due to fatigue or cyclic loading in auxiliary system piping and piping components is addressed in SLRA Section 4.3.4. This is also consistent with SRP-SLR Section 3.3.2.2.1 and is, therefore, acceptable. The staff's evaluation of this TLAA is documented in SER Section 4.3.4.

3.3.2.2.2 Cracking Due to Stress Corrosion Cracking and Cyclic Loading

SLRA Section 3.3.2.2.2, associated with SLRA Table 3.3.1 items 3.3.1-003 and 3.3.1-003a, applies to stress corrosion cracking and cyclic loading that could occur in stainless steel PWR nonregenerative heat exchanger tubing exposed to treated borated water greater than 140 °F in the chemical and volume control system. This further evaluation only applies to PWRs.

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 and 3.3.1-205, addresses cracking due to stress corrosion cracking for stainless steel piping, piping components, and tanks and insulated piping, piping components, and tanks exposed to air or condensation, which will be managed by the One-Time Inspection program. The staff reviewed Exelon's proposal against the criteria in SRP-SLR Section 3.3.2.2.3.

Exelon stated that the auxiliary systems contain no stainless steel components exposed to an environment of air-indoor controlled or insulated stainless steel components exposed to the environments of air-indoor uncontrolled or air-indoor controlled in the auxiliary systems. The staff evaluated Exelon's claim and finds it acceptable based on a review of the UFSAR and SLRA related to these component, material, and environment combinations.

In its review of components associated with AMR items 3.3.1-004 and 3.3.1-205, the staff finds that Exelon has met the further evaluation criteria, and Exelon's proposal to manage the effects of aging using the One-Time Inspection program is acceptable for the following reasons: (a) cracking has not been identified as an aging effect by Exelon for stainless steel components exposed to air-indoor uncontrolled, air-outdoor, and condensation and insulated stainless steel exposed to air-outdoor and condensation; (b) use of the One-Time Inspection program can demonstrate that cracking due to stress corrosion cracking does not occur at a rate that affects the intended function of the components, which is consistent with SRP-SLR Section 3.3.2.2.3; and (c) the inspections consistent with GALL-SLR Report AMP XI.M32 (e.g., surface examination, VT-1) can be capable of detecting cracking.

Based on the program identified, the staff concludes that Exelon's program meets 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 Exelon 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 3.3.2.2.3, associated with SLRA Table 3.3.1, AMR items 3.3.1-094a, 3.3.1-146, and 3.3.1-231, addresses cracking due to stress corrosion cracking for stainless steel components exposed to air, condensation, or the underground environment. Exelon stated that these items are not applicable. The staff evaluated Exelon's claim and finds it acceptable because based on a review of the UFSAR and SLRA, there are no stainless steel ducting or ducting components and stainless steel tanks within the scope of GALL-SLR Report AMP XI.M29 exposed to air or condensation; and no stainless steel underground piping, piping components, and tanks in the auxiliary systems.

3.3.2.2.4 Loss of Material Due to Pitting and Crevice Corrosion in Stainless Steel and Nickel Alloys

SLRA Section 3.3.2.2.4, associated with SLRA Table 3.3.1 AMR items 3.3.1-006, 3.3.1-222, 3.3.1-232, and 3.3.1-241, addresses loss of material due to pitting or crevice corrosion for stainless steel and nickel alloy components exposed to air or condensation, which will be managed by the One-Time Inspection program. The staff reviewed Exelon's proposal against the criteria in SRP-SLR Section 3.3.2.2.4.

Exelon stated that the auxiliary systems contain no: (a) stainless steel components exposed to an environment of air-indoor controlled; (b) nickel alloy components; or (c) insulated stainless steel components exposed to the environments of air-indoor uncontrolled or air-indoor controlled in the auxiliary systems. The staff evaluated Exelon's claim and finds it acceptable based on a review of the UFSAR and SLRA related to these component, material, and environment combinations.

In its review of components associated with AMR items 3.3.1-006, 3.3.1-222, 3.3.1-232, and 3.3.1-241, the staff finds that Exelon has met the further evaluation criteria, and Exelon's proposal to manage the effects of aging using the One-Time Inspection program is acceptable for the following reasons: (a) loss of material has not been identified as an aging effect by Exelon for stainless steel components in the remaining applicable environments; (b) use of the One-Time Inspection program can demonstrate that loss of material due to pitting and crevice corrosion does not occur at a rate that affects the intended function of the components, which is consistent with SRP-SLR Section 3.3.2.2.4; and (c) the visual inspections can be capable of detecting loss of material.

Based on the program identified, the staff concludes that Exelon's program meets 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 Exelon 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 3.3.2.2.4, associated with SLRA Table 3.3.1 AMR items 3.3.1-094, 3.3.1-228, and 3.3.1-246, addresses loss of material due to pitting or crevice corrosion for stainless steel and nickel alloy components exposed to air, condensation, or the underground environment. Exelon stated that these items are not applicable. The staff evaluated Exelon's claim and finds it acceptable because based on a review of the UFSAR and SLRA, there are no nickel alloy components; stainless steel ducting, ducting components, or tanks within the scope of GALL-SLR Report AMP XI.M29 exposed to air or condensation; and stainless steel underground piping, piping components, and tanks in the auxiliary systems.

3.3.2.2.5 Quality Assurance for Aging Management of Nonsafety-Related Components

SER Section 3.0.4 documents the staff's evaluation of the applicant's QA program.

3.3.2.2.6 Ongoing Review of Operating Experience

SER Section 3.0.5 documents the staff's evaluation of the applicant's ongoing review of operating experience.

3.3.2.2.7 Loss of Material Due to Recurring Internal Corrosion

SLRA Section 3.3.2.2.7, associated with SLRA Table 3.3.1, item 3.3.1-127, addresses loss of material due to recurring internal corrosion in metallic components exposed to various water environments in auxiliary systems. Exelon will manage this aging effect/mechanism with the Open-Cycle Cooling Water System program for components in the emergency service water, high pressure service water, and service water systems. The Fire Water System program will manage this aging effect/mechanism for components in the fire protection system.

The staff reviewed Exelon's approach against the criteria in SRP-SLR Section 3.3.2.2.7 for the components associated with item 3.3.1-127. During its review, the staff identified issues that needed additional information, which resulted in RAI 3.3.2.2.7-1. The staff's request and Exelon's response are documented in ADAMS Accession No. ML19122A289. In its response dated May 2, 2019, Exelon revised SLRA Sections A.2.1.11, A.2.1.17, B.2.1.11, B.2.17, and Commitment Nos. 11 and 17 to include enhancements to the Open-Cycle Cooling Water System program and the Fire Water System program.

The staff finds Exelon's response and changes to the above SLRA sections acceptable because the additional enhancements to the Open-Cycle Cooling Water System and Fire Water System program address the minimum number of inspections that will be performed either for each outage or when pipe wall thickness inspections do not meet criteria, and procedural guidance for consideration of the standard mill tolerance for wall thickness. The staff's evaluations of these enhancements to the Open-Cycle Cooling Water System and Fire Water System programs are documented in SER Sections 3.0.3.2.6 and 3.0.3.2.11, respectively. The staff concludes the SLRA is consistent with the GALL-SLR Report and that Exelon 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).

Based on these changes, the staff also finds that Exelon has met the further evaluation criteria and its approach to manage the associated aging effect/mechanism using the cited programs acceptable because both programs include appropriate types of inspections, sample selection methodology, trending, performance monitoring, and use of the corrective action program to identify loss of material prior to the loss of intended function. In addition, the staff did not identify other examples of recurring internal corrosion in auxiliary systems that were not identified by Exelon, during its independent review of the plant-specific operating experience database.

3.3.2.2.8 Cracking Due to Stress Corrosion Cracking in Aluminum Alloys

As amended by letter dated May 23, 2019 (ADAMS Accession No. ML19143A053), SLRA Section 3.3.2.2.8 associated with SLRA Table 3.3.1, AMR item 3.3.1-189, addresses cracking due to stress corrosion cracking for aluminum alloy piping, piping components, and tanks exposed to air, condensation, raw water, raw water (potable), or waste water, which will be managed by the One-Time Inspection program. The staff reviewed Exelon's proposal against the criteria in SRP-SLR Section 3.3.2.2.8.

Exelon stated that the auxiliary systems contain no aluminum components exposed to air-indoor controlled, raw water, or waste water in the auxiliary systems. The staff evaluated Exelon's claim and finds it acceptable based on a review of the UFSAR and SLRA related to these component, material, and environment combinations.

In its review of components associated with AMR item 3.3.1-189 where cracking will be managed with the One-Time Inspection program, the staff finds that Exelon has met the further evaluation criteria, and Exelon's proposal to manage the effects of aging using the One-Time Inspection program is acceptable for the following reasons: (a) cracking has not been identified as an aging effect by Exelon for aluminum alloy components in these environments; (b) use of the One-Time Inspection program can demonstrate that cracking due to stress corrosion cracking does not occur at a rate that affects the intended function of the components, which is consistent with SRP-SLR Section 3.3.2.2.8; and (c) the inspections consistent with GALL-SLR Report AMP XI.M32 (e.g., surface examination, VT-1) can be capable of detecting cracking.

SLRA Tables 3.2.2-2, 3.2.2-6, 3.3.2-23, and 3.3.2-30 state that for aluminum core spray pump room cooler fins, residual heat removal pump room cooler fins, piping and piping components, and the oil level glass bodies located on the standby liquid control system pump gear boxes exposed to air-indoor uncontrolled or condensation, which cite SLRA Table 3.3.1 AMR items 3.3.1-189 and 3.3.1-254 and generic note I, there is no aging effect and no AMP is proposed. The SLRA states that these components are constructed of 3003 or 6063-T6 aluminum alloys and that neither of these alloys are susceptible to cracking due to stress corrosion cracking.

The staff reviewed the associated items in the SLRA to confirm that this aging effect is not applicable for this component, material, and environment combination. The staff finds Exelon's proposal related to the 3003 series aluminum alloy acceptable because it is consistent with SRP-SLR Section 3.3.2.2.8. However, for 6063-T6 series aluminum alloys the staff determined the need for additional information, which resulted in the issuance of an RAI. RAI 3.3.2.2.8-1 and Exelon's responses are documented in ADAMS Accession No. ML19122A289.

The staff reviewed Exelon's response and also independently reviewed the susceptibility of 6063-T6 aluminum alloys and concluded the following. Aluminum alloy 6063-T6 is a wrought material alloyed primarily with magnesium (Mg) and silicon (Si). It is a moderate strength precipitation hardened aluminum alloy in the peak-aged condition. The strengthening phase precipitated during the artificial aging of 6063 is Mg_2Si. Generally, 6xxx series alloys have satisfactory SCC resistance and inservice performance (Spuhler 1982, Brown 1972). However, some 6xxx series alloys are known to be susceptible to SCC when exposed to certain atypical processing histories. The majority of 6xxx series SCC testing and characterization has been performed on 6061-T6, which is known to be resistant to SCC. Much more limited SCC testing and characterization has been performed on 6063-T6 (Aluminum Standards and Data 2006, Brown 1977); although, results have been consistent with those of 6061-T6. Alloy 6063 is a compositionally leaner version of 6061 that has been optimized for extrusion. The two alloys have the same strengthening mechanism and their nominal Mg/Si ratios are also similar. Therefore, it is expected that the SCC resistance is comparable. Additionally, the known inservice performance of aluminum alloy 6063-T6 has shown satisfactory SCC resistance across multiple industries (Sprowls and Brown, 1969)]. Based on the metallurgical characteristics, available laboratory testing, and known service history, the staff has determined that 6063-T6 is not susceptible to SCC.

The staff finds Exelon's response acceptable because alloy 6063-T6 is not susceptible to SCC.

Based on the program identified, the staff concludes that Exelon'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 Exelon 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, 3.3.1-192, and 3.3.1-233, address cracking due to stress corrosion cracking for aluminum alloy components exposed to air, condensation, soil, concrete, raw water, waste water, or the underground environment. Exelon stated that these items are not applicable. The staff evaluated Exelon's claim and finds it acceptable because based on a review of the UFSAR and SLRA, there are no aluminum alloy tanks within the scope of GALL-SLR Report AMP XI.M29 exposed to air, condensation, soil, concrete, raw water, waste water; underground piping, piping components, or tanks, or insulated piping, piping components, or tanks exposed to air or condensation in the auxiliary systems.

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, AMR items 3.3.1-112 and 3.3.1-202, addresses applicable aging effects for steel and stainless steel piping components exposed to concrete. The staff reviewed Exelon's proposal against the criteria in SRP-SLR Section 3.2.2.2.9.

SLRA Section 3.3.2.2.9 states that for steel piping and piping components exposed to concrete in the emergency cooling water system, emergency diesel generator system, emergency service water system, fire protection system, high pressure service water system, and service water system, loss of material will be managed by the Buried and Underground Piping program because the piping could be exposed to groundwater. In lieu of item 3.3.1-112, the SLRA cites AMR item 3.3.1-109 to manage aging effects for these items. SLRA Section 3.3.2.2.9 also states that for stainless steel piping and piping components exposed to concrete in the refueling water storage and transfer system, loss of material and cracking will be managed by the Buried and Underground Piping program because the piping could be exposed to groundwater. In lieu of item 3.3.1-202, the SLRA cites AMR items 3.3.1-107 and 3.3.1-144 to manage aging effects for these items. In its review of components associated with AMR items 3.3.1-112 and 3.3.1-202, the staff finds that Exelon has met the further evaluation criteria, and Exelon's proposal to manage the effects of aging using the Buried and Underground Piping and Tanks program is acceptable because the periodic visual inspections conducted for the program can be capable of detecting concrete degradation that could lead to susceptibility of loss of material in steel piping exposed to concrete.

The staff noted that SLRA Table 3.3.1, AMR items 3.3.1-112 and 3.3.1-202, cite no aging effects for the steel and stainless steel components exposed to concrete. This appeared to be an editorial error in that loss of material and cracking will be managed for these items using alternative AMR items as cited above. Additionally, as stated above, SLRA Section 3.3.2.2.9 addresses steel piping exposed to concrete in the service water system; however, SLRA Table 3.3.2-29, "Service Water System," does not cite any steel piping exposed to concrete. As amended by Supplement No. 2, Exelon stated that the concrete is not an applicable environment for the service water system and revised SLRA Section 3.3.2.2.9 to delete reference to the service water system. The staff finds the change acceptable for the following reasons: (a) the change corrects an editorial error in the SLRA, and (b) a search of the UFSAR did not reveal any instances of steel piping exposed to concrete in the service water system.

SLRA Section 3.3.2.2.9 states that for steel piping exposed to concrete in the plant equipment and floor drain system, loss of material is not considered an applicable aging effect. The staff finds Exelon's proposal acceptable because: (a) Exelon stated and there is objective evidence in the UFSAR that ACI-318 was used for the design of concrete structures (e.g., Table C.4.4, "Reactor Building Floor System," and Table C.4.5, "Drywell Shielding Concrete," cite parameters from ACI-318-63 for developing concrete maximum strength values); (b) Exelon stated that there was no plant-specific operating experience related to degradation of concrete within buildings that could lead to water penetrating the concrete to the metal surface; and (c) there is reasonable assurance that drain piping within buildings will not be exposed to groundwater.

Based on the program identified, the staff concludes that Exelon'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 Exelon 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

As amended by letter dated May 23, 2019 (ADAMS Accession No. ML19143A053), SLRA Section 3.3.2.2.10, associated with SLRA Table 3.3.1 AMR items 3.3.1-234 and 3.3.1-242, addresses loss of material due to pitting or crevice corrosion for aluminum alloy piping, piping components, tanks, and heat exchanger components exposed to air or condensation, which will be managed by the One-Time Inspection program. The staff reviewed Exelon's proposal against the criteria in SRP-SLR Section 3.3.2.2.10.

Exelon stated that the auxiliary systems contain no aluminum alloy components exposed to air-indoor controlled or heat exchanger components exposed to air-indoor uncontrolled or air-indoor controlled in the auxiliary systems. The staff evaluated Exelon's claim and finds it acceptable based on a review of the UFSAR and SLRA related to these component, material, and environment combinations.

In its review of components associated with AMR items 3.3.1-234 and 3.3.1-242, the staff finds that Exelon has met the further evaluation criteria, and Exelon's proposal to manage the effects of aging using the One-Time Inspection program is acceptable for the following reasons: (a) loss of material has not been identified as an aging effect by Exelon for aluminum alloy components in the remaining applicable environments; (b) use of the One-Time Inspection program can demonstrate that loss of material due to pitting and crevice corrosion does not occur at a rate that affects the intended function of the components, which is consistent with SRP-SLR Section 3.2.2.2.10; and (c) the visual inspections can be capable of detecting loss of material.

Based on the program identified, the staff concludes that Exelon's program meets 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 Exelon 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 3.3.2.2.10 associated with SLRA Table 3.3.1, AMR items 3.3.1-223, 3.3.1-227, 3.3.1-240, 3.3.1-245, and 3.3.1-247, addresses loss of material due to pitting and crevice corrosion for aluminum alloy components, exposed to air, condensation, waste water, raw water, or the underground environment. Exelon stated that these items are not applicable. The staff evaluated Exelon's claim and finds it acceptable because, based on a review of the UFSAR and SLRA, there are no aluminum alloy underground piping, piping components, and tanks; tanks within the scope of GALL-SLR Report AMP XI.M29 exposed to air or condensation; heat exchanger components exposed to waste water, insulated piping, piping components, and tanks exposed to air or condensation; or piping, piping components, and tanks exposed to raw water or waste water 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 3.3.2-36 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 Battery and Emergency Switchgear Ventilation System - Summary of Aging Management Evaluation - SLRA Table 3.3.2-3

<u>Elastomer Flexible Connections Exposed to Condensation</u>

The staff's evaluation for elastomer flexible connections exposed to condensation, which will be managed for loss of material due to wear by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program and are associated with generic note G, is documented in SER Section 3.2.2.3.5.

3.3.2.3.2 Chilled Water System - Summary of Aging Management Evaluation - SLRA Table 3.3.2-4

<u>Insulated Carbon Steel Piping Components Internally Exposed to Closed Cycle Cooling Water</u>

SLRA Table 3.3.2-4 states that wall thinning for insulated carbon steel piping components internally exposed to closed cycle cooling water will be managed by the Flow-Accelerated Corrosion program. The AMR item cites generic note H, for which Exelon has identified wall thinning as an aging effect that is not in the GALL-SLR Report for this specific combination of component, material, and environment.

The staff noted that although the GALL-SLR Report does not include this specific combination, wall thinning of carbon steel piping internally exposed to treated water, which credits the same AMP, is included in several AMR items. The staff finds Exelon's proposal to manage this component, material, environment, and aging effect combination acceptable because the periodic wall thickness measurements conducted by the Flow-Accelerated Corrosion program provide reasonable assurance that the CLB will be maintained during the subsequent period of extended operation.

3.3.2.3.3 Control Room Ventilation System - Summary of Aging Management Evaluation - SLRA Table 3.3.2-7

Elastomer Flexible Connections Exposed to Condensation

The staff's evaluation for elastomer flexible connections exposed to condensation, which will be managed for loss of material due to wear by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program and are associated with generic note G, is documented in SER Section 3.2.2.3.5.

3.3.2.3.4 Diesel Generator Building Ventilation System - Summary of Aging Management Evaluation - SLRA Table 3.3.2-9

Elastomer Flexible Connections Exposed to Condensation

The staff's evaluation for elastomer flexible connections exposed to condensation, which will be managed for loss of material due to wear by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program and are associated with generic note G, is documented in SER Section SER Section 3.2.2.3.5.

3.3.2.3.5 Fire Protection System – Summary of Aging Management Evaluation – SLRA Table 3.3.2-14

Subliming Compound with and without Reinforcement Exposed to Indoor Air

SLRA Table 3.3.2-14, state that loss of material and cracking for subliming compounds with and without reinforcement (fire barriers) exposed to uncontrolled indoor air will be managed by the Fire Protection program. The AMR items cite generic note F. The AMR items cite plant-specific note 1, which states subliming compounds with and without reinforcement are fire-resistant insulation and coating materials potentially subject to cracking and loss of material, which will be managed by the Fire Protection program.

The staff reviewed the associated items in the SLRA and considered whether the aging effects proposed by Exelon constitute all of the applicable aging effects for this component, material, and environment description. GALL-SLR Item A-797, an AMR item for generic polymeric materials cites hardening or loss of strength, loss of material, and cracking as applicable aging effects. The staff noted that Exelon did not cite hardening or loss of strength as applicable aging effects; however, given its application as providing fire proofing, these aging effects are not critical to the intended function of enclosing the material to be protected. The staff finds that Exelon has identified all applicable aging effects for this component, material, and environment combination.

The staff finds Exelon's proposal to manage the effects of aging acceptable because the Fire Protection program includes periodic visual inspections, which can identify and manage the applicable aging effects that could otherwise compromise the integrity of the fire barriers upon which these subliming compounds are applied.

Cementitious Fireproofing and Penetration Seals Exposed to Indoor Air

SLRA Table 3.3.2-14, states that cracking for cementitious fireproofing and penetration seals exposed to uncontrolled indoor air will be managed by the Fire Protection program. The AMR items cite generic notes F and A, respectively. The AMR items cite plant specific note 2, which states cementitious fireproofing materials are fire-resistant insulation and coating materials potentially subject to cracking and loss of material, which will be managed by the Fire Protection program. The staff noted that the SLRA Table AMR item did not cite loss of material as an applicable aging effect.

For the items in SLRA Table 3.3.2-14 stating that cracking for cementitious fireproofing and penetration seals exposed to uncontrolled indoor air will be managed by the Fire Protection Program and citing generic note F, the staff determined the need for additional information. The staff held a clarification call with Exelon on July 10, 2019. Exelon's supplement in response to the call is documented in ADAMS Accession No. ML19193A006.

In its response, Exelon revised SLRA Table 3.3.2-14 to include loss of material as an applicable aging effect for cementitious fireproofing exposed to uncontrolled indoor air. The staff finds Exelon's response and changes to SLRA Table 3.3.2-14 acceptable because, consistent with GALL-SLR Report AMR item A-90, it identifies both loss of material and cracking, as applicable aging effects to be managed by the Fire Protection program.

The staff reviewed the associated items in the SLRA and considered whether the aging effects proposed by Exelon constitute all of the applicable aging effects for this component, material, and environment description. Based on its review of EPRI TR-1006756, which states that important parameters to maintain for structural steel fireproofing include thickness of material and continuity of material, the staff finds that Exelon has identified all credible aging effects for this component, material, and environment combination.

The staff finds Exelon's proposal to manage the effects of aging acceptable because the Fire Protection program includes periodic visual inspections, which can identify the applicable aging effects for the cementitious fireproofing to ensure that the insulated steel components are able to retain sufficient strength to perform their intended functions in the event of a building fire.

<u>Aluminum Silicate Penetration Seals Exposed to Indoor Air</u>

SLRA Table 3.3.2-14, states that change in material properties and cracking for aluminum silicate penetration seals exposed to uncontrolled indoor air will be managed by the Fire Protection program. The AMR items cite generic note F. The AMR items cite plant specific note 3, which states aluminum silicate is a fire barrier material potentially subject to cracking and change in material properties, which will be managed by the Fire Protection program.

For the items in SLRA Table 3.3.2-14 stating that change in material properties and cracking for aluminum silicate penetration seals exposed to uncontrolled indoor air will be managed by the Fire Protection Program and citing generic note F, the staff determined the need for additional information. The staff held a clarification call with Exelon on July 10, 2019. Exelon's supplement in response to the call is documented in ADAMS Accession No. ML19193A006.

In its response, Exelon revised SLRA Table 3.3.2-14 to include loss of material as an applicable aging effect for cementitious fireproofing exposed to uncontrolled indoor air. In addition, the applicant included a plant specific note stating that blistering is not an applicable aging effect. By letter dated August 13, 2019 (ADAMS Accession No. ML19225B976) Exelon confirmed that Kaowool™ is the aluminum silicate material used for penetration seals, the aluminum silicate fibers are not immersed in water for long periods of time nor bound by a resin material, and the aluminum silicate penetration seals are not exposed to hydrofluoric acid, phosphoric acid, or strong alkalis. The staff finds Exelon's response and changes to SLRA Table 3.3.2-14 acceptable because the aluminum silicate material (Kaowool™) is not exposed to an environment in which it is susceptible to blistering and the changes identify loss of material as an applicable aging effect to be managed by the Fire Protection program.

The staff reviewed the associated items in the SLRA and considered whether the aging effects proposed by Exelon constitute all of the applicable aging effects for this component, material, and environment description. Based on its review of literature on aluminum silicate and Kaowool™, which describe aluminum silicate as a refractory composite fiber material that is unaffected by most chemicals (except hydrofluoric acid, phosphoric acids, and strong alkalis), a review of the applicable aging effects for SLR-SRP Item A-720 (cracking, blistering, and loss of material), and the fact that these aluminum silicate penetration seals are not exposed to environments in which they are susceptible to blistering, the staff finds that Exelon has identified all applicable aging effects for this component, material, and environment combination.

The staff finds Exelon's proposal to manage the effects of aging acceptable because periodic inspections of the aluminum silicate fire barrier penetration seals can identify changes in material properties, loss of material, and cracking, such that the penetration seals will be able to perform their intended function in the event of a building fire.

3.3.2.3.6 Fuel Handling System - Summary of Aging Management Evaluation - SLRA Table 3.3.2-15

Aluminum Alloy Cranes Exposed to Air–Indoor Uncontrolled

This is addressed by AMR item 3.5.1-100 and is discussed in SER Sections 3.5.2.2.2.4 and 3.5.2.3.1.

3.3.2.3.7 Pump Structure Ventilation System - Summary of Aging Management Evaluation - SLRA Table 3.3.2-22

Elastomer Flexible Connections Exposed to Condensation

The staff's evaluation for elastomer flexible connections exposed to condensation, which will be managed for loss of material due to wear by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program and are associated with generic note G, is documented in SER Section 3.2.2.3.5.

3.3.2.3.8 Radiation Monitoring System - Summary of Aging Management Evaluation - SLRA Table 3.3.2-23

SLRA Tables 3.2.2-2, 3.2.2-6, 3.3.2-23, and 3.3.2-30 state that for aluminum core spray pump room cooler fins, residual heat removal pump room cooler fins, piping and piping components, and the oil level glass bodies located on the standby liquid control system pump gear boxes exposed to air-indoor uncontrolled or condensation, which cite SLRA Table 3.3.1, AMR items 3.3.1-189 and 3.3.1-254 and generic note I, there is no aging effect and no AMP is proposed. The SLRA states that these components are constructed of 3003 or 6063-T6 aluminum alloys and that neither of these alloys are susceptible to cracking due to stress corrosion cracking.

The staff reviewed the associated items in the SLRA to confirm that this aging effect is not applicable for this component, material, and environment combination. The staff finds Exelon's proposal related to the 3003 series aluminum alloy acceptable based on its review of SRP-SLR Section 3.3.2.2.8. However, the staff determined the need for additional information for 6063-T6 series aluminum alloys, which resulted in the issuance of an RAI. RAI 3.3.2.2.8-1 and Exelon's response are documented in ADAMS Accession No. ML19122A289.

The staff reviewed Exelon's response and also independently reviewed the susceptibility of 6063-T6 aluminum alloys and concluded the following. Aluminum alloy 6063-T6 is a wrought material alloyed primarily with magnesium (Mg) and silicon (Si). It is a moderate strength precipitation hardened aluminum alloy in the peak-aged condition. The strengthening phase precipitated during the artificial aging of 6063 is Mg_2Si. Generally, 6xxx series alloys have satisfactory SCC resistance and inservice performance (Spuhler 1982, Brown 1972). However, some 6xxx series alloys are known to be susceptible to SCC when exposed to certain atypical processing histories. The majority of 6xxx series SCC testing and characterization has been performed on 6061-T6, which is known to be resistant to SCC. Much more limited SCC testing and characterization has been performed on 6063-T6 (Aluminum Standards and Data 2006, Brown 1977) although, results have been consistent with those of 6061-T6. Alloy 6063 is a compositionally leaner version of 6061 that has been optimized for extrusion. The two alloys have the same strengthening mechanism and their nominal Mg/Si ratios are also similar. Therefore, it is expected that the SCC resistance is comparable. Additionally, the known inservice performance of aluminum alloy 6063-T6 has shown satisfactory SCC resistance across multiple industries (Sprowls and Brown, 1969). Based on the metallurgical characteristics, available laboratory testing, and known service history, the staff has determined that 6063-T6 is not susceptible to SCC.

The staff finds Exelon's response acceptable because alloy 6063-T6 is not susceptible to SCC.

3.3.2.3.9 Reactor Water Cleanup System - Summary of Aging Management Evaluation - SLRA Table 3.3.2-26

Internally Coated Carbon Steel Tanks Exposed to Condensation

SLRA Table 3.3.2-26 states that loss of coating integrity and loss of material for internally coated carbon steel tanks exposed to condensation 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 Exelon constitute all of the applicable aging effects for this component, material, and environment combination. Based on its review of the GALL-SLR Report, which states that internally coated carbon steel tanks exposed to more aggressive aqueous environments (e.g., raw water) are susceptible to loss of coating integrity and loss of material, the staff finds that Exelon has identified all applicable aging effects for this component, material, and environment combination.

The staff notes that GALL-SLR Report AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks," states that GALL-SLR Report AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," is an acceptable alternative to AMP XI.M42 when six specific conditions exist. During its review, the staff noted that Exelon addressed the six specific conditions in SLRA

Section B.2.1.25. The staff finds Exelon's proposal to manage the effects of aging using the Internal Surfaces in Miscellaneous Piping and Ducting Components program acceptable because (1) loss of coating integrity would not result in downstream effects of in-scope components, (2) the component's intended function is leakage boundary, (3) a condensation environment would not cause accelerated corrosion of carbon steel, (4) a condensation environment does not promote MIC, (5) the tanks are not subject to galvanic corrosion, and (6) the tank design does not credit the internal coating.

3.3.2.3.10 Refueling Water Storage and Transfer System - Summary of Aging Management Evaluation - SLRA Table 3.3.2-27

Carbon Steel Tanks (with Internal Coating) Exposed to Condensation (Internal)

SLRA Table 3.3.2-27 and Table 3.4.2-2 state that loss of coating or lining integrity and loss of material for carbon steel (with internal coating) tanks exposed to condensation (internal) will be managed by the Outdoor and Large Atmospheric Metallic Storage Tanks program. The AMR items cite generic note G. The AMR items cite plant-specific notes 1 and 2. In addition to stating that the internal environment of condensation is associated with the air space in the tanks, each note also states: (a) loss of coating or lining integrity will be managed by the Outdoor and Large Atmospheric Metallic Storage Tanks program, which incorporates the inspection recommendations of GALL-SLR Report AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks;" and (b) loss of material will be managed by the Outdoor and Large Atmospheric Metallic Storage Tanks program, which includes periodic visual inspection of accessible tank internal surfaces for loss of material, respectively.

The staff reviewed the associated items in the SLRA and considered whether the aging effects proposed by Exelon constitute all the applicable aging effects for this component, material, and environment combination. Based on its review of: (a) SLR-SRP item A-778, which cites loss of material as the applicable aging effect for steel components exposed to condensation; and (b) A-416, S-401, and E-401, which identify loss of coating or lining integrity as the applicable aging effect for components with internal coatings/linings, the staff finds that Exelon has identified all applicable aging effects for this component, material, and environment combination.

The staff finds Exelon's proposal to manage the effects of aging acceptable because the Outdoor and Large Atmospheric Metallic Storage Tanks program will provide for periodic inspection to identify loss of material of the steel tank base material and the recommendations implemented in accordance with AMP XI.M42 can identify any loss of coating/lining integrity and any associated loss of material.

3.3.2.3.11 Standby Liquid Control System - Summary of Aging Management Evaluation - SLRA Table 3.3.2-30

SLRA Tables 3.2.2-2, 3.2.2-6, 3.3.2-23, and 3.3.2-30 state that for aluminum core spray pump room cooler fins, residual heat removal pump room cooler fins, piping and piping components, and the oil level glass bodies located on the standby liquid control system pump gear boxes exposed to air-indoor uncontrolled or condensation, which cite SLRA Table 3.3.1 AMR items 3.3.1-189 and 3.3.1-254 and generic note I, there is no aging effect and no AMP is proposed. The SLRA states that these components are constructed of 3003 or 6063-T6 aluminum alloys and that neither of these alloys are susceptible to cracking due to stress corrosion cracking.

The staff reviewed the associated items in the SLRA to confirm that this aging effect is not applicable for this component, material, and environment combination. The staff finds Exelon's proposal related to the 3003 series aluminum alloy acceptable based on its review of SRP-SLR Section 3.3.2.2.8. However, for 6063-T6 series aluminum alloys the staff determined the need for additional information, which resulted in the issuance of an RAI. RAI 3.3.2.2.8-1 and Exelon's response are documented in ADAMS Accession No. ML19122A289.

In its response, Exelon stated the following:

> The basis for why 6063-T6 aluminum alloy is not susceptible to cracking due to stress corrosion cracking is as follows. Aluminum alloys in tempers other than F have either been heat treated or work hardened. The vulnerability of aluminum alloys to SCC varies widely depending on the alloy and the heat treatment or work hardening process. 6063-T6 aluminum alloy is solution heat treated and artificially aged. 6063-T6 is not susceptible to cracking due to stress corrosion cracking as described in SLRA Section 3.3.2.2.8 and as shown in Table 1 and Table 5 in NBS Monograph 156, "Stress Corrosion Cracking Control Measures," U.S. Department of Commerce/National Bureau of Standards, Issued June 1977 and Table I in NASA Standard MSFC-SPEC-522B, "Design Criteria for Controlling Stress Corrosion Cracking," July 1, 1987.

The staff independently reviewed the susceptibility of 6063-T6 aluminum alloys and concluded the following. Aluminum alloy 6063-T6 is a wrought material alloyed primarily with magnesium (Mg) and silicon (Si). It is a moderate strength precipitation hardened aluminum alloy in the peak-aged condition. The strengthening phase precipitated during the artificial aging of 6063 is Mg_2Si. Generally, 6xxx series alloys have satisfactory SCC resistance and inservice performance (Spuhler 1982, Brown 1972). However, some 6xxx series alloys are known to be susceptible to SCC when exposed to certain atypical processing histories. The majority of 6xxx series SCC testing and characterization has been performed on 6061-T6, which is known to be resistant to SCC. Much more limited SCC testing and characterization has been performed on 6063-T6 (Aluminum Standards and Data 2006, Brown 1977), although results have been consistent with those of 6061-T6. Alloy 6063 is a compositionally leaner version of 6061 that has been optimized for extrusion. The two alloys have the same strengthening mechanism and their nominal Mg/Si ratios are also similar. Therefore, it is expected that the SCC resistance is comparable. Additionally, the known inservice performance of aluminum alloy 6063-T6 has shown satisfactory SCC resistance across multiple industries (Sprowls and Brown, 1969). Based on the metallurgical characteristics, available laboratory testing, and known service history, the staff has determined that 6063-T6 is not susceptible to SCC.

The staff finds Exelon's response acceptable because alloy 6063-T6 is not susceptible to SCC.

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 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 Evaluations for the Steam and Power Conversion Systems,” is a summary comparison of the applicant’s AMRs with those evaluated 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. For AMR items that the staff found to be consistent with the GALL-SLR Report (and no SER section is referenced), the staff determined that no additional evaluation or request for additional information was necessary and finds the items acceptable based on the GALL-SLR Report review of the 10 program elements. For AMR items that required additional evaluation (such as responses to requests for additional information), the staff’s evaluation is documented in sections 3.4.2.1.2 through 3.4.2.1.4 below.

Table 3.4-1 Staff Evaluation for Steam and Power Conversion Systems 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 SER Section 3.4.2.2.1)
3.4.1-002	Consistent with the GALL-SLR Report (see SER Section 3.4.2.2.2)
3.4.1-003	Consistent with the GALL-SLR Report (see SER Section 3.4.2.2.3)
3.4.1-004	Not applicable to BWRs (See SER Section 3.4.2.1.1).
3.4.1-005	Consistent with the GALL-SLR Report
3.4.1-006	Consistent with the GALL-SLR Report
3.4.1-007	Not applicable to PBAPS (see SER Section 3.4.2.1.1)
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	Not used. Addressed by SLRA Table 3.4.1, item 3.4.1-067 (See Section 3.4.2.1.1)
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	Not applicable to PBAPS (see SER Section 3.4.2.1.1)
3.4.1-020	Not applicable to PBAPS (See SER Section 3.4.2.1.1).
3.4.1-021	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.4.1-022	Not applicable to PBAPS (See SER Section 3.4.2.1.1).
3.4.1-023	Not applicable to PBAPS (See SER Section 3.4.2.1.1).
3.4.1-024	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.4.1-025	Not applicable to PBAPS (See SER Section 3.4.2.1.1).
3.4.1-026	Not applicable to PBAPS (See SER Section 3.4.2.1.1).
3.4.1-027	Not applicable to PBAPS (See SER Section 3.4.2.1.1).
3.4.1-028	Not applicable to PBAPS (See SER Section 3.4.2.1.1).

Component Group (SRP-SLR Item No.)	Staff Evaluation
3.4.1-029	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.4.1-030	Consistent with the GALL-SLR Report
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 PBAPS (See SER Section 3.4.2.1.1).
3.4.1-033	Consistent with the GALL-SLR Report
3.4.1-034	Consistent with the GALL-SLR Report
3.4.1-035	Consistent with the GALL-SLR Report (see SER Section 3.4.2.2.9)
3.4.1-036	Not applicable to PBAPS (See SER Section 3.4.2.1.1).
3.4.1-037	Consistent with the GALL-SLR Report
3.4.1-038	Not applicable to BWRs (See SER Section 3.4.1.2.1.1)
3.4.1-039	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.4.1-040	Not applicable to PBAPS (See SER Section 3.4.2.1.1).
3.4.1-041	Not applicable to BWRs (See SER Section 3.4.2.1.1).
3.4.1-042	Not applicable to BWRs (See SER Section 3.4.2.1.1).
3.4.1-043	Not applicable to PBAPS (See SER Section 3.4.2.1.1).
3.4.1-044	Consistent with the GALL-SLR Report
3.4.1-045	Not applicable to PBAPS (See SER Section 3.4.2.1.1).
3.4.1-046	Not applicable to BWRs (See SER Section 3.4.2.1.1).
3.4.1-047	Consistent with the GALL-SLR Report
3.4.1-048	Not applicable to PBAPS (See SER Section 3.4.2.1.1).
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 PBAPS (See SER Section 3.4.2.1.1).
3.4.1-050a	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.4.1-051	Not applicable to PBAPS (See SER Section 3.4.2.2.8)
3.4.1-052	Not applicable to PBAPS (See SER Section 3.4.2.1.1).
3.4.1-053	Not applicable to PBAPS (See SER Section 3.4.2.1.1).
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 PBAPS (See SER Section 3.4.2.1.1).
3.4.1-057	Not applicable to PBAPS (See SER Section 3.4.2.1.1).
3.4.1-058	Not applicable to PBAPS (See SER Section 3.4.2.1.1).
3.4.1-059	Not applicable to PBAPS (See SER Section 3.4.2.1.1).
3.4.1-060	Consistent with the GALL-SLR Report
3.4.1-061	Not applicable to PBAPS (see SER Section 3.4.2.2.6)
3.4.1-062	Partially not applicable. Partially not used. Addressed by 3.4.1.-067
3.4.1-063	Consistent with the GALL-SLR Report
3.4.1-064	Not used. Addressed by 3.3.1-182
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
3.4.1-067	Consistent with the GALL-SLR Report
3.4.1-068	Not applicable to PBAPS (See SER Section 3.4.2.1.1).
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 PBAPS (See SER Section 3.4.2.1.1).
3.4.1-071	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.4.1-072	Consistent with the GALL-SLR Report

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 PBAPS (see SER Section 3.4.2.2.2)
3.4.1-075	Not applicable to PBAPS (See SER Section 3.4.2.1.1).
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 PBAPS (See SER Section 3.4.2.1.1).
3.4.1-078	Not applicable to PBAPS (See SER Section 3.4.2.1.1).
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	Consistent with the GALL-SLR Report (see SER Section 3.4.2.2.8)
3.4.1-083	Not applicable to PBAPS (See SER Section 3.4.2.1.1).
3.4.1-084	Not used--addressed by Item 3.1.1-079. (See SER Section 3.4.2.1.1)
3.4.1-085	Consistent with the GALL-SLR Report
3.4.1-086	Not applicable to PBAPS (See SER Section 3.4.2.1.1).
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 PBAPS (See SER Section 3.4.2.1.1).
3.4.1-090	Not applicable to PBAPS (See SER Section 3.4.2.1.1).
3.4.1-091	Not applicable to PBAPS (See SER Section 3.4.2.1.1).
3.4.1-092	Not applicable to PBAPS (See SER Section 3.4.2.1.1).
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 PBAPS (see SER Sections 3.4.2.1.1 and 3.4.2.2.9)
3.4.1-095	Not applicable to PBAPS (see SER Sections 3.4.2.1.1 and 3.4.2.2.3)
3.4.1-096	Not applicable to PBAPS (See SER Section 3.4.2.1.1).
3.4.1-097	Not applicable to PBAPS (see SER Sections 3.4.2.1.1 and 3.4.2.2.9)
3.4.1-098	Not applicable to PBAPS (see SER Sections 3.4.2.1.1 and3.4.2.2.3)
3.4.1-099	Not applicable to PBAPS (See SER Section 3.4.2.1.1).
3.4.1-100	Not applicable to PBAPS (see SER Sections 3.4.2.1.1 and 3.4.2.2.2)
3.4.1-101	Not applicable to PBAPS (See SER Section 3.4.2.1.1).
3.4.1-102	Not applicable to PBAPS (See SER Sections and 3.4.2.1.1 and3.4.2.2.7)
3.4.1-103	Consistent with the GALL-SLR Report (See SER Section 3.4.2.2.3)
3.4.1-104	Consistent with the GALL-SLR Report (See SER Section 3.4.2.2.2)
3.4.1-105	Not applicable to PBAPS (see SER Sections 3.4.2.1.1 and 3.4.2.2.7)
3.4.1-106	Not applicable to PBAPS (See SER Section 3.4.2.1.1).
3.4.1-107	Not applicable to PBAPS (See SER Section 3.4.2.1.1).
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 PBAPS (see SER Sections 3.4.2.1.1 and 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 PBAPS (see SER Sections 3.4.2.1.1 and 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	Consistent with the GALL-SLR Report
3.4.1-115	Consistent with the GALL-SLR Report
3.4.1-116	Not applicable to PBAPS (See SER Section 3.4.2.1.1).
3.4.1-117	Not applicable to PBAPS (See SER Section 3.4.2.1.1).

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 PBAPS (see SER Section 3.4.2.2.9) (See SER Section 3.4.2.1.1).
3.4.1-120	Not applicable to PBAPS (see SER Section 3.4.2.2.9) (See SER Section 3.4.2.1.1).
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 PBAPS (See SER Section 3.4.2.1.1).
3.4.1-123	Not applicable to PBAPS (See SER Section 3.4.2.1.1).
3.4.1-124	Not applicable to PBAPS (See SER Section 3.4.2.1.1).
3.4.1-125	Not applicable to PBAPS (See SER Section 3.4.2.1.1).
3.4.1-126	Not applicable to PBAPS (See SER Section 3.4.2.1.1).
3.4.1-127	Not applicable to PBAPS (See SER Section 3.4.2.1.1).
3.4.1-128	Not applicable to PBAPS (See SER Section 3.4.2.1.1).
3.4.1-129	Not applicable to PBAPS (See SER Section 3.4.2.1.1).
3.4.1-130	Consistent with the GALL-SLR Report
3.4.1-131	Not applicable to BWRs (See SER Section 3.4.2.1.1).
3.4.1-132	Not applicable to BWRs (See SER Section 3.4.2.1.1).
3.4.1-133	Not applicable to PBAPS (See SER Section 3.4.2.1.1).
3.4.1-134	Not applicable to PBAPS (See SER Section 3.4.2.1.1).
3.4.1-135	Not applicable to PBAPS (See SER Section 3.4.2.1.1).

The staff's review of component groups, as described in SER Section 3.0.2.2, is summarized in the following three sections:

(1) SER Section 3.4.2.1 discusses AMR results for components that the applicant states are either not applicable to PBAPS 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 or not used, and documents any RAIs issued and the conclusions.

(2) SER Section 3.4.2.2 discusses AMR results for which the GALL-SLR Report and SRP-SLR recommend further evaluation.

(3) SER 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 3.4.2-5 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.

Additionally, SER 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

Exelon claimed that the following SLRA Table 3.4.1 items were not applicable to PBAPS: 3.4.1-007, 3.4.1-019, 3.4.1-020, 3.4.1-022, 3.4.1-023, 3.4.1-025, 3.4.1-026, 3.4.1-027, 3.4.1-028, 3.4.1-032, 3.4.1-036, 3.4.1-040, 3.4.1-043, 3.4.1-045, 3.4.1-048, 3.4.1-050, 3.4.1-051, 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, 3.4.1-068, 3.4.1-070, 3.4.1-074, 3.4.1-075, 3.4.1-077, 3.4.1-078, 3.4.1-083, 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, 3.4.1-106, 3.4.1-107, 3.4.1-109, 3.4.1-112, 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, 3.4.1-133, 3.4.1-134, and 3.4.1-135. The staff reviewed the SLRA and UFSAR confirmed that the particular combination of aging effect, material, and environment represented by the AMR item does not exist at the site, and therefore. Exelon's SLRA does not have any AMR results that are applicable for these items or the items require no aging management.

Exelon identified the following items as not being applicable to the SLRA: items 3.4.1-004, 3.4.1-041, 3.4.1-042, 3.4.1-046, 3.4.1-038, 3.4.1-131, and 3.4.1-132. The staff reviewed and confirmed these AMR items are not applicable to the SLRA because these items are applicable only to PWRs and PBAPS is a BWR.

Items 3.4.1-062 and 3.4.1-064 are not used and are addressed by items 3.4.1-067 (partially) and 3.3.1-182. The staff reviewed and confirmed these alternate items are acceptable because they adequately address the relevant aging effects.

For SLRA Table 3.4.1, items 3.4.1-012 and 3.4.1-084 the applicant claimed that the corresponding items in the GALL-SLR Report are not applicable because they are addressed by items 3.4.1-067 and 3.1.1-079, respectively. The staff reviewed the SLRA and confirmed that the aging effects will be addressed by other SLRA Table 3.4.1 and 3.1.1 items. Therefore, the staff finds the applicant's proposal acceptable.

3.4.2.1.2 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, Crevice Corrosion, or MIC

SLRA Table 3.3.1, AMR items 3.4.1-066 and 3.4.1-067, address any type 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 that will be managed for: (a) loss of coating or lining integrity due to blistering, cracking, flaking, peeling, delamination, rusting, or physical damage (item 3.4.1-066); and (b) loss of material due to general, pitting, crevice corrosion, or MIC (AMR item 3.4.1-067). For the SLRA Table 2 AMR items that cite generic note E, the SLRA credits the Outdoor and Large Atmospheric Metallic Storage Tanks program to manage the aging effects for internally coated carbon steel tanks exposed to treated water.

The staff notes that GALL-SLR Report AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks," states that an applicant may elect to manage the aging effects for internal coatings/linings for in-scope piping, piping components, heat exchangers, and tanks with an alternative AMP as long as: (a) the recommendations of GALL-SLR Report AMP XI.M42 are incorporated into the alternative program; (b) exceptions or enhancements associated with the Internal Coatings/Linings for In-Scope Piping, Piping

Components, Heat Exchangers, and Tanks program are included in the alternative AMP; and (c) the UFSAR supplement for the Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks program is included in the SLRA with a reference to the alternative AMP. Based on its review of components associated with AMR items 3.4.1-066 and 3.4.1-067 for which Exelon cited generic note E, the staff finds Exelon's proposal to manage the effects of aging using the Outdoor and Large Atmospheric Metallic Storage Tanks program acceptable for the following reasons: (a) the activities to manage the aging effects for internal coatings are consistent with the recommendations of GALL-SLR Report AMP XI.M42; (b) the exceptions associated with the Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks program are not applicable to the subject tanks; and (c) as amended by letter dated January 23, 2019 (ADAMS Accession No. ML19023A015), SLRA Section A.2.1.29, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks," was revised to include a reference to the Outdoor and Large Atmospheric Metallic Storage Tanks program. The staff concludes that Exelon 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).

3.4.2.1.3 Wall Thinning Due to Erosion

The staff's evaluation for metallic piping components exposed to treated water greater than 140 °F and steam, which is being managed for wall thinning by the Flow-Accelerated Corrosion program through AMR item 3.4.1-060, is documented in SER Section 3.1.2.1.2.

3.4.2.1.4 No Aging Effect

SLRA Table 3.4.1, AMR item 3.4.1-115, states that there are no aging effects for titanium (ASTM Grades 1, 2, 7, 9, 11, or 12) heat exchanger components other than tubes, piping, and piping components exposed to treated water. During its review of components associated with AMR item 3.4.1-115 for which Exelon cited generic note A, the staff noted that the SLRA did not cite the specific grade of titanium. As amended by Supplement No. 2 (ADAMS Accession No. ML19023A015), Exelon revised SLRA Table 3.4.2-4 to cite plant-specific note 3, which states that the heat exchanger tube sheet citing item 3.4.1-115 is constructed of grade 2 titanium.

Based on its review of components associated with AMR item 3.4.1-115 for which Exelon cited generic note A, the staff finds Exelon's proposal that there are no aging effects for grade 2 titanium heat exchanger components other than tubes exposed to treated water acceptable because it is consistent with the GALL-SLR Report item S-463. The staff concludes that Exelon 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 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, as recommended in the GALL-SLR Report, for the steam and power conversion systems components and provides information concerning how it will manage the applicable aging effects. The staff reviewed the applicant's evaluation of component groups of which the GALL-SLR Report recommends further evaluation 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

SLRA Section 3.4.2.2.1 states that TLAAs are evaluated in accordance with 10 CFR 54.21(c)(1) and that the TLAA for evaluating cumulative fatigue damage or cracking due to fatigue or cyclic loading in steam and power conversion system piping and piping components is addressed in SLRA Section 4.3.4. This is consistent with SRP-SLR Section 3.4.2.2.1 and is, therefore, acceptable. The staff's evaluation of this TLAA is documented in SER Section 4.3.4.

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 items 3.4.1-002 and 3.4.1-104, addresses cracking due to stress corrosion cracking for stainless steel insulated and uninsulated piping, piping components, and tanks exposed to air or condensation, which will be managed by the One-Time Inspection program. The staff reviewed Exelon's proposal against the criteria in SRP-SLR Section 3.4.2.2.2.

Exelon stated that the steam and power conversion systems contain no stainless steel tanks; stainless steel piping and piping components exposed to the air-indoor controlled environment; and insulated stainless steel piping or piping components exposed to air-indoor controlled, air-indoor uncontrolled, or condensation environments in the steam and power conversion systems. The staff evaluated Exelon's claim and finds it acceptable based on a review of the UFSAR and SLRA related to these component, material, and environment combinations.

In its review of components associated with AMR items 3.4.1-002 and 3.4.1-104, the staff finds that Exelon has met the further evaluation criteria, and Exelon's proposal to manage the effects of aging using the One-Time Inspection program is acceptable for the following reasons: (a) cracking has not been identified as an aging effect by Exelon for stainless steel components in these environments; (b) use of the One-Time Inspection program can demonstrate that cracking due to stress corrosion cracking does not occur at a rate that affects the intended function of the components, which is consistent with SRP-SLR Section 3.4.2.2.2; and (c) the inspections consistent with GALL-SLR Report AMP XI.M32 (e.g., surface examination, VT-1) can be capable of detecting cracking.

Based on the program identified, the staff concludes that Exelon's program meets 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 Exelon 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 3.4.2.2.2, associated with SLRA Table 3.4.1, AMR items 3.4.1-074 and 3.4.1-100, addresses cracking due to stress corrosion cracking for stainless steel components exposed to air, condensation, or the underground environment. Exelon stated that these items are not applicable. The staff evaluated Exelon's claim and finds it acceptable because based on a review of the UFSAR and SLRA, there are no stainless steel underground piping, piping components or tanks, or stainless steel 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 Stainless Steel and Nickel Alloys

SLRA Section 3.4.2.2.3, associated with SLRA Table 3.4.1 items 3.4.1-003 and 3.4.1-103, addresses loss of material due to pitting or crevice corrosion for stainless steel and nickel alloy insulated and uninsulated piping, piping components, and tanks exposed to air or condensation, which will be managed by the One-Time Inspection program. The staff reviewed Exelon's proposal against the criteria in SRP-SLR Section 3.4.2.2.3.

Exelon stated that the steam and power conversion systems contain no stainless steel or nickel alloy tanks, nickel alloy piping or piping components; stainless steel piping, or piping components exposed to air-indoor controlled; or insulated stainless steel piping or piping components exposed to air-indoor controlled, air-indoor uncontrolled, or condensation in the steam and power conversion systems. The staff evaluated Exelon's claim and finds it acceptable based on a review of the UFSAR and SLRA related to these component, material, and environment combinations.

In its review of components associated with AMR items 3.4.1-003 and 3.4.1-103, the staff finds that Exelon has met the further evaluation criteria, and Exelon's proposal to manage the effects of aging using the One-Time Inspection program is acceptable for the following reasons: (a) loss of material has not been identified as an aging effect by Exelon for stainless steel components in these environments; (b) use of the One-Time Inspection program can demonstrate that loss of material due to pitting and crevice corrosion does not occur at a rate that affects the intended function of the components, which is consistent with SRP-SLR Section 3.4.2.2.3; and (c) the visual inspections can be capable of detecting loss of material.

Based on the program identified, the staff concludes that Exelon's program meets 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 Exelon 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 3.4.2.2.3, associated with SLRA Table 3.4.1 AMR items 3.4.1-095 and 3.4.1-098, addresses loss of material due to pitting and crevice corrosion for stainless steel and nickel alloy components, exposed to air, condensation, or the underground environment. Exelon stated that these items are not applicable. The staff evaluated Exelon's claim and finds it acceptable because based on a review of the UFSAR and SLRA, there are no stainless steel or nickel alloy underground piping, piping components, or tanks; or stainless steel or nickel alloy tanks within the scope of GALL-SLR Report AMP XI.M29 in the steam and power conversion systems.

3.4.2.2.4 Quality Assurance for Aging Management of Nonsafety-Related Components

SER Section 3.0.4 documents the staff's evaluation of the applicant's QA program.

3.4.2.2.5 Ongoing Review of Operating Experience

SER Section 3.0.5 documents the staff's evaluation of the applicant's ongoing review of operating experience.

3.4.2.2.6 Loss of Material Due to Recurring Internal Corrosion

SLRA Section 3.4.2.2.6, associated with SLRA Table 3.4.1, AMR item 3.4.1-061, addresses loss of material due to recurring internal corrosion in metallic components exposed to raw water or waste water in steam and power conversion systems. Exelon stated that this item is not applicable because its review of plant-specific operating experience did not identify any components within the steam and power conversion systems that met the criteria for this aging effect/mechanism. The staff evaluated Exelon's claim against the applicability criteria in SRP-SLR Section 3.4.2.2.6 and finds it acceptable because the staff did not identify any examples of recurring internal corrosion in steam and power conversion systems during its independent review of the plant-specific operating experience database.

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 item 3.4.1-109, addresses cracking due to stress corrosion cracking for aluminum alloy piping, piping components, and tanks exposed to air, condensation, raw water, or waste water, which have no aging effects and no proposed AMP. The staff reviewed Exelon's proposal against the criteria in SRP-SLR Section 3.4.2.2.7.

Exelon stated that the steam and power conversion systems contain no aluminum alloy tanks; aluminum alloy piping or piping components exposed to the air-indoor controlled, air-outdoor, condensation, raw water, or waste water environments in the steam and power conversion systems. The staff evaluated Exelon's claim and finds it acceptable based on a review of the UFSAR and SLRA related to these component, material, and environment combinations.

SLRA Table 3.4.2-4, plant-specific note 2, states that the rupture discs citing AMR item 3.4.1-109 are constructed of 3003 aluminum alloy. The staff reviewed the associated item in the SLRA to confirm that this aging effect is not applicable for this component, material, and environment combination. The staff finds Exelon's proposal related to the 3003 series aluminum alloy acceptable based on its review of SRP-SLR Section 3.4.2.2.7.

For those AMR items associated with SLRA Section 3.4.2.2.7, the staff concludes that the SLRA is consistent with the GALL-SLR Report and that Exelon 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 3.4.2.2.7, associated with SLRA Table 3.4.1, AMR items 3.4.1-102, 3.4.1-105, and 3.4.1-112, addresses cracking due to stress corrosion cracking for aluminum components exposed to air, condensation, soil, concrete, raw water, waste water or the underground environment. Exelon stated that these items are not applicable. The staff evaluated Exelon's claim and finds it acceptable because based on a review of the UFSAR and SLRA, there are no aluminum alloy tanks within the scope of GALL-SLR Report AMP XI.M29; insulated aluminum alloy piping, piping components, or tanks; or underground piping, piping components, or tanks 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, AMR item 3.4.1-051, addresses loss of material for steel piping and piping components exposed to concrete. Exelon stated that this item is not applicable. The staff evaluated Exelon's claim against the criteria in SRP-SLR Section 3.4.2.2.8 and finds it acceptable because based on its review of the SLRA, the staff confirmed that Exelon's SLRA does not have any AMR results that are applicable for these items. The staff also reviewed the UFSAR and did not identify any in-scope steel components located in the steam and power conversion systems exposed to concrete that would be susceptible to water intrusion.

SLRA Section 3.4.2.2.8, associated with SLRA Table 3.4.1, AMR item 3.4.1-082, addresses loss of material and cracking for stainless steel piping and piping components exposed to concrete. The staff reviewed Exelon's proposal against the criteria in SRP-SLR Section 3.4.2.2.8.

SLRA Section 3.4.2.2.8 states that for stainless steel piping exposed to concrete in the condensate storage system, loss of material and cracking are not considered applicable aging effects for portions that are outdoor and above ground level. The staff finds Exelon's proposal acceptable because: (a) Exelon stated that there is objective evidence in the UFSAR that ACI-318 was used for the design of concrete structures (e.g., Table C.4.4, "Reactor Building Floor System," and Table C.4.5, "Drywell Shielding Concrete," cite parameters from ACI-318-63 for developing concrete maximum strength values); (b) Exelon stated that there was no plant-specific operating experience related to degradation of concrete that could lead to water penetrating the concrete to the metal surface; and (c) given its configuration of being above ground level, there is reasonable assurance that the piping will not be exposed to groundwater.

SLRA Section 3.4.2.2.8 also states that for portions of the stainless steel piping and piping components exposed to concrete and that are outdoors and below ground level in the condensate storage system, cracking will be managed because the piping could be exposed to groundwater. The SLRA cites AMR item 3.4.1-072 to manage cracking for these items. SLRA Section 3.4.2.2.8 did not cite loss of material as an applicable aging effect. As amended by Supplement No. 2 (ADAMS Accession No. ML19023A015), Exelon revised SLRA Section 3.4.2.2.8 to address loss of material, citing AMR item 3.4.1-047.

In its review of components associated with AMR item 3.4.1-082 where the components are potentially exposed to groundwater, the staff finds that Exelon has met the further evaluation criteria because the staff finds that Exelon's proposal to manage the effects of aging using the Buried and Underground Piping and Tanks program is acceptable because the periodic visual inspections conducted for the program can be capable of detecting concrete degradation that could lead to susceptibility of loss of material (item 3.4.1-047) and cracking (item 3.4.1-072) in stainless steel piping exposed to concrete.

Based on the program identified, the staff concludes that Exelon's program meets SRP-SLR Section 3.4.2.2.8, and the staff concludes that the SLRA is consistent with the GALL-SLR Report and that Exelon 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 item 3.4.1-035, addresses loss of material due to pitting or crevice corrosion for aluminum alloy piping, piping components, and tanks exposed to air or condensation, which will be managed by the One-Time Inspection program. The staff reviewed Exelon's proposal against the criteria in SRP-SLR Section 3.4.2.2.9.

Exelon stated that the steam and power conversion systems contain no aluminum alloy tanks; or piping or piping components exposed to the air-indoor controlled, air-outdoor, or condensation environments in the steam and power conversion systems. The staff evaluated Exelon's claim and finds it acceptable based on a review of the UFSAR and SLRA related to these component, material, and environment combinations.

In its review of components associated with AMR item 3.4.1-035, the staff finds that Exelon has met the further evaluation criteria, and Exelon's proposal to manage the effects of aging using the One-Time Inspection program is acceptable for the following reasons: (a) loss of material has not been identified as an aging effect by Exelon for aluminum components in these environments; (b) use of the One-Time Inspection program can demonstrate that loss of material due to pitting and crevice corrosion does not occur at a rate that affects the intended function of the components, which is consistent with SRP-SLR Section 3.4.2.2.9; and (c) the visual inspections can be capable of detecting loss of material.

Based on the program identified, the staff concludes that Exelon's program meets SRP-SLR Section 3.4.2.2.9 criteria. For those AMR items associated with SLRA Section 3.4.2.2.9, the staff concludes that the SLRA is consistent with the GALL-SLR Report and that Exelon 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 3.4.2.2.9, associated with SLRA Table 3.4.1 AMR items 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 alloy components, exposed to air, condensation, raw water, waste water, or the underground environment. Exelon stated that these items are not applicable. The staff evaluated Exelon's claim and finds it acceptable because based on a review of the UFSAR and SLRA, there are no aluminum alloy underground piping, piping components, or tanks; tanks within the scope of GALL-SLR Report AMP XI.M29; insulated piping, piping components, or tanks; or piping, piping components, or tanks exposed to raw water or waste water 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 3.4.2-6 that are not consistent with, or not addressed in, the GALL-SLR Report. Additionally, the staff did not identify any Steam and Power Conversion Systems AMR results not consistent with or not addressed in the GALL-SLR Report during the review.

3.4.2.3.1 Main Condenser System - Summary of Aging Management Evaluation - SLRA Table 3.4.2-1

Titanium Heat Exchanger Tubes Exposed to Treated Water (External)

In SLRA Table 3.4.2-4, the applicant stated that for titanium heat exchanger tubes exposed to treated water, the reduction of heat transfer aging effect is not applicable, and no AMP is proposed. The AMR item cites plant-specific note 1, which states "[t]he component performs an intended function of holdup only and therefore, the aging effect of reduction of heat transfer due to fouling is not applicable."

The staff reviewed the associated items in the SLRA to confirm that this aging effect is not applicable for this component, material, and environment combination. The staff finds the applicant's proposal acceptable based on its review of the SLRA and the SRP-SLR, which states that aging effects need to be managed so that the intended function(s) of a system, structure, or component are managed during the subsequent period of extended operation. The staff finds the applicant's proposal acceptable because the reduction of heat transfer aging effect doesn't impact the intended function of the given component.

3.5 Aging Management of Containment, 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: Structures," as being subject to an AMR. SLRA Table 3.5-1, "Summary of Aging Management Evaluations for the Containment, Structures, and Component Supports," is a summary comparison of the applicant's AMRs with those evaluated in the GALL-SLR Report for the Containment Structures and the 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. For AMR items that the staff found to be consistent with the GALL-SLR Report (and no SER section is referenced), the staff determined that no additional evaluation or request for additional information was necessary and finds the items acceptable based on the GALL-SLR Report review of the 10 program elements. For AMR items that required additional evaluation (such as responses to requests for additional information), the staff's evaluation is documented in sections 3.5.2.1.2 through 3.5.2.1.4 below.

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	Not applicable to PBAPS (see SER Sections 3.5.2.1.1 and 3.5.2.2.1.1)
3.5.1-002	Not applicable to PBAPS (see SER Sections 3.5.2.1.1 and 3.5.2.2.1.1)
3.5.1-003	Not applicable to PBAPS (see SER Sections 3.5.2.1.1 and 3.5.2.2.1.2)
3.5.1-004	Not applicable to PBAPS (see SER Sections 3.5.2.1.1 and 3.5.2.2.1.3)

Component Group (SRP-SLR Item No.)	Staff Evaluation
3.5.1-005	Not applicable to PBAPS (see SER Sections 3.5.2.1.1 and 3.5.2.2.1.3)
3.5.1-006	Consistent with the GALL-SLR Report (see SER Section 3.5.2.2.1.3)
3.5.1-007	Consistent with the GALL-SLR Report (see SER Section 3.5.2.2.1.3)
3.5.1-008	Not applicable to PBAPS (see SER Sections 3.5.2.1.1 and 3.5.2.2.1.4)
3.5.1-009	Consistent with the GALL-SLR Report (see SER Section 3.5.2.2.1.5)
3.5.1-010	Consistent with the GALL-SLR Report (see SER Sections 3.5.2.1.1 and 3.5.2.2.1.6)
3.5.1-011	Not applicable to PBAPS (see SER Sections 3.5.2.1.1 and 3.5.2.2.1.7)
3.5.1-012	Not applicable to PBAPS (see SER Sections 3.5.2.1.1 and 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
3.5.1-014	Not applicable to PBAPS (see SER Sections 3.5.2.1.1 and 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	Not applicable to PBAPS (see SER Section 3.5.2.1.1)
3.5.1-017	This item number is not used in the SRP-SLR nor the GALL-SLR Report
3.5.1-018	Not applicable to PBAPS (see SER Section 3.5.2.1.1)
3.5.1-019	Not applicable to PBAPS (see SER Section 3.5.2.1.1)
3.5.1-020	Not applicable to PBAPS (see SER Section 3.5.2.1.1)
3.5.1-021	Not applicable to PBAPS (see SER Section 3.5.2.1.1)
3.5.1-022	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.5.1-023	Not applicable to PBAPS (see SER Section 3.5.2.1.1)
3.5.1-024	Not applicable to PBAPS (see SER Section 3.5.2.1.1)
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	Consistent with the GALL-SLR Report
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	Not applicable to PBAPS (see SER Section 3.5.2.1.1)
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 SER Section 3.5.2.2.1.3, Item 1)
3.5.1-036	Consistent with the GALL-SLR Report
3.5.1-037	Consistent with the GALL-SLR Report (see SER Section 3.5.2.2.2.4)
3.5.1-038	Not applicable to PBAPS (see SER Sections 3.5.2.1.1 and 3.5.2.2.1.6)
3.5.1-039	Consistent with the GALL-SLR Report (see SER Section 3.5.2.2.1.6)
3.5.1-040	Not applicable to PBAPS (see SER Section 3.5.2.1.1)
3.5.1-041	Consistent with the GALL-SLR Report
3.5.1-042	Consistent with the GALL-SLR Report (see SER Section 3.5.2.2.2.1, item 1)
3.5.1-043	Consistent with the GALL-SLR Report (see SER Section 3.5.2.2.2.1, item 2)
3.5.1-044	Consistent with the GALL-SLR Report (see SER 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	Not applicable to PBAPS (see SER Section 3.5.2.2.2.1, item 3)
3.5.1-047	Consistent with the GALL-SLR Report (see SER Section 3.5.2.2.2.1, item 4)
3.5.1-048	Not applicable to PBAPS (see SER Section 3.5.2.2.2.2)

Component Group (SRP-SLR Item No.)	Staff Evaluation
3.5.1-049	Consistent with the GALL-SLR Report (see SER Section 3.5.2.2.2.3, item 1)
3.5.1-050	Consistent with the GALL-SLR Report (see SER Section 3.5.2.2.2.3, item 2)
3.5.1-051	Consistent with the GALL-SLR Report (see SER Section 3.5.2.2.2.3, item 3)
3.5.1-052	Not applicable to PBAPS (see SER Sections 3.5.2.1.1 and 3.5.2.2.2.4)
3.5.1-053	Not applicable to PBAPS (see SER Sections 3.5.2.1.1 and 3.5.2.2.2.5)
3.5.1-054	Consistent with the GALL-SLR Report
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 (see SER Section 3.5.2.1.6)
3.5.1-058	Consistent with the GALL-SLR Report
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	Consistent with the GALL-SLR Report (see SER Section 3.5.2.1.3)
3.5.1-063	Consistent with the GALL-SLR Report (see SER Sections 3.5.2.1.8 and 3.5.2.2.2.1, item 4)
3.5.1-064	Consistent with the GALL-SLR Report
3.5.1-065	Consistent with the GALL-SLR Report
3.5.1-066	Consistent with the GALL-SLR Report
3.5.1-067	Consistent with the GALL-SLR Report
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	Consistent with the GALL-SLR Report
3.5.1-075	Consistent with the GALL-SLR Report
3.5.1-076	Not applicable to PBAPS (see SER Section 3.5.2.1.1)
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 (see SER Section 3.5.2.1.4)
3.5.1-086	Consistent with the GALL-SLR Report
3.5.1-087	Consistent with the GALL-SLR Report
3.5.1-088	Consistent with the GALL-SLR Report (see SER Section 3.5.2.1.7)
3.5.1-089	Not applicable to PBAPS (see SER Section 3.5.2.1.1)
3.5.1-090	Consistent with the GALL-SLR Report (see SER Section 3.5.2.1.5)
3.5.1-091	Consistent with the GALL-SLR Report
3.5.1-092	Consistent with the GALL-SLR Report
3.5.1-093	Consistent with the GALL-SLR Report

Component Group (SRP-SLR Item No.)	Staff Evaluation
3.5.1-094	Consistent with the GALL-SLR Report
3.5.1-095	Consistent with the GALL-SLR Report
3.5.1-096	Consistent with the GALL-SLR Report (see SER Section 3.5.2.1.2 and 3.5.2.2.2.3)
3.5.1-097	Consistent with the GALL-SLR Report (see SER Section 3.5.2.2.2.6)
3.5.1-098	Not used. Addressed by 3.5.1-099 (see Section 3.5.2.1.1)
3.5.1-099	Consistent with the GALL-SLR Report (see SER Section 3.5.2.2.2.4)
3.5.1-100	Consistent with the GALL-SLR Report (see SER Sections 3.5.2.3.1 and 3.5.2.2.2.4)

The staff's review of component groups, as described in SER Section 3.0.2.2, is summarized in the following three sections:

(1) SER Section 3.5.2.1 discusses AMR results for components that the applicant states are either not applicable to PBAPS 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 conclusions.

(2) SER Section 3.5.2.2 discusses AMR results for which the GALL-SLR Report and SRP-SLR recommend further evaluation.

(3) SER 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 3.5.2-22 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.

Additionally, SER 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 or Not Used

Exelon claimed that the following SLRA Table 3.2-1 items were not applicable to PBAPS: 3.5.1-001, 3.5.1-002, 3.5.1-003, 3.5.1-004, 3.5.1-005, 3.5.1-008, 3.5.1-011, 3.5.1-012, 3.5.1-014, 3.5.1-016, 3.5.1-018, 3.5.1-019, 3.5.1-020, 3.5.1-021, 3.5.1-023, 3.5.1-024, 3.5.1-032, 3.5.1-038, 3.5.1-040, 3.5.1-046, 3.5.1-048, 3.5.1-052, 3.5.1-053, 3.5.1-076, and 3.5.1-089. The staff reviewed the SLRA and UFSAR and confirmed that the particular combination of aging effect, material, and environment represented by the AMR item does not exist at the site.

For SLRA Table 3.5.1, AMR item 3.5.1-098, Exelon claimed that the corresponding items in the GALL-SLR Report are not applicable because they are addressed by another SLRA Table 1 AMR item (3.5.1-099). The staff reviewed the SLRA and confirmed that the aging effects will be addressed by other SLRA Table 1 AMR items. Therefore, the staff finds Exelon’s proposal to use an alternate item acceptable.

3.5.2.1.2 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 the SLRA Table 2 AMR items that cite generic note E, the SLRA credits the Federal Energy Regulatory Commission (FERC) Inspections of the Conowingo Hydroelectric Plant (Dam), which are substituted to manage aging effect(s) applicable to this component type, material, and environment combination.

Based on its review of components associated with AMR item 3.5.1-096 for which Exelon cited generic note E, the staff finds Exelon’s proposal to manage the effects of aging using the FERC Inspections of the Conowingo Hydroelectric Plant (Dam) acceptable, because of the FERC’s authority and responsibility for ensuring that its regulated projects are constructed, operated, and maintained to protect life, health, and property. Therefore, the staff finds the program acceptable. PBAPS will continue to comply with FERC inspection requirements during the subsequent period of extended operation.

3.5.2.1.3 Loss of Material and Change in Material Properties

SLRA Table 3.5.1, AMR item 3.5.1-062, addresses loss of material and changes in material properties for wooden piles exposed to outdoor air and groundwater/soil. For the SLRA Table 2 AMR items that cite generic note E, the SLRA credits the Wooden Pole program to manage the aging effect for treated wooden poles.

Based on its review of components associated with AMR item 3.5.1-062 for which Exelon cited generic note E, the staff finds Exelon’s proposal to manage the effects of aging using the Wooden Pole program acceptable, because the Wooden Pole program activities are specific to the wooden utility pole; they match the transmission and distribution industry standard for wooden pole condition monitoring; and they are implemented by qualified personnel performing wooden pole condition monitoring for the grid surrounding PBAPS.

3.5.2.1.4 Loss of Material due to Pitting, Crevice Corrosion

SLRA Table 3.5.1, AMR item 3.5.1-085, addresses loss of material due to pitting and crevice corrosion for stainless steel structural bolting exposed to treated water (external). For the SLRA Table 2 AMR item that cites generic note E, the SLRA credits the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems program to manage the aging effect for stainless steel bolting (structural). The AMR items cite plant-specific note 1, which states that the Inspection of Overhead Heavy Load and Light Load (Related to Fuel Handling) Systems program is substituted to manage the aging effect applicable to this component type, material, and environment combination.

Based on its review of components associated with AMR item 3.5.1-085 for which Exelon cited generic note E, the staff finds Exelon’s proposal to manage the effects of aging using the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems program acceptable because (1) the components are not ASME Code Class supports, and (2) the condition monitoring program was enhanced to include periodic visual inspections of bolted connections to ensure that loss of material is detected before any loss of function, and it is consistent with the GALL-SLR Report recommendations.

3.5.2.1.5 Loss of Material due to General (steel only) Pitting, Crevice Corrosion

SLRA Table 3.5.1, AMR item 3.5.1-090, addresses loss of material due to pitting and crevice corrosion for steel and stainless steel support members, welds, bolted connections, and support anchorage to building structure exposed to treated water and treated water (external). For the SLRA Table 2 AMR item that cites generic note E:

(1) The SLRA credits the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems program to manage the aging effect for stainless steel crane/hoist (fuel prep machine) and crane/hoist (refueling platform-mast). The AMR items cite plant-specific note 4, which states that the Inspection of Overhead Heavy Load and Light Load (Related to Fuel Handling) Systems is substituted to manage the aging effect applicable to this component type, material, and environment combination.

(2) The SLRA credits the Structures Monitoring program to manage the aging effect for stainless steel hatches/plugs (reactor well). The AMR items cite plant-specific note 1, which states that the Structures Monitoring program is substituted to manage the aging effect applicable to this component type, material, and environment combination.

Based on its review of components associated with AMR item 3.5.1-090 for which Exelon cited generic note E, the staff finds Exelon's proposal to manage the effects of aging using the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems program acceptable for the fuel handling system components and its proposal to manage the effects of aging using the Structures Monitoring program for the reactor building hatch components acceptable because (1) the components are not ASME Code Class supports, and (2) the condition monitoring programs include periodic visual inspections to ensure that loss of material is detected before any loss of function at intervals bounded by those in ASME Section XI, Subsection IWF.

3.5.2.1.6 Loss of Mechanical Function due to Corrosion, Distortion, Dirt or Debris Accumulation, Overload, Wear

SLRA Table 3.5.1, AMR item 3.5.1-057, addresses loss of mechanical function due to corrosion, distortion, dirt or debris accumulation, overload, wear for carbon steel constant and variable load spring hangers, guides, stops exposed to air-indoor uncontrolled. For the SLRA Table 2 AMR items that cite generic note E, the SLRA credits the Structures Monitoring program to manage the aging effect for carbon steel sliding surfaces and supports for cable trays, conduit, HVAC ducts, tube track, and instrument supports. The AMR items cite plant-specific note 4, which states that the Structures Monitoring program is substituted to manage the aging effect(s) applicable to this component type, material, and environment combination.

Based on its review of components associated with AMR item 3.5.1-057 for which Exelon cited generic note E, the staff finds Exelon's proposal to manage the effects of aging using the Structures Monitoring program acceptable because the components are not ASME Code Class supports and the Structures Monitoring program uses visual inspections that will identify corrosion, distortion, dirt or debris accumulation, overload, and wear that will indicate the potential for loss of mechanical function. In addition, the frequency of examination is every 5 or 10 years depending on the location, which is bounded by the 10-year interval in the ASME Section XI, Subsection IWF AMP.

3.5.2.1.7 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 structural bolting exposed to any environment. For the SLRA Table 2 AMR items that cite generic note E, the SLRA credits the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems program to manage the aging effect(s) for structural bolting in the fuel handling system. The AMR items cite plant-specific note 1, which states that the Inspection of Overhead Heavy Load and Light Load (Related to Fuel Handling) Systems program is substituted to manage the aging effect(s) applicable to this component type, material, and environment combination.

Based on its review of components associated with AMR item 3.5.1-088 for which Exelon cited generic note E, the staff finds Exelon's proposal to manage the effects of aging using the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems program acceptable because the condition monitoring program was enhanced to include periodic visual inspections of bolted connections to ensure that loss of preload is detected before any loss of function, and it is consistent with the GALL-SLR Report recommendations. The staff finds that Exelon 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).

3.5.2.1.8 Increase in Porosity and Permeability and Loss of Strength Due to Leaching of Calcium Hydroxide and Carbonation

SLRA Table 3.5.1, AMR item 3.5.1-063, as amended by Exelon's letter dated January 23, 2019, addresses increase in porosity and permeability and loss of strength due to leaching of calcium hydroxide and carbonation for accessible areas of concrete structures (exterior above and below-grade), and foundation exposed to air-indoor (uncontrolled) or air-outdoor environments. Exelon stated that the applicability of SLRA AMR item 3.5.1-063 is limited to Groups 2, 3, 8, and 9 structures, and the hazard barriers and elastomers commodity group. Exelon stated that a portion of the SRP-SLR AMR item is not applicable because there are no standalone Group 7 structures at PBAPS. The staff notes that SLRA Table 3.5.2-9 addresses this aging effect for the emergency cooling reservoir concrete tank using AMR item 3.5.1-061. The staff evaluated Exelon's claim and finds it acceptable because a review of the SLRA and UFSAR confirmed that Exelon does not have other standalone concrete tanks or missile barriers that are applicable for this item.

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, 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 of 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.

3.5.2.2.1 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; reduction of strength in the concrete foundation; and cracking due to differential settlement and erosion of porous concrete subfoundations in the concrete dome, wall, basemat, ring girders, and buttresses exposed to soil and water-flowing. Exelon stated that these items are not applicable. The staff evaluated Exelon's claim against the criteria in SRP-SLR Section 3.5.2.2.1.1 and finds it to be acceptable because:

- The reactor building structures are founded on bedrock; thus, the concrete foundation and subfoundations are not exposed to soil and would not be subject to increased stresses from settlement.
- Cracking and distortion due to settlement has not been identified in PBAPS power block concrete structures, which are founded on bedrock.
- The design of the concrete foundation and subfoundations does not use porous concrete.
- The PBAPS CLB does not credit a dewatering system to control settlement.
- The applicant's Structures Monitoring program manages cracking and distortion of the associated SCs consistent with the recommendations in the GALL-SLR Report.

Therefore, the recommendation from SRP-SLR that a plant-specific program be implemented to verify the continued functionality of a dewatering system is not applicable to PBAPS.

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, AMR item 3.5.1-003, addresses reduction of strength and modulus of elasticity due to elevated temperature in concrete components (e.g., dome, wall, basemat, ring girders, buttresses, fill-in annulus) of containment structures exposed to an air-indoor uncontrolled or air-outdoor environment. Exelon stated that this item is not applicable. The staff evaluated Exelon'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, UFSAR Sections 4.2.4.9 and 5.2, and site technical specifications (TS) Section 3.6, temperatures inside containment are kept below the GALL-SLR Report recommended threshold limits of 150 °F for general areas and 200 °F for local areas; therefore, concrete 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, 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 accessible and inaccessible areas of containment integral attachments, penetration sleeves, drywell shell, drywell head, drywell shell in sand pocket regions, and drywell embedded shell of steel material exposed to air-indoor uncontrolled environment that will be managed by the ASME Section XI, Subsection IWE, and 10 CFR Part 50, Appendix J AMPs. The staff reviewed Exelon's proposal against the criteria in SRP-SLR Section 3.5.2.2.1.3, item 1.

Exelon stated that items 3.5.1-004 and 3.5.1-005 are not applicable to PBAPS Mark I steel containments, noting that they apply to Mark II and Mark III containments. The staff noted from the SRP-SLR and the GALL-SLR Report that items 3.5.1-004 and 3.5.1-005 only apply to BWR Mark I concrete containments in addition to BWR Mark II, Mark III and PWR containments. Therefore, the staff finds Exelon's claim acceptable because PBAPS has BWR Mark I steel containments.

For item 3.5.1-035, which Exelon claimed as applicable, the staff noted that a plant-specific program to manage this aging effect in accessible and inaccessible areas of the PBAPS containments is not warranted based on the following: (1) the containment design includes a periodically monitored accessible moisture barrier at the interior drywell floor interface and an inaccessible sheet metal cover and joint sealing compound above the sand pocket region on the exterior of the drywell shell, to prevent moisture intrusion into inaccessible areas of drywell shell and to the sand pocket; (2) there has been no drywell corrosion detected near the moisture barrier location; (3) there has been no reported evidence of moisture or degradation when the stabilizer access hatch covers at the top of the drywell cylinders are opened to perform examinations of the exterior shear lugs; (4) the drywell air gap design incorporates seal rupture drains to divert drywell bellows leakage and also incorporates a weir wall that prevents drywell bellows leakage from entering the air gap before being drained away; (5) the drywell design prevents in-leakage to the sand pocket; (6) examinations and tests thus far, under the IWE program, of components associated with the drywell air gap region and drains confirmed that abnormal conditions that could lead to containment degradation do not exist and, if it occurs, would be identified and subject to corrective action prior to loss of intended function; (7) PBAPS operating experience has not shown any significant corrosion of the containment drywell shell; and (8) the continued monitoring of the containment shell in accordance with the ASME Section XI, Subsection IWE AMP and the leakage testing in accordance with 10 CFR Part 50, Appendix J program provide reasonable assurance that loss of material due to corrosion of the drywell steel elements will be detected and corrected prior to loss of intended function. In its review of components associated with item 3.5.1-035, the staff finds that Exelon has met the further evaluation criteria, and Exelon's proposal to manage the effects of aging using the ASME Section XI, Subsection IWE program, and the 10 CFR Part 50, Appendix J program is acceptable because: (1) the robust drywell design features along with monitoring and testing measures provide substantial defense against water entering the drywell air gap region and sand pocket region, thereby preventing degradation of the inaccessible exterior side of the drywell; (2) there has been no operating experience of moisture intrusion or degradation of inaccessible drywell areas, nor of any significant corrosion in accessible areas; and (3) the continued monitoring using these programs provides reasonable assurance that any occurrence of abnormal conditions or degradation will be identified and corrected prior to loss of intended function.

Based on the programs identified, the staff concludes that Exelon's programs meet SRP-SLR Section 3.5.2.2.1.3, item 1 criteria. For those AMR items associated with SLRA Section 3.5.2.2.1.3, item 1, the staff concludes that the SLRA is consistent with the GALL-SLR Report and that Exelon 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 due to general, pitting, crevice corrosion for steel torus shell exposed to air-indoor uncontrolled or treated water, which will be managed by the

ASME Section XI, Subsection IWE program, and the 10 CFR Part 50, Appendix J program. The staff reviewed Exelon's proposal against the criteria in SRP-SLR Section 3.5.2.2.1.3 item 2.

In the SLRA, Exelon stated that the PBAPS Units 2 and 3 torus internal coatings were each replaced with a qualified Service Level I coating in 2012 and 2013, respectively, as a result of previous monitoring and trending of coating conditions. Exelon also stated that further examinations conducted in accordance with ASME Section XI, Subsection IWE for the steel torus shells has not identified any significant corrosion. In its review of components associated with AMR item 3.5.1-006, the staff finds that Exelon has met the further evaluation criteria, and Exelon's proposal to manage the effects of aging using the ASME Section XI, Subsection IWE program, and the 10 CFR Part 50, Appendix J program is acceptable because the programs have demonstrated that the aging effects are adequately managed consistent with the GALL-SLR Report recommendations, and further examinations after the torus internal coatings replacement have not identified significant corrosion degradation in the steel torus shell.

Based on the programs identified, the staff concludes that Exelon's programs meet SRP-SLR Section 3.5.2.2.1.3 item 2 criteria. For those AMR items associated with SLRA Section 3.5.2.2.1.3.2, the staff concludes that the SLRA is consistent with the GALL-SLR Report and that Exelon 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).

<u>Item 3</u>. 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 due to general, pitting, and crevice corrosion for steel torus ring girders and downcomers exposed to air-indoor (uncontrolled) or treated water, which will be managed by the ASME Section XI, Subsection IWE program. The staff reviewed Exelon's proposal against the criteria in SRP-SLR Section 3.5.2.2.1.3 item 3.

In its review of components associated with AMR item 3.5.1-007, the staff finds that Exelon has met the further evaluation criteria, and Exelon's proposal to manage the effects of aging using the ASME Section XI, Subsection IWE program is acceptable because the proposed program is consistent with the GALL-SLR Report recommendation to adequately manage the aging effects, and plant-specific operating experience has not identified significant corrosion degradation in the torus ring girders and downcomers.

Based on the program identified, the staff concludes that Exelon's program meets SRP-SLR Section 3.5.2.2.1.3 item 3 criteria. For those applicable AMR items associated with SLRA Section 3.5.2.2.1.3.3, the staff concludes that the SLRA is consistent with the GALL-SLR Report and that Exelon 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).

3.5.2.2.1.4 Loss of Prestress Due to Relaxation, Shrinkage, Creep, and Elevated Temperature

SLRA Section 3.5.2.2.1.4, associated with SLRA Table 3.5-1, item 3.5.1-008, states that this item, which relates to prestressed tendons, is not applicable to PBAPS. The staff reviewed the applicant's UFSAR and noted that the PBAPS containment is a Mark I steel containment and does not contain prestressed tendons.

3.5.2.2.1.5 Cumulative Fatigue Damage

SLRA Section 3.5.2.2.1.5, associated with SLRA Table 3.5.1, item 3.5.1-009, addresses cumulative fatigue damage due to cyclic loading (only for an existing analysis that is part of the CLB) in metal plates, suppression pool steel shells (including welded joints) and penetrations (including personnel airlock, equipment hatch, CRD hatch, penetration sleeves, dissimilar metal welds, and penetration bellows), vent header, vent line bellows, and downcomers of the PBAPS Mark I containment exposed to air-indoor and treated water environments. The SLRA notes that TLAAs are evaluated in accordance with 10 CFR 54.21(c)(1) and states that fatigue in the associated PBAPS components is evaluated as follows:

(a) The drywell shell, drywell head, drywell personnel airlock, drywell equipment hatches, drywell CRD removal hatch, drywell electrical penetrations, and drywell mechanical penetrations (except for bellows (see paragraph (c) below) and the Unit 3 RHR supply and return line flued-head penetrations (see paragraph (d) below)) were determined by Exelon to not to have existing fatigue analyses and therefore have no fatigue TLAAs. The staff's evaluation regarding the absence of a TLAA for the drywell and its associated components cited above is documented in SER Section 4.6.

(b) The torus shell, torus penetrations, vent header and downcomers, drywell-to-torus vents, SRV discharge piping externally attached to the torus, other piping attached to the torus, drywell-to-torus vent bellows, and replacement RHR and core spray suction strainers are addressed as a TLAA in SLRA Section 4.6.1. This is consistent with SRP-SLR Section 3.5.2.2.1.5 and is, therefore, acceptable. The staff's evaluation regarding the TLAAs for these items is documented in SER Section 4.6.1.

(c) The containment process line penetration bellows, including the Unit 3 RHR system replacement penetration bellows, are addressed as a TLAA in SLRA Section 4.6.2. This is consistent with SRP-SLR Section 3.5.2.2.1.5 and is, therefore, acceptable. The staff's evaluation regarding the TLAA for bellows of process lines that penetrate the primary containment is documented in SER Section 4.6.2.

(d) The Unit 3 RHR supply and return line flued-head penetrations are addressed as a TLAA in SLRA Section 4.3.2. This is consistent with SRP-SLR Section 3.5.2.2.1.5 and is, therefore, acceptable. The staff's evaluation regarding the TLAA for these penetrations is documented in SER Section 4.3.2.

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, AMR items 3.5.1-010, 3.5.1-038 and 3.5.1-039, addresses cracking due to stress corrosion cracking (SCC) for penetration sleeves and penetration bellows made from stainless steel or dissimilar metal welds, steel suppression chamber shell, and stainless steel vent line bellows exposed to an air-indoor uncontrolled environment, which will be managed by the ASME Section XI, Subsection IWE program and the 10 CFR Part 50, Appendix J program. The staff reviewed Exelon's proposal, as amended by letter dated January 23, 2019, against the criteria in SRP-SLR Section 3.5.2.2.1.6.

Exelon stated that item 3.5.1-038 is not applicable. The staff evaluated Exelon's claim against the criteria in SRP-SLR Section 3.5.2.2.1.6 and finds it acceptable because a search of Exelon's UFSAR Table 1.7.4, "Comparison of Containment Characteristics," and Figure M.1.1, "General Arrangement of the Drywell and Suppression Chamber," confirmed that the suppression chamber shell at PBAPS is made of carbon steel and is not susceptible to SCC.

The staff noted that the ASME Section XI, Subsection IWE program was enhanced to include surface examinations in accessible portions of high temperature drywell mechanical penetrations, in addition to visual examinations, to detect cracking due to SCC in these penetrations. In its review of components associated with AMR items 3.5.1-010 and 3.5.1-039, the staff finds that Exelon has met the further evaluation criteria, and Exelon's proposal to manage the effects of aging using the ASME Section XI, Subsection IWE program and the 10 CFR Part 50, Appendix J program is acceptable because (a) a review of plant-specific operating experience did not reveal a history of cracking due to SCC for stainless steel components, and (b) the proposed programs in conjunction with the additional surface examination for those accessible areas susceptible to SCC provides reasonable assurance that this aging effect will be adequately managed during the subsequent period of extended operation.

Based on the programs identified, the staff concludes that Exelon'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, the staff concludes that the SLRA is consistent with the GALL-SLR Report and that Exelon 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 in inaccessible areas of concrete components (e.g., dome, wall, basemat, ring girder, buttresses) of containment structures exposed to air-outdoor or groundwater/soil environments. Exelon stated that this item is not applicable. The staff evaluated the applicant's claim against the criteria in SRP-SLR Section 3.5.2.2.1.7 and finds it acceptable because this aging effect is only applicable to concrete components of containment structures and based on UFSAR Section 5, these components do not exist at PBAPS for the Mark I steel containment structure.

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 concrete components (e.g., dome, wall, basemat, ring girder, buttresses) of containment structures exposed to any environment. Exelon stated that this item is not applicable. The staff evaluated the applicant's claim against the criteria in SRP-SLR Section 3.5.2.2.1.8 and finds it acceptable because this aging effect is only applicable to concrete components of containment structures and based on UFSAR Section 5, these components do not exist at PBAPS for the Mark I steel containment structure.

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 concrete components (e.g., dome, wall, basemat, ring girder, buttresses) of containment structures exposed to water-flowing. Exelon stated that this item is not applicable. The staff evaluated the applicant's claim against the criteria in SRP-SLR Section 3.5.2.2.1.9 and finds it acceptable because this aging effect is only applicable to concrete components of containment structures and based on UFSAR Section 5, these components do not exist at PBAPS for the Mark I steel containment structure.

3.5.2.2.2 Safety-Related and Other Structures and Component Supports

3.5.2.2.2.1 Aging Management of Inaccessible Areas

Item 1. SLRA Section 3.5.2.2.2.1, item 1, as amended by letter dated January 23, 2019 (ADAMS Accession No. ML19023A015), associated with SLRA Table 3.5.1, item 3.5.1-042, addresses loss of material (spalling, scaling) and cracking due to freeze-thaw in inaccessible areas of Groups 1-3, 5, and 7-9 concrete structures; foundation exposed to an air-outdoor, groundwater/soil environment, which will be managed by the Structures Monitoring program. The staff reviewed the Exelon proposal against the criteria in SRP-SLR Section 3.5.2.2.2.1, item 1.

The staff reviewed Section 5 of the UFSAR along with the SLRA and noted that PBAPS does not have any standalone Group 1 or 5 structures because these structures are part of the reactor building, which is a Group 2 structure. The staff also noted that PBAPS does not have any Group 7 structures.

Based on its review of the SLRA and Figure 1 of ASTM C33-90, "Standard Specification for Concrete Aggregates," the staff noted that PBAPS is located in a region with severe weathering conditions. The SLRA states that the concrete mix for these structures provides an air entrainment (i.e., content) of 3 percent to 6 percent leading to good freeze-thaw resistance. The SLRA also states that inspection of inaccessible reinforced concrete exposed during excavations found the concrete to be structurally sound, with no cracks or evidence of spalling. The staff noted that the Structures Monitoring program proposes to manage the effects of aging for below-grade inaccessible concrete areas of these groups of structures using visual inspections when they become accessible as a result of an excavation activity; and when observed conditions in accessible areas indicate that significant degradation may be occurring in the inaccessible area. The staff also noted that SLRA Table 3.5.1, item 3.5.1-64, consistent with the GALL-SLR Report recommendation, manages loss of material and cracking due to freeze-thaw in exterior and below-grade accessible areas and foundations of concrete structures using the Structures Monitoring program.

In its review of components associated with AMR item 3.5.1-042, the staff finds that Exelon has met the further evaluation criteria, and Exelon's proposal to manage the effects of aging using the Structures Monitoring program is acceptable because (1) concrete has an air content of 3 percent to 6 percent, which is adequate to prevent degradation due to freeze-thaw; (2) past inspections from exposed inaccessible areas have not revealed any cracking or spalling of the concrete; (3) management of these aging effects through visual inspection of inaccessible concrete areas when they become accessible for any reason and through the use of the observed condition from accessible areas as an indicator is consistent with the GALL-SLR Report recommendation; and (4) the AMP is consistent with that recommended by the GALL-SLR Report for managing these aging effects in accessible areas for these groups of structures.

Based on the program identified, the staff concludes that Exelon's program meets SRP-SLR Section 3.5.2.2.2.1, item 1 criteria. For those 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 Exelon 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, as amended by letter dated January 23, 2019 (ADAMS Accession No. ML19023A015), associated with SLRA Table 3.5.1, item 3.5.1-043, addresses cracking due to expansion and reaction with aggregates for concrete inaccessible areas for all the structural groups (except Group 6); foundation exposed to any environment that will be managed by the Structures Monitoring program. The staff reviewed Exelon's proposal against the criteria in SRP-SLR Section 3.5.2.2.2.1, item 2.

The staff reviewed Section 5 of the UFSAR along with the SLRA and noted that PBAPS does not have any standalone Group 1 or 5 structures because these structures are part of the reactor building, which is a Group 2 structure. The staff also noted that PBAPS does not have Group 7 structures.

The SLRA states that "[p]etrographic examinations of aggregates used in concrete were performed in accordance with ASTM C295, "Petrographic Examination of Aggregates for Concrete," and ASTM C289, "Potential Reactivity of Aggregates," to demonstrate that the aggregates do not adversely react within the concrete." The SLRA, as amended by letter dated January 23, 2019 (ADAMS Accession No. ML19023A015), also states that "cracking associated with expansion due to reaction with aggregates has not been observed on PBAPS Group 2, 3, 4, 8, and 9 concrete structures" and "reinforced concrete was exposed during excavations and the exposed reinforced concrete looked sound, was not cracked, and did not exhibit any evidence of spalling." Based on its review of the SLRA and documents reviewed during the audit, the staff noted that there is no operating experience with occurrences of this aging effect at PBAPS. The staff also noted that the Structures Monitoring program performs visual inspections of inaccessible areas when these areas become accessible during excavation, and when an evaluation of inaccessible areas of concrete is required because periodic visual inspections of accessible areas of concrete, performed at least once every 5 years, indicate that degradation may be occurring in inaccessible areas. The staff also noted that, SLRA Table 3.5.1, item 3.5.1-054, manages cracking due to expansion from reaction with aggregates in accessible areas of concrete for all concrete structures (except Group 6) using the Structures Monitoring program.

In its review of components associated with AMR item 3.5.1-043, the staff finds that Exelon has met the further evaluation criteria, and Exelon's proposal to manage the effects of aging using the Structures Monitoring program is acceptable because (1) PBAPS has no operating experience related to this aging effect, (2) petrographic examinations of concrete were performed in accordance with ASTM standards and no adverse reaction with aggregate was identified, (3) management of this aging effect through visual inspection of inaccessible concrete areas when they become accessible for any reason and through the use of the observed condition from accessible areas as an indicator is consistent with the GALL-SLR Report recommendations, and (4) the program is consistent with the AMP recommended by the GALL-SLR Report for managing this aging effect in accessible areas for these groups of structures.

Based on the program identified, the staff concludes that Exelon's program meets SRP-SLR Section 3.5.2.2.2.1, item 2 criteria. For those 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 Exelon 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, addresses cracking and distortion in all group structures concrete exposed to soil, which will be managed by the Structures Monitoring program. SLRA Section 3.5.2.2.2.1, item 3, is also associated with SLRA Table 3.5.1, item 3.5.1-046, which addresses reduction of foundation strength and cracking in Groups 1-3, and 5-9 structures; and foundation and subfoundation concrete exposed to water-flowing. Exelon stated that item 3.5.1-046 is not applicable.

The staff reviewed Section 5 of the UFSAR along with the SLRA and noted that PBAPS does not have any standalone Group 5 structures because these structures are part of the reactor building, which is a Group 2 structure. The staff also noted that PBAPS does not have any Group 7 structures. The staff also reviewed Section 2.7.6 of the UFSAR and noted that PBAPS concrete structures are either founded on bedrock, in compacted fill or competent soil, and that post-construction settlements were expected to be insignificant for structures founded on bedrock. During the review of the SLRA and the UFSAR, the staff noted that the foundations for PBAPS structures do not include porous concrete subfoundations and that the CLB does not rely on a dewatering system to control settlement. The SLRA states that although "[c]racking and distortion due to settlement has not been identified in PBAPS concrete building structures," the Structures Monitoring program will continue to monitor and manage concrete structures for cracking due to any mechanism. Based on SLRA Tables 3.5.2-3 and -9 and AMR items 3.5.1-050, 065, and 067, the staff noted that Group 6 concrete structures exposed to soil will be managed for the aging effect of cracking by the Structures Monitoring program.

In its review of components associated with AMR item 3.5.1-044, the staff finds that Exelon has met the further evaluation criteria, and Exelon's proposal to manage the effects of aging using the Structures Monitoring program is acceptable because there has been no operating experience indicating cracking and distortion; and the Structures Monitoring program will continue to monitor structures for this aging effect consistent with the GALL-SLR Report recommendations. The staff also evaluated the applicant's claim against the criteria in SRP-SLR Section 3.5.2.2.2.1 item 3, AMR item 3.5.1-046, and finds it acceptable because (1) PBAPS does not use a dewatering system to control settlement, (2) the applicable structural groups are not built on a porous concrete subfoundation, and (3) there has been no operating experience indicating significant settlement. Therefore, no additional plant-specific program is necessary to manage cracking, distortion, and reduction of foundation strength due to settlement.

Based on the program identified, the staff concludes that Exelon's program meets SRP-SLR Section 3.5.2.2.2.1, item 3 criteria. For those items associated with SLRA Section 3.5.2.2.2.1, item 3, item 3.5.1-44, the staff concludes that the SLRA is consistent with the GALL-SLR Report and that Exelon 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, as amended by letter dated January 23, 2019 (ADAMS Accession No. ML19023A015), associated with SLRA Table 3.5.1, item 3.5.1-047, addresses increase in porosity and permeability; loss of strength due to leaching of calcium hydroxide and carbonation in inaccessible areas of Groups 1-5 and 7-9 concrete structures; exterior above-grade and below-grade; and foundation exposed to water-flowing, which will be managed by the Structures Monitoring program. The staff reviewed Exelon's proposal against the criteria in SRP-SLR Section 3.5.2.2.2.1, item 4.

The staff reviewed Section 5 of the UFSAR along with the SLRA and noted that PBAPS does not have any standalone Group 1 or 5 structures because these structures are part of the reactor building, which is a Group 2 structure. The staff also noted that PBAPS does not have any Group 7 structures, and that this aging effect is not applicable to Group 4 structures at PBAPS because the Mark I containment and its internal structures are within the reactor building and are therefore not exposed to a water-flowing environment.

The SLRA states that "[t]he effects of carbonation have not been observed at PBAPS reinforced concrete structures," and that "concrete degradation due to chemical attack or leaching has not been observed at PBAPS." The SLRA further states that "[o]perating experience at PBAPS, which looks for concrete deterioration due to any mechanism, has not identified porosity and permeability and loss of strength," and "reinforced concrete was exposed during excavations and the exposed reinforced concrete looked sound, was not cracked, and did not exhibit any evidence of spalling." The staff noted that under the applicant's Structures Monitoring program, accessible areas of concrete will be subject to visual inspections at least once every 5 years, and inaccessible areas of concrete structures are and will continue to be examined when they become exposed during excavation for any reason and evaluated when conditions exist in accessible areas of concrete that could indicate degradation in inaccessible areas. The staff noted that the applicant intends to use its Structures Monitoring program to monitor the accessible areas of concrete as an indicator of reinforced concrete conditions in inaccessible areas. Based on its review of SLRA Table 3.5-1, item 3.5.1-063, the staff noted that the associated accessible concrete structures will be inspected for this aging effect using the Structures Monitoring program, which is an AMP consistent (with enhancements) with the GALL-SLR Report recommendations. The staff's evaluation of the applicant Structures Monitoring program is documented in SER Section 3.0.3.2.20.

In its review of components associated with AMR item 3.5.1-047, the staff finds that Exelon has met the further evaluation criteria, and Exelon's proposal to manage the effects of aging using the Structures Monitoring program is acceptable because (1) there is no operating experience at PBAPS associated to this aging effect and, therefore, a plant-specific AMP is not required; and (2) management of this aging effect through visual inspection of inaccessible concrete areas when they become accessible for any reason and through the use of the observed condition from accessible areas as an indicator is consistent with the GALL-SLR Report recommendations.

Based on the program identified, the staff concludes that Exelon's program meets SRP-SLR Section 3.5.2.2.2.1, item 4 criteria. For those AMR 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 Temperature

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 temperature in concrete for Groups 1-5 structures exposed to an air-indoor uncontrolled environment. Exelon stated that this item is not applicable. The staff evaluated Exelon's claim against the criteria in SRP-SLR

Section 3.5.2.2.2.2 and finds it acceptable because, based on its review of the SLRA, UFSAR Sections 4.2.4.9, 5.2, 10, and 11, and site TS Section 3.6: (1) temperatures are kept below the GALL-SLR Report recommended threshold limits of 150 °F for general areas and 200 °F for local areas at PBAPS concrete structures; and (2) PBAPS plant-specific operating experience has not identified this aging effect as a concern for concrete structural components; therefore, concrete components are not exposed to the temperatures required for this aging effect to occur.

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, addresses loss of material (spalling, scaling) and cracking due to freeze-thaw in inaccessible areas of Group 6 structures concrete; exterior above-grade and below-grade; foundation; and interior slab exposed to air-outdoor, groundwater/soil, which will be managed by the Structures Monitoring program. The staff reviewed Exelon's proposal against the criteria in SRP-SLR Section 3.5.2.2.2.3, item 1.

The staff reviewed the SLRA and Figure 1 of ASTM C33-90, "Standard Specification for Concrete Aggregates," and noted that PBAPS is located in a region with severe weathering conditions. The SLRA states that the concrete mix for the Group 6 structures provide an air entrainment (i.e., content) of 3 percent to 6 percent and that inspection of inaccessible reinforced concrete exposed during excavations found the concrete to be structurally sound, with no cracks or evidence of spalling. The SLRA also states that reinforced concrete at PBAPS "has not exhibited significant loss of material (spalling, scaling) and cracking due to freeze thaw in accessible areas of in scope reinforced concrete structures." The staff noted that the Structures Monitoring program proposes to manage the effects of aging for below-grade inaccessible concrete areas of Group 6 structures using visual inspections when concrete areas become accessible because of an excavation activity. The staff also noted that the Structures Monitoring program will use the condition of accessible areas of concrete as an indicator for the condition of inaccessible areas and below-grade concrete; and if unacceptable conditions are identified in accessible areas, such conditions will be evaluated and corrective actions will be taken that may include additional inspections to determine the extent of degraded conditions. The staff also noted that SLRA Table 3.5.1, AMR item 3.5.1-060, is consistent with the GALL-SLR Report recommendation and manages loss of material and cracking due to freeze-thaw in exterior and below-grade accessible areas and foundations of Group 6 concrete structures using the Inspection of Water Control Structures Associated with Nuclear Power Plants program. The staff noted that the Inspection of Water-Control Structures Associated with Nuclear Power Plants program is implemented through the Structures Monitoring program. The staff finds that Exelon 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).

In its review of components associated with AMR item 3.5.1-049, the staff finds that Exelon has met the further evaluation criteria, and Exelon's proposal to manage the effects of aging using the Structures Monitoring program is acceptable because (1) concrete has an air content of 3 percent to 6 percent, which is adequate to prevent degradation due to freeze-thaw; (2) past inspections from exposed inaccessible areas have not revealed any cracking or spalling of the concrete due to freeze-thaw and, for accessible areas, the applicant has not identified significant degradation due to freeze-thaw; and (3) management of these aging effects through visual inspection of inaccessible concrete areas when they become accessible for any reason and through the use of the observed condition from accessible areas as an indicator is consistent with the GALL-SLR Report recommendations.

Based on the program identified, the staff concludes that Exelon's program meets SRP-SLR Section 3.5.2.2.2.3, item 1 criteria. For those items associated with SLRA Section 3.5.2.2.2.3, item 1, the staff concludes that the SLRA is consistent with the GALL-SLR Report and that Exelon 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).

<u>Item 2</u>. SLRA Section 3.5.2.2.2.3, item 2 associated with SLRA Table 3.5.1, item 3.5.1-50, addresses inaccessible areas of Group 6 concrete structures exposed to any environment that will be managed for cracking due to expansion and reaction with aggregates by the Structures Monitoring program. The staff reviewed Exelon's proposal against the criteria in SRP-SLR Section 3.5.2.2.2.3, item 2.

The SLRA states that "[p]etrographic examinations of aggregates used in concrete were performed in accordance with ASTM C295, "Petrographic Examination of Aggregates for Concrete," and ASTM C289, "Potential Reactivity of Aggregates," to demonstrate that the aggregates do not adversely react within the concrete." The SLRA also states that "cracking associated with expansion due to reaction with aggregates has not been observed on PBAPS Group 6 concrete structures" and "reinforced concrete was exposed during excavations and the exposed reinforced concrete looked sound, was not cracked, and did not exhibit any evidence of spalling." Based on its review of the SLRA and documents reviewed during the audit, the staff noted that there is no operating experience with occurrences of this aging effect at PBAPS. The staff also noted that the Structures Monitoring program performs visual inspections of inaccessible areas when these areas become accessible during excavation; and when an evaluation of inaccessible areas of concrete is required because periodic visual inspections of accessible areas of concrete, performed at least once every 5 years, indicate that degradation may be occurring in inaccessible areas. The staff also noted that SLRA Table 3.5.1, AMR item 3.5.1-096, consistent with the GALL-SLR Report recommendation, manages cracking due to expansion from reaction with aggregates in accessible areas of Group 6 structures using the Inspection of Water Control Structures Associated with Nuclear Power Plants program. The staff noted that the Inspection of Water-Control Structures Associated with Nuclear Power Plants program is implemented through the Structures Monitoring program.

In its review of components associated with AMR item 3.5.1-050, the staff finds that Exelon has met the further evaluation criteria, and Exelon's proposal to manage the effects of aging using the Structures Monitoring program is acceptable because (1) PBAPS has no operating experience related to this aging effect, (2) petrographic examinations of concrete were performed in accordance with ASTM standards and no adverse reaction with aggregate was identified, and (3) management of this aging effect through visual inspection of inaccessible concrete areas when they become accessible for any reason and through the use of the observed condition from accessible areas as an indicator is consistent with the GALL-SLR Report recommendations.

Based on the program identified, the staff concludes that Exelon's program meets SRP-SLR Section 3.5.2.2.2.3, item 2 criteria. For those items associated with SLRA Section 3.5.2.2.2.3, item 2, the staff concludes that the SLRA is consistent with the GALL-SLR Report and that Exelon 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 3.5.1-51, addresses inaccessible areas of Group 6 concrete structures; exterior above-grade and below-grade; foundation; interior slab exposed to water-flowing, which will be managed for increase in porosity and permeability; and loss of strength due to leaching of calcium hydroxide and carbonation by the Structures Monitoring program. The staff reviewed Exelon's proposal against the criteria in SRP-SLR Section 3.5.2.2.2.3, item 3.

The SLRA states that "[t]he effects of carbonation have not been observed at PBAPS reinforced concrete structures." The SLRA also states that "concrete degradation due to chemical attack or leaching has not been observed at PBAPS." The SLRA further states that "[o]perating experience at PBAPS, which looks for concrete deterioration due to any mechanism, has not identified porosity and permeability and loss of strength" and "reinforced concrete was exposed during excavations and the exposed reinforced concrete looked sound, was not cracked, and did not exhibit any evidence of spalling." The staff noted that under the applicant's Structures Monitoring program, the accessible areas of concrete structures will be subject to visual inspections at least once every 5 years, and the inaccessible areas of concrete structures are and will continue to be examined when they become exposed during excavation for any reason and will be evaluated when conditions exist in accessible areas of concrete that could indicate degradation in inaccessible areas. The staff noted that the applicant intends to use its Structures Monitoring program to monitor the accessible areas of concrete as an indicator of reinforced concrete conditions in inaccessible areas. Based on SLRA Table 3.5-1, item 3.5.1-061, which is consistent with the GALL-SLR Report recommendations, the staff noted that the associated accessible concrete structures will be inspected for this aging effect using the Inspection of Water Control Structures Associated with Nuclear Power Plants program. The staff noted that the Inspection of Water-Control Structures Associated with Nuclear Power Plants program is implemented through the Structures Monitoring program. The staff noted that the Structures Monitoring program is an AMP consistent (with enhancements) with the GALL-SLR Report recommendations. The staff's evaluation of the applicant's Structures Monitoring program is documented in SER Section 3.0.3.2.20.

In its review of components associated with AMR item 3.5.1-051, the staff finds that Exelon has met the further evaluation criteria, and Exelon's proposal to manage the effects of aging using the Structures Monitoring program is acceptable because (1) there is no operating experience at PBAPS associated to this aging effect and, therefore, a plant-specific AMP is not required; and (2) management of this aging effect through visual inspection of inaccessible concrete areas when they become accessible for any reason and through the use of the observed condition from accessible areas as an indicator is consistent with the GALL-SLR Report recommendations.

Based on the program identified, the staff concludes that Exelon's program meets SRP-SLR Section 3.5.2.2.2.3, item 3 criteria. For those AMR 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, associated with SLRA Table 3.5.1, items 3.5.1-052, 3.5.1-099 and 3.5.1-100, addresses cracking due to stress corrosion cracking (SCC) and loss of material due to pitting and crevice corrosion for stainless steel (SS) tank liners exposed to standing water, for which Exelon claimed that it is not applicable; and aluminum and SS support members, welds, bolted connections, and support anchorage to building structure exposed to air with condensation, which will be managed by the One-Time Inspection program and the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems program. The staff reviewed Exelon's proposal against the criteria in SRP-SLR Section 3.5.2.2.2.4.

Exelon stated that Table 1 item 3.5.1-052 is not applicable because PBAPS does not have Group 7 or 8 stainless steel tank liners exposed to standing water. The staff evaluated Exelon's claim against the criteria in SRP-SLR Section 3.5.2.2.2.4 and finds it acceptable because a search of Exelon's UFSAR and SLRA confirmed that no in-scope Group 7 or 8 stainless steel tank liners exposed to standing water are present at PBAPS.

Exelon stated that for Table 1 item 3.5.1-099, the applicability is limited to stainless steel structural components exposed to air with condensation because there are no aluminum structural components that use this item. The staff noted that a search of Exelon's UFSAR and SLRA confirmed that no in-scope aluminum structural components exposed to air with condensation are present in the ASME Classes 1, 2, and 3, or Class MC piping support systems.

During its review of components associated with Table 1 items 3.5.1-099 and 3.5.1-100, the staff determined the need for additional information, which resulted in the issuance of RAIs. RAI 3.5.2.2.2.4-1 and Exelon's response are documented in ADAMS Accession No. ML19122A289. RAI 3.5.2.2.1.6-1 and Exelon's response are documented in ADAMS Accession No. ML19143A053.

In its response to RAI 3.5.2.2.2.4-1, Exelon stated that although plant-specific operating experience did not reveal a history of pitting or crevice corrosion or cracking in aluminum and/or stainless steel components exposed to air environments, the ASME XI, Section XI, Subsection IWF program will be used instead of the One-Time Inspection program to manage the aging effects for components associated with Table 1 item 3.5.1-099. Further, the Structures Monitoring program will be used, instead of the One-Time Inspection program, to manage the aging effects for components associated with Table 1 item 3.5.1-100, with the exception of the stainless steel containment refueling bellows assemblies and the thermal insulation jacketing components that will remain to be managed by the One-Time Inspection program. Exelon also stated that the containment closure bolting components will be managed for the aging effects using Table 1 items 3.5.1-010 and 3.5.1-037, instead of Table 1 item 3.5.1-100. Exelon revised SLRA Sections 3.5.2.2.2.4 and 3.5.2.2.1.6, and Tables 3.5.1, 3.5.2-3, 3.5.2-4, 3.5.2-5, 3.5.2-8, 3.5.2-10, 3.5.2-12, and 3.5.2-14 through 3.5.2-20 to address these changes.

During its evaluation of Exelon's response to RAI 3.5.2.2.2.4-1, the staff noted that (1) the ASME Section XI, Subsection IWF program will use periodic visual inspections (VT-3) and examination criteria that is in accordance with the ASME IWF-2500 requirement to manage the aging effects, (2) the Structures Monitoring program will use periodic visual inspections to manage the aging effects, and (3) the One-Time Inspection program will follow the inspection recommended in GALL-SLR Report AMP XI.M32, Table XI.M32-1 (e.g., EVT-1 enhanced visual inspections) to manage the aging effects. The staff finds Exelon's response and changes to the SLRA sections and Tables 1 and 2s (listed above) acceptable because (1) a review of plant-specific operating experience did not reveal a history of pitting or crevice corrosion or cracking in aluminum and/or stainless steel components, and (2) the proposed visual inspections to be used to detect cracking and loss of material in aluminum and stainless steel components are consistent with the GALL-SLR Report recommendations for AMR items 3.5.1-099 and 3.5.1-100.

In its response to RAI 3.5.2.2.1.6-1, Exelon stated that the refueling bellows assemblies are included in the population subject to the examination requirements under the One-Time Inspection program. Exelon also stated that an enhanced visual inspection (e.g., EVT-1), volumetric examination, or surface examination will be used to detect cracking due to SCC, and visual inspection (e.g., VT-1) or volumetric examination will be used to detect loss of material in this population, to ensure that the intended function is maintained consistent with the CLB. Exelon revised the associated items in SLRA Table 3.5.2-5 to reflect these changes as consistent with the GALL-SLR Report for material, environment, and aging effect, but having a different component (i.e., generic note "C").

During its evaluation of Exelon's response to RAI 3.5.2.2.1.6-1, the staff noted that the proposed visual inspections under the One-Time Inspection program are consistent with the GALL-SLR Report recommendations for AMR item 3.5.1-100 to ensure that the intended function is maintained consistent with the CLB during the subsequent period of extended operation. The staff finds Exelon's response and changes to SLRA Table 3.5.2-5 acceptable because the applicant provided sufficient information that demonstrated how its One-Time Inspection program will adequately manage the aging effects of the refueling bellows assemblies.

In its review of components associated with AMR item 3.5.1-100 for which Exelon cited generic note E, the staff noted that the SLRA credits the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems program to manage the aging effect for stainless steel bolting, and stainless steel or aluminum cranes/hoists from the fuel handling system. The AMR item cites plant-specific note 1, which states that the Inspection of Overhead Heavy Load and Light Load (Related to Fuel) Handling Systems program is substituted to manage the aging effect(s) applicable to this component type, material, and environment combination.

Based on its review of components associated with AMR item 3.5.1-100 for which Exelon cited generic note E, the staff finds Exelon's proposal to manage the effects of aging using the Inspection of Overhead Heavy Load and Light Load (Related to Fuel) Handling Systems program acceptable because the use of periodic visual inspections is consistent with similar GALL-SLR Report recommendations to adequately manage the aging effects and to ensure that the aging effects are detected and actions are taken prior to a loss of intended function.

In its review of components associated with AMR item 3.5.1-100 for which Exelon cited generic note I, Exelon claimed that for some thermal jacketing insulations and cranes/hoists (fuel prep machine) constructed of specific aluminum alloys material exposed to air-indoor uncontrolled or air-outdoor, the effects of aging are not applicable, and Exelon proposed no AMP. The AMR items cite plant-specific note 1 from SLRA Table 3.5.2-11, which states that the aluminum jacketing is constructed of 1100, 3003, 3105, or 5005 aluminum alloys which are not susceptible to stress corrosion cracking, and plant-specific note 2 from SLRA Table 3.3.2-15, which states that the aluminum fuel prep machine components are constructed of 6061-T6 aluminum alloy, which also is not susceptible to stress corrosion cracking. The staff reviewed the associated items in the SLRA to confirm that these aging effects are not applicable for these components, material, and environment combination. The staff finds Exelon's proposal acceptable based on its review of SRP-SLR Sections 3.2.2.2.8 and 3.5.2.2.2.4, which confirm that the aluminum alloys associated with these components are not susceptible to SCC.

Based on the programs identified, the staff concludes that Exelon's programs meet SRP-SLR Section 3.5.2.2.2.4 criteria. For those applicable 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 Exelon 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, AMR item 3.5.1-053, addresses cumulative fatigue damage or cracking due to fatigue, cyclic loading, or cyclical displacement in Group III.B1.1 component supports (i.e., ASME Class 1 component supports), Group III.B1.2 component supports (i.e., ASME Classes 2 or 3 component supports), and Group III.B1.3 component supports (ASME metal containment supports) component supports. Exelon stated that this item is not applicable because the CLB does not include any component fatigue analyses for structural supports, bolted structural connections, or component anchorages in the PBAPS design for these classifications of components.

The staff evaluated Exelon's claim against the criteria in SRP-SLR Section 3.5.2.2.2.5, the information in UFSAR Appendix C, "Structural Design Criteria," and the applicable design codes identified for the component supports in UFSAR Appendix C. For component supports associated with ASME Code Class 1 piping or penetrations (SRP-SLR Group III.B1.1 supports), the staff noted that the ASME Section III, Subsection NF code of record did not require the applicant to perform any time-dependent fatigue or cyclic loading analysis for the supports. The staff also did not identify any component-specific time-dependent fatigue analyses or cyclic loading analysis for ASME Code Class 1 supports in the current licensing basis (CLB). Therefore, the staff finds the applicant's claim to be valid because it has confirmed that the CLB does not include any time-dependent fatigue or cyclic loading analyses for ASME Code Class 1 supports in the CLB.

For component supports associated with ASME Code Classes 2 or 3 piping or penetrations or ANSI B31.1 piping components (SRP-SLR Group III.B1.2 supports), the staff noted that the ASME Section III, Subsection NF code of record or ANSI B31.1 code of record did not require the applicant to include the component supports to be within the scope of the cycle-based thermal expansion analyses that were required for the corresponding Class of piping components in the CLB and were evaluated as the metal fatigue TLAA in SRLA Section 4.3.4. The staff also noted that the design codes did not require the applicant to perform any other type of fatigue or cyclic loading analysis for these types of Code Class supports. Based on its review, the staff finds the applicant's claim to be valid because it has confirmed that the CLB does not include any time-dependent fatigue or cyclic loading analyses for ASME Code Classes 2 or 3 or ANSI B31.1 piping supports in the CLB.

For component supports or anchors associated with the metal drywell containment structures or associated torus structures (SRP-SLR Group III.B1.3 supports), the staff noted that the SLRA in Section 4.6.1 states that the design cumulative usage factor (CUF) for the PBAPS Units 2 and 3 strainer support elements welded to the torus shell is 0.661. In a letter dated March 5, 2019

(ADAMS Accession No. ML19065A008), Exelon confirmed that these component support elements were evaluated in accordance with an ASME Section III, Subsection NF fatigue analysis (i.e., CUF analysis). Specifically, in its March 5, 2019 letter, the applicant stated that the support legs for the strainer modules in the torus structures have been evaluated for fatigue and have been found to have a CUF value of 0.661.

Based on this review, the staff concludes that the CLB does not include any fatigue or cyclical loading analyses for SRP-SLR Group III.B1.1 or Group III.B1.2 piping supports, but it does include an applicable fatigue analysis for Group III.B1.3 metal containment structure supports. The staff's review and evaluation of the CUF analysis for the torus strainer module supports is provided in SER Section 4.6.

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, addresses reduction of strength and loss of mechanical properties due to irradiation for concrete of the reactor sacrificial shield wall and reactor vessel support/pedestal structure exposed to an air-indoor uncontrolled environment, which will be managed by the Structures Monitoring program. The staff reviewed Exelon's proposal against the criteria in SRP-SLR Section 3.5.2.2.2.6, which states that a plant-specific program is not required if the calculated neutron radiation and gamma radiation dose received by any portion of the concrete structures do not exceed the threshold values of 1×10^{19} neutrons/cm^2 and 1×10^{10} rad, respectively; and that there is no plant-specific operating experience of irradiation damage that may impact the intended functions of those structures.

Based on its review of the SLRA and UFSAR Appendix C, "Structural Design Criteria," Section 12, "Structures and Shielding," Section 4.0, "Reactor Coolant System," and site drawing S-191, the staff noted that the reactor pressure vessels (RPVs) at PBAPS are of the BWR/4 design; and that the concrete structures, the sacrificial shield wall, and the RPV support pedestal, in closest proximity to the RPV, are exposed to the highest level of irradiation and are susceptible to this aging effect. The SLRA states that based on EPRI Report 3002008128, "Structural Disposition of Neutron Radiation Exposure in BWR Vessel Support Pedestals," dated July 2016; EPRI Report 3002002676, "Expected Condition of Reactor Cavity Concrete after 80 Years of Radiation Exposure," dated February 2014; and a plant-specific calculation used to estimate the gamma radiation dose, the peak levels of irradiation on the concrete are 1.9×10^{18} neutron/cm^2 (neutron fluence) and 1×10^{10} rad (gamma dose) on the inner face of the concrete shield wall at the RPV beltline elevation. The SLRA also states that the radiation exposure at the RPV support/pedestal structure "is much less than at the sacrificial shield wall along the reactor vessel belt line."

The staff noted that the sacrificial shield wall is a concrete structure that surrounds the RPV and its primary function is to provide protection (shielding) against radiation exposure. UFSAR Appendix C.4.6 states the following:

> The sacrificial shield was designed without considering the concrete for any structural purpose, except the lower 10 ft of the wall. The forces considered were: seismic forces, pipe loading, pipe restraints, platform loads, and jet load reaction. The 27-in thick cylindrical structure consists of 12 steel columns equally spaced and continually tied by a 1/4-in thick steel plate on the inside and outside of the columns.

Based on its review of the SLRA and the UFSAR, the staff noted that the radiation shielding at the sacrificial shield wall is provided by standard density concrete with limestone coarse aggregate consisting of calcite and dolomite, as well as quartz sand at the top and bottom of the shield wall; and high-density ilmenite concrete at the central portion of the shield wall. The staff also noted that the reactor vessel pedestal structure is a reinforced concrete structure that provides structural support to both the reactor vessel and the sacrificial shield wall, and that the bottom of the sacrificial shield wall structure and the reactor vessel skirt are supported by the reactor vessel pedestal at an elevation of approximately 145.5 ft. The top and bottom of the reactor belt line (fuel core) are at an elevation of approximately 180 ft and 165 ft, respectively. Based on these elevations, the staff noted that the portion of the shield concrete wall that performs a structural intended function (lower 10 ft of the shield wall) and the top of the reactor pedestal concrete are at a distance of approximately 9.5 ft and 19.5 ft, respectively, from the bottom of the reactor vessel beltline. During its audit review of operating experience for degradation of concrete structures at PBAPS and based on its review of operating experience in the SLRA for the Structures Monitoring program and ASME Section XI, Subsection IWF program (ADAMS Accession No. ML19142A369), the staff noted that there is no plant-specific operating experience with indications of irradiation degradation that may impact the intended functions of structures at PBAPS. The staff's evaluations of the Structures Monitoring program and ASME Section XI, Subsection IWF program are documented in SER Sections 3.0.3.2.20 and 3.0.3.2.18, respectively.

Exelon provided estimates for the neutron and gamma fluence levels at the inner surface of the sacrificial shield wall at the peak location. The estimates Exelon provided for the peak location are based on a number of different calculations such as:

- EPRI Reports 3002008128 and 3002002676.
- PBAPS plant-specific analyses in NEDC-32983P-A (Licensing Topical Report, "General Electric Methodology for Reactor Pressure Vessel Fast Neutron Flux Evaluations," dated January 2006), performed using NRC-approved RPV fluence analysis methods.
- Generic evaluations from NUREG/CR-5449, "Determination of the Neutron and Gamma Flux Distribution in the Pressure and Cavity of a Boiling Water Reactor," ADAMS Accession No. (ADAMS Accession No. ML18081A003) dated June 1990, which take advantage of reasonable sources of information from studies performed by Department of Energy laboratories.

The staff did not perform a detailed review of the information presented to draw any conclusions about the referenced EPRI reports or plant-specific calculations. However, the staff finds Exelon's approach to quantify its fluence levels and the SLRA estimated fluence values of 1.9×10^{18} neutron/cm^2 and 1×10^{10} rad to be an appropriate and reasonable estimation of the neutron and gamma fluences at the peak location for the sacrificial shield wall for the end of the subsequent license renewal period. The staff confirmed that the fluence values at the structural portion of the sacrificial shield wall concrete and at the RPV pedestal are bounded by Exelon's estimated peak values. The staff noted that in its estimation of fluence and dose levels, Exelon conservatively ignored the attenuation and shielding provided by the ¼-inch thick steel liner on the inner side of the shield wall. The staff noted that the fluence peak location is typically within 1.0-1.5 ft of the centerline of the RPV beltline; and at that elevation, the shield wall concrete does not perform a structural function. The staff noted that the top of the load-bearing portion of the sacrificial shield wall concrete that performs a structural function is located approximately 17 ft from the center of the RPV beltline. The staff also noted that the top of the RPV pedestal is located approximately 27 ft away from center of the RPV beltline. Taking into consideration these distances, the staff performed calculations based on (1) typical reductions in fluence due to decrease in flux at the bottom of the core relative to the elevations corresponding to the RPV beltline, and (2) spatial dispersion of fluence due to distance from the neutron/gamma source and noted that the fluence at the top of the load-bearing portion of the sacrificial shield wall can be expected to be lower than the peak location by approximately an order of magnitude (i.e., approximately 10 percent). As a result, substantial margin exists between the fluence expected at the structural concrete of the sacrificial shield wall and the RPV pedestal, and the SRP-SLR thresholds at which the neutron and gamma fluences would be expected to affect the concrete strength. Thus, the staff finds that any uncertainties due to the applicability of specific assumptions and methods for the PBAPS sacrificial shield wall and the RPV pedestal structural concrete will be accommodated by the available margin when compared to the SRP-SLR damage thresholds.

In its review of components associated with AMR item 3.5.1-097, the staff finds that Exelon has met the further evaluation criteria, and Exelon's proposal to manage the effects of aging using the Structures Monitoring program is acceptable because:

(1) The sacrificial shield wall concrete (except for the lower 10 ft of the shield wall) does not perform a structural function and is only required to provide radiation shielding.

(2) The peak neutron fluence and gamma dose values will not exceed the SRP-SLR thresholds at which this aging effect is expected to degrade concrete mechanical properties; and at areas where the shield wall and the RPV pedestal concrete do perform a structural function, the neutron fluence and gamma dose are well below the GALL-SLR thresholds. Therefore, a plant-specific program is not needed.

(3) The Structures Monitoring program will monitor for indication of this aging effect as well as the aging effects of loss of material, cracking, and distortion by performing visual inspections of concrete structure at a 5-year frequency consistent with the GALL-SLR Report.

<u>Loss of Fracture Toughness Due to Neutron Irradiation Embrittlement</u>. 10 CFR 54.21 requires, in part, that for those SCs within the scope of license renewal, the SLRA identify and list those subject to an AMR and demonstrate that the effects of aging will be adequately managed for the subsequent period of extended operation. The staff noted that steel components near the RPV are exposed to high levels of irradiation and therefore may be susceptible to the aging effect of loss of fracture toughness due to neutron irradiation embrittlement. During the in-office audit (ADAMS Accession No. ML19205A206), the staff noted and communicated to Exelon that the original SLRA did not address whether this aging effect is applicable for steel SCs near the RPV (the sacrificial shield wall, the RPV skirt, and the RPV lateral stabilizers) and, if so, how will it be managed. By letter dated March 18, 2019 (ADAMS Accession No. ML19077A253), Exelon revised SLRA Section 3.5.2.2.2.6 (SLRA Supplement No. 4) to address the aging effect of loss of fracture toughness due to neutron irradiation embrittlement for the sacrificial shield wall, the RPV skirt, and the RPV lateral stabilizers.

The staff noted that in Supplement No. 4 to Section 3.5.2.2.2.6 of the SLRA, Exelon discusses attenuation calculations performed to determine estimated fluences at the areas that may be susceptible to loss of fracture toughness due to irradiation embrittlement (i.e., RPV skirt and sacrificial shield wall). As discussed in SLRA Section 4.2.1.1, the fluence calculated for the inner surface of the RPV were performed using NRC-approved methodologies that are consistent with RG 1.190, "Calculational and Dosimetry Methods for Determining Pressure Vessel Neutron Fluence," dated March 2001 (ADAMS Accession No. ML010890301). In order to assess Exelon's calculations, the staff used the maximum fluence value computed for the RPV beltline, provided in SLRA Table 4.2.1.1-1, and was able to independently develop a conservative estimate of the fluence at the top of the RPV support skirt and the limiting location on the inner surface of the sacrificial shield wall liner that considers both the attenuation of flux through the RPV itself and the dispersion of neutrons in space with distance from the source. The attenuation of flux through the RPV can be computed based on RG 1.99, Revision 2, "Radiation Embrittlement of Reactor Vessel Materials," dated May 1988 (ADAMS Accession No. ML003740284) though the attenuation factor given in Equation (3) of RG 1.99, Revision 2, which is based on displacements per atom (dpa) attenuation rather than flux attenuation. The dispersion of neutrons in space is simply computed as a ratio of the squares of radii, assuming that the core is a point source. This approach is equivalent to spreading the same quantity of neutrons throughout the surface area of spheres or infinite cylinders with different radii. The staff finds that this estimate is appropriate as a maximum value for the sacrificial shield wall liner because the fluence value used is the maximum for the RPV and any attenuation through the sacrificial shield wall liner is neglected. Further, this approach is conservative for the RPV support skirt because it neglects the neutron interactions through other materials between the core and the RPV support skirt and the fact that the RPV support skirts are located below the beltline region of the RPV. Since this approach is consistent with NRC guidance and fundamental physical principles, the staff finds that these fluence estimates are acceptable for determining the expected nil-ductility transition temperature (NDTT) for the RPV support skirt and the sacrificial shield wall for the end of the subsequent license renewal period.

The staff noted that the fluence given at the inner surface of the RPV is for neutrons with energies greater than 1.0 MeV, which dominate the irradiation embrittlement effects for that location. However, recent research has shown that additional damage can occur at lower fluences due to lower operating temperatures and neutrons at lower energies. This research finding is of interest for the RPV support skirt and the sacrificial shield wall, because the metal will be maintained at a much lower temperature than the RPV; and the significant amount of moderator between the core and the RPV support skirt will adjust the neutron flux at the RPV support skirt toward lower energies. Information is provided in NUREG-1509, "Radiation Effects on Reactor Pressure Vessel Supports" (Figure 3-1) (not publicly available) which utilizes available data to develop a bounding estimate of the expected NDTT shift for different dpa, including data from conditions that are representative of low temperature, low energy flux conditions. The estimated fluences were converted to dpa to utilize this data (note that since the attenuation through the RPV was based on dpa attenuation, no adjustment was necessary to account for the shift in neutron energies below 1.0 MeV because of neutron interactions with the RPV metal). The staff noted that the NDTT shifts resulted in significant margin when compared to the threshold at which embrittlement would become a concern.

In the SLRA, Exelon referenced two EPRI reports to justify its conclusion that radiation embrittlement of the RPV support skirt was not a concern. These reports have not been submitted to the NRC for review or approval. Therefore, this SER does not represent an endorsement of the findings in these reports. However, the NRC staff was able to derive similar conclusions through information available in NRC regulatory guidance. While some residual uncertainty remains due to the simple nature of this evaluation, the fluence levels identified are sufficient to perform the AMR for the RPV support skirt and the sacrificial shield wall.

<u>*SLR Reactor Vessel Support Steel Evaluation*</u>. SLRA Supplement No. 4, dated March 18, 2019, added to SLRA Section 3.5.2.2.2.6 a new subsection entitled "SLR Reactor Vessel Support Steel Evaluation," which addresses the aging effect of loss (or reduction) in

fracture toughness due to irradiation embrittlement of the RPV support steel. The SLRA evaluation utilized the transition temperature approach described in Figure 4-4 of NUREG-1509.

EPRI Report 3002014882, "An Assessment of the Integrity of BWR Vessel Structural Steel Supports for Long-Term Operations," dated December 2018, is referenced in the SLRA subsection in relation to the integrity of the RPV support skirt, including the high stress knuckle region of the skirt. This SLRA subsection identifies this report as applicable to PBAPS.

The SLRA states that the RPV support skirt is fabricated from plate steel conforming to ASME SA-302, Grade B. UFSAR Section 4.2.4.1 further states that the initial NDTT for this material in the as-fabricated condition is no higher than +40 °F.

EPRI Report 3002014882 states that the maximum total fluence in the supports is not expected to exceed 10^{17} n/cm^2 (E > 1 MeV) or 2.02×10^{-4} dpa for 80 years of plant operation. From Figure 3-1 of NUREG-1509, this dpa level correlates to a ΔNDTT of about 22 °F. When combined with the initial NDTT of 40 °F, the 80-year NDTT is a maximum of 62 °F for PBAPS. With a lowest service temperature (LST) for the supports of 100°F, the margin between the supports' 80-year NDTT and the LST is +38 °F.

For the high stress knuckle region, EPRI Report 3002014882 states that the operating temperature during normal operation is approximately that of the reactor coolant system (RCS) coolant temperature. Therefore, RG 1.99, Revision 2, can be used to estimate the embrittlement in lieu of NUREG-1509. Using a copper level of 0.05 weight percent (wt. percent) and a nickel content of 0.7 wt. percent, ΔNDTT is calculated as 3.4 °F and the 80-year NDTT is 46.8 °F.

The staff's review focused on the assumptions used in the SLRA and EPRI Report 3002014882 for concluding that loss of fracture toughness due to irradiation embrittlement is not a concern for the RV support steel. The staff notes that Exelon used a bounding level of neutron fluence for the supports. For the cylindrical portion of the support skirt, the LST identified in EPRI Report 3002014882 is approximately 100 °F, while UFSAR Section 4.2.4.9 identifies the temperature for the RPV outside air at average operating conditions for PBAPS to be 135 °F. With the 80-year NDTT appropriately identified using the methodology of NUREG-1509, the staff finds that there is adequate margin between the 80-year NDTT value and the LST, and therefore loss of fracture toughness due to irradiation embrittlement is not an aging effect that requires management for the RV support skirt cylinder.

For the knuckle region of the support skirt, the staff finds the approach in EPRI Report 3002014882 to use RG 1.99, Revision 2, to be acceptable because the operating temperature of the knuckle region is expected to be close to that of the RCS. The staff does not accept the unsupported assumption in EPRI Report 3002014882 that the support skirt is necessarily a low copper material. From a review of the NRC's Reactor Vessel Integrity Database (RVID), Revision 2, SA-302 Grade B materials used in reactor vessels have approximate average copper and nickel levels of 0.16 wt. percent and 0.47 wt. percent, respectively. This combination would yield a chemistry factor of 108 °F from RG 1.99, Revision 2, a ΔNDTT of 12 °F, and an 80-year NDTT of 64 °F. This calculation still provides a sufficient margin of plus 36 °F to the LST. Based on this review, the staff finds that loss of fracture toughness due to irradiation embrittlement is not an aging effect that requires management for the knuckle region of the RPV support skirt. Therefore, a plant-specific AMP to manage this aging effect is not required.

SLR Sacrificial Shield Wall Structural Steel Evaluation. SLRA Supplemental No. 4, dated March 18, 2019, added to SLRA Section 3.5.2.2.2.6 a new subsection entitled "SLR Sacrificial Shield Wall Structural Steel Evaluation," which addresses the aging effect of loss (or reduction) in fracture toughness due to irradiation embrittlement on the structural steel elements of the sacrificial shield wall.

The SLRA evaluation utilized the transition temperature approach described in Figure 4-4 of NUREG-1509 for the ASTM A36 steel used to fabricate the shield walls. This approach identifies the margin between the lowest service temperature of the structural steel and the projected 80-year NDTT of the shield wall structural steel. The 80-year NDTT is determined from the sum of the initial NDTT for the steel and the ΔNDTT temperature from Figure 3-1 of NUREG-1509. The SLRA identifies the shield wall steel elements as fabricated from ASTM A36 steel, with an estimated initial NDTT of +39 °F from Table 4-1 of NUREG-1509 for carbon-manganese steel, considering NDT + 1.3σ (where σ = standard deviation).

The SLRA supplement states that the peak neutron fluence at the shield wall for 70 effective full power years (EFPY) equates to a dpa of 4.43×10^{-4} dpa. From Figure 3-1 of NUREG-1509, Exelon stated that ΔNDTT is 45 °F, for an 80-year NDTT of +84 °F. With a stated normal operating temperature of 135°F, the SLRA cites a margin of +plus 51 °F.

The SLRA also states that welding of the sacrificial shield wall was performed using the shielded-metal arc welding (SMAW) process utilizing E-7018 and E-7028 electrodes, which do not incorporate a copper coating on the electrode. The original design specification did not add requirements for additional copper and nickel and there were no measurements in material receipt records for the weld rods used. The SLRA further states that the conclusions related to the sacrificial shield wall steel elements also apply to the weld materials.

The SLRA concludes that there is adequate margin between the normal operating temperature and the ductile-to-brittle fracture mode transition temperature that was adjusted for the potential effects due to irradiation embrittlement; and that no additional aging management of the sacrificial shield wall beyond the current Structures Monitoring (SLRA Section B.2.1.34) program is necessary for aging effects due to irradiation embrittlement during the subsequent period of extended operation of PBAPS. Further, the SLRA concludes that the radiation dose to the sacrificial shield wall bounds other Class 1 steel structures at PBAPS, and because the aging effects due to irradiation are not significant for the sacrificial shield wall, a plant-specific program is not necessary to manage the aging effects due to irradiation embrittlement of structural steel components.

The staff reviewed the information provided in the SLRA related to the fluence and materials that compose the sacrificial shield wall and Exelon's conclusions related to the need for additional aging management of the sacrificial shield wall. As described previously under "Loss of Fracture Toughness Due to Neutron Irradiation Embrittlement," the staff finds the maximum neutron fluence level for the sacrificial shield wall to be an acceptable, conservative estimate. Because the transition temperature methodology of NUREG-1509 includes the use of the lowest service temperature, which is defined in NUREG-1509 as "the minimum temperature of the most vulnerable part of the fracture-critical member when design-basis accident loads occur," the use of the "normal operating temperature," of the sacrificial shield wall (and other relevant support structures) would be applicable only for those accidents that occur under operating conditions. For the sacrificial shield wall, the LST should be no less than the 100 °F identified previously for the RV support skirt. In this case, there is a sufficient margin between the 80-year NDTT and the minimum LST.

The staff finds Exelon's assumptions to implement the transition temperature approach described in NUREG-1509 to be acceptable because it specifically relates to the determination of the initial NDTT of the A36 steel and the evaluation of ΔNDTT. As described above, there is sufficient margin between the 80-year NDTT and the expected LST. Additionally, the staff finds Exelon's conclusion to be acceptable because the applicant demonstrated that the aging effects due to irradiation embrittlement for the A36 steel sacrificial shield wall are more limiting than those for other structural steel components, including the welds of the sacrificial shield wall and the RV lateral stabilizer at the top of the sacrificial shield wall. Finally, the staff finds that loss of fracture toughness due to irradiation embrittlement is not an aging effect that requires management at PBAPS for the sacrificial shield wall and lateral stabilizer structural steel components. Therefore, a plant-specific AMP to manage this aging effect is not required.

Note that the staff's consideration of EPRI Report 3002014882 for its review of this aging effect at PBAPS is not an endorsement of the EPRI Report 3002014882, and only those portions of the report cited in this evaluation were reviewed and considered for the plant-specific conditions at PBAPS.

3.5.2.2.3 Quality Assurance for Aging Management of Nonsafety-Related Components

SER Section 3.0.4 documents the staff's evaluation of the applicant's QA program.

3.5.2.2.4 Ongoing Review of Operating Experience

SER Section 3.0.5 documents the staff's evaluation of the applicant's ongoing review of operating experience.

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 3.5.2-22 that are either not consistent with or not addressed in the GALL-SLR Report and are usually denoted with generic notes F through J. PBAPS does not have any generic notes F-J in Tables 3.5.2-1 through 3.5.2-22.

3.5.2.3.1 Insulation

As discussed in SER Section 3.5.2.2.2.4, AMR item 3.5.1-100 was part of a broader request for additional information (RAI 3.5.2.2.1.6-1).

In its review of components associated with AMR item 3.5.1-100 for which Exelon cited generic note I, Exelon claimed that for some thermal jacketing insulations and cranes/hoists (fuel prep machine) constructed of specific aluminum alloys material exposed to air-indoor uncontrolled or air-outdoor, the effects of aging are not applicable, and Exelon proposed no AMP. The AMR items cite plant-specific note 1 from SLRA Table 3.5.2-11, which states that the aluminum jacketing is constructed of 1100, 3003, 3105, or 5005 aluminum alloys which are not susceptible to stress corrosion cracking, and plant-specific note 2 from SLRA Table 3.3.2-15, which states that the aluminum fuel prep machine components are constructed of 6061-T6 aluminum alloy that also is not susceptible to stress corrosion cracking. The staff reviewed the associated items in the SLRA to confirm that these aging effects are not applicable for these components, material, and environment combination. The staff finds Exelon's proposal acceptable based on its review of SRP-SLR Sections 3.2.2.2.8 and 3.5.2.2.2.4, which confirm that the aluminum alloys associated with these components are not susceptible to SCC.

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, "Scoping and Screening Results: Electrical," as being subject to an AMR. SLRA Table 3.6-1, "Summary of Aging Management Evaluations for Electrical Commodities," is a summary comparison of the applicant's AMRs with those evaluated 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. For AMR items that the staff found to be consistent with the GALL-SLR Report (and no SER section is referenced), the staff determined that no additional evaluation or request for additional information was necessary and finds the items acceptable based on the GALL-SLR Report review of the 10 program elements. For AMR items that required additional evaluation (such as responses to requests for additional information), the staff's evaluation is documented in section 3.6.2.1.2.

Table 3.6-1 Staff Evaluation for Electrical Components in the GALL-SLR Report

Component Group (SRP-SLR Item No.)	Staff Evaluation
3.6.1-001	Consistent with the GALL-SLR Report (see SER Section 3.6.2.2.1)
3.6.1-002	Not applicable to PBAPS (see SER Sections 3.6.2.1.1 and 3.6.2.3.2)
3.6.1-003	Not applicable to PBAPS (see SER Sections 3.6.2.1.1 and 3.6.2.3.2)
3.6.1-004	Not applicable to PBAPS (see SER Sections 3.6.2.1.1, 3.6.2.2.3, and 3.6.2.3.3)
3.6.1-005	Not applicable to PBAPS (see SER Sections 3.6.2.1.1, 3.6.2.2.3, and 3.6.2.3.3)
3.6.1-006	Not applicable to PBAPS (see SER Section3.6.2.1.1, 3.6.2.2.3, and 3.6.2.3.3)
3.6.1-007	Not applicable to PBAPS (see SER Sections 3.6.2.1.1, 3.6.2.2.3, and 3.6.2.3.3)
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 (See SER Section 3.6.2.1.2)
3.6.1-012	Consistent with the GALL-SLR Report
3.6.1-013	Consistent with the GALL-SLR Report
3.6.1-014	Not applicable to PBAPS (see SER Section 3.6.2.1.1)
3.6.1-015	Consistent with the GALL-SLR Report
3.6.1-016	Not applicable to PBAPS (see SER Sections 3.6.2.1.1 and 3.6.2.3.1)
3.6.1-017	Not applicable to PBAPS (see SER Sections 3.6.2.1.1 and 3.6.2.3.1)
3.6.1-018	Not applicable to PBAPS (see SER Sections 3.6.2.1.1 and 3.6.2.3.1)
3.6.1-019	Consistent with the GALL-SLR Report
3.6.1-020	Not applicable to BWRs (see SER Section 3.6.2.1.1)
3.6.1-021	Not applicable to PBAPS (see SER Sections 3.6.2.1.1 and 3.6.2.2.3)

Component Group (SRP-SLR Item No.)	Staff Evaluation
3.6.1-022	Not applicable to PBAPS (see SER Sections 3.6.2.1.1 and 3.6.2.3.1)
3.6.1-023	Consistent with the GALL-SLR Report
3.6.1-024	Not applicable to PBAPS (see SER Section 3.6.2.1.1)
3.6.1-025	This item number is not used in the SRP-SLR no the GALL-SLR Report
3.6.1-026	This item number is not used in the SRP-SLR no the GALL-SLR Report
3.6.1-027	Not applicable to PBAPS (see SER Section 3.6.2.1.1)
3.6.1-028	This item number is not used in the SRP-SLR no the GALL-SLR Report
3.6.1-029	Not applicable to PBAPS (see SER Sections 3.6.2.1.1 and 3.6.2.2.2)
3.6.1-030	Not applicable to PBAPS (see SER Sections 3.6.2.1.1 and 3.6.2.2.2)
3.6.1-031	Not applicable to PBAPS (see SER Sections 3.6.2.1.1 and 3.6.2.2.2)
3.6.1-032	Not applicable to PBAPS (see SER Sections 3.6.2.1.1 and 3.6.2.2.2)

The staff's review of component groups, as described in SER Section 3.0.2.2, is summarized in the following three sections:

(1) SER Section 3.6.2.1 discusses AMR results for components that the applicant states are either not applicable to PBAPS 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 or not used, and Section 3.6.2.1.2 documents any RAIs issued and the staff's conclusions.

(2) SER Section 3.6.2.2 discusses AMR results for which the GALL-SLR Report and SRP-SLR recommend further evaluation.

(3) SER 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 Table 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; 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.

Additionally, SER Section 3.6.2.1.1 documents the staff's review of AMR items that the applicant determined to be not applicable or not used.

3.6.2.1.1 Aging Management Review Results Identified as Not Applicable or Not Used

Exelon claimed that the following SLRA Table 3.6-1 items were not applicable to PBAPS: 3.6-1-002, 3.6-1-003, 3.6-1-004, 3.6-1-005, 3.6-1-006, 3.6-1-007, 3.6-1-014, 3.6-1-016, 3.6-1-017, 3.6-1-018, 3.6-1-021, 3.6-1-022, 3.6-1-024, 3.6-1-027, 3.6-1-029, 3.6-1-030, 3.6-1-031, and 3.6-1-032. The staff reviewed the SLRA and UFSAR and confirmed that the particular combination of aging effect, material, and environment represented by the AMR item does not exist at the site.

Exelon identified item 3.6.1-020 as not applicable to the SLRA. The staff reviewed and confirmed this AMR item is not applicable to the SLRA because this item is applicable only to PWRs.

For SLRA Table 3.6.1, no items were identified as not used.

3.6.2.1.2 Request for Additional Information

SLRA Table 3.6.1, item 3.6.1-011, describes metal enclosed bus enclosure assemblies composed of elastomers exposed to air-indoor, controlled or uncontrolled, and air-outdoor. In the original SLRA, Exelon stated that this item is not applicable because there are no gaskets, sealants, and boots as part of the external portions of the in-scope metal enclosed buses. The staff determined the need for additional information, which resulted in the issuance of an RAI. RAI B.2.1.42-1 and Exelon's response are documented in ADAMS Accession No. ML19143A053. In its response, Exelon stated that elastomers will be added to the scope of the metal enclosed bus AMP as well as the program basis document, the implementing procedures, and work orders to include visual inspection of accessible elastomers for age-related degradation. Exelon revised SLRA Section 3.6.2.1.5, Table 3.6.1 item 3.6.1-011, added this item to Table 3.6.2-1, and assigned a generic note "A" for this AMR item.

During its evaluation of Exelon's response to RAI B.2.1.42-1, the staff noted that elastomers will be included and addressed for proper age management in the proposed AMP. The staff finds Exelon's response and changes to the SLRA (Section 3.6.2.1.5, Table 3.6.1 item 3.6.1-011, and Table 3.6.2-1) acceptable because elastomer material age management is consistent with the recommendations of GALL-SLR Report AMP XI.E4. The staff finds that Exelon 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).

3.6.2.2 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, as recommended in the GALL-SLR Report, for the electrical and instrumentation and controls system components and provides information concerning how it will manage the applicable aging effects. The staff reviewed the applicant's evaluation of component groups of which the GALL-SLR Report recommends further evaluation 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 states that TLAAs are evaluated in accordance with 10 CFR 54.21(c) and that the evaluation of this TLAA is addressed in Section 4.4. This is consistent with SRP-SLR Section 3.6.2.2.1 and is, therefore, acceptable. The staff's evaluation of the TLAA for environmental qualification (EQ) of electrical equipment is documented in SER 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 associated with SLRA Table 1 items 3.6.1-029, 3.6.1-030, 3.6.1-031, and 3.6.1-032, address 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. Exelon stated that these items are not applicable because there are no in-scope cable bus arrangements at PBAPS. The staff reviewed PBAPS electrical arrangement drawings and performed an independent search of the operating experience database and finds Exelon's statement is acceptable because cable bus arrangements are not utilized at PBAPS.

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 Bus, and Connections

SLRA Section 3.6.2.2.3 associated with SLRA Table 1 items 3.6.1-004, 3.6.1-005, 3.6.1-006, 3.6.1-007, and 3.6.1-021, addresses 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 connections as well as switchyard buses and connections. The criteria in SRP-LR Section 3.6.2.2.3 states 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 is provided as follows.

<u>Transmission Conductors Composed of Aluminum, Steel Exposed to Air-Outdoor</u>. SLRA Table 1 items 3.6.1-004 and 3.6.1-021 address the aging effect of loss of strength due to corrosion in transmission conductors composed of aluminum and steel exposed to air-outdoor environment. SLRA Section 3.6.2.2.3 states that loss of conductor strength is not an aging effect requiring management (AERM) for PBAPS transmission conductors based on PBAPS design, and plant-specific and industry operating experience.

There are two in-scope transmission conductor circuits used in PBAPS. The first circuit consists of three 34 kV 556 kilo-circular-mil (kcmil) all-aluminum conductors (AAC), which are not susceptible to corrosion and loss of strength. In SLRA Table 3.6.1, item 3.6.1-021, Exelon stated that loss of conductor strength due to corrosion for transmission conductors composed of aluminum exposed to air-outdoor is not applicable for AAC transmission conductors. The staff finds that this is consistent with GALL-SLR Report Section VI Table A item VI.A.LP-46.

The second circuit, which consists of three 13 kV 1590 kcmil aluminum conductor steel reinforced (ACSR) overhead transmission conductors, is subject to loss of strength due to corrosion. Exelon referenced an Ontario Hydro study that encompassed the results of ACSR transmission conductor laboratory and field tests, including the evaluation of conductor aging effects due to locations near pollution sources and major urban areas. The Ontario Hydro study results indicate acceptable loss of strength due to corrosion in areas affected by industrial pollution of an 80-year-old ACSR conductor due to corrosion. Conductor construction types included in the Ontario Hydro study are representative of the PBAPS overhead transmission conductors.

There is a set percentage of composite conductor strength established at which a transmission conductor is replaced. Exelon stated that there is ample strength margin to maintain the SLR intended function of these PBAPS transmission conductors through the subsequent period of extended operation. The National Electrical Safety Code (NESC) requires tension on installed conductors to be a maximum of 60 percent of the ultimate conductor strength. For PBAPS transmission conductors (1,590 kcmil ACSR), this translates to 32,700 lbs (new conductor strength is 54,500). The conductor strength after 80 years of service, in accordance with the Ontario Hydro study, a 30 percent loss of strength is stipulated, which amounts to 38,150 lbs. Consequently, if the design limits for load tensions are below the above figures, the conductors can perform the intended functions without any need for replacement or age management. The design heavy load tension limit for PBAPS is 12,500 lbs, which is well below the expected ultimate strength at 80 years of operation. Exelon also stated that a review of industry operating experience and NRC generic communications related to the aging of transmission conductors confirmed that no additional aging effects exist beyond those previously identified. A review of plant-specific operating experience did not identify any unique aging effects for transmission conductors.

The staff noted that the Ontario Hydro study bounds the in-scope PBAPS transmission conductors. With a 30 percent loss of conductor strength, sufficient margin exists between the NESC requirements and the actual conductor strength. Furthermore, Exelon has confirmed that plant-specific operating experience did not identify any aging effects for transmission conductors at PBAPS. The staff's independent review of the PBAPS operating experience database did not identify any records of reported failure or issue related to transmission conductor aging. Therefore, the staff finds that loss of conductor strength due to corrosion is not a significant AERM at PBAPS and items 3.6.1-004 and 3.6.1-021 are not applicable.

<u>Transmission Connectors Composed of Aluminum and Steel Exposed to an Air-Outdoor Environment</u>. SLRA Table 1 item 3.6.1-005 addresses the aging effect of increased resistance of connection due to oxidation or loss of preload in transmission connectors composed of aluminum, steel, exposed to air-outdoor environment. SLRA Section 3.6.2.2.3 states that oxidation and loss of preload are not applicable aging effects for PBAPS transmission connectors based on PBAPS design and operating experience.

Exelon stated that at PBAPS, transmission connector surfaces are coated with corrosion inhibitors to prevent the formation of oxides. The design of these connections and construction practices along with operating experience at PBAPS indicate that increased resistance due to general corrosion and oxidation are not AERMs. The SLRA also stated that PBAPS transmission connectors are designed and installed using stainless steel lock washers that provide vibration absorption and prevent loss of preload. Therefore, based on PBAPS design and as confirmed by operating experience, Exelon concluded that oxidation and loss of preload are not applicable aging mechanisms for PBAPS transmission connectors.

The staff reviewed the associated items in the SLRA and confirmed that these aging effects are not applicable for this component, material, and environmental combination. The staff finds the applicant's further evaluation acceptable because the PBAPS transmission connectors have not exhibited significant aging effects based on site-specific experience and routine maintenance and inspections. In addition, the transmission connectors that are bolted connections employ corrosion inhibitors and bolting practices that prevent loss of preload and corrosion of the contact surfaces.

Switchyard Bus and Connections Composed of Aluminum, Copper, Bronze, Stainless Steel, Galvanized Steel Exposed to Air-Outdoor. SLRA Table 1 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 bus and connections composed of aluminum, copper, bronze, stainless steel, or galvanized steel exposed to air-outdoor environment. SLRA Section 3.6.2.2.3 states that loss of material and increased resistance of connection are not applicable aging effects for PBAPS switchyard bus and connections.

Exelon stated that switchyard bus and connections can be susceptible to increased resistance due to oxidation. At PBAPS, switchyard connection surfaces are coated with an antioxidant compound (grease-type sealant), providing a corrosion-resistant low electrical resistance connection. The absence of plant-specific operating experience problems with switchyard buses, as evidenced by routine infrared inspection, indicates that increased connection resistance due to general corrosion and oxidation is not an AERM at PBAPS.

Exelon also stated that due to the design of the transmission switchyard conductors and bus bolted connections, torque relaxation (loss of preload) is precluded. The design calls for use of stainless steel lock washers that are torqued at the time of installation to preclude connection degradation due to loss of preload. The operating experience at PBAPS has confirmed the absence of loss of preload. Therefore, increased connection resistance due to loss of preload of switchyard connections and switchyard bus connections is not an AERM at PBAPS.

The staff reviewed the associated items in the SLRA and confirmed that these aging effects are not applicable for this component, material, and environment combination. The staff finds the applicant’s evaluation acceptable because operating experience and periodic inspections have also demonstrated that increased connection resistance due to corrosion, oxidation, or loss of preload is not an aging effect requiring management (AERM) at PBAPS and therefore, is not applicable. The staff also noted that the switchyard bus connections are rigidly mounted, torqued, and use stainless steel lock washers and corrosion inhibitors to preclude oxidation and loss of preload.

Transmission Conductors Composed of Aluminum, Steel Exposed to Air-Outdoor. SLRA Table 1 item 3.6.1-007 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. SLRA Section 3.6.2.2.3 states that loss of material due to wind loading and abrasion is not an applicable aging effect for PBAPS transmission conductors.

The staff noted that wind-induced vibration and abrasion have not been shown to be a contributor to loss of material based on industry operating experience and at PBAPS. Therefore, the staff finds that loss of material (wear) of transmission conductors and connections due to wind-induced abrasion is not an aging effect requiring management (AERM) at PBAPS.

Conclusion. Based on its review, the staff concludes that Exelon has met the SRP-SLR Section 3.6.2.2.3 criteria. For those Table 1 items that apply to SLRA Section 3.6.2.2.3 (items 3.6.1-004, 3.6.1-005, 3.6.1-006, 3.6.1-007, and 3.6.1-021), the staff finds that the SLRA is consistent with the GALL-SLR Report and that Exelon 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).

3.6.2.2.4 Quality Assurance for Aging Management of Nonsafety-Related Components

SER Section 3.0.4 documents the staff's evaluation of the applicant's QA program.

3.6.2.2.5 Ongoing Review of Operating Experience

SER Section 3.0.5 documents the staff's evaluation of the applicant's ongoing review of operating experience.

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 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.

3.6.2.3.1 Fuse Holders Metallic Components and Insulation Material Exposed to Air-indoor Controlled or Uncontrolled.

SLRA Table 3.6.1, items 3.6.1-016, 3.6.1-017, 3.6.1-018, and 3.6.1-022, state that increased electrical resistance of connection due to chemical contamination, corrosion, oxidation, fatigue caused by frequent fuse removal/manipulation or vibration, thermal/thermo-oxidative degradation of organics, radiolysis, and photolysis (UV sensitive materials only) of organics, radiation-induced oxidation, and moisture intrusion for fuse holders (not part of active component), metallic clamps composed of various metals, as well as reduced insulation resistance of electrical insulation material, Bakelite, phenolic melamine or ceramic, and molded polycarbonate exposed to air-indoor controlled or uncontrolled are not applicable and no AMP is proposed. The AMR items cite generic note I as well as plant-specific notes 1 through 4, stating that PBAPS in-scope fuse holders are not subject to moisture, contamination, corrosion, vibration, and frequent manipulation.

In SLRA Section 3.6.2.3.1, Exelon stated that a systematic review of fuse holders (not part of active equipment) was performed and a total of 30 fuse holders were identified in the battery rooms and switchyard control houses. Exelon stated that the fuses are protected from contaminations and are located in mild indoor environments. Walkdowns were performed and the fuse holders were found to be clean, dry, and with no evidence of moisture intrusion, chemical contamination, oxidation, or corrosion. Based on Exelon's review, these fuses operate at low currents with no appreciable thermal cycling or ohmic heating. The SLRA also stated that due to design, location, and application, none of these fuses were found to be subject to frequent manipulation/removal or vibration. Exelon concluded that the in-scope fuses, are therefore, not subject to the aging effects mentioned in GALL-SLR Report and an AMP is not proposed.

The staff reviewed the associated items in the SLRA to confirm that these aging effects are not applicable for this component, material, and environment combination. The staff finds Exelon's proposal acceptable based on its review of SLRA 3.6.2.3.1, as well as an independent search of the operating experience at PBAPS. In-scope fuse holders, due to their location, design, and based on the operating experience at the site, are not subject to corrosion, contamination, radiation, frequent manipulation, or vibration. Therefore, PBAPS in-scope fuse holders do not experience aging effects requiring management and provisions of GALL-SLR Report AMP XI.E5 are not applicable.

3.6.2.3.2 High-Voltage Electrical Insulators

SLRA Table 3.6.1, items 3.6.1-002 and 3.6.1-003, address managing loss of material due to mechanical wear or corrosion caused by movement of transmission conductors due to significant wind and reduced electrical insulation resistance due to presence of cracks, foreign debris, salt, dust, cooling tower plume or industrial effluent contamination for high-voltage electrical insulators composed of porcelain; malleable iron; aluminum; galvanized steel; cement exposed to air-outdoor. Exelon stated that based on PBAPS geographic location, design, and operating experience, loss of material and reduced insulation resistance are not applicable aging effects for high-voltage electrical insulators in electrical commodities. SLRA Section 3.6.2.3.2, as amended by letter dated January 23, 2019, provided an evaluation of the aging effects requiring management and concluded that an AMP per GALL-SLR Report AMP XI.E7, "High-Voltage Insulators" is not applicable. SLRA Table 3.6.2-1 cites generic note I and plant-specific notes 5 and 6 that reference the discussions in SLRA 3.6.2.3.2 for review of these two items.

For SLRA Table 3.6.1 item 3.6.1-002, Exelon stated that for high-voltage insulators, loss of material due to mechanical wear of metallic parts caused by significant wind and the resulting oscillating movement of the associated transmission conductor is not an AERM at PBAPS. Exelon stated that experience has shown transmission conductors supported by strain insulators do not normally swing and movement due to significant wind will subside after a short period. The SLRA also stated that loss of material due to corrosion has not been observed during routine switchyard inspections as attributed to lack of airborne contaminants due to site location.

For SLRA Table 3.6.1 item 3.6.1-003, Exelon stated that PBAPS is not located near sources of contamination, airborne particles, salt, dust, fog, cooling tower plume, foreign debris, and industrial effluent. Therefore, Exelon claimed that reduced insulation resistance that can occur due to buildup of surface contamination is not an applicable aging effect for high-voltage insulators at PBAPS. SLRA Section 3.6.2.3.2 also addressed porcelain cracking due to expansion of cement at the joints of high-voltage insulators, which is known as cement growth that is primarily caused by improper manufacturing. Plant-specific operating experience has shown that cracking due to cement growth has not occurred at PBAPS.

Exelon provided results of a review of operating experience at PBAPS and concluded that failures associated with high-voltage insulators were determined to be due to factors other than aging, such as misapplication of hollow core insulators on 500 kV overhung insulators. SLRA Section 3.6.2.3.2, as amended by letter dated January 23, 2019, cited routine predictive and preventive maintenance, inspections, and thermography that is performed by the station personnel as well as transmission and distribution maintenance crews.

The staff noted that EPRI 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. EPRI 1003057 indicates that this mechanism is possible, but industry operating experience has shown that transmission conductors are designed not to normally 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 noted that rainfall will wash away minor contamination while the glazed insulator surface of porcelain insulators aid 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 and industrial plumes.

The staff evaluated Exelon’s claims and finds them acceptable because Exelon’s evaluation discussion in the amended SLRA section 3.6.2.3.2, as well as the staff’s independent review of the PBABS corrective actions program, show no operating experience of age-related failures and no evidence of loss of material due to wind, mechanical wear, and corrosion. In addition, the ongoing routine preventive and predictive maintenance at the site is credited for inspection and corrective actions needed to maintain the intended functions of in-scope high-voltage insulators at PBAPS. Therefore, AMR items 3.6.1-002 and 3.6.1-003 are not applicable.

3.6.2.3.3 Transmission Connectors Composed of Aluminum, and Steel, and Switchyard Bus and Connections Composed of Aluminum, Stainless Steel, Copper, Bronze, and Galvanized Steel, and Transmission Conductors Composed of Aluminum, and Steel, Exposed to Air-Outdoor

In SLRA Table 3.6.1, Exelon stated that transmission conductors composed of aluminum and steel exposed to air-outdoor environment (Table 1 item 3.6.1-004); transmission connectors composed of aluminum and steel exposed to an air-outdoor environment (Table 1 item 3.6.1-005); switchyard bus and connections composed of aluminum, stainless steel, copper, bronze, and galvanized steel exposed to air-outdoor environment (Table 1 item 3.6.1-006); and transmission conductors composed of aluminum and steel exposed to air-outdoor environment (Table 1 item 3.6.1-007) are not applicable.

As a result, Exelon proposed no AMPs for the above component, material, and environment combinations. The AMR items in SLRA Table 3.6.2-1 associated with these Table 1 items cite generic note I, which states that the aging effect in NUREG-2191 for this component, material, and environment combination is not applicable. In addition to note I, these AMR items cite plant-specific notes 7, 9, 10, and 11 for these AMR items respectively, as follows:

- Plant-specific note 7. PBAPS switchyard bus and connections. “In-scope switchyard bus and connections comprised of aluminum and stainless steel in an air-outdoor environment are not subject to wind induced abrasion nor oxidation or loss of pre-load. For more information see SLRA Section 3.6.2.2.3, Further Evaluation.”

- Plant-specific note 9. “Based on PBAPS design and operating experience, loss of material is not an applicable aging effect for PBAPS ACSR transmission conductors. In-scope PBAPS transmission conductors comprised of aluminum and steel in an air-outdoor environment are not subject to wind induced abrasion. For more information see SLRA Section 3.6.2.2.3, Further Evaluation.”
- Plant-specific note 10. “Based on PBAPS design and operating experience, loss of conductor strength is not an applicable aging effect for PBAPS ACSR transmission conductors. In-scope PBAPS transmission conductors comprised of aluminum and steel in an air-outdoor environment are not subject to corrosion. For more information see SLRA Section 3.6.2.2.3, Further Evaluation.”
- Plant-specific note 11. “Based on PBAPS design and operating experience, increased resistance of connection is not an applicable aging effect for PBAPS transmission connectors. In-scope PBAPS transmission connectors comprised of stainless steel in an air-outdoor environment are not subject to oxidation or loss of pre-load. For more information see SLRA Section 3.6.2.2.3, Further Evaluation.”

The staff reviewed the associated items in the SLRA and confirmed that these aging effects are not applicable for these component, material, and environment combinations. The staff finds Exelon’s proposal acceptable based on Exelon’s further evaluation performed consistent with the SRP-SLR Section 3.6.2.2.3 criterion.

3.7 Conclusion for Aging Management Review Results

The NRC staff reviewed SLRA Section 3, “Aging Management Review Results,” and SLRA Appendix B, “Aging Management Programs,” as supplemented. Based on its audit and review of the applicant’s AMR 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 adequately describes the AMPs and activities credited for managing aging at PBAPS.

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 Peach Bottom Units 2 and 3, if issued, will continue to be conducted in accordance with the current licensing basis, and that any changes made to the current licensing basis in order to comply with 10 CFR 54.29(a).

4 TIME-LIMITED AGING ANALYSES

4.1 Identification of Time-Limited Aging Analyses and Exemptions

This section of the SER provides the staff's evaluation of the applicant's basis for identifying those time-limited aging analyses (TLAAs) and exemptions that need to be identified and evaluated in the SLRA. TLAAs are certain plant-specific safety analyses that involve time-limited assumptions defined by the current operating term.

The regulation in 10 CFR 54.21(c)(1) requires a license renewal application (LRA) to identify each evaluation, analysis, or calculation (henceforth referred to as "analysis" or "analyses") in the current licensing basis (CLB) that conforms to the definition of a TLAA, as defined in 10 CFR 54.3, "Definitions." TLAAs are defined in 10 CFR 54.3(a), "Definitions," as:

> … those licensee calculations and analyses that:
>
> (1) Involve systems, structures, and components within the scope of license renewal, as delineated in [10 CFR] 54.4(a);
>
> (2) Consider the effects of aging;
>
> (3) Involve time-limited assumptions defined by the current operating term, for example, 40 years [for initial license renewal or 60 years for subsequent license renewal];
>
> (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 system, structure, and component [SSC] to perform its intended functions, as delineated in [10 CFR] 54.4(b); and
>
> (6) Are contained or incorporated by reference in the CLB.

For each TLAA, the provisions in 10 CFR 54.21(c)(1) require the applicant to show that the TLAA is acceptable for use during the period of extended operation by demonstrating that:

> (i) the analysis will remain valid for the period of extended operation;
>
> (ii) the analysis has been projected to the end of the period of extended operation; or
>
> (iii) the effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

In addition, pursuant to 10 CFR 54.21(c)(2), applicants must list all plant-specific exemptions in effect that were granted in accordance with the exemption approval criteria in 10 CFR 50.12, "Specific Exemption," and are based on a TLAA. For any such exemptions, the applicant must provide an evaluation that justifies the continuation of the exemptions during the subsequent period of extended operation.

For subsequent license renewal, the Part 54 citations to the "period of extended operation" are interpreted as the "subsequent period of extended operation."

The NRC's acceptance criteria and procedures for reviewing TLAA identification methodologies and results in a subsequent license renewal application (SLRA) are given in Sections 4.1.2 and 4.1.3, respectively, of NUREG-2192, "Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants" (NRC's Agencywide Documents Access and Management System (ADAMS) Accession No. M17188A158).

4.1.1 Summary of Technical Information in the Application

4.1.1.1 Identification of TLAAs

SLRA Section 4.1 summarizes the methodology that the applicant applied to its CLB in order to identify those analyses that conform to the definition of a TLAA. The applicant provides its list of TLAAs in SLRA Table 4.1-2. The applicant discusses and evaluates these TLAAs in applicable subsections of SLRA Sections 4.2 through 4.7. The applicant's evaluations of these TLAAs provide the applicant's bases for demonstrating acceptance of the TLAAs in accordance with the criteria in 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 in accordance with 10 CFR 54.21(c)(2) to identify any exemptions in the CLB that were granted in accordance with 10 CFR 50.12 and that are based on a TLAA. 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 and that are based on a TLAA.

4.1.2 Staff Evaluation

4.1.2.1 Identification of TLAAs

The staff reviewed the applicant's TLAA identification methodology and results in accordance with the acceptance criteria and review procedures in SRP-SLR Section 4.1.

4.1.2.1.1 Analyses in the Current Licensing Basis Conforming to the 10 CFR 54.3 TLAA Definition Criteria

SLRA Table 4.1-2 identifies those generic analyses and plant-specific analyses in the CLB that have been identified and evaluated as TLAAs in the SLRA. The staff confirmed that these analyses conform to the six criteria for defining TLAAs in 10 CFR 54.3. Therefore, the staff finds that the identification of these TLAAs is acceptable because it complies with the requirement in 10 CFR 54.21(c)(1). SER Sections 4.2 through 4.7 document the staff's evaluations of these TLAAs.

4.1.2.1.2 Absence of TLAA Bases—TLAAs for Pressurized Water Reactor Designed Light Water Reactors that are not Applicable to the SLRA

Consistent with information in SRP-SLR Table 4.1-2 or SRP-SLR Table 4.7-1, the following types of analyses are only applicable to the CLBs for pressurized-water reactor (PWR)-designed light-water reactors: (a) pressurized thermal shock analyses,

(b) time-dependent PWR low-temperature overpressure protection (LTOP) analyses, (c) time-dependent ductility reduction analyses for PWR reactor internals designed by the Babcock & Wilcox Company, (d) time-dependent reactor pressure vessel (RPV) underclad cracking analyses, (e) time-dependent leak-before-break analyses, (f) time-dependent reactor coolant pump flywheel flaw tolerance or fatigue flaw growth analyses, (g) PWR pressurizer surge line thermal stratification analyses (NRC Bulletin 88-11 analyses), and (h) reactor coolant system branch piping thermal stress analyses (NRC Bulletin 88-08 analyses).

The staff confirmed that these analyses are not applicable to the CLB for the Peach Bottom Atomic Power Station (PBAPS) Units 2 and 3, because the updated final safety analysis report (UFSAR) confirms that the reactor units are boiling-water reactor (BWR)-4 model light-water reactors designed by the General Electric Company. Therefore, the staff finds that the applicant does not need to identify or evaluate these types of TLAAs in the SLRA because the analyses are not contained or incorporated by reference in the CLB, and thus the analyses do not conform to criterion 6 for defining TLAAs in 10 CFR 54.3(a).

4.1.2.1.3 Absence of TLAA Bases—Other Plant Analyses Not Identified as TLAAs

In the SLRA, the applicant identifies that the following analyses, or types of analyses, do not exist in the CLB or qualify as TLAAs for the SLRA:

- concrete containment tendon prestress analysis
- main steam line flow restrictor erosion analysis
- fatigue analysis for the spent fuel pool liner
- stress corrosion cracking flaw growth analysis
- predicted lower limit analysis

In relation to these analyses, the staff confirmed that the UFSAR does not reference these types of analyses as being applicable to the CLB of PBAPS Units 2 and 3. Therefore, based on this determination, the staff finds that these types of analyses are not contained or incorporated by reference in the CLB. The staff also finds that these analyses do not need to be evaluated as TLAAs in the SLRA because they do not conform to the criterion 6 for defining TLAAs in 10 CFR 54.3(a).

During the staff's audit of SLRA Section 4.1 and supporting information, the staff did not identify any plant-specific or generic analyses, evaluations, calculations, or assessments in the CLB that might qualify as TLAAs in accordance with the definition of a TLAA in 10 CFR 54.3(a) or that might, otherwise, need to be included and evaluated as TLAAs in the SLRA in accordance with the requirement in 10 CFR 54.21(c)(1).

4.1.2.1.4 Staff Determination Regarding TLAAs Identified and Evaluated in the SLRA

Based on this 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 the TLAAs in Chapter 4 of the SLRA. The staff evaluates these TLAAs in SER Sections 4.2–4.7. The staff did not find any additional analyses contained or incorporated by reference in the CLB (i.e., in addition to those already identified and evaluated as TLAAs in the SLRA) 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 10 CFR 54.21(c)(1).

4.1.2.2 Identification of Exemptions

The staff performed a search of the PBAPS Units 2 and 3 CLB and the NRC's ADAMS to identify any exemptions for the CLB that were granted in accordance with the requirements in 10 CFR 50.12. The staff identified that the only exemptions granted in the CLB under the requirements of 10 CFR 50.12 were exemptions from meeting either the staff's fire protection requirements specified in 10 CFR Part 50, Appendix R, "Fire Protection Program for Nuclear Power Facilities Operating Prior to January 1, 1979," or the staff's requirements for performing containment local leak rate testing in accordance with 10 CFR Part 50, Appendix J, "Primary Reactor Containment Leakage Testing for Water-Cooled Power Reactors." For these exemptions, the staff determined that the exemptions either proposed the use of simple, alternative implementation schedules from those specified in the applicable regulations or involved applicant-proposed alternatives that were not based on the results of time-dependent analyses or time-dependent assumptions. Therefore, the staff finds that these exemptions do not need to be evaluated in the SLRA because the staff has confirmed that the exemptions are not based on a TLAA. Based on this review, the staff also finds that the CLB does not include any exemptions granted in accordance with 10 CFR 50.12 that are based on a TLAA.

4.1.3 Conclusion

On the basis of its review, the staff concludes that the applicant has provided an acceptable list of TLAAs as defined in 10 CFR 54.3(a). The staff also concludes that the PBAPS Units 2 and 3 CLB does not include any exemptions granted in accordance with 10 CFR 50.12 that are based on a TLAA.

4.2 Reactor Vessel and Internals Neutron Embrittlement Analyses

SLRA Section 4.2 provides Exelon's time-limited aging analyses (TLAAs) for analyzing neutron irradiation embrittlement in RPV components or reactor vessel internal (RVI) components. The section includes the following TLAAs that are dependent on the cumulative neutron fluence exposure of components that are within the scope of the TLAAs:

- neutron fluence analyses for the RPV and RVI
- upper-shelf energy (USE) analysis for the RPV
- pressure-temperature limits (P-T limits) analysis
- RPV probability and mean RT_{NDT} analysis for RPV circumferential welds
- RPV probability and mean RT_{NDT} analysis for RPV axial welds
- RPV reflood thermal shock analysis
- RPV core shroud reflood thermal shock analysis
- loss of preload analysis for the core plate rim hold-down bolts
- loss of preload analysis for the jet pump slip joint repair clamps
- loss of preload analysis for the jet pump auxiliary spring wedge assemblies
- loss of preload analysis for the jet pump riser repair clamps
- stress relaxation (loss of preload) analysis for the core plate replacement plugs

- irradiation-assisted stress corrosion cracking and neutron embrittlement analysis for the core shroud assembly
- loss of preload analysis for the core spray replacement piping bolts (Unit 3-specific analysis)

4.2.1 Reactor Vessel and Internals Neutron Fluence Analyses

4.2.1.1 Summary of Technical Information in the Application

SLRA Section 4.2.1.1 describes Exelon's TLAA for the reactor vessel neutron fluence analyses. Exelon dispositioned the TLAA for the reactor vessel in accordance with 10 CFR 54.21(c)(1)(ii) by demonstrating that the analyses have been projected to the end of the subsequent period of extended operation.

SLRA Section 4.2.1.2 describes Exelon's TLAA for the RVI neutron fluence analyses. Exelon dispositioned the TLAA for the RVI in accordance with 10 CFR 54.21(c)(1)(ii) by demonstrating that the analyses have been projected to the end of the subsequent period of extended operation.

4.2.1.2 Staff Evaluation

<u>Reactor Vessel Neutron Fluence Analyses</u>

The staff reviewed Exelon's TLAA for the RPV neutron fluence analyses and the corresponding disposition of the TLAA, consistent with the review procedures in SRP-SLR Section 4.2.3.1.1.

The applicant has linearly scaled its previously approved neutron fluence projections for its measurement uncertainty recapture (MUR) uprate (ADAMS Accession No. ML17286A013) from the end of the initial period of extended operation to the end of the subsequent period of extended operation. The staff finds this acceptable because experience has shown, for a given set of operating conditions (e.g., after a power uprate, design envelope change such as with MELLLA+, or a fuel design change), that fluence accumulation can often be approximated by linear extrapolation.

In this case, given that: (1) the extrapolation is based on the previously approved initial period of extended operation projections that account for operating conditions during the subsequent period of extended operation (i.e., NRC approved EPU/MELLLA+ based fluence scaled to the NRC-approved latest MUR based fluence), (2) the applicant assumed a conservative 70 effective full power years (EFPY) accumulation period (i.e., assumes no outages) corresponding to the end of the subsequent period of extended operation, and (3) because the 70 EFPY fluence projections will be validated by the Neutron Fluence Monitoring (B.3.1.2) aging management program during the subsequent period of extended operation," the NRC staff finds the PBAPS Units 2 and 3 RPV beltline component fluence projections through the subsequent period of extended operation for RPV neutron embrittlement TLAA evaluations in SLRA Sections 4.2.2 through 4.2.7 to be acceptable.

Reactor Vessel Internals Neutron Fluence Analyses

The staff reviewed Exelon's TLAA for the RVI neutron fluence analyses and the corresponding disposition that the fluence analyses have been satisfactorily projected through the subsequent period of extended operation, consistent with the review procedures in SRP-SLR Section 4.2.3.1.1.

The staff noted that the TLAA in SLRA Section 4.2.1.2 only applies to the 80-year neutron fluence bases for specific RVI, where the 80-year neutron fluence values serve as inputs for the RVI and aging effects evaluated in the following SLRA Sections:

- loss of fracture toughness in the core shrouds, as evaluated in SLRA Section 4.2.8,
- loss of preload in the core plate rim hold-down bolts, as evaluated in SLRA Section 4.2.9
- loss of preload in the jet pump slip joint repair clamp assembly bolts (Unit 2 only), as evaluated in SLRA Section 4.2.10
- loss of preload in the jet pump auxiliary wedge assembly bolts, as evaluated in SLRA Section 4.2.11
- loss of preload in the jet pump riser repair clamp assembly bolts, as evaluated by the applicant in SLRA Section 4.2.12.

The staff noted that the applicant used TransWare Enterprises' RAMA software code and methodology described in Electric Power Research Institute (EPRI) Proprietary Report No. BWRVIP-114-A as the basis for projecting the neutron fluence for these components to the end of the subsequent period of extended operation (i.e., to 70 EFPY) at rated power (4016 MWt).

The staff noted that the staff previously found the neutron fluence methodology in the proprietary BWRVIP-114-A report (see staff safety evaluation [SE]) within the final report, ADAMS Accession No. ML092650377 (non-publicly available)) to appropriately perform the transport calculations required to estimate the fluence within the RPV. However, the staff also noted in the SE that the report did not quantify the bias and uncertainty required for qualification of the methodology for determining the fluence for specific RVI as part of licensing applications. The staff stated in the SE that the methods in BWRVIP-114-A could be applied to BWR RVI locations if an applicant desiring to use the RAMA methodology benchmarks the use of RAMA for the RVI locations.

The staff noted that the applicant justified its use of the BWRVIP-114-A methodology to develop fluence projections supporting the aging effect evaluations documented in SLRA Sections 4.2.8 through 4.2.12 by referencing BWRVIP-145-A (ADAMS Accession No. ML053260601, not publicly available) because the PBAPS Units 2 and 3 reactors are of the same design as the General Electric BWR/4 reactors in Susquehanna Nuclear Power Station, which served as the basis for BWRVIP-145-A. The applicant stated that because the units have an identical number of fuel assemblies and the reactor vessel and internals geometries are similar, the use of RAMA may be justified to calculate and project the neutron fluences for the stated RVI at PBAPS in a similar manner as that done for Susquehanna in BWRVIP-145-A.

The staff reviewed BWRVIP-145-A to determine whether it represented a suitable technical basis to expand the benchmarking for Susquehanna to the aforementioned RVI at PBAPS. The staff noted that the same RAMA methodology was used to model the Susquehanna reactor and finds that the geometry and material composition similarities between Susquehanna and PBAPS are sufficient to conclude that the benchmarking results for Susquehanna would be applicable to PBAPS. However, the fluence predictions used as a basis for the TLAA evaluations documented in SLRA Sections 4.2.8 through 4.2.12 are for different locations than those benchmarked in BWRVIP-145-A, and with the intent of addressing different aging effects. These considerations are discussed below.

Five locations are discussed in SLRA Sections 4.2.8 through 4.2.12: the core shrouds, the core plate rim hold-down bolts, the jet pump slip joint repair clamp assembly bolts, the jet pump auxiliary wedge assembly bolts, and the jet pump riser repair clamp assembly bolts. In all cases, the TLAA evaluations are performed using assumed fluence values that are higher than the fluences for these locations predicted by the RAMA calculations for PBAPS. Therefore, the focus of the staff's review of the applicability of BWRVIP-145-A to PBAPS was focused on whether the margin between the predicted fluences for PBAPS and the assumed fluences for the TLAA evaluations was sufficient to account for the uncertainties associated with the fluence predictions, such that reasonable assurance exists that the fluences for the PBAPS components will not exceed the fluences assumed in the TLAA evaluations. The individual components were considered as follows:

- BWRVIP-145-A includes benchmarking for the core shroud, which is directly applicable to the PBAPS predictions. The margin between the PBAPS predicted fluence and the fluence assumed in the TLAA evaluation documented in SLRA Section 4.2.8 is significantly higher than the 20 percent uncertainty recommended in RG 1.190 (which was confirmed to be applicable to the core shroud in BWRVIP-145-A).
- The core plate rim hold-down bolts are located near the bottom of the core, with primarily simple geometries (e.g., the core baffle and core plate) located between the core and the bolts. The BWRVIP-145-A benchmarking was for locations adjacent to (i.e., shroud) and above (i.e., core guide) the core. However, in typical RAMA models, the top and bottom of the core are nodalized in a consistent manner. BWRVIP-145-A shows a significant fluence overprediction from RAMA for the core guide immediately above the core, which is attributed to the relatively coarse mesh for the steep flux gradient near the top of the core. The staff finds, based on previous experience with similar models, that this would also be the case for the fluence predictions near the bottom of the core. While the core plate rim hold-down bolts are not directly below the core, the staff expects that some of the bias due to the coarse mesh resolution at the bottom of the core would carry over to the location of the core plate rim hold-down bolts. Based on a comparison of the biases, measurement uncertainties, and standard deviation for the calculated-to-measured fluence ratios documented in BWRVIP-145-A and considering the lower safety significance of the core plate rim hold-down bolts relative to the RPV (for which the 20 percent uncertainty guidance in RG 1.190 was developed), the staff finds the margin between the predicted fluence for PBAPS and the value assumed in the TLAA evaluation documented in SLRA Section 4.2.9 to be acceptable to reasonably account for uncertainties in the fluence predictions.
- The bolts associated with the jet pump repair assemblies are located in areas between the shroud and the RPV, and many of the surveillance capsules used to support the benchmarking of the RAMA methodology for the RPV are located between the jet pumps and the RPV. However, the geometries associated with the paths that neutrons must traverse from the core to the jet pump repair assembly bolts are expected to be more complicated, and the jet pumps are most likely simplified in the RAMA model used to perform the PBAPS fluence predictions. The staff noted that the margin between the

predicted fluences for PBAPS and the values assumed in the TLAA evaluations documented in SLRA Sections 4.2.10–4.2.12 is substantial, with a minimum margin of over 200 percent. The bulk of the jet pumps are modeled with sufficient fidelity to support the 20 percent uncertainty documented in RG 1.190 for the RPV behind the jet pumps (as concluded by the NRC in review and approval of BWRVIP-114-A). Therefore, due to the magnitude of the aforementioned margins, the staff finds reasonable assurance exists that the fluence uncertainties for the jet pumps are accommodated by the large margin between the predicted fluences for PBAPS and the values assumed in the TLAA evaluations documented in SLRA Sections 4.2.10–4.2.12.

The aging effects that are addressed in SLRA Sections 4.2.8 through 4.2.12 are different from those that BWRVIP-114-A and BWRVIP-145-A are intended to address. However, the primary concern with the application of specified fluence values to different aging effects is whether the fluence value includes neutrons from the whole energy spectrum of interest for the given aging effect. The TLAA evaluations described in SLRA Sections 4.2.8 through 4.2.12 were all based on assumed fast fluence (E > 1.0 MeV) values, which is consistent with the fluence predictions for PBAPS using the RAMA methodology. As a result, the staff finds the given fluence predictions to be acceptable because the neutron energy spectrum considered is consistent with the fluences used to support the aforementioned TLAA evaluations.

Therefore, the staff finds that the applicant’s neutron fluence methodology for projecting the neutron fluence values and the neutron fluence values specified for the components at 70 EPFY are acceptable because:

- the methods are based on the applicant ‘s use of RAMA software code, the approved methods in BWRVIP-114-A, and the benchmarked calculations approved for Susquehanna core shroud and top guide components in the BWRVIP-145-A report;

- the similarity of the Susquehanna and PBAPS reactor designs support a conclusion that the benchmarking of RAMA as a qualified fluence methodology for evaluation of neutron fluence for energies above 1.0 MeV at specified locations is applicable to the PBAPS calculations; and

- the neutron fluence values reported in SLRA Tables 4.2.1.2-1 and 4.2.1.2-2 for the core plate rim hold-down bolts and the stated jet pump repair assembly components at 70 EPFY, and in SLRA Section 4.2.8 for the core shrouds at 70 EPFY, contain adequate margin to the design fluence values used in the TLAA evaluations in SLRA Sections 4.2.8 through 4.2.12 to accommodate calculational uncertainties, when taking into consideration available benchmarking information and the relevant modeling considerations.

The staff also finds that this basis addresses and resolves, for the specific fluence predictions performed to support the TLAA evaluations in the PBAPS SLRA Sections 4.2.8 through 4.2.12 for operation to 70 EFPY, the conditions or limitations that were issued in the staff’s SEs for the BWRVIP-114-A and BWRVIP-145-A reports.

Staff Finding: Reactor Vessel and Internals Neutron Fluence Analyses

For the reasons cited above, the staff finds that Exelon has demonstrated pursuant to 10 CFR 54.21(c)(1)(ii) that the analyses for the reactor vessel neutron fluence and the reactor vessel internals neutron fluence have been projected to the end of the subsequent period of extended operation.

Additionally, the applicant's analyses meet the acceptance criteria in SRP-SLR Section 4.2.2.1.1 because Exelon provided updated calculations, projected through 80 years or 70 EFPY, to address the fluence effects during the subsequent period of extended operation, evaluated in accordance with methodology that has been approved by the NRC.

4.2.1.3 UFSAR Supplement

SLRA Section A.4.2.1.1 provides the UFSAR supplement summarizing the RPV neutron fluence analyses. The staff reviewed SLRA Section A.4.2.1.1 consistent with the review procedures in SRP-SLR Section 4.2.3.1.1.

SLRA Section A.4.2.1.2 provides the UFSAR supplement summarizing the reactor vessel internals neutron fluence analyses. The staff reviewed SLRA Section A.4.2.1.2 and found it consistent with the review procedures in SRP-SLR Section 4.2.3.1.1.

Based on its review of the UFSAR supplements, the staff finds that they meet the acceptance criteria in SRP-SLR Section 4.2.2.1.1 and are therefore acceptable. Additionally, the staff finds that Exelon provided an adequate summary description of its actions to address the reactor vessel neutron fluence and the reactor vessel internals neutron fluence, as required by 10 CFR 54.21(d).

4.2.1.4 Conclusion

On the basis of its review, the staff concludes that Exelon has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(ii), that the analyses for the reactor vessel neutron fluence have been projected to the end of the subsequent period of extended operation. The staff also concludes that Exelon has demonstrated, pursuant to 10 CFR 54.21(c)(1)(ii), that the analyses for the RVI neutron fluence 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).

4.2.2 Reactor Vessel Upper Shelf Energy Analyses

The regulation in Appendix G requires the USE values for these RPV components to be greater than or equal to 50 ft-lb at the end of the licensed operating period. For RPV component materials that cannot be demonstrated to comply with this 50-ft-lb requirement, the rule requires the licensee to perform a supplemental safety analysis for the components by demonstrating that the components will have margins of safety on fracture that are equivalent or greater than those required for the components by the ASME Boiler and Pressure Vessel Code, Section XI, Appendix G. Licensees that are required to meet these conditions demonstrate compliance with the conditions through the performance of equivalent margins analyses (EMAs). For BWR RPV materials that require performance of EMAs, the staff-approved methods in Appendix B of the Electric Power Research Institute (EPRI) Proprietary Report No. TR-1008872 (BWRVIP-74-A, ADAMS Accession No. ML031710349 for the non-publicly available report; ADAMS Accession

No. ML012920549 for the staff's non-publicly available, proprietary safety evaluation on the report) provide one method that may be used to meet these EMA requirements.

4.2.2.1 Summary of Technical Information in the Application

SLRA Section 4.2.2 describes Exelon's TLAA for evaluating potential drop in the USE values of ferritic RPV shell, nozzle, and weld materials used in the fabrication of the PBAPS Units 2 and 3 RPVs. The applicant stated that the updated calculations are based on the EMAs for the limiting RPV plate and weld materials in PBAPS Units 2 and 3, as projected to the end of the subsequent period of extended operation. The applicant stated that it performed the EMA consistent with the staff-approved methodology for performing EMAs of BWR RPV base metal and weld materials in EPRI proprietary Report No. BWRVIP-74-A (ADAMS Accession No. ML1708142A0). The applicant provided its EMA results in the following SLRA tables: (a) SLRA Table 4.2.2-3 for the limiting Unit 2 RPV plate material, (b) SLRA Table 4.2.2-4 for the limiting Unit 2 RPV weld material, (c) SLRA Table 4.2.2-5 for the limiting Unit 3 RPV plate material, and (d) SLRA Table 4.2.2-6 for the limiting Unit 3 RPV weld material.

Exelon dispositioned the TLAA in accordance with 10 CFR 54.21(c)(1)(ii) by demonstrating that the EMAs for the components have been projected to the end of the subsequent period of extended operation.

4.2.2.2 Staff Evaluation

The staff reviewed Exelon's TLAA on USE, and the corresponding disposition of the TLAA, consistent with the staff's acceptance criteria that are defined in SRP-SLR Section 4.2.2.1.2.2 and the staff's review procedures that are defined in SRP-SLR Section 4.2.3.1.2.2. These SRP-SLR sections provide the staff acceptance criteria and review procedures for reviewing TLAAs on USE that are dispositioned in accordance with 10 CFR 54.21(c)(1)(ii).

The staff noted that the applicant's TLAA on USE is based on the limiting EMA calculations for the PBAPS Units 2 and 3 RPV materials that were included in the scope of SLRA Section 4.2.2. The staff also noted that the EMAs were projected to the end of the subsequent period of extended operation (i.e., 80 years of licensed operation). During this period, the applicant projects that the plant will accumulate not more than 70 EFPY of operation. The staff confirmed that the TLAA was performed in accordance with the NRC-approved BWRVIP methodology defined for BWR plate and weld materials in EPRI BWRVIP Proprietary Topical Report BWRVIP-74-A (ADAMS Accession No. ML031710349).

During its audit review of this TLAA, the staff observed that the current licensing basis for the units did not have a sufficient amount of unirradiated Charpy-impact data to firmly establish the unirradiated upper-shelf energy values for the RPV beltline and extended beltline shell, nozzle, and weld materials within the scope of the TLAA. Based on this observation, the staff determined that the applicant's approach to perform 70 EFPY EMAs of the limiting RPV plate and weld materials in PBAPS Units 2 and 3 was an acceptable basis for dispositioning the TLAA on USE in accordance with 10 CFR 54.21(c)(1)(ii). The staff also determined that the approach was consistent with the staff's acceptance criteria guidance in SRP-SLR Section 4.2.2.1.2.2.

The staff performed independent EMA calculations for the limiting RPV beltline plate and weld materials in PBAPS Units 2 and 3 using the methods approved in Appendix B of the BWRVIP-74-A report. Based on its independent calculations, the staff confirmed the following:

(a) The applicant appropriately applied the EMA methodology in the BWRVIP-74-A report.

(b) The input parameters for the EMA calculations are consistent with those previously approved by the NRC in its review and SE for the MUR power uprate license amendment request of the facility (ADAMS Accession No. ML17286A013).

(c) The RPV materials proposed by the applicant as being the limiting RPV plate and weld materials in PBAPS Units 2 and 3 are the limiting plate and weld materials for the unit-specific EMA assessments.

(d) The results of the limiting EMAs performed by the applicant are consistent with those independently calculated by the staff.

(e) The results of the limiting EMAs performed by the applicant for 70 EFPY meet the generic acceptance criteria for BWR EMAs and the RPV material-specific percent-drop in USE values and end-of-life USE values that were approved in the BWRVIP-74-A report.

Therefore, the staff finds the applicant's EMAs for 70 EFPY are acceptable because: (a) the applicant has projected the EMAs for the limiting RPV plate and weld materials in PBAPS Units 2 and 3 to the end of the subsequent period of extended operation, and (b) the applicant has provided sufficient demonstration that the component-specific EMAs for 70 EPFY are bounded by the generic EMAs approved for BWR plate and welds materials in the BWRVIP-74-A report.

The staff finds Exelon has demonstrated, pursuant to 10 CFR 54.21(c)(1)(ii), that the TLAA on USE has been projected to the end of the subsequent period of extended operation. Additionally, the TLAA meets the acceptance criteria in SRP-SLR Section 4.2.2.1.2.2 because the applicant has projected the EMAs for the limiting PBAPS Units 2 and 3 RPV beltline materials to the end of the subsequent period of extended operation and has demonstrated that the EMA results are bounded by the limiting percent-drop in USE and end-of-life USE values for these materials in the staff-approved BWRVIP-74-A report.

4.2.2.3 UFSAR Supplement

SLRA Section A.4.2.2 provides the UFSAR supplement summarizing the TLAA on USE. The staff reviewed SLRA Section A.4.2.2 consistent with the staff's acceptance criteria in SRP-SLR Section 4.2.2.2 and the staff's review procedures in SRP-SLR Section 4.2.3.2.

Based on its review of this section of the UFSAR supplement, the staff finds the UFSAR summary meets the acceptance criteria in SRP-SLR Section 4.2.2.2 and is therefore acceptable. Additionally, the staff finds that Exelon provided an adequate summary description of its actions to address the TLAA on USE, as required by 10 CFR 54.21(d).

4.2.2.4 Conclusion

On the basis of its review, the staff concludes that Exelon has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(ii), that the TLAA on USE 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).

4.2.3 Reactor Vessel Adjusted Reference Temperature (ART) Analyses

4.2.3.1 Summary of Technical Information in the Application

SLRA Section 4.2.3 describes Exelon's TLAA for the reactor vessel adjusted reference temperature (ART) analyses. Exelon dispositioned the TLAA for the reactor vessel ART in accordance with 10 CFR 54.21(c)(1)(ii) by demonstrating that the analyses have been projected to the end of the subsequent period of extended operation.

Exelon provided the following additional information to support its basis for dispositioning the TLAA in accordance with 10 CFR 54.21(c)(1)(ii). Exelon provided ART values for reactor vessel beltline ferritic materials for 70 EFPY. The beltline materials include plates, axial welds, circumferential welds, and the N16 nozzles, which are projected to experience neutron fluence greater than 1.0×10^{17} n/cm^2. Although the N16 nozzles and welds are not ferritic, the ART values for the austenitic N16 nozzles and welds were determined using the limiting material property values for the surrounding ferritic plate material. The applicant states that the ART values for all these beltline materials remain well below the 200 °F end of life value as specified in Section 3 of NRC Regulatory Guide (RG) 1.99, Revision 2 (ADAMS Accession No. ML003740284).

4.2.3.2 Staff Evaluation

The staff reviewed Exelon's TLAA for the reactor vessel ART, and the corresponding disposition of the TLAA, consistent with the review procedures in SRP-SLR Section 4.7.3.1.2.

As part of its review, the staff confirmed that the values in SLRA Section 4.2.3 for beltline materials (e.g., copper content, nickel content, chemistry factor, initial RT_{NDT}, ΔRT_{NDT}, and RT_{NDT} of the RPV circumferential welds) were calculated in accordance with methods acceptable to the NRC and described in NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants," Branch Technical Position 5-3 (ADAMS Accession No. ML070850035).

The staff used the guidance in RG 1.99 Revision 2 to perform confirmatory calculations to evaluate the adequacy of the ART values projected to the end of the subsequent period of extended operation for these beltline materials. Based on its review of the applicant's data, calculational methods, and calculation results, the NRC staff finds that the applicant has acceptably projected the ART values of the reactor vessel beltline materials to 70 EFPY.

In addition, Exelon did not identify any active aging degradation in the N16 nozzle or in the associated weld. Therefore, the staff concludes that there is reasonable assurance that the functionality of the N16 nozzle and weld will be maintained until the end of the subsequent period of extended operation.

The staff finds Exelon has demonstrated pursuant to 10 CFR 54.21(c)(1)(ii), that the analyses for the reactor vessel ART have been projected to the end of the subsequent period of extended operation. Additionally, the applicant's ART analyses meet the acceptance criteria in SRP-SLR Section 4.7.4 because the existing analyses have been projected for the subsequent period of extended operation.

4.2.3.3 UFSAR Supplement

SLRA Section A.4.2.3 provides the UFSAR supplement summarizing the reactor vessel ART analyses. The staff reviewed SLRA Section A.4.2.3 consistent with the review procedures in SRP-SLR Section 4.7.3.2.

Based on its review of the UFSAR supplement, the staff finds the UFSAR supplement for the TLAA meets the acceptance criteria in SRP-SLR and the UFSAR summary, therefore, is acceptable. Additionally, the staff finds that Exelon provided an adequate summary description of its actions to address the reactor vessel ART analyses, as required by 10 CFR 54.21(d).

4.2.3.4 Conclusion

On the basis of its review, the staff concludes that Exelon has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(ii), that the analyses for the reactor vessel ART 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 Reactor Pressure Vessel Pressure-Temperature (P-T) Limits

4.2.4.1 Summary of Technical Information in the Application

SLRA Section 4.2.4 describes Exelon's TLAA for pressure-temperature (P-T) limits. Exelon dispositioned the TLAA for the RPV P-T limits in accordance with 10 CFR 54.21(c)(1)(iii) by demonstrating that the effects of loss of fracture toughness due to neutron irradiation on the intended functions will be adequately managed for the subsequent period of extended operation. The SLRA states that the P-T limits will be updated at the appropriate time through the plant's administrative section of the PBAPS Technical Specification (TS) 5.6.7, "Reactor Coolant System (RCS) Pressure and Temperature Limits Report (PTLR)," and the plant's PTLR process.

4.2.4.2 Staff Evaluation

The staff reviewed Exelon's TLAA for the RPV P-T limits, and the corresponding disposition in accordance with the criterion in 10 CFR 54.21(c)(1)(iii), consistent with the review procedures in SRP-SLR Section 4.2.3.1.4.

By letter dated April 1, 2013 (ADAMS Accession No. ML13079A219), the NRC staff issued Amendment Nos. 286 and 289 for PBAPS Units 2 and 3, respectively, authorizing the relocation of the P-T limits from the TSs to the applicant-controlled PTLR. By letter dated November 15, 2017, the staff determined that the current P-T limits are acceptable for the MUR uprate conditions and satisfy the requirements of 10 CFR Part 50, Appendix G. These current P-T limits are applicable for 53 EFPY.

The staff reviewed the applicant’s CLB and confirmed that the applicant updates its P-T limits through a PTLR process that is governed and controlled by the administrative controls section of the PBAPS TS.

Therefore, the staff finds that Exelon has demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of loss of fracture toughness due to neutron irradiation on P-T limits will be adequately managed for the subsequent period of extended operation. Additionally, the TLAA meets the acceptance criteria in SRP-SLR Section 4.2.2.1.4 because the TS administrative controls and PTLR process ensure that the P-T limits will be: (a) updated prior to the expiration of currently licensed 53 EFPY limit curves, (b) maintained through the subsequent period of extended operation, and (c) compliant with the applicable requirements in Appendix G of 10 CFR Part 50.

4.2.4.3 UFSAR Supplement

SLRA Section A.4.2.4 provides the UFSAR supplement summarizing the RPV P-T limits TLAA. The staff reviewed SLRA Section A.4.2.4 consistent with the review procedures in SRP-SLR Section 4.2.3.2.

Based on its review of the UFSAR supplement, the staff finds it meets the acceptance criteria in SRP-SLR Section 4.2.2.2 and the UFSAR supplement summary is therefore acceptable. Additionally, the staff finds that Exelon provided an adequate summary description of its actions to address the RPV P-T limits TLAA, as required by 10 CFR 54.21(d).

4.2.4.4 Conclusion

On the basis of its review, the staff concludes that Exelon has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of loss of fracture toughness due to neutron irradiation on the P-T limits will be adequately managed by the TS administrative controls and PTLR process 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).

4.2.5 Reactor Vessel Circumferential Weld Failure Probability Analyses

4.2.5.1 Summary of Technical Information in the Application

SLRA Section 4.2.5 describes Exelon’s TLAA for the RPV circumferential weld failure probability analyses. Exelon dispositioned the TLAA for the RPV circumferential welds in accordance with 10 CFR 54.21(c)(1)(iii) by demonstrating that the effects of loss of fracture toughness due to neutron irradiation on the intended functions will be adequately managed by the 10 CFR 50.55a relief request process for the subsequent period of extended operation, where the applicant will resubmit a relief request for the RPV circumferential weld examinations during the subsequent period of operation using the acceptable alternative provisions of 10 CFR 50.55a(z)(1).

4.2.5.2 Staff Evaluation

The staff reviewed Exelon’s TLAA for the RPV circumferential weld failure probability and the corresponding disposition according to 10 CFR 54.21(c)(1)(iii), consistent with the review procedures in SRP-SLR Section 4.2.3.1.5.

By letter dated January 24, 2012, The NRC granted inspection relief for the PBAPS Units 2 and 3 RPV circumferential welds for up to 60 years of operation and 54 EFPY. By letter dated November 15, 2017, the NRC determined that the inspection relief remains valid for the MUR uprate conditions.

Exelon used the inside surface (i.e., zero RPV wall thickness, 0T) fluence at 80 years and 70 EFPY to project the mean RT_{NDT} values for each circumferential weld in the beltline for PBAPS Units 2 and 3. The fluence was projected using the methodology described in SLRA Section 4.2.1.1, “Reactor Vessel Neutron Fluence Analyses.” The results of the RPV circumferential weld failure probability analyses are provided in SLRA Table 4.2.5-1, “PBAPS Unit 2 Circumferential Weld Failure Probability Analyses,” and SLRA Table 4.2.5-2, “PBAPS Unit 3 Circumferential Weld Failure Probability Analyses.”

The NRC staff evaluation of the PBAPS fluence methodology is provided in Section 4.2.1 of this SER. The staff reviewed the copper content, nickel content, chemistry factor, unirradiated initial RT_{NDT}, ΔRT_{NDT}, and mean RT_{NDT} of the RPV circumferential welds for PBAPS Units 2 and 3. The staff confirmed that the chemistry values and chemistry factor are consistent with the best estimate values in BWRVIP-135, Revision 3. The staff confirmed that the unirradiated initial RT_{NDT} values are consistent with the CLB. The staff confirmed that the correct NRC acceptance criteria for a Chicago, Bridge and Iron Works Company fabricated RPV was applied for the circumferential welds. The staff noted that the delta RT_{NDT} and ΔRT_{NDT} values for the circumferential welds are determined using staff-approved methodologies. The staff also noted that the mean RT_{NDT} value of 70.6 °F from the staff’s July 28, 1998, SE for BWRVIP-05 bounds the mean RT_{NDT} values reported in SLRA Table 4.2.5-1 and Table 4.2.5-2 for the PBAPS circumferential welds in the beltline.

Based on this review, the staff finds that Exelon has demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of loss of fracture toughness due to neutron irradiation on the intended functions of the RPV circumferential welds will be adequately managed for the subsequent period of extended operation. The TLAA meets the acceptance criteria in SRP-SLR Section 4.2.2.1.5 because the applicant states that relief from the inspection of circumferential welds during the subsequent period of expended operation will be requested through a reapplication under the 10 CFR 50.55a process.

4.2.5.3 UFSAR Supplement

SLRA Section A.4.2.5 provides the UFSAR supplement summarizing the RPV circumferential weld failure probability TLAA. The staff reviewed SLRA Section A.4.2.5 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 Exelon provided an adequate summary description of its actions to address the circumferential weld failure probability, as required by 10 CFR 54.21(d).

4.2.5.4 Conclusion

On the basis of its review, the staff concludes that Exelon has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of loss of fracture toughness due to neutron irradiation on the circumferential weld failure probability analyses will be adequately managed by the 10 CFR 50.55a process 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).

4.2.6 Reactor Vessel Axial Weld Failure Probability Analyses

4.2.6.1 Summary of Technical Information in the Application

SLRA Section 4.2.6 describes Exelon's TLAA for the RPV axial weld failure probability analyses. Exelon dispositioned the TLAA for the RPV axial welds in accordance with 10 CFR 54.21(c)(1)(ii) by demonstrating that the analyses have been projected to the end of the subsequent period of extended operation.

4.2.6.2 Staff Evaluation

The staff reviewed Exelon's TLAA for the RPV axial weld failure probability and the corresponding disposition of 10 CFR 54.21(c)(1)(ii), consistent with the review procedures in SRP-SLR Section 4.2.3.1.6.

Exelon used the bounding inside surface (i.e., zero RPV wall thickness, 0T) fluence at 80 years and 70 EFPY to project the mean RT_{NDT} values for the limiting axial welds in PBAPS Units 2 and 3. The fluence was projected using the methodology described in SLRA Section 4.2.1.1, "Reactor Vessel Neutron Fluence Analyses." The mean RT_{NDT} values were determined using a methodology consistent with the staff's supplemental SE report for BWRVIP-05, dated March 7, 2000. The results of the RPV axial weld failure probability analyses are provided in SLRA Table 4.2.6-1, "PBAPS Unit 2 Axial Weld Failure Probability Analyses," and SLRA Table 4.2.6-2, "PBAPS Unit 3 Axial Weld Failure Probability Analyses."

The NRC staff evaluation of the fluence methodology is in Section 4.2.1 of this SER. The staff reviewed the copper content, nickel content, chemistry factor, unirradiated initial RT_{NDT}, ΔRT_{NDT}, and mean RT_{NDT} of the limiting axial welds for PBAPS Units 2 and 3. The staff confirmed that the chemistry values, chemistry factor, and unirradiated initial RT_{NDT} values are consistent with the current licensing basis (CLB). The staff also noted that the delta RT_{NDT} and mean RT_{NDT} values for the limiting axial welds are determined using staff-approved methodologies. The end-of-life mean RT_{NDT} values for the limiting axial welds in PBAPS Units 2 and 3 are 11.3 °F and 10.4 °F, respectively. The staff analyses in the supplemental SE for BWRVIP-05 use a mean RT_{NDT} value of 114 °F in Table 3, "Comparison of Results from Staff and BWRVIP," to demonstrate that the RPV failure frequency due to failure of the axial welds in the BWR fleet is no greater than 5.02×10^{-6} per reactor year. The mean RT_{NDT} value of 114 °F from the staff's analyses bounds the limiting mean RT_{NDT} values for the PBAPS Units 2 and 3 axial welds.

The staff finds that Exelon has demonstrated, pursuant to 10 CFR 54.21(c)(1)(ii), that the analyses for the RPV axial weld failure probability have been projected to the end of the subsequent period of extended operation. The TLAA meets the acceptance criteria in SRP-SLR Section 4.2.2.1.6 because Exelon has demonstrated that the projected mean RT_{NDT} values for the PBAPS Units 2 and 3 RPV beltline axial welds are bounded by the acceptance criterion in the staff's SE for BWRVIP-05 and license renewal action item No. 12 in the SE for BWRVIP-74-A.

4.2.6.3 UFSAR Supplement

SLRA Section A.4.2.6 provides the UFSAR supplement summarizing the RPV axial weld failure probability TLAA. The staff reviewed SLRA Section A.4.2.6 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 Exelon provided an adequate summary description of its actions to address the axial weld failure probability, as required by 10 CFR 54.21(d).

4.2.6.4 Conclusion

On the basis of its review, the staff concludes that Exelon has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(ii), that the analyses for the RPV axial weld failure probability 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).

4.2.7 Reactor Vessel Reflood Thermal Shock Analysis

4.2.7.1 Summary of Technical Information in the Application

SLRA Section 4.2.7 describes Exelon's TLAA for the reactor vessel reflood thermal shock analysis. Exelon dispositioned the 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

Exelon stated that the applied stress intensity reaches a peak value at 300 seconds into the event, when the vessel wall temperature at 1/4T depth from the inside surface is reduced from 550 °F to approximately 400 °F. Based on the maximum ART values calculated for the beltline material, and using the equation for K_{IC} (material resistance to fracture) presented in Appendix A of ASME Section XI, Exelon stated that the temperature at which K_{IC} reaches the upper shelf is 174 °F for PBAPS Unit 2 and 200 °F for PBAPS Unit 3.

Given that these values are substantially less than the projected temperature where stress intensity reaches its peak (400 °F), Exelon concluded that there is sufficient toughness margin to prevent reactor vessel fracture due to reflood thermal shock.

4.2.7.2 Staff Evaluation

The staff reviewed Exelon's TLAA for the reactor vessel reflood thermal shock analysis and the corresponding disposition of 10 CFR 54.21(c)(1)(ii) to determine whether the analysis has been satisfactorily projected through the subsequent period of extended operation, consistent with the review procedures in SRP-SLR Section 4.7.3.

The staff finds that Exelon's projected ART evaluation provides sufficient demonstration that the RPV will continue to behave in a ductile mode of behavior when subjected to the stress intensities imparted to the RPV wall during the postulated event, given that the RPV ART is substantially lower than the metal temperature of the reactor vessel at the peak stress intensity, based on the following:

- Exelon's limiting ART analysis demonstrates that the reactor vessel will continue to behave in a ductile mode at reactor vessel metal temperatures of 174 °F for PBAPS Unit 2 and 200 °F for PBAPS Unit 3.
- The design basis calculation demonstrates that the metal temperature of the reactor vessel will be 400 ºF during the postulated reflood thermal shock event.

The staff finds Exelon has demonstrated, pursuant to 10 CFR 54.21(c)(1)(ii), that the reactor vessel reflood thermal shock analysis has been projected to the end of the subsequent period of extended operation and has provided sufficient demonstration that existing flaws in the reactor vessel would not propagate due to brittle fracture during a loss-of-coolant accident (LOCA) as a result of thermal shock during the postulated event.

Additionally, it meets the acceptance criteria in SRP-SLR Section 4.7.2.1.2 because the existing analysis is updated or recalculated to show acceptable results for the subsequent period of extended operation.

4.2.7.3 UFSAR Supplement

SLRA Section A.4.2.7 provides the UFSAR supplement summarizing the reactor vessel reflood thermal shock analysis. The staff reviewed SLRA Section A.4.2.7 consistent with the review procedures in SRP-SLR Section 4.7.3.

Based on its review of the UFSAR supplement, the staff finds it meets the acceptance criteria in SRP-SLR Section 4.7.2 and is therefore acceptable. Additionally, the staff finds that Exelon provided an adequate summary description of its actions to address reactor vessel reflood thermal shock analysis, as required by 10 CFR 54.21(d).

4.2.7.4 Conclusion

On the basis of its review, the staff concludes that Exelon has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(ii), that the analysis for the reactor vessel reflood thermal shock 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).

4.2.8 Core Shroud Reflood Thermal Shock Analysis

4.2.8.1 Summary of Technical Information in the Application

SLRA Section 4.2.8 describes Exelon's TLAA for the core shroud reflood thermal shock analysis. Exelon dispositioned the TLAA in accordance with 10 CFR 54.21(c)(1)(i) by demonstrating that the analysis remains valid for the subsequent period of extended operation.

Exelon used an evaluation of the Browns Ferry core shroud from the Browns Ferry license renewal and applied this evaluation to the PBAPS subsequent license renewal. Specifically, Exelon stated that both Browns Ferry and PBAPS core shroud evaluations determined the maximum thermal shock stress in the shroud to be 155.7 ksi with an equivalent 0.57 percent strain. Exelon stated that an evaluation performed for Browns Ferry using a 60-year core shroud fluence of 5.34×10^{21} n/cm^2 can be applied to PBAPS, since this fluence level bounds the 80-year core shroud fluence of 3.63×10^{21} n/cm^2 at PBAPS. With the Browns Ferry analyses having demonstrated that reduction in area and elongation at fracture of the stainless steel used in the core shrouds is much larger than the maximum strain range of 0.57 percent, Exelon concluded that these evaluations show that the PBAPS core shrouds have sufficient ductility to resist a maximum thermal stress of 155.7 psi, and an equivalent 0.57 percent strain, during a reflood thermal shock transient.

4.2.8.2 Staff Evaluation

The staff reviewed Exelon's TLAA for the core shroud reflood thermal shock analysis, and the corresponding disposition of the TLAA, consistent with the review procedures in SRP-SLR Section 4.7.3.1.1.

The staff finds that the PBAPS Units 2 and 3 core shroud reflood thermal shock analysis remains valid for the subsequent period of extended operation. This is based on the following:

- Exelon used data from an evaluation of the Browns Ferry core shroud during the Browns Ferry license renewal (60 years) (ADAMS Accession Nos. ML061030029 and ML061030032) applied this evaluation to the PBAPS Units 2 and 3 subsequent license renewal (80 years). It is reasonable to use the Browns Ferry core shroud reflood evaluation to demonstrate the acceptability of the PBAPS core shroud because both Browns Ferry and PBAPS are BWRs of the General Electric Type 4 design and the maximum thermal stress during a core shroud reflood event is 155.7 ksi, with an equivalent 0.57 percent strain.
- The Browns Ferry 60-year core shroud fluence exceeds the PBAPS Units 2 and 3 80-year core shroud fluence. Therefore, it is reasonable to assume that any irradiation effects on the Browns Ferry core shroud at 60 years will bound the irradiation effects on the PBAPS Units 2 and 3 core shrouds at 80 years.
- The Browns Ferry 60-year license renewal evaluation included test data which showed that, for austenitic stainless-steel material subjected to a fluence even higher than the Browns Ferry core shroud at the end of its 60-year operating period, the worst-case ductility is represented by test material that failed at 4 percent elongation, which exceeds the maximum strain from a core shroud reflood event of 0.57 percent. Based on Exelon's calculation that the staff confirmed, which showed that the maximum strain from a core shroud reflood event would be 0.57 percent, the applicant concluded that the Browns Ferry irradiated core shroud material had sufficient ductility to withstand a core shroud reflood event without failure.
- The safety evaluation report related to the license renewal of Browns Ferry (ADAMS Accession No. ML060120453) accepted the Browns Ferry 60-year core shroud reflood evaluation showing that the core shroud can withstand the maximum thermal stress of a core shroud reflood event.

Based on this review, the staff finds that Exelon has demonstrated, pursuant to 10 CFR 54.21(c)(1)(i), that the analysis for the core shroud reflood thermal shock analysis remains valid for the subsequent period of extended operation. Additionally, the applicant's TLAA meets the acceptance criteria in SRP-SLR Section 4.7.2 because the existing analysis has been demonstrated to remain valid for the subsequent period of extended operation.

4.2.8.3 UFSAR Supplement

SLRA Section A.4.2.8 provides the UFSAR supplement summarizing the core shroud reflood thermal shock analysis. The staff reviewed SLRA Section A.4.2.8 consistent with the review procedures in SRP-SLR Section 4.7.3.

Based on its review, the staff finds this section of the UFSAR supplement meets the acceptance criteria in SRP-SLR Section 4.7.2 and is therefore acceptable. Additionally, the staff finds that Exelon provided an adequate summary description of its actions to address the core shroud reflood thermal shock analysis, as required by 10 CFR 54.21(d).

4.2.8.4 Conclusion

On the basis of its review, the staff concludes that Exelon has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(i), that the analysis for the core shroud reflood thermal shock remains 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).

4.2.9 Core Plate Rim Hold-Down Bolt Loss of Preload Analysis

4.2.9.1 Summary of Technical Information in the Application

SLRA Section 4.2.9 describes Exelon's TLAA for assessing loss of preload due to neutron irradiation-induced stress relaxation in the core plate rim hold-down bolts (CPRH-DBs) that are included in the core plate assemblies of PBAPS Units 2 and 3. Exelon dispositioned the CPRH-DB preload TLAA in accordance 10 CFR 54.21(c)(1)(i) by demonstrating that the analysis remains valid for the subsequent period of extended operation

4.2.9.2 Staff Evaluation

The staff reviewed Exelon's CPRH-DB preload TLAA, and the corresponding disposition of the TLAA, consistent with the acceptance criteria in SRP-SLR Section 4.7.2.1.1 and the review procedures in SRP-SLR Section 4.7.3.1.1. Consistent with the acceptance criteria in SRP-SLR Section 4.7.2.1.1, a plant-specific TLAA may be accepted in accordance with 10 CFR 54.21(c)(1)(i) if the applicant can demonstrate that the time-dependent parameter for the analysis, as projected to the end of the subsequent period of extended operation, is bounded by the value of the time-dependent parameter evaluated in the original analysis. For a plant-specific TLAA that meets this criterion, an applicant may conclude that the analysis will remain valid during the subsequent period of extended operation.

In the applicant's original loss of preload analysis for the CPRH-DBs, the applicant demonstrated that the preload loss in the original preload tensioning force for the bolts would not be any greater than 19 percent of the initial tensioning force. The staff noted that this was based on a limiting, average bolt neutron fluence of 8.0×10^{19} n/cm^2 assumed in the analysis. The staff also noted that, in its TLAA evaluation, the applicant stated that the average bolt fluence for the PBAPS Unit 2 CPRH-DBs at 70 EFPY is 6.57×10^{19} n/cm^2 and the average bolt fluence for the PBAPS Unit 3 CPRH-DBs at 70 EFPY is 6.53×10^{19} n/cm^2.

During the staff's in-office audit of the TLAA (see the audit report at ADAMS Accession No. ML19205A206), the staff determined that the applicant's TLAA is based on: (a) a

GE-Hitachi (GEH) loss of preload analysis for the CPRH-DBs, and (b) a vendor-specific neutron fluence calculation for the CPRH-DBs that calculated and projected the average fluence values for the limiting irradiated CPRH-DBs in PBAPS Units 2 and 3 through 70 EPFY. The staff confirmed the acceptability of GEH's analysis through verification of past approvals of the methodology, as cited in previous Exelon license renewal applications and reviewed by the staff in the SER for those applications. The staff confirmed the acceptability of the vendor's methodology and basis for performing the neutron fluence calculations for reactor vessel internal components by means of a vendor inspection that was performed at the vendor's facility during the week of October 22–26, 2018 (see ADAMS Accession No. ML18332A458 for the NRC inspection report).

Based on its audit assessment, the staff confirmed that the limiting bolt fluences reported in SLRA Section 4.2.9 for the PBAPS Units 2 and 3 CPRH-DBs are less than the limiting average bolt fluence of 8.0×10^{19} n/cm^2 assumed in the GEH CPRH-DB analysis. The staff noted that this provides sufficient demonstration that the neutron fluence values for the CPRH-DBs at 70 EFPY are less than those assumed for the bolts in the original analysis and that the acceptance criteria in SRP-SLR Section 4.7.2.1.1 have been met.

Therefore, the staff finds Exelon has demonstrated, pursuant to 10 CFR 54.21(c)(1)(i), that the CPRH-DB preload TLAA remains 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 limiting neutron fluence for the CPRH-DBs, as projected to 70 EFPY, is bounded by the limiting average neutron fluence assumed for the bolts in the preload analysis, which provides sufficient demonstration that the TLAA will remain valid for the subsequent period of extended operation and is acceptable in accordance with 10 CFR 54.21(c)(1)(i).

4.2.9.3 UFSAR Supplement

SLRA Section A.4.2.9 provides the UFSAR supplement summarizing the core plate rim hold-down bold preload TLAA. The staff reviewed SLRA Section A.4.2.9 consistent with the acceptance criteria in SRP-SLR Section 4.7.2.2 and the review procedures in SRP-SLR Section 4.7.3.2.

Based on its review of the UFSAR supplement, the staff finds the UFSAR supplement meets the acceptance criteria in SRP-SLR Section 4.7.2.2 and is therefore acceptable. Additionally, the staff finds that Exelon provided an adequate summary description of its actions to address the core plate rim hold-down bold preload TLAA, as required by 10 CFR 54.21(d).

4.2.9.4 Conclusion

On the basis of its review, the staff concludes that Exelon has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(i), that the core plate rim hold-down bolt preload TLAA remains 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).

4.2.10 Jet Pump Slip Joint Repair Clamp Loss of Preload Analysis

4.2.10.1 Summary of Technical Information in the Application

SLRA Section 4.2.10 describes Exelon's TLAA for assessing loss of preload due to neutron irradiation-induced stress relaxation in the jet pump slip joint repair clamps (JPSJRCs) that were installed in PBAPS Unit 2 in 2004, 2008, and 2014. The applicant stated that the original hot-condition, preloaded force in the clamp-assembly bolts is 500 pounds at 550 ºF. The applicant stated that the analysis permits the bolt preload to drop to 350 pounds (i.e., 150 pounds of preload loss) under hot conditions, as associated with a bounding bolt neutron fluence exposure of 1.115×10^{20} n/cm^2 (E > 1.0 MeV) over the life of the plant. The applicant also stated that the neutron fluence for the repair clamps is projected to be 1.17×10^{19} n/cm^2 at the end of the subsequent period of extended operation (i.e., at 70 EFPY). The applicant stated that this demonstrates that the loss of preload analysis will remain valid during the subsequent period of extended operation.

Exelon dispositioned the loss of preload TLAA for these components in accordance with 10 CFR 54.21(c)(1)(i) by demonstrating that the analysis remains valid for the subsequent period of extended operation.

4.2.10.2 Staff Evaluation

The staff reviewed Exelon's JPSJRC preload TLAA, and the corresponding disposition of the TLAA, consistent with the acceptance criteria in SRP-SLR Section 4.7.2.1.1 and the review procedures in SRP-SLR Section 4.7.3.1.1. These SRP-SLR criteria permit the staff to accept the TLAA in accordance with the criterion in 10 CFR 54.21(c)(1)(i) if the staff can verify that the time-dependent parameter, as projected to the end of the subsequent period of extended operation for the applicable system, structure, or component assessed in the analysis, is less than that assumed for the time-dependent parameter in the original analysis. The time-dependent parameter that applies to the preload evaluation of the JPSJRCs is the cumulative neutron fluence exposure that applies to the clamp assembly bolts at the end of the subsequent period of extended operation.

Based on the review procedures in SRP-SLR Section 4.7.3.1.1 and the staff's in-office audit of documents associated with the TLAA (see audit report at ADAMS Accession No. ML19205A206), the staff confirmed that the applicant's projected neutron fluence for the JPSJRCs at 70 EFPY is 1.17×10^{19} n/cm^2 (E > 1.0 MeV). The staff also confirmed that the 70 EFPY neutron fluence for the JPSJRCs was performed using an acceptable neutron fluence methodology (see the staff's evaluation in SER Section 4.2.1). The staff noted that this provides sufficient demonstration that the neutron fluence value for the JPSJRCs at 70 EFPY is less than the neutron fluence value of 1.115×10^{20} n/cm^2 assumed for these clamps in in the JPSJRC preload TLAA, and that the TLAA is acceptable in accordance with 10 CFR 54.21(c)(1)(i).

Therefore, the staff finds Exelon has demonstrated, pursuant to 10 CFR 54.21(c)(1)(i), that the JPSJRC preload TLAA remains 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: (a) the neutron fluence for the clamps, as projected to 70 EFPY, is bounded by the fluence assumed for the clamps in the preload analysis, and (b) the TLAA will remain valid for the subsequent period of extended operation and is acceptable in accordance with 10 CFR 54.21(c)(1)(i).

4.2.10.3 UFSAR Supplement

SLRA Section A.4.2.10 provides the UFSAR supplement summarizing the JPSJRC preload TLAA. The staff reviewed SLRA Section A.4.2.10 consistent with the acceptance criteria in SRP-SLR Section 4.7.2.2 and the review procedures in SRP-SLR Section 4.7.3.2.

Based on its review of the UFSAR supplement, the staff finds it meets the acceptance criteria in SRP-SLR Section 4.7.2.2 and is therefore acceptable. Additionally, the staff finds that Exelon provided an adequate summary description of its actions to address the JPSJRC preload TLAA, as required by 10 CFR 54.21(d).

4.2.10.4 Conclusion

On the basis of its review, the staff concludes that Exelon has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(i), that the JPSJRC preload TLAA remains 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).

4.2.11 Jet Pump Auxiliary Spring Wedge Assembly Loss of Preload Analysis

4.2.11.1 Summary of Technical Information in the Application

SLRA Section 4.2.11 describes Exelon's TLAA for assessing loss of preload due to neutron irradiation-induced stress relaxation in the jet pump auxiliary spring wedges (JPASWs) that were installed in PBAPS Unit 2 in 2004, 2006, and 2014; and in PBAPS Unit 3 in 2001. The applicant stated that the original analysis assumed a 10 percent maximum allowable drop in the wedge assembly bolt tensioning force in order to account for thermal and radiation effects. The applicant stated that the original analyses assumed a bounding 40-year bolt neutron fluence exposure of 5.0×10^{20} n/cm^2 (E > 1.0 MeV). The applicant also stated that the maximum neutron fluence values for the JPASWs in PBAPS Units 2 and 3 are projected to be 1.53×10^{20} n/cm^2 and 8.12×10^{18} n/cm^2, respectively, at the end of the subsequent period of extended operation (i.e., at 70 EFPY). The applicant stated that this demonstrates that the loss of preload analyses for the JPASWs will remain valid during the subsequent period of extended operation.

Exelon dispositioned the loss of preload TLAA for these components in accordance with 10 CFR 54.21(c)(1)(i) by demonstrating that the analysis remains valid for the subsequent period of extended operation.

4.2.11.2 Staff Evaluation

The staff reviewed Exelon's JPASW Preload TLAA, and the corresponding disposition of the TLAA, consistent with the acceptance criteria in SRP-SLR Section 4.7.2.1.1 and the review procedures in SRP-SLR Section 4.7.3.1.1. These SRP-SLR criteria permit the staff to accept the TLAA in accordance with the criterion in 10 CFR 54.21(c)(1)(i) if the staff can verify that the time-dependent parameter, as projected to the end of the subsequent period of extended operation for the applicable system, structure, or component assessed in the analysis, is less than that assumed for the time-dependent parameter in the original analysis. The time-dependent parameter that applies to the preload evaluation of the JPASWs is the cumulative neutron fluence exposure that applies to the wedge assembly bolts at the end of the subsequent period of extended operation.

Based on the review procedures in SRP-SLR Section 4.7.3.1.1 and the staff's in-office audit of documents associated with the TLAA (see the audit report at ADAMS Accession No. ML19205A206), the staff confirmed that the applicant's projected neutron fluence for the JPASWs at 70 EFPY are 1.53×10^{20} n/cm^2 (E > 1.0 MeV) for those installed in PBAPS Unit 2 and 8.12×10^{18} n/cm^2 (E > 1.0 MeV) for those installed in PBAPS Unit 3. The staff also confirmed that the 70 EFPY neutron fluence for the JPASWs was performed using an acceptable neutron fluence methodology (see the staff's evaluation in SER Section 4.2.1). The staff noted that this provides sufficient demonstration that the neutron fluence values for the JPASWs at 70 EFPY are less than the neutron fluence value of 5.0×10^{20} n/cm^2 assumed for these wedges in the TLAA, and that the TLAA is acceptable in accordance with the TLAA acceptance criteria in 10 CFR 54.21(c)(1)(i).

Therefore, the staff finds Exelon has demonstrated, pursuant to 10 CFR 54.21(c)(1)(i), that the JPASW preload TLAA remains 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: (a) the neutron fluence for the wedges, as projected to 70 EFPY, is bounded by the fluence assumed for the wedges in the preload analysis, and (b) the TLAA will remain valid for the subsequent period of extended operation and is acceptable in accordance with 10 CFR 54.21(c)(1)(i).

4.2.11.3 UFSAR Supplement

SLRA Section A.4.2.11 provides the UFSAR supplement summarizing the JPASW preload TLAA. The staff reviewed SLRA Section A.4.2.11 consistent with the acceptance criteria in SRP-SLR Section 4.7.2.2 and the review procedures in SRP-SLR Section 4.7.3.2.

Based on its review of the UFSAR supplement, the staff finds it meets the acceptance criteria in SRP-SLR Section 4.7.2.2 and is therefore acceptable. Additionally, the staff finds that Exelon provided an adequate summary description of its actions to address the JPASW preload TLAA, as required by 10 CFR 54.21(d).

4.2.11.4 Conclusion

On the basis of its review, the staff concludes that Exelon has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(i), that the JPASW preload TLAA remains 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).

4.2.12 Jet Pump Riser Repair Clamp Loss of Preload Analysis

4.2.12.1 Summary of Technical Information in the Application

SLRA Section 4.2.12 describes Exelon's TLAA for assessing loss of preload due to neutron irradiation-induced stress relaxation in the jet pump riser repair clamps (JPRRCs) that were installed in 1998 in PBAPS Unit 3. The repair clamps were installed as a mechanical repair for flaw indications detected in the jet pump riser elbow-to-thermal sleeve welds of jet pumps 01/20 and 13/14 in PBAPS Unit 3. The preloaded tensioning forces apply to the bolts used in the mechanical repair clamp design. The applicant stated that, although the analysis was based on a 17-year service life for the repair clamps, the analysis qualifies as a TLAA because it was projected to the end of initial 40-year licensing term for the unit. The applicant stated that the analysis assumed an upper bound neutron fluence value of 2.5×10^{19} n/cm^2 (E > 1.0 MeV) for the JPRRCs. The applicant also stated that the limiting neutron fluence for the repair clamps is projected to be 5.29×10^{15} n/cm^2 (see SRLA Table 4.2.1.2-2) at the end of the subsequent period of extended operation (i.e., at 70 EFPY) and that this demonstrates that the loss of preload analysis will remain valid during the subsequent period of extended operation.

Exelon dispositioned the loss of preload TLAA for these components in accordance with 10 CFR 54.21(c)(1)(i) by demonstrating that the analysis remains valid for the subsequent period of extended operation.

4.2.12.2 Staff Evaluation

The staff reviewed Exelon's JPRRC preload TLAA, and the corresponding disposition of the TLAA, consistent with the acceptance criteria in SRP-SLR Section 4.7.2.1.1 and the review procedures in SRP-SLR Section 4.7.3.1.1. These SRP-SLR criteria permit the staff to accept the TLAA in accordance with the criterion in 10 CFR 54.21(c)(1)(i) if the staff can verify that the time-dependent parameter, as projected to the end of the subsequent period of extended operation for the applicable system, structure, or component assessed in the analysis, is less than that assumed for the time-dependent parameter in the original analysis. The time-dependent parameter that applies to the preload evaluation of the JPRRCs is the cumulative neutron fluence exposure that applies to the repair clamps at the end of the subsequent period of extended operation.

Based on the review procedures in SRP-SLR Section 4.7.3.1.1 and the staff's in-office audit of documents associated with the TLAA (refer to the staff in-office audit in ADAMS Accession No. ML19205A206), the staff confirmed that the applicant's projected neutron fluence for the JPRRCs at 70 EFPY is 5.29×10^{15} n/cm^2 (E > 1.0 MeV). The staff also confirmed that the 70 EFPY neutron fluence for the JPRRCs was performed using an acceptable neutron fluence methodology (see the staff's evaluation in SER Section 4.2.1). The staff noted that this provides sufficient demonstration that the neutron fluence value for the JPRRCs at 70 EFPY is less than the neutron fluence value of 2.59×10^{19} n/cm^2 assumed for these clamps in the JPRRC preload TLAA, and that the TLAA is acceptable in accordance with 10 CFR 54.21(c)(1)(i).

Therefore, the staff finds Exelon has demonstrated, pursuant to 10 CFR 54.21(c)(1)(i), that the JPRRC preload TLAA remains 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: (a) the neutron fluence for the clamps, as projected to 70 EFPY, is bounded by the fluence assumed for the clamps in the preload analysis, and (b) the TLAA will remain valid for the subsequent period of extended operation and is acceptable in accordance with 10 CFR 54.21(c)(1)(i).

4.2.12.3 UFSAR Supplement

SLRA Section A.4.2.12 provides the UFSAR supplement summarizing the JPRRC preload TLAA. The staff reviewed SLRA Section A.4.2.12 consistent with the acceptance criteria in SRP-SLR Section 4.7.2.2 and the review procedures in SRP-SLR Section 4.7.3.2.

Based on its review of the UFSAR supplement, the staff finds it meets the acceptance criteria in SRP-SLR Section 4.7.2.2 and is therefore acceptable. Additionally, the staff finds that Exelon provided an adequate summary description of its actions to address the JPRRC preload TLAA, as required by 10 CFR 54.21(d).

4.2.12.4 Conclusion

On the basis of its review, the staff concludes that Exelon has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(i), that the JPRRC preload TLAA remains 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).

4.2.13 Replacement Core Plate Extended Life Plug Irradiation-Enhanced Stress Relaxation Analysis

4.2.13.1 Summary of Technical Information in the Application

SLRA Section 4.2.13, as supplemented by the applicant's response to the request for additional information (RAI) 4.2.13-1, dated May 2, 2019, describes Exelon's TLAA for the irradiation-induced stress relaxation of the extended life core support plugs (ELCSPs). Exelon dispositioned the TLAA for the ELCSPs 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.

4.2.13.2 Staff Evaluation

The staff reviewed Exelon's TLAA for the ELCSPs and the corresponding disposition of 10 CFR 54.21(c)(1)(ii) and found them to be consistent with the review procedures in SRP-SLR Section 4.7.3.1.

The ELCSPs were installed in PBAPS Unit 2 during an outage in 2012. The ELCSPs were installed in PBAPS Unit 3 during an outage in 2001. The ELCSPs are held in place against a differential pressure of 46.7 lbs. The as-installed service life of the ELCSPs was 35 EFPY corresponding to a fluence of 5.25+20 n/cm^2. The applicant stated that its reevaluation of the ELCSPs concluded that at 55 EFPY, corresponding to 8.25+20 n/cm^2, the end-of-life preload is 111 pounds. The predicted end-of-life preload of 111 pounds exceeds the differential pressure of 46.7 pounds acting on the ELCSPs.

The NRC staff performed an independent evaluation of the ELCSPs loss of preload. The staff used the as-installed design margin, the 80-year fluence of 8.25 x 10^{20} n/cm^2, and the information provided in Appendix I of BWRVIP-25, Revision 1 (ADAMS Accession No. ML16273A476 for the proprietary, non-publicly available report), to determine that the design margin for the preload remains above "1.0" at 55 EFPY. The staff finds that the service life of the ELCSPs can be extended to 55 EFPY because the preload will remain above the differential pressure of 46.7 pounds acting on the ELCSPs.

The staff finds Exelon has demonstrated, pursuant to 10 CFR 54.21(c)(1)(ii), that the analysis for the ELCSPs has been projected to the end of the subsequent period of extended operation. The TLAA meets the acceptance criteria in SRP-SLR Section 4.7.2.1.2 because the existing analysis has been updated to show acceptable results for the subsequent period of extended operation.

4.2.13.3 UFSAR Supplement

SLRA Section A.4.2.13 provides the UFSAR supplement summarizing the TLAA for the irradiation-induced stress relaxation of the ELCSPs. The staff reviewed SLRA Section A.4.2.13 consistent with the review procedures in SRP-SLR Section 4.7.3.2.

Based on its review of the UFSAR supplement, the staff finds it meets the acceptance criteria in SRP-SLR Section 4.7.2.2 and is therefore acceptable. Additionally, the staff finds that Exelon provided an adequate summary description of its actions to address the TLAA for the irradiation-induced stress relaxation of the ELCSPs, as required by 10 CFR 54.21(d).

4.2.13.4 Conclusion

On the basis of its review, the staff concludes that Exelon has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(ii), that the analysis for the ELCSPs 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).

4.2.14 First License Renewal Application Core Shroud Irradiation-Assisted Stress Corrosion Cracking and Embrittlement Analysis

4.2.14.1 Summary of Technical Information in the Application

SLRA Section 4.2.14 describes Exelon’s TLAA for the reactor vessel core shroud analysis for susceptibility to irradiation-assisted stress corrosion cracking (IASCC) and embrittlement. Exelon dispositioned the TLAA for the core shroud in accordance with 10 CFR 54.21(c)(1)(iii) by demonstrating that the effects of cracking due to IASCC and loss of fracture toughness due to neutron irradiation embrittlement on the intended functions will be adequately managed by the BWR vessel internals aging management program (AMP) (SLRA Section B.2.1.7) for the subsequent period of extended operation.

4.2.14.2 Staff Evaluation

The staff reviewed Exelon’s TLAA for the core shroud and the corresponding disposition of 10 CFR 54.21(c)(1)(iii), consistent with the review procedures in SRP-SLR Section 4.7.3.1.2.

The staff evaluation of the core shroud susceptibility to IASCC and embrittlement for 60 years of operation is documented in NUREG-1769, “Safety Evaluation Report Related to the License Renewal of Peach Bottom Atomic Power Station, Units 2 and 3” (ADAMS Accession Nos. ML031010042, ML031010053, and ML031010127). NUREG-1769 documents the staff’s determination that the core shroud for Peach Bottom Units 2 and 3 is not expected to exceed the fluence threshold to be susceptible to IASCC and embrittlement for 60 years of operation. The 80-year projected fluence for the core shroud exceeds the susceptibility threshold and, therefore, the core shroud will be periodically inspected in accordance with the PBAPS BWR vessel internals AMP and staff-approved BWRVIP-76-R1-A, "BWR Core Shroud Inspection and Flaw Evaluation Guidelines" (ADAMS Accession No. ML15266A176 for the proprietary, non-publicly available report). The staff's evaluation of the PBAPS BWR Vessel Internals AMP is documented in SER Section 3.0.3.2.3.

The staff finds that Exelon has demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of cracking due to IASCC and loss of fracture toughness due to neutron irradiation embrittlement on the intended functions of the core shroud will be adequately managed for the subsequent period of extended operation. The TLAA meets the acceptance criteria in SRP-SLR Section 4.7.2.1.2 because the effects of IASCC and embrittlement on the intended functions of the core shroud will be adequately managed for the subsequent period of extended operation using the NRC-approved BWRVIP-76-R1-A and PBAPS BWR vessel internals AMP.

4.2.14.3 UFSAR Supplement

SLRA Section A.4.2.14 provides the UFSAR supplement summarizing the TLAA for the reactor vessel core shroud analysis for susceptibility to IASCC and embrittlement. The staff reviewed SLRA Section A.4.2.14 consistent with the review procedures in SRP-SLR Section 4.7.3.2.

Based on its review of the UFSAR supplement, the staff finds it meets the acceptance criteria in SRP-SLR Section 4.7.2.2 and is therefore acceptable. Additionally, the staff finds that Exelon provided an adequate summary description of its actions to address the TLAA for the reactor vessel core shroud susceptibility to IASCC and embrittlement, as required by 10 CFR 54.21(d).

4.2.14.4 Conclusion

On the basis of its review, the staff concludes that Exelon has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of cracking due to IASCC and loss of fracture toughness due to neutron irradiation embrittlement on the intended functions of the reactor vessel core shroud will be adequately managed by the PBAPS BWR vessel internals AMP 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).

4.2.15 PBAPS Unit 3 Core Spray Replacement Piping Bolting Loss of Preload Evaluation

4.2.15.1 Summary of Technical Information in the Application

SLRA Section 4.2.15 describes Exelon's TLAA for the Unit 3 core spray replacement piping bolting loss of preload evaluation. Exelon dispositioned the TLAA for the PBAPS Unit 3 core spray replacement piping bolting 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.

In 2013, Exelon performed a loss of preload evaluation based on a projected fluence value of 3.6×10^{19} n/cm^2 over a 40-year life. For the SLRA, Exelon reevaluated the projection for a neutron fluence of 4.1×10^{19} n/cm^2 over a 45-year life by demonstrating that the tensioning forces on the core spray replacement bolts will remain above a minimum tensioning requirement of 3,504 pounds of force. The updated analysis calculated an updated tensioning force on the bolts of 3,682 pounds of force.

4.2.15.2 Staff Evaluation

The staff reviewed Exelon's TLAA for the PBAPS Unit 3 core spray replacement piping bolting and the corresponding disposition of 10 CFR 54.21(c)(1)(ii), that the PBAPS Unit 3 replacement core spray piping bolting loss of preload evaluation has been satisfactorily projected through the subsequent period of extended operation, consistent with the review procedures in SRP-SLR Section 4.7.3.

Exelon's 2013 evaluation shows a reduction of preload to 3,775 pounds at the end of the 40-year period. The SLRA evaluation shows a reduction of preload to 3,682 pounds at the end of the 45-year period. Both evaluations meet the acceptance criterion of 3,504 lbs. Additionally, the 45-year period spans the subsequent period of extended operation. Therefore, Exelon's 45-year evaluation is acceptable for the subsequent period of extended operation. The staff finds Exelon has demonstrated, pursuant to 10 CFR 54.21(c)(1)(ii), that the analysis for the PBAPS Unit 3 core spray replacement piping 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 because the existing analysis is projected to show acceptable results for the subsequent period of extended operation.

4.2.15.3 UFSAR Supplement

SLRA Section A.4.2.15 provides the UFSAR supplement summarizing the PBAPS Unit 3 core spray replacement piping bolting loss of preload evaluation. The staff reviewed SLRA Section A.4.2.15 consistent with the review procedures in SRP-SLR Section 4.7.3.

Based on its review of the UFSAR supplement, the staff finds it meets the acceptance criteria in SRP-SLR Section 4.7.2 and is therefore acceptable. Additionally, the staff finds that Exelon provided an adequate summary description of its actions to address the PBAPS Unit 3 core spray replacement piping bolting loss of preload evaluation, as required by 10 CFR 54.21(d).

4.2.15.4 Conclusion

On the basis of its review, the staff concludes that Exelon has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(ii), that the evaluation for the PBAPS Unit 3 core spray replacement piping bolting loss of preload 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).

4.3 <u>Metal Fatigue</u>

SLRA Section 4.3 provides the TLAAs associated with the thermal and mechanical fatigue analyses of plant mechanical components. Fatigue is an age-related degradation mechanism caused by cyclic stressing of a component by either mechanical or thermal stresses. Evaluation of fatigue analyses and fatigue waivers of Class 1 components is provided in SLRA Sections 4.3.2 and 4.3.3, respectively. Fatigue analysis of piping components is discussed in SLRA Section 4.3.4. Evaluation of environmentally assisted fatigue (EAF) is documented in

SLRA Section 4.3.5. In addition, RVI fatigue analyses are discussed in SLRA Section 4.3.6. High-energy line break analyses based on cumulative fatigue usage is discussed in SLRA Section 3.3.7.

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 describes Exelon's basis for projecting transient-specific design cycles to the end of the subsequent period of extended operation.

SLRA Tables 4.3.1-1 and 4.3.1-2 provide the cycle-specific projection results for design transients that apply to the Class 1 component-specific cumulative usage factor (CUF) or environmentally-assisted fatigue (CUF_{en}) calculations for PBAPS Units 2 and 3, respectively. The applicant stated that the cycle-specific projection results for some design transients in SLRA Tables 4.3.1-1 or 4.3.1-2 may apply to the structural analyses in SLRA Section 4.6 or some of the plant-specific cyclical loading analyses in SLRA Section 4.7.

The applicant did not formally identify this aspect of the fatigue analysis as a TLAA for the application. However, SLRA Section 4.3.1 includes the applicant's summary of the methods and efforts for reviewing the existing Fatigue Monitoring program (SLRA AMP B.3.1.1) and SI:FatiguePro™ software implementation for past design transient occurrences, and how the cumulative cycle numbers for the specified transients were used to establish the 80-year design cycle projection values for the design transients that are specified in SLRA Table 4.3.1-1 for PBAPS Unit 1 and SLRA Table 4.3.1-2 for PBAPS Unit 2. SLRA Section 4.3.1 also provides additional explanations for the projection bases for some transients.

For design transients that apply to the component-specific fatigue waiver analyses, the applicant provided its cycle projection bases and results for the analyses in SLRA Table 4.3.3-2. For design transients that apply to component-specific maximum allowable stress analyses for ASME Code Class 2 and 3 components or ANSI B31.1 components, the applicant provided its cycle projection bases and results for the analyses in SLRA Table 4.3.4-2.

4.3.1.2 Staff Evaluation

The staff noted that the applicant's basis for assessing and projecting design transient cycles to the end of the subsequent period of extended operation is not a TLAA because the basis does not involve an assessment of an applicable aging effect and does not meet Criterion 2 for defining TLAAs in 10 CFR 54.3(a). The transient cycle numbers are inputs to the applicant's fatigue or cyclic loading TLAAs. Therefore, the staff evaluated the adequacy of transient cycle projection bases as described below.

The 80-year transient cycle projections in SLRA Tables 4.3.1-1 and 4.3.1-2 are based on cycle counts as of December 31, 2015, and projections from that time to 80 years based on transient occurrences over the last 15 years, with changes in the projected cycles in some cases based on the applicant's review of the data. The staff noted that the 80-year cycle projection bases for some transients included additional, conservative transient-specific factors. The staff also noted that the applicant has had a declining trend of transient occurrences since initial operations of the PBAPS units. The applicant also explained that this declining trend justifies the use of the latest 15-year accumulation rates as the projection bases for the specified design transients.

Based on its review of SLRA Section 4.3.1, the staff finds the applicant's 80-year transient-specific cycle projection bases and values for the transients evaluated in SLRA Tables 4.3.1-1 and 4.3.1-2 to be acceptable because: (a) the projections use the cycle counts as of December 31, 2015, (b) the cycle projections add in the transient cycles that are projected to occur from January 1, 2016, through the end of the subsequent period of extended operation based on the 15-year accumulation rates for the transients, as adjusted in some cases, (c) the declining trend in the transient-specific accumulation rates since initial plant operations provides sufficient justification for using the 15-year accumulation rates as the 80-year transient-specific projections, and (d) the transient cycle projections include additional conservative, transient-specific factors in the cycle projection bases for some of the transients specified and analyzed in SLRA Tables 4.3.1-1 and 4.3.1-2.

The staff's evaluation of the applicant's cycle projection bases and results for components that are subject to component-specific fatigue waiver analyses is documented in SER Section 4.3.3. The staff's evaluation of the applicant's cycle projection bases and results for non-Class 1 components subject to a maximum allowable stress relaxation analysis (i.e., component-specific expansion stress analysis) is documented in SER Section 4.3.4. The Fatigue Monitoring program (SLRA Section B.3.1.1) is evaluated and found acceptable in SER Section 3.0.3.2.1.

4.3.1.3 UFSAR Supplement

In SLRA Section A.4.3.1, the applicant provided a UFSAR supplement summary description for the applicant's 80-year cycle projection basis even though the applicant does not identify the 80-year cycle projection assessment as a TLAA for the facility. Since the applicant provided a UFSAR supplement section for information in SLRA Section 4.3.1, the staff reviewed SLRA Section A.4.3.1 consistent with the review procedures in SRP-SLR Section 4.3.3.2.

Based on its review of the UFSAR supplement, the staff finds it meets the acceptance criteria in SRP-SLR Section 4.3.2.2 and is therefore acceptable. Additionally, the staff finds that Exelon provided an adequate summary description of its actions to address transient cycle projections for 80 years, as required by 10 CFR 54.21(d).

4.3.1.4 Conclusion

On the basis of its review, the staff concludes that Exelon has provided an acceptable basis for projecting the transient cycle numbers to the end of the subsequent period of extended operation. The staff also concludes that the applicant has provided an adequate UFSAR supplement summary description of its design transient cycle projection basis, as given and discussed in SLRA Section A.4.3.1.

4.3.2 Metal Fatigue of Class 1 Components

4.3.2.1 Summary of Technical Information in the Application

SLRA Section 4.3.2 describes Exelon's metal fatigue TLAAs for the reactor recirculation system piping, the reactor vessels, RVIs, and reactor recirculation pumps that were designed in accordance with the ASME Boiler and Pressure Vessel Code, Section III, Class 1. In addition, this section describes that the Unit 3 flued-head penetrations for the RHR system were designed in accordance with ASME Section III, Class I requirements. Exelon dispositioned these metal fatigue TLAAs in accordance with 10 CFR 54.21(c)(1)(iii) by demonstrating that the effects of fatigue of these components on the intended functions will be adequately managed by the Fatigue Monitoring program for the subsequent period of extended operation.

4.3.2.2 Staff Evaluation

The staff reviewed Exelon's metal fatigue TLAAs for the reactor recirculation loop piping, the reactor vessels, reactor vessel internals, reactor recirculation pumps, and the Unit 3 flued-head penetrations for the RHR system, which were designed in accordance with the ASME Code, Section III, Class 1, and the disposition of 10 CFR 54.21(c)(1)(iii), following the review procedures in SRP-SLR Section 4.3.3.1.1.3.

Based on its review of SLRA Section 4.3.2, the staff determined Exelon appropriately dispositioned its TLAAs for metal fatigue of Class 1 components in accordance with 10 CFR 54.21(c)(1)(iii), so that the effects of aging on the intended function will be adequately managed by the Fatigue Monitoring program for the subsequent period of extended operation. The staff finds Exelon's disposition acceptable because the Fatigue Monitoring program will continue to monitor and ensure the validity of the TLAAs and trigger corrective actions prior to analyses becoming invalid during the subsequent period of extended operation.

The staff finds Exelon has demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of fatigue on the intended functions of Class 1 components designed in accordance with the ASME Code, Section III, including the Unit 3 flued-head penetrations for the RHR system, will be adequately managed for the subsequent period of extended operation.

Additionally, it meets the acceptance criteria in SRP-SLR Section 4.3.2.1.1.3 because the use of the Fatigue Monitoring program is consistent with the SRP-SLR and the program continually monitors and ensures the validity of these TLAAs and triggers corrective actions prior to analyses becoming invalid during the subsequent period of extended operation. The staff's evaluation of the Fatigue Monitoring program is documented in SER Section 3.0.3.2.1, in which the NRC determined that the AMP will be adequate to manage the applicable aging effects.

4.3.2.3 UFSAR Supplement

SLRA Section A.4.3.2 provides the UFSAR supplement summarizing the metal fatigue TLAAs for ASME I Code, Section III, Class 1 components, including the Unit 3 flued-head penetrations for the RHR system,. The staff reviewed SLRA Section A.4.3.2 consistent with the review procedures in SRP-SLR Section 4.3.3.2.

Based on its review of the UFSAR supplement, the staff finds it meets the acceptance criteria in SRP-SLR Section 4.3.2.2 and is therefore acceptable. Additionally, the staff finds that Exelon provided an adequate summary description of its actions to address the TLAAs for the ASME Code, Section III fatigue analyses for Class 1 components, including the Unit 3 flued-head penetrations for the RHR system, as required by 10 CFR 54.21(d).

4.3.2.4 Conclusion

On the basis of its review, the staff concludes that Exelon 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 Class 1 components designed in accordance with the ASME Code, Section III, including the Unit 3 flued-head penetrations for the RHR system, 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 adequate summary description of the metal fatigue of Class 1 components, including the Unit 3 flued-head penetrations for the RHR system, TLAA evaluation for the subsequent period of extended operation, as required by 10 CFR 54.21(d)

4.3.3 ASME Section III, Class 1 Fatigue Waivers

4.3.3.1 Summary of Technical Information in the Application

SLRA Section 4.3.3 describes Exelon's TLAA for evaluation of the original Class 1 fatigue waivers for certain RPV components allowed by ASME Code, Section III, Paragraph N-415.1. Exelon dispositioned the TLAAs for the RPV steam outlet nozzle, liquid control nozzle, instrumentation nozzle, vent nozzle, jet pump instrument nozzle, and RPV drain nozzle in accordance with 10 CFR 54.21(c)(1)(ii) by demonstrating that the analyses have been projected to the end of the subsequent period of extended operation.

4.3.3.2 Staff Evaluation

The staff reviewed Exelon's TLAA for the evaluation of the original Class 1 fatigue waivers for the RPV steam outlet nozzle, liquid control nozzle, instrumentation nozzle, vent nozzle, jet pump instrument nozzle, and RPV drain nozzle, and the corresponding disposition of the TLAA, consistent with the review procedures in SRP-SLR Section 4.3.3.1.1.2.

The staff reviewed the applicant's evaluation of the validity of the Class 1 fatigue waivers for the PBAPS Units 2 and 3 RPV nozzles for the subsequent period of extended operation. The evaluation projected the number and severity of the significant load fluctuations acting at each nozzle over the 80-year life. The staff confirmed that the evaluation showed that the six conditions required by NB-415.1 for a fatigue waiver of the RPV nozzles continued to be met through the subsequent period of extended operation.

The staff finds Exelon has demonstrated, pursuant to 10 CFR 54.21(c)(1)(ii), that the analyses for the evaluation of the original Class 1 fatigue waivers for the RPV steam outlet nozzle, liquid control nozzle, instrumentation nozzle, vent nozzle, jet pump instrument nozzle, and RPV drain nozzle have been projected to the end of the subsequent period of extended operation.

Additionally, the TLAA meets the acceptance criteria in SRP-SLR Section 4.3.2.1.1.2, because Exelon revised the projection of the cumulative number and assumed severity of the cyclic loadings related to the RPV nozzles. The revised projections were verified to be consistent with historical plant operating characteristics and anticipated future operation. The criterion for the original fatigue waivers continues to be met to the end of the subsequent period of extended operation.

4.3.3.3 UFSAR Supplement

SLRA Section A.4.3.3 provides the UFSAR supplement summarizing the re-evaluation of the original Class 1 fatigue waivers for the RPV steam outlet nozzle, liquid control nozzle, instrumentation nozzle, vent nozzle, jet pump instrument nozzle, and RPV drain nozzle. The staff reviewed SLRA Section A.4.3.3 consistent with the review procedures in SRP-SLR Section 4.3.3.2.

Based on its review of the UFSAR supplement, the staff finds it meets the acceptance criteria in SRP-SLR Section 4.3.2.2 and is therefore acceptable. Additionally, the staff finds that Exelon provided an adequate summary description of its actions to address re-evaluation of the original Class 1 fatigue waivers for the RPV steam outlet nozzle, liquid control nozzle, instrumentation nozzle, vent nozzle, jet pump instrument nozzle, and RPV drain nozzle, as required by 10 CFR 54.21(d).

4.3.3.4 Conclusion

On the basis of its review, the staff concludes that Exelon has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(ii), that the analyses for the original Class 1 fatigue waivers for the RPV steam outlet nozzle, liquid control nozzle, instrumentation nozzle, vent nozzle, jet pump instrument nozzle, and RPV drain nozzle 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).

4.3.4 ASME Section III Class 2, Class 3, and ANSI B31.1 Allowable Stress Analyses

4.3.4.1 Summary of Technical Information in the Application

SLRA Section 4.3.4 describes Exelon's allowable stress analyses TLAA for the piping systems designed in accordance with the ASME Code, Section III, Subsections NC, ND, and the American National Standards Institute (ANSI) B31.1. Exelon dispositioned the allowable stress analyses TLAA for the ASME Code, Section III, Class 2, Class 3, and ANSI B31.1 piping systems in accordance with 10 CFR 54.21(c)(1)(i) by demonstrating that the analyses remain valid for the subsequent period of extended operation.

4.3.4.2 Staff Evaluation

The staff reviewed Exelon's allowable stress analyses TLAA for the ASME Code, Section III, Class 2, Class 3, and ANSI B31.1 piping systems and the corresponding disposition of 10 CFR 54.21(c)(1)(i), consistent with the review procedures in SRP-SLR Section 4.3.3.1.1.1.

The staff notes that an explicit analysis of cumulative fatigue usage is not required for the ASME Code, Section III, Class 2, Class 3, and ANSI B31.1 piping, but rather cyclic loading is considered by the implicit method in the design. To account for the cyclic loading, the ASME Code, Section III, Subsections NC, ND, and ANSI B31.1 require a stress range reduction factor be applied to the allowable stress range if the number of equivalent full temperature cycles exceeds the 7,000-cycle limit.

Exelon stated that the evaluation for the stress range reduction factors is based on the number of fatigue cycles anticipated for the life of the component; therefore, it is considered a TLAA requiring evaluation for the subsequent period of extended operation.

Exelon evaluated this TLAA for portions of the ASME Code, Section III, Class 2, Class 3, and ANSI B31.1 piping systems that are connected to Class 1 piping and affected by the thermal and pressure transients that are the same as the operational RCS transients. Exelon identified these piping systems as the control rod drive, core spray, feedwater, main steam, off gas and recombiner, primary containment isolation, reactor recirculation, reactor vessel instrumentation, residual heat removal, and standby liquid control. SLRA Tables 4.3.1-1 and 4.3.1-2 document descriptions of all operational RCS transients and the 80-year projected transient cycles in PBAPS Units 2 and 3, respectively.

Exelon also evaluated this TLAA for the remaining ASME Code, Section III, Class 2, Class 3, and ANSI B31.1 piping systems that are affected by thermal and pressure transients that are different from the operational RCS transients. SLRA Table 4.3.4-2 includes the different transients, and the 80-year projected transient cycles for the auxiliary steam lines, high-pressure coolant injection (steam supply and turbine exhaust piping), reactor water cleanup, reactor core isolation cooling (steam supply and turbine exhaust piping), emergency diesel generator (engine exhaust piping), and fire protection (engine exhaust piping) systems in both PBAPS Units 2 and 3. In addition, SLRA Table 4.3.4-3 documents descriptions of different transients and the 80-year projected transient cycles for the high temperature sample lines in the process sampling system in both PBAPS Units 2 and 3.

Based on its evaluation, Exelon stated that the summation of the 80-year transient cycle projections from each table above for the applicable piping systems is substantially less than 7,000 cycles.

From review of SLRA Tables 4.3.1-1 and 4.3.1-2, the staff confirmed that the total number of the projected thermal and pressure cycles of all operational RCS transients for 80 years in each table will not exceed the allowable 7,000 cycles during the subsequent period of extended operation. Therefore, the staff finds that the stress range reduction factor will not change and the TLAA will remain valid for the subsequent period of extended operation for the ASME Code, Section III, Class 2, Class 3, and ANSI B31.1 affected by the operational RCS transient cycles. Furthermore, the staff noted that the Fatigue Monitoring program will monitor and track actual RCS transient cycles for all limiting locations to ensure corrective actions are taken prior to exceeding the ASME Code, Section III acceptance criteria. Exelon's Fatigue Monitoring program is documented in SLRA Section B.3.1.1, and the staff's evaluation of Exelon's Fatigue Monitoring program is documented in SER Section 3.0.3.2.28. The staff finds that Exelon ensures that the allowable 7,000 cycles will not be exceeded through the subsequent period of extended operation without Exelon taking corrective actions.

From review of SLRA Tables 4.3.4-2 and 4.3.4-3, the staff confirmed that the total number of the 80-year projected thermal and pressure cycles for each applicable piping system will not exceed the allowable 7,000 cycles during the subsequent period of extended operation. Therefore, the staff finds that the stress range reduction factor will not change and the TLAA will remain valid for the subsequent period of extended operation for the ASME Code, Section III, Class 2, Class 3, and ANSI B31.1 piping affected by the thermal and pressure cycles other than the operational RCS transient cycles.

The staff finds Exelon has demonstrated, pursuant to 10 CFR 54.21(c)(1)(i), that the ASME Code, Section III, Class 2, Class 3, and ANSI B31.1 allowable stress analyses remain valid for the subsequent period of extended operation. Additionally, the TLAA analysis meets the acceptance criteria in SRP-SLR Section 4.3.2.1.1.1 because the projected total number of full thermal range transients over the subsequent period of extended operation for the ASME Code, Section III, Class 2, Class 3, and ANSI B31.1 piping does not exceed the 7,000-cycle limit and maintains significant margin to account for unanticipated cycling of the systems.

4.3.4.3 UFSAR Supplement

SLRA Section A.4.3.4 provides the UFSAR supplement summarizing the allowable stress analyses for the ASME Code, Section III, Class 2, Class 3, and ANSI B31.1 piping systems. The staff reviewed SLRA Section A.4.3.4 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. Additionally, the staff finds that Exelon provided an adequate summary description of its actions to address the ASME Code, Section III, Class 2, Class 3, and ANSI B31.1 allowable stress analyses, as required by 10 CFR 54.21(d).

4.3.4.4 Conclusion

On the basis of its review, the staff concludes that Exelon has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(i), that the allowable stress analyses for the ASME Code, Section III, Class 2, Class 3, and ANSI B31.1 piping systems 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).

4.3.5 Environmental Fatigue Analyses for Reactor Pressure Vessel and Class 1 Piping

4.3.5.1 Summary of Technical Information in the Application

SLRA Section 4.3.5 describes Exelon’s TLAA for environmentally assisted fatigue (EAF) in the RPV and ASME Code, Class 1 piping at the PBAPS. Exelon dispositioned the EAF TLAA for the RPV and Class 1 piping in accordance with 10 CFR 54.21(c)(1)(iii) by demonstrating that the effects of EAF on the intended functions of the components will be adequately managed by the Fatigue Monitoring program for the subsequent period of extended operation.

4.3.5.2 Staff Evaluation

The staff reviewed Exelon’s TLAA for the RPV and Class 1 piping and the corresponding disposition of 10 CFR 54.21(c)(1)(iii), consistent with the review procedures in SRP-SLR Section 4.3.3.1.2.3.

In SLRA Section 4.3.5, Exelon stated that the environmental fatigue calculations for 80 years of operation were prepared in accordance with NUREG/CR-6909, Revision 1 (ADAMS Accession No. ML14087A068). Specifically, Exelon estimated the 80-year environmental cumulative usage factor (CUF_{en}) values in accordance with the environmental factor formulas and fatigue design curves described in NUREG/CR-6909, Revision 1. The environmental factor and CUF_{en} calculations also considered the specific materials (i.e., carbon and low alloy steels, stainless steels, and nickel-chromium-iron (Ni-Cr-Fe) alloys) for the RPV and piping locations.

The staff noted that the applicant's use of the methods in NUREG/CR-6909, Revision 1, is appropriate for the EAF analysis because the methods are consistent with SRP-SLR Section 4.3.2.1.2, GALL-SLR Report AMP X.M1 (Fatigue Monitoring program), and RG 1.207, Revision 1.

SLRA Table 4.3.1-3 describes the projected CUF_{en} values of the limiting (critical and bounding) locations for 80 years of operation. SLRA Sections 4.3.1 and 4.3.5 also indicate that the Fatigue Monitoring program will be used to calculate and monitor the CUF_{en} values of the limiting locations for the subsequent period of extended operation. The staff's evaluations for specific aspects of the EAF analyses are described below.

During its audit, the staff noted that the following vendor report discusses the applicant's plant transients related to fatigue analysis and monitoring: SIR-99-091, Revision 0, "Report on System Review and Recommendations for a Transient and Fatigue Monitoring System at Peach Bottom Atomic Power Station," dated September 1999. The plant transients and associated cycle numbers addressed in this reference are used as input for the applicant's fatigue analyses that are described in SLRA Sections 4.3.1 and 4.3.5.

Specifically, Tables 2.1 and 2.2 of SIR-99-091, Revision 0, indicate that some transient cycles will not be included in the automatic counting by the fatigue monitoring software (SI:FatiguePro™ software) because the transients are difficult to track or have insufficient impact on fatigue (e.g., transients related to weekly power reductions). SIR-99-091, Revision 0, also indicates that these cycles will be preloaded in the fatigue monitoring software and therefore there is a need for users to ensure that the actual cycle numbers are reasonable in comparison with the preloaded cycle numbers.

In comparison, SLRA Tables 4.3.1-1 and 4.3.1-2 describe the design transients used in the applicant's fatigue analyses, including the EAF analysis. The staff noted that these tables do not identify or discuss any preloaded transients that are addressed in SIR-99-091, Revision 0. In addition, SLRA Section 4.3.5 does not discuss the applicant's activities or evaluations to confirm that the actual cycle numbers for preloaded transients (if any) are less than the design basis cycle numbers. Therefore, the staff found the need for additional information, which resulted in the issuance of an RAI.

RAI 4.3.5-1 and Exelon's response are documented in ADAMS Accession No. ML19122A289. In its response, Exelon explained that the SIR-99-091 report was issued in 1999 and served as a recommendation report for the implementation of the SI:FatiguePro software prior to the installation of the software at PBAPS. Exelon also stated that this report documented background information relevant to the PBAPS Fatigue Monitoring program, including transients identified in the fatigue monitoring procedures and in GE thermal cycle diagrams.

Exelon further explained that if one of the following criteria is applied to a design transient, the design transient is not monitored by the fatigue monitoring software as discussed in the SIR-99-091 report. The following bullets also describe the applicant's final dispositions regarding the preloading of design transients in the fatigue monitoring software.

- The transients involve insignificant changes in pressure and temperature, thereby causing no impact on fatigue (e.g., design transients related to potential weekly power reductions/recoveries and reactor vessel drain nozzle on/off flow). Because the transients in this category do not need to be monitored, they are not preloaded in the fatigue monitoring software.
- For the "reactor vessel head spray injection" transient, the associated nozzle has been capped. Since this transient is no longer applicable to PBAPS, it is not preloaded in the fatigue monitoring software.

- The transients are based on a one-time faulted event (e.g., "pipe rupture and blowdown" transient). The transients in this category are not preloaded in the fatigue monitoring software.
- The transient would be difficult to track. For the transient, the fatigue monitoring software assumes and preloads a conservative number of occurrences to bound the number of transient occurrences for the plant operation. The transient in this category is the "control rod drive isolation" transient (50 cycles preloaded for 80 years of operation). The contribution of this transient to the CUF_{en} value of the control rod drive nozzle is insignificant (less than 0.001 compared to a CUF_{en} value of 0.186 for 80 years of operation).

The staff finds Exelon's response acceptable because Exelon has provided an acceptable basis for not monitoring certain design transients by the fatigue monitoring software. RAI 4.3.5-1 is resolved.

SLRA Section 4.3.5 addresses the determination of the limiting locations in the EAF analysis, stating that the EAF analysis and monitoring include the component locations listed in NUREG/CR-6260 (ADAMS Accession No. ML14087A068) for the older-vintage BWR plants (GE Model 4 BWRs) as applicable to PBAPS. Exelon also explained that as part of the EAF TLAA, environmental fatigue screening was performed to identify other critical locations that may be more limiting than the NUREG/CR-6260 locations. Exelon indicated that a CUF_{en} threshold of 0.25 is used in the screening process to ensure that the limiting locations are appropriately identified for EAF monitoring and corrective actions are taken before the actual CUF_{en} values exceed the CUF_{en} limit (1.0).

In its review, the staff noted that the NUREG/CR-6260 recommends that the following component locations be included in the EAF analysis for the older vintage BWR plants: (1) reactor vessel shell and lower head; (2) reactor vessel feedwater nozzle; (3) reactor recirculation piping (including inlet and outlet nozzles); (4) core spray line reactor vessel nozzle and associated Class 1 piping; (5) residual heat removal (RHR) return line Class 1 piping; and (6) feedwater line Class 1 piping. The staff noted that the guidance in NUREG/CR-6260 is applied to the EAF analysis for PBAPS because PBAPS (BWR/4 design) belongs to the older vintage BWR category.

SLRA Table 4.3.1-3 describes the limiting locations and associated 80-year CUF_{en} values for the EAF analysis. In comparison with the NUREG/CR-6260 locations, the staff noted that SLRA Table 4.3.1-3 does not provide the EAF analysis results for the core spray line piping location. In addition, the SLRA does not provide justification for the omission of the core spray piping location in SLRA Table 4.3.1-3. Therefore, the staff found the need for additional information, which resulted in the issuance of a RAI.

RAI 4.3.5-2 and Exelon's response are documented in ADAMS Accession No. ML19122A289. In its response, Exelon stated that the limiting location with the maximum stresses was identified as the core spray nozzle at the reactor vessel. Exelon explained that this is due to the geometric discontinuities within the nozzle and the proximity of the nozzle to the hot reactor vessel, thereby creating the largest transient stresses for cold fluid injections.

In its review, the staff finds that Exelon's response is acceptable and RAI 4.3.5-2 is resolved because (1) Exelon confirmed that in the stress and fatigue analyses for the core spray system, the limiting location for EAF was determined to be the core spray nozzle location; and (2) the limiting core spray nozzle location will be monitored by the Fatigue Monitoring program. The staff also noted that the core spray nozzle location is projected to have an 80-year CUF_{en} value of 0.510 as listed in SLRA Table 4.3.1-3, which meets the acceptance criterion for the EAF analysis (not to exceed 1.0).

As discussed in SLRA Section 4.3.5, Exelon performed environmental fatigue screening to determine the limiting locations for EAF in addition to the NUREG/CR-6260 locations. SLRA Table 4.3.1-3 lists the projected 80-year CUF_{en} values for the limiting locations in the RPV and Class 1 piping. The screening process to determine the limiting locations is summarized below.

The screening process includes all component locations that have a CUF value in the current licensing basis (e.g., RPV nozzles; RPV shells; and recirculation, RHR, feedwater and main steam piping). Any locations that were previously exempt from fatigue usage analysis are also reviewed to ensure that these locations are still exempt for 80 years of operation.

All component locations currently monitored by the fatigue monitoring software are screened-in for the more detailed EAF analysis. Exelon will continue to monitor these locations for EAF by using the Fatigue Monitoring program during the subsequent period of extended operation.

Exelon further performed screening evaluation for the component locations that are in contact with reactor water and had not been monitored by the Fatigue Monitoring program, as described in SLRA Section 4.3.5.

SLRA Section 4.3.5 includes the screening process to determine the limiting locations that have not been monitored for environmental fatigue. In the screening process, the locations are first screened based on 80-year non-environmental CUF values. The selected locations are further evaluated considering the environmental adjustment factor (F_{en}) to determine whether the projected 80-year CUF_{en} values for the screening purpose exceed the screening threshold (0.25) for the limiting locations.

In its review, the staff noted that the applicant's screening method may inappropriately omit locations that have a relatively low non-environmental CUF value but have a very high F_{en} value even though such locations may result in a CUF_{en} value greater than the screening threshold (0.25). Therefore, the staff found the need for additional information, which resulted in the issuance of an RAI.

RAI 4.3.5-4 and Exelon's response are documented in ADAMS Accession No. ML19122A289. In its response, Exelon identified the locations that were screened out based on CUF values less than 0.25 as follows: (a) "RPV Region B1 (Ni-Cr-Fe)/Shroud Support" (Juncture 3) location; (b) "Core Spray Nozzles (stainless steel)/Thermal Sleeve Location 3"; and (c) steam dryer locations.

Exelon also provided the following information to confirm that these screened-out locations are bounded by the limiting locations or evaluated in another TLAA section of the SLRA.

"RPV Region B1 (Ni-Cr-Fe)/Shroud Support" (Juncture 3) location is bounded by location 23 described in SLRA Table 4.3.1-3, which is "RPV Region B1 (Ni-Cr-Fe)/Shroud Support, Baffle Plate to Vessel Juncture" (Juncture A) location.

“Core Spray Nozzles (stainless steel)/Thermal Sleeve Location 3” is bounded by location 2 described in SLRA Table 4.3.1-3, which is “Core Spray Nozzles (SS)/Thermal Sleeve Juncture 9” location.

The fatigue analysis associated with steam dryers is separately described in SLRA Section 4.3.6.5.

As part of the response, Exelon also confirmed that the other screened-out components (not selected as the limiting locations) are bounded by the limiting locations or are no longer in service (i.e., the capped control rod drive return line nozzle). Exelon further stated that the conservatively projected 80-year CUF_{en} values for these screened-out components do not exceed the CUF_{en} limit (1.0).

As discussed above, the staff finds Exelon’s response to RAI 4.3.5-4 acceptable, and RAI 4.3.5-4 is resolved because: (1) the screened-out component locations are either bounded by the limiting locations, evaluated in a separate TLAA section, or are no longer in service; and (2) the limiting locations will be monitored as the leading locations for EAF by the Fatigue Monitoring program.

SLRA Section 4.3.5 indicates that the limiting locations for EAF have CUF_{en} values greater than the screening threshold (0.25). The SLRA also indicates that after the screening process for determining the limiting locations, the more detailed EAF analysis is performed and the CUF_{en} values are monitored by the Fatigue Monitoring program. However, it was not clear to the staff what method is used in the more detailed EAF analysis. Therefore, the staff determined the need for additional information, which resulted in the issuance of an RAI.

RAI 4.3.5-3 and Exelon’s response are documented in ADAMS Accession No. ML19122A289. In its response, Exelon explained that the more detailed EAF analysis calculates the CUF_{en} values for the limiting locations in accordance with NUREG-6909, Revision 1, as documented in SLRA Table 4.3.1-3. Exelon also clarified that in the detailed EAF analysis and CUF_{en} calculations, the 80-year transient cycle numbers are based on the projections of the actual cumulative cycle numbers to date (as of December 31, 2015). Exelon further clarified that in the detailed EAF analysis, the F_{en} values are based on the actual operating temperatures of the components, not on the conservatively assumed maximum temperatures.

In comparison, Exelon indicated that the EAF screening process used more conservative design cycle numbers of transients and F_{en} values than the detailed EAF analysis. For example, the screening process uses the 80-year transient cycle numbers that are based on the linear extrapolation of conservative design cycle numbers (e.g., two times 40-year design cycle numbers). In addition, the screening process used F_{en} values based on the maximum temperature for the component.

In its review, the staff finds Exelon’s response acceptable because the applicant clarified that in the detailed EAF analysis performed after the screening process, the actual cumulative numbers of transient cycles are used in the 80-year cycle projections and the actual operating conditions of the components are used in the F_{en} calculations. RAI 4.3.5-3 is resolved.

As evaluated above, the staff finds that the detailed EAF analysis is acceptable because: (1) the analysis was performed in accordance with NUREG-6909, Revision 1, consistent with SRP-SLR Section 4.3.2.1.2 and GALL-SLR Report AMP X.M1; (2) the NUREG/CR-6260 locations were adequately evaluated in the analysis; (3) for each material type within a thermal zone (i.e., thermal zones are groupings of locations that undergo essentially the same thermal and pressure transients during plant operations), the screening process considered the highest CUF and bounding F_{en} value; and (4) the screening process used a CUF_{en} threshold of 0.25, which is sufficiently low to select the limiting locations for EAF analysis and monitoring.

In addition, Exelon indicated the following with respect to the use of the Fatigue Monitoring program: Environmental fatigue will be managed by the Fatigue Monitoring program using the SI:FatiguePro software, including periodic validation of cycles and water chemistry parameters that contribute to F_{en}. The Fatigue Monitoring program includes requirements that initiate corrective actions if any CUF_{en} values exceed 80 percent of the ASME Code, Section III acceptance criterion. Corrective actions may include revision of the affected environmental fatigue analysis to qualify an increased number of cycles determined to bound 80 years of operation, repair and replacement activities, or establishing an inspection program using an approach acceptable to the NRC (such as an inspection program performed in accordance with Appendix L of ASME Code, Section XI based on flaw tolerance analysis) prior to the CUF_{en} value exceeding the allowed value.

The staff finds that Exelon adequately proposed the use of the Fatigue Monitoring program to manage the effects of EAF for the RPV and Class 1 piping, as evaluated and found acceptable in SER Section 3.0.3.2.28.

The staff finds Exelon has demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of EAF on the intended functions of the RPV and Class 1 piping will be adequately managed for the subsequent period of extended operation. The staff also finds that the EAF TLAA meets the acceptance criteria in SRP-SLR Section 4.3.2.1.2.3 because the applicant has demonstrated that the effects of reactor water environment on fatigue have been adequately addressed and will be managed by the Fatigue Monitoring program.

4.3.5.3 UFSAR Supplement

SLRA Section A.4.3.5 provides the UFSAR supplement summarizing the TLAA for EAF in the RPV and Class 1 piping. The staff reviewed SLRA Section A.4.3.5 consistent with the review procedures in SRP-SLR Section 4.3.3.2.

Based on its review of the UFSAR supplement, the staff finds it meets the acceptance criteria in SRP-SLR Section 4.3.2.2 and is therefore acceptable. Additionally, the staff finds that Exelon provided an adequate summary description of its actions to address the TLAA for EAF, as required by 10 CFR 54.21(d).

4.3.5.4 Conclusion

On the basis of its review, the staff concludes that Exelon 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 RPV and Class 1 piping 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).

4.3.6 Reactor Vessel Internals Fatigue Analysis

4.3.6.1 Generic BWR Fatigue Analyses for Various Reactor Vessel Internal Components

4.3.6.1.1 Summary of Technical Information in the Application

SLRA Section 4.3.6.1 describes Exelon's TLAA evaluation of the generic BWR fatigue analyses for the RVI. Exelon dispositioned the fatigue TLAA for the RVI in accordance with 10 CFR 54.21(c)(1)(ii) by demonstrating that the fatigue analyses have been projected to the end of the subsequent period of extended operation (i.e., up to 80 years of operation). The generic fatigue analyses for the core shroud are separately addressed in SLRA Section 4.3.6.2.

4.3.6.1.2 Staff Evaluation

The staff reviewed Exelon's TLAA evaluation on the generic fatigue analyses for BWR RVI and the corresponding disposition of 10 CFR 54.21(c)(1)(ii), consistent with the review procedures in SRP-SLR Section 4.3.3.1.1.2.

SLRA Table 4.3.6.1-1 lists the 40-year, 60-year, and 80-year CUF values for various RVI (e.g., core shroud, core plate, top guide and jet pump riser brace), with the 80-year CUF values determined by doubling the 40-year values, except for the core shroud. The staff noted that, except for the core shroud, the projected 80-year CUF values for the RVI meet the acceptance criteria (i.e., do not exceed the CUF limit of 1.0). A more detailed evaluation of the shroud fatigue analyses is provided in SLRA Section 4.3.6.2 and the staff's evaluation of the core shroud fatigue analyses is separately documented in Section 4.3.6.2 of this SER.

The staff noted that all of the projected 80-year transient cycle numbers in SLRA Tables 4.3.1-1 and 4.3.1-2 are significantly less than double the number of the 40-year design transients, except for transient number 27a, "HPCI [high-pressure coolant injection system] Injection," and 27b, RCIC [reactor core isolation cooling system] Injection." Exelon stated that, although the projected 80-year transient cycle numbers for transient numbers 27a and 27b exceed twice the numbers originally assumed for the design transients, the overall effect of these transients on bulk reactor coolant temperature and fatigue damage to the RVI is insignificant. Exelon also explained that, since the HPCI and RCIC flow is injected into the reactor vessel through the feedwater lines and not directly into the reactor vessel, the resulting thermal stresses on the RVI are negligible.

As discussed above, the staff noted that, for the generic BWR RVI fatigue analyses, the applicant used essentially double the 40-year generic design cycle numbers in the projections of the 80-year cycle numbers and CUF values at PBAPS, by doubling the 40-year CUF values. The staff also noted that Exelon adequately determined that the potential impact of HPIC and RCIC injection transients on the fatigue analyses is insignificant. The staff finds that these approaches support the adequacy of the applicant's TLAA evaluation on the generic BWR RVI fatigue analyses because the 80-year CUF values are projected by doubling the 40-year CUF values and the HPIC and RCIC transients cause insignificant impact on the fatigue analyses.

However, the staff noted that Note 1 of SLRA Tables 4.3.1-1 and 4.3.1-2 indicates that transient numbers 1 through 28 are based on the original GE reactor thermal cycle diagrams. Note 1 of the SLRA tables also indicates that transient numbers 29 through 33 were added in the fatigue TLAA for subsequent license renewal because the transients are associated with other transients that contribute to fatigue usage. Transient numbers 29 through 33 are the following transients: No. 29, “SRV [safety relief valve] LIFT” transient; No. 30, “Loss of RWCU [reactor water cleanup] and Restart of RWCU” transient; No. 31, “Operating-Basis Earthquake” transient; No. 32, “Faulted Condition – Safe Shutdown Earthquake” transient; and No. 33, “FW [feedwater] Temp Reduction” transient. A review of the added transients could not clarify if the design cycles analyzed in the generic RVI fatigue analyses (based on the GE reactor thermal cycle diagrams) considered the effects of PBAPS transient numbers 29 through 33 on RVI fatigue. Therefore, the staff determined the need for additional information, which resulted in the issuance of RAI 4.3.6.1-1.

Exelon’s response to RAI 4.3.6.1-1 is documented in ADAMS Accession No. ML19143A053. In its response, Exelon stated that the generic BWR RVI fatigue analyses consider the effects of the “Operating Basis Earthquake [OBE]” transient (No. 31) but did not consider the effects of transient numbers 29, 30, 32, and 33 because these transients do not apply to BWR RVI.

In its review, the staff finds that the applicant’s response regarding the OBE transient (No. 31) is acceptable because the applicant clarified that: (1) the OBE transient was not included in the GE thermal cycle diagrams because the transient does not cause bulk fluid temperature and pressure changes; and (2) the OBE mechanical loads are included in both the 40-year original fatigue analyses and the 80-year fatigue analyses. Therefore, the effects of OBE are adequately considered in the fatigue analyses.

For the SRV lift transient (No. 29), the response states that this transient involves the temperature and pressure changes in the torus and containment, resulting from SRV lifts, and is not applicable to the RVI. The staff finds acceptable the exclusion of this transient from fatigue analyses for the RVI because it is not applicable.

For the loss of reactor water cleanup (RWCU) and restart of RWCU transient (No. 30), the response states that this transient is used in the fatigue analyses for the replaced residual heat removal system piping, and has insignificant fatigue impact on the RVI. The staff finds acceptable the exclusion of this transient from fatigue analyses for the RVI because it has insignificant fatigue impact on the RVI.

The response also stated the safe shutdown earthquake transient (No. 32) is a one-time event under the faulted condition, and the transient definition specifies the loads due to a safe shutdown earthquake (SSE) stress loadings concurrent with multiple SRV lifts. The staff finds acceptable the exclusion of this transient for the RVI because (a) this is a one-time faulted transient and (b) the stress loads associated with the SSE transient are used only in the fatigue analyses of torus penetrations but are not applied to the RVI fatigue.

The feedwater temperature reduction transient (No. 33) was added to the Fatigue Monitoring program to more accurately calculate fatigue usage on various reactor vessel components. This transient is not applicable to the RVI because the associated feedwater temperature change of 20 °F is small and feedwater will mix with reactor coolant before reaching the RVI. The staff finds acceptable the exclusion of this transient from fatigue analyses for the RVI because it has insignificant fatigue impact on the RVI.

Based on the applicant’s response as described above, RAI 4.3.6.1-1 is resolved.

In the SLRA, the applicant also stated that the previous submittals for EPU and MUR requests documented that the 40-year and 60-year CUF values for the following components are negligible: (a) control rod drive housing; (b) control rod guide tube; (c) orificed fuel support;

(d) shroud head and steam separator assembly (including shroud head bolts); (e) access hole cover; (f) in-core housing and guide tube; and (g) core differential pressure and liquid control line. The staff finds that the applicant adequately confirmed that the 80-year CUF values for these components are negligible and significantly less than the CUF acceptance criterion (not exceeding 1.0), consistent with the existing fatigue analyses incorporated in the current licensing basis.

The staff finds Exelon has demonstrated, pursuant to 10 CFR 54.21(c)(1)(ii), that the generic fatigue analyses for the RVI have been projected to the end of the subsequent period of extended operation. Additionally, the TLAA evaluation for the generic RVI fatigue analyses meets the acceptance criteria in SRP-SLR Section 4.3.2.1.1.2 because the applicant has demonstrated that the 80-year CUF values are conservatively projected and shown to remain valid throughout the subsequent period of extended operation. Therefore, the staff finds that there is reasonable assurance that the CUF values of the RVI will not exceed the acceptance limit of 1.0 during the subsequent period of extended operation.

4.3.6.1.3 UFSAR Supplement

SLRA Section A.4.3.6.1 provides the UFSAR supplement summarizing the TLAA for the generic BWR RVI fatigue analyses. The staff reviewed SLRA Section A.4.3.6.1, 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. Additionally, the staff finds that Exelon provided an adequate summary description to address the TLAA for the generic BWR RVI fatigue analyses, as required by 10 CFR 54.21(d).

4.3.6.1.4 Conclusion

On the basis of its review, the staff concludes that Exelon has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(ii), that the generic fatigue analyses for BWR RVI 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).

4.3.6.2 Generic BWR Fatigue Analyses for the Core Shroud

4.3.6.2.1 Summary of Technical Information in the Application

SLRA Section 4.3.6.2 describes the generic BWR fatigue analyses for the reactor vessel core shroud. Exelon dispositioned the fatigue TLAA for the core shroud in accordance with 10 CFR 54.21(c)(1)(i) by demonstrating that the analyses remain valid for the subsequent period of extended operation.

4.3.6.2.2 Staff Evaluation

The staff reviewed Exelon's fatigue TLAA for the core shroud and the corresponding disposition of 10 CFR 54.21(c)(1)(i), consistent with the review procedures in SRP-SLR Section 4.3.3.1.1.1 and acceptance criteria in Section 4.3.2.1.1.1.

SLRA Section 4.3.6.2 states that the generic BWR fleet 40-year and 60-year CUF values for the core shroud are 0.593 and 0.89, respectively. Exelon stated that these generic fatigue analysis results were addressed in the PBAPS EPU license amendment submittal (September 2012) and MUR power uprate license amendment submittal (February 2017) to the NRC. Exelon also stated that the generic fatigue analyses were used to demonstrate that the core shroud is structurally qualified for 60 years of operation under the EPU and MUR operating conditions. The staff noted that the PBAPS submittals for the EPU and MUR power uprates were approved in the NRC letters dated August 25, 2014, and November 15, 2017, respectively (ADAMS Accession Nos. ML14133A046 and ML17286A013, respectively).

Exelon indicated that the analyses used a worst-case approach to define the geometry, and thermal and mechanical stresses. The analyses assumed the following transients:

- Event 1, "Cooldown –- Loss of AC [alternating current] Power Natural Circulation Restart," 15 cycles,
- Event 2, "Cooldown –- LPCI [low pressure coolant injection] During Vessel Startup & Shutdown," 10 cycles, and
- Event 3, "Operational Basis Earthquake (OBE)," 10 cycles.

Exelon indicated that, in the generic analyses, events 1 and 2 contribute to the majority (approximately 95 percent) of the 40-year CUF value. Exelon explained that events 1 and 2 are not specified on the PBAPS reactor thermal cycle diagrams and were not originally part of the CLB of PBAPS. Exelon stated that, for events 1 and 2, the generic BWR fatigue analyses assumed reactor vessel and LPCI system configurations that are different from the PBAPS configurations. Exelon also stated that the PBAPS reactor vessels do not have LPCI nozzles and, at PBAPS, LPCI is an operating mode of the residual heat removal (RHR) system.

Exelon further explained that the potentially colder LPCI/RHR injection fluid will mix with hotter reactor coolant in the recirculation loop piping before it enters the reactor vessel through the recirculation inlet nozzles and jet pumps. In addition, Exelon clarified that the resulting thermal stresses on the core shroud are negligible compared to those predicted in the generic fatigue analyses that are based on 40 °F fluid impinging directly on the core shroud.

Based on the evaluations above, Exelon determined that the generic core shroud fatigue analyses represent very conservative fatigue analysis results for the core shroud. Exelon also confirmed that PBAPS Units 2 and 3 have not experienced any cycles of events 1 or 2 since the beginning of operation up to May 2017. Exelon further confirmed that the PBAPS site has not experienced an OBE event (event 3) since the beginning of operation up to May 2017.

In its review, the staff noted that the transient cycles assumed in the generic fatigue analyses conservatively bound the PBAPS transient cycles for 80 years of operation. The staff finds that significant conservatism exists in the generic fatigue analyses when they are applied for the PBAPS core shroud and therefore the analyses are valid through the subsequent period of extended operation.

The staff finds that Exelon has demonstrated, pursuant to 10 CFR 54.21(c)(1)(i), that the generic BWR fatigue analyses for the core shroud remain valid for the subsequent period of extended operation. Additionally, the fatigue TLAA for the core shroud meets the acceptance criteria in SRP-SLR Section 4.3.2.1.1.1 because the applicant has appropriately demonstrated that the transient cycles assumed in the generic fatigue analyses conservatively bound the

PBAPS transient cycles for 80 years of operation. The staff also finds there is reasonable assurance that the 80-year CUF of the core shroud will not exceed the acceptance limit (1.0) for the subsequent period of extended operation.

4.3.6.2.3 UFSAR Supplement

SLRA Section A.4.3.6.2 provides the UFSAR supplement summarizing the fatigue TLAA for the core shroud. The staff reviewed SLRA Section A.4.3.6.2 consistent with the review procedures in SRP-SLR Section 4.3.3.2.

Based on its review of the UFSAR supplement, the staff finds it meets the acceptance criteria in SRP-SLR Section 4.3.2.2 and is therefore acceptable. Additionally, the staff finds that Exelon provided an adequate summary description to address the fatigue TLAA for the core shroud, as required by 10 CFR 54.21(d).

4.3.6.2.4 Conclusion

On the basis of its review, the staff concludes that Exelon has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(i), that the generic BWR fatigue analysis for the core shroud remains 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).

4.3.6.3 Core Shroud Support Fatigue Analysis Reevaluation

4.3.6.3.1 Summary of Technical Information in the Application

SLRA Section 4.3.6.3 describes Exelon's TLAA for core shroud support fatigue reevaluation. Exelon dispositioned the fatigue TLAA for the core shroud support in accordance with 10 CFR 54.21(c)(1)(iii) by demonstrating that the effects of fatigue on the intended functions of the core shroud support will be adequately managed by the Fatigue Monitoring program for the subsequent period of extended operation.

4.3.6.3.2 Staff Evaluation

The staff reviewed Exelon's fatigue TLAA for the core shroud support and the corresponding disposition of 10 CFR 54.21(c)(1)(iii), consistent with the review procedures in SRP-SLR Section 4.3.3.1.2.3.

SLRA Section 4.3.6.3 indicates that, as described in Section 4.3.2 of the first PBAPS license renewal application, the core shroud support fatigue analysis was reevaluated in 1998 to consider the effects of the sudden recirculation pump start transient. SLRA Section 4.3.6 also indicates that the reevaluation conservatively computed a non-environmental CUF of 0.834 for the first license renewal term (60-year operation).

The staff noted that SLRA Section 4.3.6.3 and Table 4.3.1-3 (80-year CUF table) do not provide the projected 80-year CUF for the core shroud support in comparison with the existing CUF values for the component. The staff found that such a comparison with the existing CUF calculations was needed to confirm that the 80-year CUF is a reasonable projection for the core shroud support. Therefore, the staff determined the need for additional information, which resulted in the issuance of RAI 4.3.6.3-1.

Exelon’s response and supplement to the response are documented in ADAMS Accession Nos. ML19122A289 and ML19163A223, respectively. In its supplemental response, Exelon indicated that the following transient cycles are used in the core shroud support fatigue reevaluation TLAA for subsequent license renewal: (a) 16 cycles of the “sudden start of pump in cold recirculation loop” transient, (b) 8 cycles of the “scram – loss of feedpumps – isolation valves close” transient, (c) 144 cycles of the “startup and heatup (100 °F/hour maximum)” transient, and (d) 52 cycles of the “design hydrostatic test to 1,250 psig” transient.

Exelon also explained that these cycles are based on the 80-year projected cycles for the core shroud support of PBAPS Unit 3 that is more limiting than the 80-year projected cycles for the core shroud support of PBAPS Unit 2 in the fatigue analysis. Exelon clarified that the 40-year fatigue analysis addressed in the initial license renewal application assumed 40 cycles of the “sudden start of pump in cold recirculation loop” transient in comparison with 16 cycles projected for 80 years of operation in the subsequent license renewal fatigue TLAA.

The staff finds that the response is acceptable because Exelon clarified that: (a) the “sudden start of pump in cold recirculation loop” transient is the major transient that contributes to the CUF and environmental CUF (CUF_{en}) values for the core shroud support, (b) the 40-year CUF value (0.834) addressed in the first license renewal application is significantly higher than the projected 80-year CUF value (0.2395) because the number of the transient cycles assumed for the 40-year CUF analysis was very conservative compared to those used in the 80-year CUF calculations, (c) the 80-year CUF value is based on the projections of the actual cycle numbers that have been monitored for the core shroud support at PBAPS, (d) the projected 80-year CUF_{en} value (0.726) is less than the CUF_{en} limit, and (e) Exelon will continue to use the Fatigue Monitoring program to ensure that the CUF_{en} value will not exceed the CUF_{en} limit by monitoring the transient cycles and taking corrective actions as needed.

As discussed above, SLRA Section 4.3.6.3 indicates that the fatigue reevaluation performed in 1998 for the core shroud support considers the “sudden start of pump in cold recirculation loop” transient. In comparison, the staff noted that SLRA Table 4.3.1-1 addresses plant design transients for fatigue TLAAs, including another recirculation loop transient, that is, the “improper start of cold recirculation loop” transient.

The staff noted that SLRA Section 4.3.6.3 does not clearly discuss why the fatigue analysis for the core shroud support does not include the “improper start of cold recirculation loop” transient, which is another recirculation loop transient and may be similar to the “sudden start of pump in cold recirculation loop” transient. Therefore, the staff determined the need for additional information, which resulted in the issuance of RAI 4.3.6.3-2.

Exelon’s response is documented in ADAMS Accession No. ML19122A289. With respect to the “improper start of cold recirculation loop” transient, Exelon stated that the reactor is operating with an isolated idle recirculation loop and the reactor coolant in the isolated loop has cooled down to 130 °F. A transient is then assumed when the idle loop is improperly aligned to the reactor by suddenly opening the recirculation loop motor-operated isolation valve. In the transient, the idle recirculation pump remains out of service and this situation allows the other inservice recirculation pump to drive flow through the idle loop in the reverse direction into the reactor vessel. Exelon further explained that in this case the cold water from the idle loop is injected into the reactor vessel via the recirculation pump suction line and reactor vessel outlet nozzle and into the downcomer above the jet pump shroud support plate. Exelon clarified that the cold reactor coolant is not directly injected to the core shroud support location and the recirculation flow rate remains at approximately 50 percent of the normal flow rate because only one recirculation pump is inservice.

In its review, the staff finds that the response to the RAI is acceptable because Exelon clarified: (a) the definition of the “improper start of cold recirculation loop” transient, and (b) the transient does not cause significant thermal stresses for the core shroud support based on the reactor coolant flow path and rate of the transient. RAI 4.3.6.3-2 is resolved

SLRA Section 4.3.6.3 confirms that the Fatigue Monitoring program (SLRA Section B.3.1.1) continues to monitor the transient cycles and CUF_{en} values for the core shroud support. Specifically, the staff noted that the applicant’s fatigue monitoring includes the bounding locations of the core shroud support (locations 22 and 23 in SLRA Table 4.3.1-3) to ensure that corrective action is taken prior to exceeding the acceptance criterion of 1.0 for CUF_{en} through the subsequent period of extended operation.

The staff finds that Exelon has demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of fatigue on the intended functions of the core shroud support will be adequately managed for the subsequent period of extended operation. Additionally, the TLAA for the core shroud support fatigue reevaluation meets the acceptance criteria in SRP-SLR Section 4.3.2.1.2.3 because the applicant has demonstrated that the effects of fatigue on the core shroud support have been adequately addressed and will be managed by the Fatigue Monitoring program. Therefore, the core shroud support fatigue reevaluation will remain valid, and the acceptance limit (1.0) for CUF_{en} will not be exceeded during the subsequent period of extended operation by monitoring the transient cycles and taking corrective actions as necessary.

The staff’s evaluation of the Fatigue Monitoring program is documented in SER Section 3.0.3.2.28, which determined that the AMP will be adequate to manage the applicable aging effects.

4.3.6.3.3 UFSAR Supplement

SLRA Section A.4.3.6.3 provides the UFSAR supplement summarizing the TLAA for the core shroud support fatigue reevaluation. The staff reviewed SLRA Section A.4.3.6.3 consistent with the review procedures in SRP-SLR Section 4.3.3.2. Based on its review of the UFSAR supplement, the staff finds it meets the acceptance criteria in SRP-SLR Section 4.3.2.2 and is therefore acceptable. Additionally, the staff finds that Exelon provided an adequate summary description of its actions to address the TLAA for the core shroud support fatigue reevaluation, as required by 10 CFR 54.21(d).

4.3.6.3.4 Conclusion

On the basis of its review, the staff concludes that Exelon 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 core shroud support 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).

4.3.6.4 Jet Pump Diffuser/Core Shroud Support Plate Fatigue Analysis

4.3.6.4.1 Summary of Technical Information in the Application

SLRA Section 4.3.6.4 describes Exelon's fatigue TLAA for the jet pump diffuser/core shroud support plate. Exelon dispositioned the fatigue TLAA for the jet pump diffuser/core shroud support plate in accordance with 10 CFR 54.21(c)(1)(iii) by demonstrating 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.

4.3.6.4.2 Staff Evaluation

The staff reviewed Exelon's fatigue TLAA for the jet pump diffuser/core shroud support plate and the corresponding disposition of 10 CFR 54.21(c)(1)(iii), consistent with the review procedures in SRP-SLR Section 4.3.2.1.2.3.

Exelon stated that a 40-year cumulative fatigue usage factor (CUF) value of 0.35 and a 60-year CUF value of 0.525 for the jet pump diffuser/core shroud support plate were documented in the first PBAPS license renewal application (LRA). Since the first PBAPS Units 2 and 3 LRA projected a 60-year CUF, this projection represents a TLAA that must be re-evaluated for the subsequent period of extended operation.

Exelon stated that it committed in the first PBAPS Units 2 and 3 LRA to enhance the Fatigue Monitoring program to include automated transient cycle counting and automated calculation and tracking of fatigue CUFs for bounding locations in the RPV internals. As a result, Exelon installed SI:FatiguePro™ cycle counting and fatigue usage factor tracking software to monitor fatigue and calculate CUFs for bounding component locations in 2010. Among these bounding locations, Exelon has been monitoring "Jet Pump Shroud Support, Diffuser Weld to Baffle Plate" location number 24 by SI:FatiguePro™. In 2015, Exelon updated the SI:FatiguePro™ software to also include the calculation and tracking of environmentally assisted fatigue usage (CUF_{en}). As a result, SLRA Table 4.3.1-3 documents the CUF_{en} value for the bounding location of the "Jet Pump Shroud Support, Diffuser Weld to Baffle Plate" (i.e., location number 24; nickel–chromium–iron material). From its review of SLRA Section B.3.1.1 and SLRA Table 4.3.1-3, the staff confirmed that the projected 80-year CUF_{en} value associated with location number 24 is 0.984, which is below the acceptance criterion of 1.0. Furthermore, the staff finds that Exelon will monitor location number 24 and ensure that corrective action is taken prior to exceeding the acceptance criterion of 1.0.

The staff finds Exelon has demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of fatigue on the intended functions of the jet pump diffuser/core shroud support plate 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 Exelon's Fatigue Monitoring program monitors and tracks the transient cycles assumed in the analysis and performs corrective action prior to exceeding the CUF acceptance criterion of 1.0.

Exelon's Fatigue Monitoring program is documented in SLRA Section B.3.1.1, and the staff's evaluation finding the program acceptable is documented in Section 3.0.3.2.28 of this SER.

4.3.6.4.3 UFSAR Supplement

SLRA Section A.4.3.6.4 provides the UFSAR supplement summarizing the fatigue analysis for the jet pump diffuser/core shroud support plate. The staff reviewed SLRA Section A.4.3.6.4 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. Additionally, the staff finds that Exelon provided an adequate summary description of its actions to address the jet pump diffuser/core shroud support plate fatigue analysis, as required by 10 CFR 54.21(d).

4.3.6.4.4 Conclusion

On the basis of its review, the staff concludes that Exelon 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 jet pump diffuser/core shroud support plate 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).

4.3.6.5 Replacement Steam Dryer Stress Report and Fatigue Evaluation

4.3.6.5.1 Summary of Technical Information in the Application

SLRA Section 4.3.6.5 describes Exelon's fatigue TLAA for the replacement steam dryer. Exelon dispositioned the fatigue TLAA for the replacement steam dryer in accordance with 10 CFR 54.21(c)(1)(i) by demonstrating that the analysis remains valid for the subsequent period of extended operation.

4.3.6.5.2 Staff Evaluation

The staff reviewed Exelon's fatigue TLAA for the replacement steam dryer and the corresponding disposition of 10 CFR 54.21(c)(1)(i), consistent with the review procedures in SRP-SLR Section 4.3.3.1.1.1.

To support the EPU operation in 2014, Exelon replaced the steam dryer for PBAPS Units 2 and 3. Exelon performed the structural design evaluations of the replacement steam dryer under the EPU conditions in accordance with the 2007 Edition and 2008 Addenda of the ASME Code, Section III, Subsection NG. As part of the design evaluations, Exelon calculated the cumulative fatigue usage factor (CUF) value due to applicable transients and load cycles assumed for the life of the replacement steam dryer. The calculated CUF value for the replacement steam dryer is 0.0015, which is less than the allowable CUF value of 1.0. Exelon's design evaluation showed that the primary contributors to the CUF of 0.0015 are 400 startup and shutdown transient cycles and one operating basis earthquake (OBE) event with 63 cycles. SLRA Tables 4.3.1-1 and 4.3.1-2 documented applicable transients projected for the subsequent period of extended operation for PBAPS Units 2 and 3, respectively.

From its review of Exelon's structural design evaluations for the replacement steam dryer, SLRA Tables 4.3.1-1 and 4.3.1-2, the staff confirmed that (1) the primary contributors to the CUF are the startup and shutdown transient cycles and the stress cycles associated with the OBE event, and (2) the projected number of fatigue cycles over the subsequent period of extended operation are bounded by the fatigue cycles assumed in the design evaluation of the replacement steam dryer. Therefore, the existing fatigue evaluation of the replacement steam dryer remains valid for the subsequent period of extended operation.

The staff finds Exelon has demonstrated, pursuant to 10 CFR 54.21(c)(1)(i), that the analysis for the replacement steam dryer remains valid for the subsequent period of extended operation. Additionally, the TLAA analysis meets the acceptance criteria in SRP-SLR Section 4.3.2.1.1.1 because (1) the projected number of fatigue cycles over the subsequent period of extended operation is bounded by the fatigue cycles assumed in the design evaluation of the replacement steam dryer, and (2) the calculated CUF value remains less than 1.0.

4.3.6.5.3 UFSAR Supplement

SLRA Section A.4.3.6.5 provides the UFSAR supplement summarizing the fatigue analysis for the replacement steam dryer. The staff reviewed SLRA Section A.4.3.6.5 consistent with the review procedures in SRP-SLR Section 4.3.3.2.

Based on its review of the UFSAR supplement, the staff finds it meet the acceptance criteria in SRP-SLR Section 4.3.2.2 and is therefore acceptable. Additionally, the staff finds that Exelon provided an adequate summary description of its actions to address the replacement steam dryer stress report and fatigue evaluation, as required by 10 CFR 54.21(d).

4.3.6.5.4 Conclusion

On the basis of its review, the staff concludes that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(i), that the fatigue analysis for the replacement steam dryer remains 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).

4.3.7 High-Energy Line Break Analyses Based on Cumulative Fatigue Usage

4.3.7.1 Summary of Technical Information in the Application

SLRA Section 4.3.7 describes Exelon’s high-energy line break (HELB) fatigue analysis TLAA for recirculation system piping and RHR system piping, which were designed in accordance with the ASME Boiler and Pressure Vessel Code, Section III, Class 1 requirements and evaluated for cyclical loading impacts through performance of CUF analyses for the components. Exelon dispositioned its HELB fatigue analysis TLAA in accordance with 10 CFR 54.21(c)(1)(iii) by demonstrating that the effects of fatigue of these components on the intended functions will be adequately managed by the Fatigue Monitoring program for the subsequent period of extended operation.

4.3.7.2 Staff Evaluation

The staff reviewed Exelon’s HELB fatigue analysis TLAA consistent with the review procedures in SRP-SLR Section 4.3.3.1.1.3. The staff confirmed that the HELB analysis determined the need for restraining intermediate piping segments (including those in the Class 1 portions of the recirculation and RHR piping systems) based on a CUF acceptance criterion of 0.1, where the piping design would need to include a pipe whip restraint if the analyzed CUF value is greater than a value of 0.1. The staff also confirmed that the acceptance criteria in SRP-SLR

Section 4.3.2.1.1.3 and the guidance in GALL-SLR Report AMP X.M1, "Fatigue Monitoring," identify that the Fatigue Monitoring program corresponding to the program in GALL-SLR Report AMP X.M1 may be used to disposition CUF analyses or other types of cyclical loading analyses in accordance with 10 CFR 54.21(c)(1)(iii).

Based on its review of SLRA Section 4.3.7, the staff determined Exelon appropriately dispositioned its TLAA for the recirculation system piping and RHR system piping components in accordance with 10 CFR 54.21(c)(1)(iii), so that the effects of aging on the intended function will be adequately managed by the Fatigue Monitoring program for the subsequent period of extended operation. The staff finds Exelon's disposition acceptable because the Fatigue Monitoring program will continue to monitor and ensure the validity of the TLAAs and trigger corrective actions prior to analyses becoming invalid during the subsequent period of extended operation.

The staff finds Exelon has demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of fatigue on the intended functions of Class 1 components designed in accordance with the ASME Code, Section III, will be adequately managed for the subsequent period of extended operation.

Additionally, it meets the acceptance criteria in SRP-SLR Section 4.3.2.1.1.3 because the use of the Fatigue Monitoring program is consistent with the SRP-SLR and the program continually monitors and ensures the validity of the TLAA and triggers corrective actions prior to analyses becoming invalid during the subsequent period of extended operation. The staff's evaluation of the Fatigue Monitoring program is documented in SER Section 3.0.3.2.28, which determined that the AMP will be adequate to manage the applicable aging effects.

4.3.7.3 UFSAR Supplement

SLRA Section A.4.3.7 provides the UFSAR supplement summarizing the HELB fatigue analyses for ASME Boiler and Pressure Vessel Code, Section III, Class 1 Components. The staff reviewed SLRA Section A.4.3.7 consistent with the review procedures in SRP-SLR Section 4.3.3.2.

Based on its review of the UFSAR supplement, the staff finds it meets the acceptance criteria in SRP-SLR Section 4.3.2.2 and is therefore acceptable. Additionally, the staff finds that Exelon provided an adequate summary description of its actions to address the HELB fatigue analyses, as required by 10 CFR 54.21(d).

4.3.7.4 Conclusion

On the basis of its review, the staff concludes that Exelon has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(iii), that the HELB TLAA 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 adequate summary description of the HELB TLAA evaluation for the subsequent period of extended operation, as required by 10 CFR 54.21(d).

4.3.8 Inservice 60-Year RPV Closure Head Weld Flaw Analyses

4.3.8.1 Summary of Technical Information in the Application

SLRA Section 4.3.8 describes Exelon's TLAA for inservice 60-year RPV closure head weld flaw analysis. Exelon dispositioned the TLAA for the PBAPS Units 2 and 3 RPV closure head welds in accordance with 10 CFR 54.21(c)(1)(i) by demonstrating that the analyses remain valid for the subsequent period of extended operation.

The applicant performed three separate flaw evaluations on the PBAPS Units 2 and 3 RPV closure head welds, as described in the SLRA. Each of the flaw analyses is based on the fatigue growth of the identified flaws. The relevant transient cycles used in the fatigue analysis were (1) bolt-up, (2) hydrostatic test, and (3) heatup-cooldown. Each of the analyses was based on the same number of transient cycles as follows: (1) 100 bolt-up cycles, (2) 195 hydrostatic test cycles, and (3) 245 heatup-cooldown cycles. These assumptions were conservative because they ignored actual cycles that occurred prior to the 2001–2002 time frame. For all three transients, the number of cycles projected to the end of the 80-year period of operation is less than the numbers assumed in the original flaw evaluations for 60 years. Therefore, the applicant stated that the flaw evaluations remain valid for the subsequent period of extended operation (i.e., 80 years).

4.3.8.2 Staff Evaluation

The staff reviewed Exelon's TLAA for the RPV closure head welds and the corresponding disposition of flaw evaluations performed on the PBAPS Units 2 and 3 RPV closure head welds, consistent with the review procedures in SRP-SLR Section 4.7.3.1.1.

The staff reviewed the original 2001, 2002, and 2010 flaw evaluations and the assumptions used. The staff confirmed that the numbers of cycles for each transient relevant to the flaw analysis projected by the applicant for the 80-year time period was less than those assumed in the flaw evaluations and, therefore, Exelon's flaw evaluations are acceptable.

The staff finds Exelon has demonstrated, pursuant to 10 CFR 54.21(c)(1)(i), that the analyses for the PBAPS Units 2 and 3 RPV closure head weld flaw analyses remain valid for the subsequent period of extended operation. Additionally, the flaw evaluations meet the acceptance criteria in SRP-SLR Section 4.7.2.1.1 because the number of cycles for each transient used in the evaluations of flaws in the RPV closure head are bounding for the subsequent period of extended operation.

4.3.8.3 UFSAR Supplement

SLRA Section A.4.3.8 provides the UFSAR supplement summarizing the inservice 60-year RPV closure head weld flaw analyses. The staff reviewed SLRA Section A.4.3.8 consistent with the review procedures in SRP-SLR Section 4.7.1.2.

Based on its review of the UFSAR supplement, the staff finds it meets the acceptance criteria in SRP-SLR Section 4.7.2.2 and is therefore acceptable. Additionally, the staff finds that Exelon provided an adequate summary description of its actions to address inservice 60-year RPV closure head weld flaw analyses, as required by 10 CFR 54.21(d).

4.3.8.4 Conclusion

On the basis of its review, the staff concludes that Exelon has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(i), that the RPV closure head weld flaw analyses for PBAPS Units 2 and 3 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).

4.4 Environmental Qualification of Electric Equipment

4.4.1 Summary of Technical Information in the Application

SLRA Section 4.4 describes Exelon's TLAA for evaluation of environmental qualification (EQ) 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. Exelon 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" AMP described in SLRA Section B.3.1.3 for the subsequent period of extended operation.

4.4.2 Staff Evaluation

The staff reviewed Exelon'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 EQ requirements established by Criterion 4, "Environmental and Dynamic Effects Design Bases," of Appendix A to 10 CFR Part 50 and 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. An EQ program that is in accordance with the requirements of 10 CFR 50.49, is considered an adequate AMP for the purposes of license renewal. Electric components in Exelon's EQ program identified as having a qualified life equal to, or greater than, the current operating term (i.e., 60 years) are considered a TLAA for subsequent license renewal.

The staff reviewed SLRA Section 4.4 and the associated program basis documents to determine that Exelon's EQ program meets the requirements of 10 CFR 54.21(c)(1). Exelon's EQ program is implemented in accordance with the requirements of 10 CFR 54.21(c)(1)(iii) to show that components evaluated under Exelon's TLAA evaluation are adequately managed during the subsequent period of extended operation. The staff reviewed Exelon's EQ program, including the management of aging effects, to confirm that electric equipment requiring environmental qualification 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 B.3.1.3 and the program basis documents, including reports reviewed by the staff during the audit. Based on the staff review of SLRA Section B.3.1.3 and audit result, the staff concludes that Exelon's EQ program elements are consistent with the GALL-SLR Report AMP X.E1. The staff's evaluation finding Exelon's Environmental Qualification of Electric Equipment AMP acceptable is documented in SER Section 3.0.3.2.30.

The staff also reviewed Exelon's EQ program reanalysis attributes evaluation and concludes that it is consistent with SRP-SLR Section 4.4.3.1.2 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). Exelon stated that environmentally qualified equipment must be refurbished, replaced, or have its qualification extended prior to reaching the aging limits established in the aging evaluation.

Based on its review, the staff finds Exelon has demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of thermal, radiation, and cyclical aging on plant electrical and instrumentation components located in harsh environments and 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. Exelon's EQ program manages the effects of thermal, radiation, and cyclic aging through the use of aging evaluation based on 10 CFR 50.49(f) qualification methods. As required by 10 CFR 50.49(e)(5), EQ components are refurbished, replaced, or their qualification is extended prior to reaching the aging limit established in the evaluation.

4.4.3 UFSAR Supplement

SLRA Section A.4.4.1 addresses thermal, radiation, and cyclical aging analyses of plant electrical and I&C components, developed to meet 10 CFR 50.49 requirements, as time-limited aging analyses (TLAAs) for PBAPS. SLRA section A.3.1.3 provides the UFSAR supplement summarizing the EQ of electric equipment. The staff reviewed SLRA sections A.4.4.1 and A.3.1.3 consistent with the review procedures in SRP-SLR Section 4.4.3.2.

Based on its review of the UFSAR supplement, the staff finds it meets the acceptance criteria in SRP-SLR Section 4.4.3.2 and is therefore acceptable. Additionally, the staff determines that Exelon 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

On the basis of its review, the staff concludes that Exelon has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(iii), that the Environmental Effects of Electric Equipment TLAA will be adequately managed by the Environmental Qualification 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 states that the PBAPS containment does not contain prestressed tendons; therefore, this topic is not a TLAA. The staff reviewed the applicant's UFSAR and noted that the

PBAPS containment is a Mark I steel containment and does not contain prestressed tendons. A TLAA for prestressed tendons is not necessary.

4.6 Primary Containment Fatigue Analyses

SLRA Section 4.6 identifies and evaluates TLAAs related to primary containment fatigue analyses. SLRA Section 4.6.1 describes primary containment structures, penetrations, and associated components with fatigue analyses, and SLRA Section 4.6.2 describes the fatigue analyses for the bellows of the process lines that penetrate the primary containment.

SLRA Section 4.6 also identifies PBAPS Unit 2 and Unit 3 primary containment structures, penetrations, and associated components that were determined not to have an existing fatigue analysis and therefore have no fatigue TLAAs. The claim that the drywell and its components do not have fatigue analyses and therefore do not have TLAAs is evaluated below.

Drywell and Its Components

Summary of Technical Information in the Application

SLRA Section 4.6 describes Exelon's disposition for the drywell and its components,including the drywell shell, drywell head, drywell personnel airlock, drywell equipment hatches, drywell CRD removal hatch, drywell electrical penetrations, and drywell mechanical penetrations except for bellows and the Unit 3 RHR supply and return line flued-head penetrations which the applicant discussed in SLRA sections 4.6.2 and 4.3.2, respectively. Exelon stated that PBAPS has no existing fatigue analyses for these components (with the above exceptions) and therefore it has no fatigue TLAAs. Exelon also stated that "[t]he original design for the Primary Containment for both units was in accordance with ASME Section III, Subsection B, 1965 Edition with addenda through the Summer of 1966, which did not require an evaluation of fatigue." However, as part of the reactor circulation and RHR system piping replacement in the 1980s, the Unit 3 drywell flued-head penetrations for the RHR system were also replaced and analyzed for fatigue in accordance with ASME Section III, Class 1 requirements. Exelon considers these fatigue analyses to be TLAAs and the addressed them in SLRA Section 4.3.2. The staff's evaluation of ASME Section III, Class I components, including these RHR penetrations, is documented in SER Section 4.3.2.

Staff Evaluation

The staff reviewed Exelon's drywell shell, drywell head, drywell personnel airlock, drywell equipment hatches, drywell CRD removal hatch, drywell electrical penetrations, and drywell mechanical penetrations for PBAPS and the corresponding disposition that these components are not identified as TLAAs, consistent with the review procedures in SRP-SLR Section 4.1.3.

To assess the applicant's disposition of these components, the staff also reviewed SLRA Section B.2.1.30, "ASME Section XI, Subsection IWE," which states that PBAPS "primary containment was designed in accordance with ASME Section III, 1965 edition and applicable addenda through the Summer 1966 edition." The SLRA also states that "[n]o fatigue analysis or exemption/waiver was required per this code year or original construction specifications as permitted by later code year editions." The staff then reviewed Section 5.2 of the PBAPS UFSAR and confirmed that "[t]he primary containment is designed, fabricated, and inspected in compliance with the requirements of ASME Boiler and Pressure Vessel Code, Section III, Subsection B (1965) with all applicable addenda through Summer 1966." The staff also reviewed Subsection B of the ASME Code Section III, 1965 Edition with addenda through the summer of 1966, and further confirmed that there are no Code requirements for cyclic operations for components designed to Subsection B.

However, during the staff's in-office audit of (ADAMS Accession No. ML19205A206 for the in-office audit report), the staff found that generic fatigue evaluations may be considered for the drywell shell and drywell head. In discussions with Exelon on January 17, 2019 and docketed as a supplement to the SLRA dated March 5, 2019 (ADAMS Accession No. ML19065A008), the staff noted that the referenced report was exploratory to provide recommendations to Exelon, but it was not necessary because the ASME Code Section III Code requirements were met in the original design. A subsequent SLRA supplement (Supplement 2) submitted to the NRC on January 23, 2019 (ADAMS Accession No. ML19023A015), included waivers for the drywell shell, drywell head, drywell personnel airlock, drywell equipment hatches, drywell CRD removal hatch, drywell electrical penetrations and drywell mechanical penetrations. The submitted waivers were to "justify the ASME Section XI, Subsection IWE aging management program (B.2.1.30) exception that visual or surface examinations are not necessary on these containment components."

The staff reviewed Exelon's disposition that the drywell and its components do not have TLAAs and found it acceptable, because there are no ASME Section III code of record requirements to perform fatigue analyses for such components, and there are no fatigue assessments or referenced fatigue calculations in the UFSAR for the described components that meet the TLAA criteria defined in 10 CFR 54.3(a).

The staff finds that Exelon has demonstrated, pursuant to 10 CFR 54.3(a), that there are no TLAA requirements for the drywell shell, drywell head, drywell personnel airlock, drywell equipment hatches, drywell CRD removal hatch, drywell electrical penetrations, and drywell mechanical penetrations (except for the Unit 3 RHR supply and return line flued-head penetrations and containment process line penetration bellows, which are evaluated in SER sections 4.3.2 and 4.6.2, respectively) for the subsequent period of extended operation.

UFSAR Supplement

The staff finds Exelon's exclusion of the drywell and its components from the UFSAR supplement for SLRA Section 4.6 acceptable because the drywell shell, drywell head, drywell personnel airlock, drywell equipment hatches, drywell CRD removal hatch, drywell electrical penetrations, and drywell mechanical penetrations (except for the Unit 3 RHR supply and return line flued-head penetrations and containment process line penetration bellows, which are evaluated in SER sections 4.3.2 and 4.6.2, respectively) associated with this section are not TLAAs.

Conclusion

On the basis of its review, the staff concludes that Exelon has provided an acceptable demonstration, pursuant to 10 CFR 54.3(a), that that the effects of cyclic loading on the drywell structure and its components do not require a TLAA review for the subsequent period of extended operation.

4.6.1 Primary Containment Structures, Penetrations, and Associated Components with Fatigue Analyses

4.6.1.1 Summary of Technical Information in the Application

SLRA Section 4.6.1 describes Exelon's TLAA for the torus shell, torus penetrations, drywell-to-torus vents, SRV discharge piping, other piping attached to the torus, drywell-to-torus vent bellows, and replacement RHR and core spray suction strainers. Exelon dispositioned the TLAAs of these components in accordance with 10 CFR 54.21(c)(1)(iii) by demonstrating that the effects of fatigue due to cyclic loadings on the intended functions of listed components will be adequately managed by SLRA Section B.3.1.1, "Fatigue Monitoring" AMP for the subsequent period of extended operation.

4.6.1.2 Staff Evaluation

The staff reviewed Exelon's TLAA for the torus shell, torus penetrations, drywell-to-torus vents, SRV discharge piping, other piping attached to the torus, drywell-to-torus vent bellows, and replacement RHR and core spray suction strainers, and the corresponding disposition 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.

The review procedures of SRP-SLR state that the applicant may propose an AMP corresponding to GALL-SLR Report AMP X.M1 as the basis for managing cumulative fatigue damage or cracking due to fatigue or cyclical loading in the structures or components. The SRP-SLR also states that the applicant's proposed AMP is reviewed for consistency against the program elements defined in GALL-SLR Report AMP X.M1.

The staff reviewed SLRA Section 4.6.1 and noted that Exelon plans to manage the effects of cyclic loading that could result in cumulative fatigue damage or fatigue-induced cracking on the intended functions of the components with the SLRA Section B.3.1.1, "Fatigue Monitoring" AMP. The staff also noted that the SI:FatiguePro™ software monitors the cyclic loading and calculates the cumulative usage factors (CUFs) at two locations (torus shell, torus penetrations) for both PBAPS Units 2 and 3 torus shell, torus penetrations, drywell-to-torus vents, safety relief valve (SRV) discharge piping, other piping attached to the torus, drywell-to-torus vent bellows, replacement RHR and core spray suction strainers. In addition, the NRC staff reviewed and evaluated other relevant SLRA sections against NRC guidance and past reviews (e.g., NUREG-1769) to assess the effectiveness of the Fatigue Monitoring AMP to manage the effects of cyclic loading.

Subsequent to the above reviews and audit discussions, Exelon supplemented the SLRA by letter dated March 5, 2019 (ADAMS Accession No. ML19065A008), further clarifying the consistency of the PBAPS fatigue monitoring AMP with GALL-SLR Report AMP X.M1, and its ability to manage the effects of cyclic loading on the intended functions of SLRA Section 4.6.1 TLAA components. The staff reviewed Exelon's clarifications from the March 5, 2019, supplement to resolve concerns regarding consistency of its proposed Fatigue Monitoring AMP with GALL-SLR Report AMP X.M1, as follows:

(a) Discrepancies between SLRA Section 4.6.1 and Appendix Q.5.4.1 of the UFSAR for 10 CFR 54.21(c)(1) dispositioning of components having CUFs less than 0.4, affecting program element "parameters monitored or inspected": Exelon stated that the PBAPS UFSAR indicating that components having CUFs less than 0.4

dispositioned as 10 CFR 54.21(c)(1)(i) applies to the period of extended operation of the first license renewal. Exelon also stated that "[t]he SLRA 10 CFR 54.21(c)(1)(iii) disposition results in the actual number of transients being monitored" and this "disposition for these components reflects that the (fatigue monitoring) program has monitored these locations as of 2018 and is appropriate for the subsequent period of extended operation." Exelon further stated that upon approval of the SLRA, a new appendix will be added to the UFSAR outlining fatigue monitoring during the subsequent period of extended operation.

The staff reviewed Exelon's supplemental information and found it to be acceptable, because its Fatigue Monitoring AMP uses the SI:FatiguePro™ that performs more detailed monitoring and tracking of the number of transients for calculating CUFs consistent with the "parameters monitored or inspected" program element of the GALL-SLR Report, than those based on an assumed number of transients used when dispositioning the first renewed license TLAAs as 10 CFR 54.21(c)(1)(i).

(b) Limited number of fatigue monitoring locations, affecting program element "parameters monitored or inspected": Exelon stated that the "Torus(CS[carbon steel])/Torus Shell" and "Torus Penetration (CS)/Torus Shell" are critical monitoring locations based on the greatest thermal, pressure, and seismic alternating stresses identified by detailed analyses and the fatigue curves of ASME Code Section III determining the allowable number of transient cycles. Exelon also stated that these analyses resulted in a bounding cumulative usage factor (CUF) for all other locations of SLRA Section 4.6.1 primary containment structures, penetrations, and associated components with TLAAs.

The staff reviewed Exelon's supplemental information and found it to be acceptable, because the PBAPS fatigue monitoring AMP assesses the performance of specified critical transient monitoring locations of higher severity and number of transient cycles to calculate bounding CUFs for all other Section 4.6.1 component locations, consistent with the "parameters monitored or inspected" program element of GALL-SLR Report AMP X.M1.

(c) Recorded CUF values necessary to trigger corrective actions and further evaluations, affecting program element "corrective actions": Exelon stated that SI:FatiguePro™ is an automated transient cycle counting software that calculates CUFs from cyclic loading information received from the two aforementioned critical monitoring locations. Exelon also stated that when a monitored location indicates cyclic loading resulting in a SI:FatiguePro™ calculation of a CUF greater than 0.8, then the triggering condition and its effects on all of the TLAA components described in SLRA Section 4.6.1 will be evaluated so that licensing and design basis CUFs are not exceeded. Exelon further stated that if a plant transient occurs outside of the bounding parameters, that condition will also be entered into corrective actions and subsequently evaluated. The supplement also states that significant degradation that could impact existing fatigue analysis would be evaluated and corrective actions would be taken (e.g., refining the impacted fatigue analysis to include the degradation, or repair or replacement).

The staff reviewed Exelon's supplemental information and found it to be acceptable because it clarified that when a CUF value exceeds 0.8 or when plant transients not bounded by the existing program definition occur at these locations, corrective actions and evaluations ensue for all of the listed TLAA Section 4.6.1 components. This is consistent with the "corrective actions" program element of GALL-SLR Report

AMP X.M1, which states that the program provides for corrective actions that include more rigorous analyses of components to prevent design fatigue analyses limits from being exceeded during the subsequent period of extended operation.

(d) Loss of material affecting fatigue-life (corrosion-fatigue), affecting program element “acceptance criteria”: Exelon stated that the existing fatigue analyses are based on global analyses that are unaffected by isolated, localized loss of material. These analyses also meet the ASME Section XI, Subsection, IWE AMP acceptance criteria in SLRA Section Appendix B.2.1.30. Exelon also stated that the fatigue analyses incorporate inherent conservative inputs, assumptions, and methods to bound minor loss of material conditions. Exelon further stated that all degraded conditions exceeding the ASME Section XI, Subsection, IWE acceptance criteria are entered into the corrective action program and evaluated as noted in (c).

The staff reviewed Exelon’s supplemental information and found it to be acceptable, because:

(1) It considered all appropriate environments, including water, consistent with the “acceptance criteria” program element of GALL-SLR Report AMP X.M1 in conjunction with the “acceptance criteria” of GALL-SLR Report AMP XI.S1, “ASME Section XI, Subsection IWE” for all degraded conditions. These conditions were identified in the SLRA as local or global loss of material impacting existing design and fatigue analyses.

(2) The IWE “acceptance criteria’” were developed so that conditions meeting such criteria would have no impact on the overall global analysis, including fatigue analyses. However, when necessary, such conditions are entered into the “corrective actions” program and evaluated.

(e) Operating experience program element: Exelon stated that as of December 31, 2016, operating experience has shown that the actual loading cycles processed by the SI:FatiguePro™ at “Torus (CS)/Torus Shell” monitoring location were: (1) 57 and 36 SRV lifts for PBAPS Unit 2 and PBAPS Unit 3, respectively, (2) 0 SSEs, (3) 0 OBEs, and (4) 0 chugging cycles. Exelon also stated that the resulting CUFs were 0.06085 and 0.03843, for PBAPS Unit 2 and PBAPS Unit 3, respectively, which are a fraction of the licensing and design basis CUF value of 0.942 and the projected CUF value of 0.862 to the end of the subsequent period of extended operation. Exelon further stated that the projected reduction in design CUF values for the “Torus(CS)/Torus Shell” and “Torus Penetration (CS)/Torus Shell” monitoring locations (from CUFs of 0.942 and 0.992 to CUFs of 0.591 and 0.862 through the subsequent period of extended operation, respectively), is due to 80 years of conservatively projected transient cycle occurrences.

Exelon stated that at each of the two monitoring locations the licensing and design basis used: (1) 800 SRV lifts (with each resulting in 13 loading cycles); (2) 1 SSE; (3) 5 OBEs; and (4) 11,390 chugging cycles that yielded CUFs of 0.942 and 0.992, respectively. Exelon also stated that the 80-year projected CUFs at “Torus(CS)/Torus Shell” and “Torus Penetration (CS)/Torus Shell” are based on: (1) 800 SRV lifts, (2) 1 SSE, (3) 1 OBE, and (4) 3,037 chugging cycles.

The staff reviewed Exelon’s supplemental information and found it to be acceptable, because the applicant reviewed its operating experience relative to fatigue cracking at selected locations. Exelon confirmed that it is consistent with the review procedures of the “operating experience” program element that the current

SI:FatiguePro™ calculated CUFs at PBAPS Units 2 and 3. Further, the Torus(CS)/Torus Shell" and "Torus Penetration (CS)/Torus Shell" monitoring locations are a fraction of the original calculated CUFs based on conservatively calculated cyclic loading through the subsequent period of extended operation.

The staff finds the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of cyclic loading that could result in cumulative fatigue damage or fatigue-induced cracking on the intended functions of the TLAA components (i.e., PBAPS torus shell, torus penetrations, drywell-to-torus vents, safety relief valve (SRV) discharge piping, other piping attached to the torus, drywell-to-torus vent bellows, replacement RHR and core spray suction strainers) will be adequately managed for the subsequent period of extended operation.

Additionally, the applicant's TLAA input for the above-described components meets the acceptance criteria in SRP-SLR Section 4.6.2.1.1.3 because Exelon has demonstrated that it meets the requirements of 10 CFR 54.21(c)(1)(iii) to manage the effects of cumulative fatigue damage/cracking due to cyclic loadings on the intended functions of PBAPS torus shell, torus penetrations, drywell-to-torus vents, safety relief valve (SRV) discharge piping, other piping attached to the torus, drywell-to-torus vent bellows, replacement RHR and core spray suction strainers) in accordance with SLRA Section B.3.1.1, "Fatigue Monitoring" AMP.

The staff's evaluation of the Fatigue Monitoring program is documented in SER Section 3.0.3.2.28, which determined that the AMP will be adequate to manage the applicable aging effects.

4.6.1.3 UFSAR Supplement

SLRA Section A.4.6.1 provides the UFSAR supplement summarizing the effects of fatigue due to cyclic loading for the torus shell, torus penetrations, drywell-to-torus vents, safety relief valve (SRV) discharge piping, other piping attached to the torus, drywell-to-torus vent bellows, replacement RHR and core spray suction strainers. The staff reviewed SLRA Section A.4.6.1 consistent with the review procedures in SRP-SLR Section 4.6.3.2.

The staff also noted that Exelon committed (Commitment No. 44) to enhance the fatigue monitoring AMP as applicable to TLAA Section 4.6.1 for fatigue analyses and monitored component location CUF updates based on operating experience, plant modifications, inspection findings, changes to transient definitions, and unanticipated newly discovered fatigue loading events.

Based on its review of the UFSAR supplement, the staff finds it meets the acceptance criteria in SRP-SLR Section 4.6.3.2 and is therefore acceptable. Additionally, the staff finds that Exelon provided an adequate summary description of its actions to address the effects of fatigue due to cyclic loading for the torus shell, torus penetrations, drywell-to-torus vents, safety relief valve (SRV) discharge piping, other piping attached to the torus, drywell-to-torus vent bellows, replacement RHR and core spray suction strainers, as required by 10 CFR 54.21(d).

4.6.1.4 Conclusion

On the basis of its review, the staff concludes that Exelon has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of fatigue due to cyclic loading that could result in cumulative fatigue damage or fatigue-induced cracking on the intended functions of the torus shell, torus penetrations, drywell-to-torus vents, safety relief valve (SRV) discharge piping, other piping attached to the torus, drywell-to-torus vent bellows, replacement RHR and core spray suction strainers will be adequately managed by the fatigue monitoring AMP for the subsequent period of extended operation. The staff also concludes that the UFSAR supplement contains an adequate summary description of TLAA evaluation for the subsequent period of extended operation, as required by 10 CFR 54.21(d).

4.6.2 Containment Process Line Penetration Bellows

4.6.2.1 Summary of Technical Information in the Application

SLRA Section 4.6.2 describes Exelon's TLAAs for the bellows of the process lines that penetrate the primary containment. The applicant dispositioned the TLAAs for the bellows of the main steam lines, the feedwater lines, the HPCI steam line, the RHR supply and return lines, the RWCU pump suction line, the core spray discharge lines, and the vessel head spray line in accordance with 10 CFR 54.21(c)(1)(i) by demonstrating that the analyses remain valid for the subsequent period of extended operation.

4.6.2.2 Staff Evaluation

The staff reviewed Exelon's TLAAs for the containment process line penetration bellows, including the bellows for the main steam lines, the feedwater lines, the HPCI steam line, the RHR supply and return lines, the RWCU pump suction line, the core spray discharge lines, and the vessel head spray line, and the corresponding disposition of 10 CFR 54.21(c)(1)(i), consistent with the review procedures in SRP-SLR Section 4.6.3.1.1.1.

The staff reviewed the design specifications for the containment expansion joints during the audit (ADAMS Accession No. ML19205A206 for the in-office audit report) and confirmed the applicable codes and cyclic loadings described in SLRA Section 4.6.2. During the review of the "Design Specification 1187- P-314(Q)," the staff noted that the equipment specified was installed at both PBAPS Units 2 and 3 and that the "effects of relative end point displacement[s] resulting from thermal and seismic movements" were to be considered in the fatigue evaluation, which contradicted in part the description provided in SLRA Section 4.6.2.

By letter dated March 5, 2019 (ADAMS Accession No. ML19065A008), Exelon supplemented the SLRA clarifying that, although the cited design was applicable to both units, only PBAPS Unit 3 RHR system process line bellows were replaced. Exelon also stated that the lack of specifications for startup-shutdowns typically cycling from 0 psig at 70 °F to 2 psig at 150 °F for the replaced bellows was not a concern because the applicable ASME Code Section III 1980 Edition with Winter 1981 Addenda did not require consideration for startup-shutdown cyclic loading as opposed to that of the 1968 ASME Code Section III original design requirements. Exelon further stated that both the original and newer bellows were designed to 1,500 design basis accident (DBA) transient cycles of pressure and thermal cycling from 2 psig at 150 °F to 56 psig at 281 °F, which significantly bound those of startup-shutdown transient cyclic requirements. Exelon further stated that the assumed DBA transient cycles of pressure and thermal cycling of the replaced bellows resulted in the same maximum allowable stresses and displacements as those specified in the original bellows designs and led to the issuance of a vendor certificate of conformance.

The staff reviewed Exelon's supplemental information and found it to be acceptable because:

(a) the projected 186 and 140 startup/heatup (100 °F/hr) and corresponding 4 and 2 excessive rate startup/heatup (greater than 100 ºF/hr, less than 160 ºF/hr.) transient cycles for PBAPS Units 2 and 3 are less than the anticipated transients during the assumed 1,500 design basis accident transient cycles of pressure and thermal cycling, and

(b) as of the SLRA submittal, seismic cyclic loading of 0 OBEs and 0 SSEs has not exceeded the original design of assumed 5 OBEs and 1 SSE, and as discussed in SER Section 4.6.1, the projected 1 OBE and 1 SSE for the subsequent period of extended operation.

The staff finds Exelon has demonstrated, pursuant to 10 CFR 54.21(c)(1)(i), that the analyses for the containment process line penetration bellows remain valid for the subsequent period of extended operation.

Additionally, the applicant's TLAA input for the above-described components meets the acceptance criteria in SRP-SLR Section 4.6.2.1.1.1, because the original designs, consistent with applicable ASME Code Section III requirements, provide a significant margin in anticipated pressure and thermal cycling, and seismic maximum allowable stresses and displacements that could occur during the subsequent period of extended operation.

4.6.2.3 UFSAR Supplement

SLRA Section A.4.6.2 provides the UFSAR supplement summarizing the TLAA of the containment process line penetration bellows. The staff reviewed SLRA Section A.4.6.2 consistent with the review procedures in SRP-SLR Section 4.6.3.2.

Based on its review of the UFSAR supplement, the staff finds it meets the acceptance criteria in SRP-SLR Section 4.6.2.2 and is therefore acceptable. Additionally, the staff finds that Exelon provided an adequate summary description of its actions to address the containment process line penetration bellows, as required by 10 CFR 54.21(d).

4.6.2.4 Conclusion

On the basis of its review, the staff concludes that Exelon has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(i), that the analyses for the containment process line penetration bellows 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).

4.7 Other Plant-Specific Time-Limited Aging Analyses

4.7.1 Crane Cyclic Loading Analyses

4.7.1.1 Summary of Technical Information in the Application

SLRA Section 4.7.1, as amended by letter dated February 11, 2019 (ADAMS Accession No. ML19042A131), describes Exelon's TLAAs for crane cycle limits (i.e., fatigue of cranes).

Exelon dispositioned the TLAAs for the reactor building cranes, emergency diesel generator bridge cranes, turbine building cranes, and circulating water pump structure 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.

4.7.1.2 Staff Evaluation

The staff reviewed Exelon's TLAAs for the reactor building cranes, emergency diesel generator bridge cranes, turbine building cranes, circulating water pump structure crane and the corresponding disposition of 10 CFR 54.21(c)(1)(i), consistent with the review procedures in SRP-SLR Section 4.7.3.1.1.

Reactor Building Cranes. The SLRA states that each PBAPS unit has a reactor building crane that is designed for a rated load of 125 tons and is designated as a Class A (standby service) crane in accordance with the Crane Manufacturers Association of America Specification No. 70 (CMAA-70), "Specifications for Electric Overhead Traveling Cranes," revised 2004. The SLRA states that based on CMAA-70 design considerations, the Class A reactor building crane can withstand between 20,000 to 100,000 load cycles. SLRA Table 4.7.1-1 provides a description of heavy loads, lift frequency, and estimation of crane load cycles for 80 years of operation for the reactor building cranes. The SLRA also states that load cycles that are less than 50 percent (62.5 tons) of the crane design capacity (125 tons) result in minimal fatigue of the crane; therefore, only load cycles that lift 50 tons or more are evaluated. The SLRA further states that the number of expected cycles for 80 years of operation is 4,032 cycles for each reactor building crane and, because this value is less than the minimum design value of 20,000 cycles, the cranes cycle limit remains valid for the subsequent period of extended operation.

Emergency Diesel Generator Bridge Cranes. The SLRA states that there are four emergency diesel generator bridge cranes within the PBAPS emergency diesel generator building (EDGB). The SLRA states that each of these cranes is designed for a rated load of 15 tons and designated as Class A (standby service) cranes in accordance with CMAA-70. The SLRA states that, based on CMAA-70 design considerations, the Class A emergency diesel generator cranes can each withstand between 20,000 to 100,000 load cycles. The SLRA states that, to conservatively estimate the load cycles for each crane, the applicant took into consideration station procedures and personnel knowledgeable about the use of the cranes. The applicant also conservatively estimated that each crane experienced 500 cycles during original construction of the EDGB and 50 cycles per year during maintenance activities. The SLRA also states that load cycles that lift less than 50 percent (7.5 tons) of the crane design capacity (15 tons) result in minimal fatigue of the crane; therefore, only load cycles that lift 6 tons or more are evaluated. The SLRA further states that, based on the applicant's conservative estimate, the number of expected cycles for 80 years of operation is 4,500 cycles for each crane and because this value is less than the minimum design value of 20,000 cycles, the crane cycle limit remains valid for the subsequent period of extended operation.

Turbine Building Cranes. The SLRA states that each PBAPS unit has a turbine building crane. The SLRA states that each of these cranes is designed for a rated load of 115 tons and designated as Class A (standby service) crane in accordance with CMAA-70. The SLRA states that, based on CMAA-70 design considerations, the Class A turbine building cranes can each withstand between 20,000 to 100,000 load cycles. SLRA Table 4.7.1-2 provides a description of heavy loads, lift frequency, and estimation of crane load cycles for 80 years of operation for the turbine building cranes. The SLRA also states that load cycles that lift less than 50 percent (57.5 tons) of the crane design capacity (115 tons) result in minimal fatigue of the crane;

therefore, only load cycles that lift 50 tons or more are evaluated. The SLRA further states that the number of expected cycles for 80 years of operation is 1,400 cycles for each turbine building crane and because this value is less than the minimum design value of 20,000 cycles, the cranes cycle limit remains valid for the subsequent period of extended operation.

Circulating Water Pump Structure Crane. The SLRA states that PBAPS Units 2 and 3 have a common circulating water pump structure crane. The SLRA states that the crane is designed for a rated load of 35 tons and designated a Class A (standby service) crane in accordance with CMAA-70. The SLRA states that based on CMAA-70 design considerations, the Class A circulating water pump structure crane can withstand between 20,000 to 100,000 load cycles. SLRA Table 4.7.1-3 provides a description of heavy loads, lift frequency, and estimation of crane load cycles for 80 years of operation for the circulating water pump structure crane. The SLRA also states that load cycles that lift less than 50 percent (17.5 tons) of the crane design capacity (35 tons) result in minimal fatigue of the crane; therefore, only load cycles that lift 17 tons or more are evaluated. The SLRA further states that the number of expected cycles for 80 years of operation is 1,780 cycles for the circulating water pump structure crane and because this value is less than the minimum design value of 20,000 cycles, the crane cycle limit remains valid for the subsequent period of extended operation.

The staff reviewed UFSAR Sections Q.5.7, “Crane Load Cycle Limit,” 10.4.10, “Reactor Building Crane,” and 10.4.11, “Heavy Load Compliance,” and confirmed that the reactor building cranes, emergency diesel generator cranes, turbine building cranes, and circulating water pump structure crane have load cycle limits considered to be TLAAs and are designed in accordance with the requirements of the American National Standards Institute (ANSI) B30.2, “Overhead and Gantry Cranes,” dated 1976, and CMAA-70. Based on its review, the staff finds that the above cranes meet the CMAA-70 description of Class A (standby service) cranes because these cranes are used during refueling outages, handling of spent fuel storage casks, and maintenance activities where precise handling of equipment at slow speeds with long idle periods between lifts is required; and where capacity loads may be handled for initial installation of machinery and for infrequent maintenance.

The staff noted that the above cranes are made of structural steel that shall conform to ASTM A36 specifications as required by CMAA-70. The staff reviewed stress versus number of cycles (S-N) curves in the American Society for Metals’ “Atlas of Fatigue Curves,” dated 1986, and noted that, for ferrous metals (e.g., steel), when the applied load/stress is below 50 percent of the fracture strength/stress, the fatigue life (i.e., number of cycles) of steel components increases significantly and a region in the S-N curve is reached in which an infinite number of cycles can be applied without fatigue failure. The staff finds the applicant’s determination to not consider lifting loads that are less than 50 percent of the design capacity (rated load) for the cranes fatigue cycle counting acceptable because based on the S-N curves for ferrous metal materials (e.g., steel) and the CMAA-70 allowable design stresses for the cranes at the applicable rated loads, these lifting loads result in low stresses and therefore their contribution to the crane’s cycle usage is minimal.

The staff also notes that the applicant selection of a crane cycle limit of 20,000 cycles for all the above cranes is conservative because that value represents the lower bound cycle limit stated in CMAA-70 for a Class A (standby service crane), which provides a cycle limit that ranges from 20,000 to 100,000 cycles. The staff also notes that the expected number of cycles at or near the rated load through the subsequent period of extended operation for the reactor building cranes (4,032 cycles), emergency diesel generator cranes (4,500 cycles), turbine building cranes (1,400 cycles), and circulating water pump structure crane (1,780 cycles) are well below the crane cycle limit, with the highest cycle count expected to be less than 25 percent of the minimum allowable value of 20,000 cycles.

The staff finds that Exelon has demonstrated, pursuant to 10 CFR 54.21(c)(1)(i), that the crane cycle limit for the reactor building cranes, emergency diesel generator bridge cranes, turbine building cranes, and circulating water pump structure crane remains valid for the subsequent period of extended operation. Additionally, the applicant's TLAA input for the above-described components meets the acceptance criteria in SRP-SLR Section 4.7.2.1.1 because the applicant has demonstrated that the crane cycle limits analyses remain well below the CMAA-70 lower bound crane cycle limit of 20,000 cycles for Class A (standby service) cranes and therefore are valid through the subsequent period of extended operation.

4.7.1.3 UFSAR Supplement

SLRA Section A.4.7.1 provides the UFSAR supplement summarizing the crane cyclic loading analyses. The staff reviewed SLRA Section A.4.7.1 consistent with the review procedures in SRP-SLR Section 4.7.3.2.

Based on its review of the UFSAR supplement, as amended by letter dated February 11, 2019, the staff finds it meets the acceptance criteria in SRP-SLR Section 4.7.2.2 and is therefore acceptable. The staff finds that Exelon has provided an adequate summary description of its actions to address the crane cycle limits, as required by 10 CFR 54.21(d).

4.7.1.4 Conclusion

On the basis of its review, the staff concludes that Exelon has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(i), that the crane cycle limit analyses for the reactor building cranes, emergency diesel generator bridge cranes, turbine building cranes, and circulating water pump structure crane load cycles 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).

4.7.2 Reactor Vessel Main Steam Nozzle Clad Removal Corrosion Allowance

4.7.2.1 Summary of Technical Information in the Application

SLRA Section 4.7.2 describes Exelon's TLAA for reactor vessel main steam nozzle clad removal corrosion allowance. Exelon dispositioned the TLAA for the PBAPS Units 2 and 3 reactor vessel main steam nozzle cladding in accordance with 10 CFR 54.21(c)(1)(ii) by demonstrating that the predicted loss of material resulting from corrosion has been projected to the end of the subsequent period of extended operation.

The applicant evaluated corrosion data for unclad portions of the vessel interior and predicted a loss of nozzle material of about 0.040 inch in 80 years. The main steam nozzle clad removal calculation was validated to confirm that the 1/16-inch (.0625-inch) corrosion allowance remains conservative for 80 years of operation.

4.7.2.2 Staff Evaluation

The staff reviewed Exelon's TLAA for the PBAPS Units 2 and 3 reactor vessel main steam nozzle cladding removal corrosion allowance and the corresponding disposition of the analysis has been projected satisfactorily through the subsequent period of extended operation, consistent with the review procedures in SRP-SLR Section 4.7.3.1.2.

Based on information provided in WCAP-17649-P, “Replacement Steam Dryer ASME Stress Report,” dated February 2014, the applicant determined average corrosion rates for high- and low-temperature operating conditions. The applicant stated that assuming 72 years at high temperature and 8 years at low temperature (90 percent availability for 80 years of operation), and doubling the average corrosion rate, the amount of metal loss due to corrosion for 80 years of operation was estimated to be 0.040 inch. The applicant’s analysis is acceptable to the staff because the analysis used the average of available data and conservatively doubled the average corrosion rate to estimate the amount of corrosion for 80 years of operation. Based on the applicant’s conservative analysis of the predicted loss of material resulting from corrosion during 80 years of operation, the staff concludes that the corrosion allowance of 0.0625 inch identified when the clad was removed from the main steam nozzles is valid for 80 years of operation.

The staff finds Exelon has demonstrated, pursuant to 10 CFR 54.21(c)(1)(ii), that the analysis for the corrosion allowance for the removal of the cladding from the reactor vessel main steam nozzle has been projected to the end of the subsequent period of extended operation.

Additionally, Exelon’s analysis meets the acceptance criteria in SRP-SLR Section 4.7.2.1.2 because the projected material loss of 0.040 inch for 80 years shows the corrosion allowance for the reactor vessel main steam nozzle will still be valid for 80 years of operation.

4.7.2.3 UFSAR Supplement

SLRA Section A.4.7.2 provides the UFSAR supplement summarizing the analysis of the corrosion allowance of the cladding removal from the reactor vessel main steam nozzle. The staff reviewed SLRA Section A.4.7.2 consistent with the review procedures in SRP-SLR Section 4.7.3.2.

Based on its review of the UFSAR supplement, the staff finds it meets the acceptance criteria in SRP-SLR Section 4.7.3.2 and is therefore acceptable. Additionally, the staff finds that the applicant provided an adequate summary description of its actions to address the TLAA of the corrosion allowance for the main steam nozzle clad removal, as required by 10 CFR 54.21(d).

4.7.2.4 Conclusion

On the basis of its review, the staff concludes that Exelon has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(ii), that the analysis for the corrosion allowance for the removal of the cladding from the reactor vessel main steam nozzle 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 Generic Letter 81-11 Crack Growth Analysis to Demonstrate Conformance to the Intent of NUREG-0619, "BWR Feedwater Nozzle and Control Rod Drive Return Line Nozzle Cracking"

4.7.3.1 Summary of Technical Information in the Application

SLRA Section 4.7.3 describes Exelon's TLAA for the crack growth analysis associated with NRC Generic Letter (GL) 81-11, "BWR Feedwater Nozzle and Control Rod Drive Return Line Nozzle Cracking (NUREG-0619)," by demonstrating conformance to the intent of NUREG-0619. Exelon dispositioned the TLAA for the BWR feedwater nozzles and the control rod drive return line nozzles in accordance with 10 CFR 54.21(c)(1)(iii) by demonstrating that the effects of cracking due to cyclic loading on the intended functions will be adequately managed by the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program (SLRA Section B.2.1.1) for the subsequent period of extended operation.

To address the issues identified in NUREG-0619 per GL 81-11 and cracking observed in the feedwater nozzles at PBAPS Units 2 and 3 early in each unit's life, Exelon implemented the following three modifications recommended by NUREG-0619 at PBAPS Units 2 and 3 to reduce or eliminate the feedwater nozzle rapid thermal cycling fatigue cracking mechanism: (a) installation of improved nozzle triple thermal sleeves with dual piston ring seals, (b) removal of cladding from the nozzle bore and blend radii, and (c) improvement of the low-flow feedwater controllers. Also, Exelon capped the control rod drive return line (CRDRL) nozzles at PBAPS Units 2 and 3 to eliminate cracking due to rapid thermal cycling.

Exelon stated that augmented ISI inspections of the feedwater nozzles have been implemented at PBAPS Units 2 and 3 since 1983, with the current inspections based on a plant-specific fracture mechanics analysis for Units 2 and 3 in accordance with the Boiling Water Reactor Owners Group and NRC-approved guidance. Exelon stated that this PBAPS plant-specific fracture mechanics analysis is not a TLAA because it does not involve time-limited assumptions defined by the current operating term, but rather provides the basis for inspection criteria and inspection intervals.

PBAPS UFSAR Appendix C, Section C.5.3.1.1 documents that the feedwater nozzles have been evaluated for low cycle fatigue in accordance with ASME Section III as Class 1 components through the initial period of extended operation. While the PBAPS plant-specific fracture mechanics analysis for rapid cycle thermal fatigue is not a TLAA, the SLRA states that the original ASME Section III fatigue analysis of the feedwater nozzles is considered a TLAA and must be evaluated for the subsequent period of extended operation.

The SLRA states that management of this TLAA will occur through implementation of the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program (SLRA Section B.2.1.1) to provide confirmation that cracking due to rapid thermal cycling fatigue has been mitigated, and the Fatigue Monitoring program (SLRA Section B.3.1.1) will manage feedwater nozzle low cycle fatigue TLAAs through the subsequent period of extended operation.

4.7.3.2 Staff Evaluation

The staff reviewed Exelon's TLAA for the BWR feedwater nozzles and the control rod drive return line nozzles and the corresponding disposition of 10 CFR 54.21(c)(1)(iii), consistent with the review procedures in SRP-SLR Section 4.7.3.1.3.

The staff finds that Exelon's TLAA meets the acceptance criteria in SRP-SLR Section 4.7.2.1.3 because the effects of aging will be adequately managed during the subsequent period of extended operation. Specifically, examinations in accordance with ASME Section XI Table IWB-2500-1, Examination Category B-D as a part of the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program (SLRA Section B.2.1.1) will continue to provide confirmation that fatigue due to rapid thermal cycling has been mitigated, consistent with recommendations in the GALL-SLR Report. The staff found this AMP acceptable, as described in SER Section 3.0.3.1.1. In addition, the staff determined that the applicant's Fatigue Monitoring program (SLRA Section B.3.1.1) will manage feedwater nozzle low cycle fatigue through the subsequent period of extended operation. The staff found this AMP acceptable, as described in SER Section 3.0.3.2.28.

The staff finds that Exelon has demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of cracking due to cyclic loading on the intended functions of the BWR feedwater nozzles will be adequately managed for the subsequent period of extended operation.

4.7.3.3 UFSAR Supplement

SLRA Section A.4.7.3 provides the UFSAR supplement summarizing the TLAA. The staff reviewed SLRA Section A.4.7.3 consistent with the review procedures in SRP-SLR Section 4.7.3.2.

Based on its review of the UFSAR supplement, the staff finds it meets the acceptance criteria in SRP-SLR Section 4.7.2.2 and is therefore acceptable. Additionally, the staff finds that Exelon provided an adequate summary description of its actions to address mitigation of cyclic fatigue as discussed in GL 81-11, as required by 10 CFR 54.21(d).

4.7.3.4 Conclusion

On the basis of its review, the staff concludes that Exelon has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of cracking due to cyclic loading on the intended functions of the BWR feedwater nozzles will be adequately managed by the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program and 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).

4.7.4 Fracture Mechanics Analysis of ISI-Reportable Indications for Group I Piping: As-Forged Laminar Tear in a Unit 3 Main Steam Elbow Near Weld 1-B-3BC-LDO Discovered During Preservice UT

4.7.4.1 Summary of Technical Information in the Application

SLRA Section 4.7.4 describes Exelon's TLAA for the fracture mechanics analysis of a laminar tear in a Unit 3 main steam elbow near weld 1-B-3BC-LDO discovered during preservice ultrasonic volumetric examination. The laminar indication did not extend into the weld. Exelon dispositioned the TLAA in accordance with 10 CFR 54.21(c)(1)(ii) by demonstrating that the analyses have been projected to the end of the subsequent period of extended operation.

4.7.4.2 Staff Evaluation

The staff reviewed Exelon's TLAA for the laminar tear in a PBAPS Unit 3 main steam elbow 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.

This TLAA was evaluated consistent with the analysis for the initial license renewal, as described in Section 4.7.3.2 of the SER, "NUREG-1769, Safety Evaluation Report Related to the License Renewal of the Peach Bottom Power Stations, Unit 2 and 3." When the flaw was first identified, Exelon performed a stress evaluation and a 40-year fatigue analysis using cumulative usage factor (CUF), with a conservative assumption that the flaw extended into the weld. This analysis was re-evaluated for the subsequent period of extended operation, and a CUF of 0.072 was identified in the SLRA.

The staff reviewed Exelon's TLAA on the fatigue analysis for the main steam elbow at PBAPS, Unit 3 and focused on several elements of the evaluation.

Firstly, Exelon used a conservative assumption that the flaw extended into the weld to perform its fatigue analysis for the subsequent period of extended operation. This conservative assumption is acceptable.

Secondly, the staff noted that the applicant performed a fatigue analysis consistent with the ASME Code, Section III, Class 1 even though a fatigue analysis is not required for this portion of the main steam elbow. The applicant conservatively applied the ASME Code Section III, Class 1 criteria, including the primary and secondary stresses and calculated CUF value for the main steam elbow. The effect of the flaw is accounted for by the introduction of a fatigue strength reduction factor, or an equivalent stress concentration factor, as specified in the ASME Section III, Subsection NB design rules. The staff finds this approach to the fatigue analysis acceptable due to the high level of rigor in an ASME Code, Section III, Class 1 fatigue analysis.

Thirdly, Exelon projected the staff-approved CUF value for the initial period of extended operation on a proportional basis to an 80-year period of operation. The staff finds this approach acceptable because the CUF values increase linearly along with the number of cycles, which can be modeled to increase linearly with the time of plant operation. Therefore, the projection of CUF values for the subsequent period of extended operation is reasonably estimated as a linear projection.

Finally, the value of CUF that was projected for the subsequent period of extended operation value is considerably lower than the ASME Code, Section III value of 1.0 which ensures that sufficient safety margin exists in the elbow.

Therefore, based on the above evaluation, the staff concludes that Exelon has provided reasonable assurance that the functionality of the main steam elbow will be maintained during the subsequent period of extended operation.

The staff finds that Exelon has demonstrated, pursuant to 10 CFR 54.21(c)(1)(ii), that the fatigue analyses for the laminar tear in the PBAPS Unit 3 main steam elbow has been projected to the end of the subsequent period of extended operation. The TLAA meets the acceptance criteria in SRP-SLR Section 4.7.2.1.2 because the projected fatigue analysis for the subsequent period of extended operation meets the CUF criteria with sufficient safety margin.

4.7.4.3 UFSAR Supplement

In SLRA Section A.4.7.4, Exelon provides the UFSAR supplement summarizing the TLAA for PBAPS Unit 3 as-forged laminar tear in the main steam elbow near weld 1-B-3BC-LDO discovered during preservice ultrasonic testing (UT). The staff reviewed SLRA Section A.4.7.4 consistent with the review procedures in SRP-SLR Section 4.7.3.2.

Based on its review of the UFSAR supplement, the staff finds it meets the acceptance criteria in SRP-SLR Section 4.7.3.2 and is therefore acceptable. Additionally, the staff finds that Exelon provided an adequate summary description of its actions to address fracture mechanics analysis of laminar tear in a PBAPS Unit 3 main steam elbow as required by 10 CFR 54.21(d).

4.7.4.4 Conclusion

On the basis of its review, the staff concludes that Exelon has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(ii), that the fracture mechanics analysis for the laminar tear in the Unit 3 main steam elbow 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 PBAPS Unit 3 Core Spray Replacement Piping Fatigue and Leakage Assessment

4.7.5.1 Summary of Technical Information in the Application

SLRA Section 4.7.5 describes Exelon’s TLAA for PBAPS Unit 3 core spray replacement piping fatigue and leakage assessment. Exelon dispositioned the TLAA for PBAPS Unit 3 core spray replacement piping in accordance with 10 CFR 54.21(c)(1)(i).

Exelon replaced portions of core spray piping at PBAPS Unit 3 in 2013. Exelon’s analysis contains leakage assessment of the new core spray piping taking into consideration the following technical issues: (1) corrosion evaluation of the new piping, and (2) fatigue analysis valid for the subsequent period of extended operation. Exelon stated that this analysis is valid for a total of 45 years of design life and it replaces the original analysis that is valid for 40 years of design life. The new analysis is valid for the subsequent period of extended operation.

4.7.5.2 Staff Evaluation

The staff reviewed Exelon’s TLAA on fatigue analysis and leakage assessment for the new core spray piping system at PBAPS Unit 3 and the corresponding disposition of 10 CFR 54.21(c)(1)(i), consistent with the review procedures in SRP-SLR Section 4.7.3.1.1.

The staff noted that the selection of the new piping materials was based on the corrosion resistance of these replaced materials (austenitic stainless steel and alloy 718) in the reactor coolant environment. Therefore, the piping materials used in the new piping system will have better corrosion resistance than the replaced piping. The staff concluded that the selection of piping materials with better corrosion resistance provides reasonable assurance that the new core spray piping will maintain its functionality for the subsequent period of extended operation.

The staff noted that fatigue analysis was performed based on the design transients valid for 45 years of operation until 2058. The cumulative usage factor (CUF) value associated with fatigue analysis is valid for 45 years of operation. Based on its review, the staff concluded that Exelon had adequately demonstrated that it used the relevant design transients in its evaluation.

The staff finds that Exelon has demonstrated, pursuant to 10 CFR 54.21(c)(1)(i), that the fatigue analysis for the Unit 3 core spray replacement piping system remains valid for the subsequent period of extended operation. The staff also noted that Exelon adequately evaluated the corrosion properties of the replaced piping, fatigue analyses, and leakage assessment of the piping. Based on this evaluation, the staff determined Exelon has adequately demonstrated that the functionality of the replaced core spray piping will be adequately maintained during the subsequent period of extended operation.

4.7.5.3 UFSAR Supplement

SLRA Section A.4.7.5 provides the UFSAR supplement summarizing the TLAA for PBAPS Unit 3, core spray replacement piping fatigue and leakage assessment. The staff reviewed SLRA Section A.4.7.5 consistent with the review procedures in SRP-SLR Section 4.7.3.2.

Based on its review of the UFSAR supplement, the staff finds it meets the acceptance criteria in SRP-SLR Section 4.7.2.2 and is therefore acceptable. Additionally, the staff finds that Exelon provided an adequate summary description of its actions to address fatigue analysis and leakage assessment of the PBAPS Unit 3 core spray replacement piping as required by 10 CFR 54.21(d).

4.7.5.4 Conclusion

On the basis of its review, the staff concludes that Exelon has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(i), that the fatigue and leakage evaluations of the PBAPS Unit 3 core spray replacement piping remain valid for the subsequent period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the evaluation, as required by 10 CFR 54.21(d).

4.8 Conclusion for TLAAs

The staff reviewed SLRA Section 4, “Time-Limited Aging Analyses.” Based on its review, the staff concludes that Exelon has provided a sufficient list of TLAAs, as defined in 10 CFR 54.3, and that Exelon has demonstrated that: (1) the TLAAs will 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 the supplement contains descriptions of the TLAAs sufficient to satisfy the requirements of 10 CFR 54.21(d). In addition, the staff concludes, as required by 10 CFR 54.21(c)(2), that no plant-specific, TLAA-based exemptions are in effect. With regard to these matters, the staff concludes that there is reasonable assurance that Exelon 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 regulations.

5 REVIEW BY THE ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

In accordance with Title 10 of the *Code of Federal Regulations* Part 54, “Requirements for Renewal of Operating Licenses for Nuclear Power Plants,” the Advisory Committee on Reactor Safeguards (ACRS) reviews the subsequent license renewal application for Peach Bottom Atomic Power Station (PBAPS) Units 2 and 3. The ACRS Subcommittee on Plant License Renewal also reviews the U.S. Nuclear Regulatory Commission staff’s safety evaluation report for the PBAPS subsequent license renewal application. The applicant and the NRC staff attend ACRS subcommittee and the full committee meetings to discuss issues associated with the PBAPS subsequent license renewal application.

After the ACRS completes its review of the subsequent license renewal application and the safety evaluation report, the ACRS full committee issues a report discussing the results of its review. An update to this safety evaluation report will include the ACRS report as well as the staff’s response to any ACRS issues and concerns.

6 CONCLUSION

The staff of the U.S. Nuclear Regulatory Commission (NRC) reviewed the subsequent license renewal application (SLRA) for Peach Bottom Atomic Power Station (PBAPS) Units 2 and 3 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). Title 10 of the *Code of Federal Regulations* Section 54.29, “Standards for issuance of a renewed license” (10 CFR 54.29), sets the standards for issuance of a renewed license. In accordance with 10 CFR 54.29(a), the Commission may issue a renewed license if it finds that actions have been identified and have been or will be taken, such that there is reasonable assurance that the activities authorized by the renewed license will continue to be conducted in accordance with the current licensing basis (CLB).

On the basis of its review of the PBAPS subsequent license renewal application, the 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 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).

The staff notes that its review of environmental impacts under the requirements of 10 CFR Part 51, Subpart A, “National Environmental Policy Act—Regulations Implementing Section 102(2),” will be documented in NUREG-1437, “Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Supplement 10, Second Renewal, Regarding Subsequent License Renewal for Peach Bottom Atomic Power Station Units 2 and 3,” following the NRC staff’s consideration of comments received on the Draft Supplement 10, Second Renewal, dated July 30, 2019 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML19210D453).

APPENDIX A
LICENSE RENEWAL COMMITMENTS

During the review of the Peach Bottom Atomic Power Station (PBAPS) Units 2 and 3 subsequent license renewal application by the staff of the U.S. Nuclear Regulatory Commission (NRC or the staff), Exelon Generation Company, LLC (Exelon) made commitments related to aging management programs (AMPs) to manage aging effects for structures and components. The following table lists these commitments along with the implementation schedules and sources for each commitment. The subsequent period of extended operation for PBAPS would begin on August 8, 2033, for Unit 2 and July 2, 2034, for Unit 3.

Table A-1 PBAPS License Renewal Commitments

Item No.	FSAR Supplement Section	Commitment	Implementation Schedule	Source
1	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	Existing program is credited	Ongoing	Subsequent License Renewal Application Section A.2.1.1 7/10/2018 ML18193A689
2	Water Chemistry	Existing program is credited	Ongoing	Subsequent License Renewal Application Section A.2.1.2 7/10/2018 ML18193A689
3	Reactor Head Closure Stud Bolting	Existing program is credited	Ongoing	Subsequent License Renewal Application Section A.2.1.3 7/10/2018 ML18193A689
4	BWR Vessel ID Attachment Welds	Existing program is credited	Ongoing	Subsequent License Renewal Application Section A.2.1.4 7/10/2018 ML18193A689
5	BWR Stress Corrosion Cracking	Existing program is credited	Ongoing	Subsequent License Renewal Application Section A.2.1.5 7/10/2018 ML18193A689
6	BWR Penetrations	Existing program is credited	Ongoing	Subsequent License Renewal Application Section A.2.1.6 7/10/2018 ML18193A689

Item No.	FSAR Supplement Section	Commitment	Implementation Schedule	Source
7	BWR Vessel Internals	BWR Vessel Internals is an existing program that will be enhanced to: 1 In accordance with BWRVIP-25, Revision 1, install core plate wedges, or inspect core plate rim hold-down bolts for stress corrosion cracking, or demonstrate via analysis that the installation of wedges and inspections of the core plate rim hold down bolts are not required, no later than six months prior to the second period of extended operation, or before the end of the last refueling outage prior to the second period of extended operation, whichever occurs later. 2 Perform a VT-3 inspection of the jet pump inlet mixer and beam regions every refuel cycle after a fluence value of 1.3E+20 n/cm^2 (51 EFPY for Unit 2 and 63 EFPY for Unit 3) is reached at the jet pump holddown beam. 3 Perform periodic visual inspections of the PBAPS Westinghouse (Nordic style) stainless steel steam dryers for the aging effects of loss of material and cracking at a frequency not exceeding 10 years, with the first inspections performed prior to the second period of extended operation, as described below. The inspection guidance contained in BWRVIP-139-A does not address the Westinghouse (Nordic style) steam dryers installed in PBAPS Unit 2 and Unit 3 and therefore is not directly applicable. However, the general principles and conclusions from BWRVIP-139-A, “BWR Vessel and Internals Project: Steam Dryer Inspection and Flaw Evaluation Guidelines”, BWRVIP-181-R1-A, “BWR Vessel and Internals Project: Steam Dryer Repair Design Criteria”, and Regulatory Guide 1.20, “Comprehensive Vibration Assessment Program for Reactor Internals During Preoperational and Initial Startup Testing” were applied to the inspection plan described in WCAP-17635-P, “Peach Bottom Atomic Power Station Unit 2 and Unit 3 Replacement Steam Dryer Comprehensive Vibration Assessment Program (CVAP)”. WCAP-17635- P also includes manufacturer's recommendations based on relevant operating experience. The scope of the inspection will include the items listed in Table 1 below. The steam dryer inspections are based on the BWRVIP-139-A and WCAP-17635-P guidelines to identify loss of material (wear) and cracking using appropriate visual examination techniques (e.g., VT-1, VT-3) and qualified inspectors. The examination procedures identify the type and location of examination required for each dryer component as well as the reason for inspection. Acceptance criteria are consistent with BWRVIP-139-A and are described in procedures and work instructions. Flaws and abnormal indications identified will be entered into the corrective action program for engineering evaluation. The evaluations will consider increasing inspection frequency and scope as appropriate. Identified degradation left in the as found condition will be reinspected as required by the engineering evaluation.	Program will be enhanced in accordance with the schedule described within the commitments. Initial steam dryer inspections will be completed no later than six months prior to the second period of extended operation, or no later than the last refueling outage prior to the second period of extended operation.	Subsequent License Renewal Application Section A.2.1.7 7/10/2018 ML18193A689 Exelon Letter PBAPS SLRA Supplement No. 9 10/9/2019 ML19283A362

<table>
<tr><th>Item No.</th><th>FSAR Supplement Section</th><th>Commitment</th><th>Implementation Schedule</th><th>Source</th></tr>
<tr><td>7
(Cont'd)</td><td></td><td>The repair design criteria contained in BWRVIP-181-R1-A and BWRVIP-139-A will be used for any future repairs of the steam dryers. Repairs to the steam dryer will be inspected as specified in the repair design package.
<table>
<tr><th colspan="2">Table 1
Steam Dryer Inspection Program for the Second Period of Extended Operation in accordance with WCAP-17635-P</th></tr>
<tr><th>Inspection Location</th><th>Basis for Selection</th></tr>
<tr><td>1. Overall General Inspection of Outside of the Replacement Steam Dryer (to include outside of skirt)</td><td>Industry Operating Experience (BWRVIP-139-A, Section 1.1, Section 2.4.2)
General Inspection for evidence of damage</td></tr>
<tr><td>2. Lifting Rods Top Ends (Unit 3 only)</td><td>Surfaces in contact during operation
RG 1.20 Sec 2.3 (1)(b,d)</td></tr>
<tr><td>3. Hold Down Rods Top Ends (Unit 2 only)</td><td>Surfaces in contact during operation
RG 1.20 Sec 2.3 (1)(b,d)</td></tr>
<tr><td>4. Support Ring Bottom Surface</td><td>RG 1.20 Sec 2.3 (1)(b,d) Surfaces in contact during operation</td></tr>
<tr><td>5. Outer hood (welds on outer surface)</td><td>Industry Operating Experience (BWRVIP-139-A, Section 1.1, Section 2.4.2)
Higher stressed area identified in analysis (RG 1.20 Sec 2.3(1)(e))
Inspection for evidence of IGSCC (weld not solution annealed)</td></tr>
<tr><td>6. Outer Ring Top Cage</td><td>Higher stressed area identified in analysis (RG 1.20 Sec 2.3(1)(e))
Inspection for evidence of IGSCC (weld not solution annealed)</td></tr>
<tr><td>7. Weld attachments between the brackets to the lifting rod and hold down rod and weld attachments between the brackets to top plate (lifting rod, Unit 3 only)</td><td>Industry Operating Experience (BWRVIP-139-A, Section 2.4.8)
Higher stressed area identified in analysis (RG 1.20 Sec 2.3(1)(e))
Inspection for evidence of IGSCC (weld not solution annealed)</td></tr>
</table></td><td></td><td></td></tr>
</table>

Item No.	FSAR Supplement Section	Commitment	Implementation Schedule	Source
8	Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)	Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS) aging management program is a new condition monitoring program that will provide assurance that reactor coolant pressure boundary CASS components (i.e., Class 1 piping and pump casings) with the potential for significant thermal aging embrittlement meet their intended functions.	Program will be implemented no later than six months prior to the second period of extended operation.	Subsequent License Renewal Application Section A.2.1.8 7/10/2018 ML18193A689
9	Flow-Accelerated Corrosion	Flow-Accelerated Corrosion is an existing program that will be enhanced to: 1 Reassess infrequently used piping systems excluded from the scope of the program to ensure adequate bases exist to justify this exclusion for the second period of extended operation.	Program will be enhanced no later than six months prior to the second period of extended operation.	Subsequent License Renewal Application Section A.2.1.9 7/10/2018 ML18193A689
10	Bolting Integrity	Bolting Integrity is an existing program that will be enhanced to: 1 Ensure that submerged carbon steel closure bolts on the ESW, HPSW, and fire protection pumps are inspected for loss of material and to confirm that the closure bolting is hand tight. A minimum of 19 bolt inspections shall be performed each 10-year period during the second period of extended operation for each unit. Inspection of closure bolting on these pumps during pump overhaul and replacement activities may be credited during each 10-year period in the second period of extended operation. 2 Ensure that submerged stainless steel mechanical bolts on the 2AS008, 2BS008, 3AS008, and 3BS008 Circulating Water Pump Structure intake traveling screens are inspected for loss of material and to confirm that the mechanical bolting is hand tight. A minimum of 19 bolt inspections shall be performed each 10-year period during the second period of extended operation for each unit. Inspection of mechanical bolting on these screens during overhaul and replacement activities may be credited during each 10-year period in the second period of extended operation. 3 Ensure that closure bolts on pressure-retaining components that contain air or gas are inspected for cracking and loss of material for the carbon steel/ air-indoor uncontrolled and the stainless steel/ air-indoor uncontrolled material and environment combinations. In addition, the inspections will confirm that this closure bolting is leak tight applying inspection techniques, such as soap bubble testing, thermography, acoustic testing, or verifying closure bolting is hand tight. A minimum of 19 bolt inspections shall be performed each 10-year period during the second period of extended operation for each unit. Opportunistic inspections during maintenance activities may be credited during the same 10-year period. 4 Ensure that closure bolts on pressure-retaining components that contain air or gas are inspected for loss of material for the carbon steel/air-outdoor material and environment combination. In addition, the inspections will confirm that this closure bolting is leak tight applying inspection techniques, such as soap bubble testing, thermography, acoustic testing, or verifying	Program will be enhanced no later than six months prior to the second period of extended operation.	Subsequent License Renewal Application Section A.2.1.10 7/10/2018 ML18193A689 Exelon Letter PBAPS SLRA Supplement No. 2 1/23/2019 ML19023A015

Item No.	FSAR Supplement Section	Commitment	Implementation Schedule	Source
10 (Cont'd)		closure bolting is hand tight. A minimum of 25 bolt inspections shall be performed each 10-year period during the second period of extended operation for both Units 2 and 3. Opportunistic inspections during maintenance activities may be credited during the same 10-year period. 5 Revise site walkdown procedures to specify proper lighting and appropriate distances to adequately identify visible component leakage, evidence of past leakage, or other age-related degradation on pressure-retaining bolted joints that contain fluids such as water, oil, or steam. Cameras and video equipment may be used to supplement these inspections. 6 Revise existing repetitive tasks to provide guidance for proper lighting and appropriate inspection distances to adequately identify loss of material in submerged environments. Cameras and video equipment may be used to supplement these inspections. 7 Ensure no fewer than five additional bolts are inspected for each sample based inspection that does not meet acceptance criteria, or 20 percent of the total bolt population of each applicable material, environment, and aging effect combination; whichever is less. If these subsequent inspections do not meet acceptance criteria, an extent of condition and extent of cause analysis are performed to determine the further extent of inspections. These additional inspections will be completed within the inspection interval for which the original sample based inspections are conducted. 8 Revise engineering procedures to require volumetric examination in accordance with ASME Code Section XI, Table IWB-2500-1, Examination Category B-G-1, regardless of the code classification of the bolting, should high strength bolting greater than 2 inches in diameter be installed. 9 Clarify that the recommended guidance for proper selection of bolting material and lubricants, and appropriate installation torque or tension to prevent or minimize loss of bolting preload and cracking of high-strength bolting is a requirement at Peach Bottom in accordance with the guidelines provided in EPRI NP-5067 and TR-104213. Clarify that the recommended requirements for storage, lubricant selection, and bolting and coating material selection to include the recommendations in Section 2 of Research Council on Structural Connections (RCSC) publication "Specification for Structural Joints Using High Strength Bolts," are a requirement at Peach Bottom.		

Item No.	FSAR Supplement Section	Commitment	Implementation Schedule	Source
11	Open-Cycle Cooling Water System	Open-Cycle Cooling Water System is an existing program that will be enhanced to: 1 Provide procedural direction to perform additional inspections if the cause of the aging effect for each applicable material and environment combination is not corrected by repair or replacement for all components constructed of the same material and exposed to the same environment. These additional inspections will be conducted if any of the inspections do not meet acceptance criteria. No fewer than five additional inspections will be performed for each inspection that does not meet acceptance criteria, or 20 percent of each applicable material, environment, and aging effect combination, whichever is less. 2 Perform a minimum of 20 inspections for recurring internal corrosion in the raw water cooling 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 SLRA Section 3.3.2.2.7. 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 Provide procedural direction to require the use of a mill tolerance of 12.5% for added conservatism when determining corrosion rates at new inspection locations if corrosion rates from other locations with nearly identical operating conditions, material, size, and configuration cannot be used.	Program will be enhanced no later than six months prior to the second period of extended operation.	Subsequent License Renewal Application Section A.2.1.11 7/10/2018 ML18193A689 Exelon Letter PBAPS SLRA RAI Response 5/2/2019 ML19122A289
12	Closed Treated Water Systems	Closed Treated Water Systems is an existing program that will be enhanced to: 1 Perform condition monitoring including opportunistic visual inspections and sample-based periodic inspections using techniques (visual, surface, or volumetric) capable of detecting loss of material, cracking, and fouling, as appropriate to verify the effectiveness of water chemistry control to mitigate aging effects in each 10-year period during the second period of extended operation. The rate of identified degradation will be projected until the next scheduled inspection. Additional sample-based inspections will be performed if aging effects are identified. If those inspections identify aging effects, the corrective action program will be used to determine the extent of condition and extent of cause to determine the further extent of inspections.	Program will be enhanced no later than six months prior to the second period of extended operation.	Subsequent License Renewal Application Section A.2.1.12 7/10/2018 ML18193A689

Item No.	FSAR Supplement Section	Commitment	Implementation Schedule	Source
13	Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems	Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems is an existing program that will be enhanced to: 1 Provide additional guidance to include inspection of crane-related bridges, structural members, and structural components for deformation, cracking, and loss of material due to corrosion or wear; and associated bolted connections for loss of material, cracking, and indications of loss of preload. 2 Provide procedural direction to document deficiencies identified during inspection activities within the corrective action program. 3 Provide site-specific procedural direction to evaluate and repair visual indication of loss of material, deformation, or cracking, and any visual sign of loss of bolting preload in accordance with ASME B30.2 or other applicable industry standard in the ASME B30 series.	Program will be enhanced no later than six months prior to the second period of extended operation.	Subsequent License Renewal Application Section A.2.1.13 7/10/2018 ML18193A689
14	Compressed Air Monitoring	Compressed Air Monitoring is an existing program that will be enhanced to: 1 Perform daily inspection of instrument nitrogen after dryer desiccant for signs of moisture. Results will be recorded and reviewed to determine if corrective actions are required. 2 Perform opportunistic visual inspections of component internal surfaces exposed to a dry air environment for signs of loss of material due to corrosion.	Program will be enhanced no later than six months prior to the second period of extended operation.	Subsequent License Renewal Application Section A.2.1.14 7/10/2018 ML18193A689
15	BWR Reactor Water Cleanup System	Existing program is credited.	Ongoing	Subsequent License Renewal Application Section A.2.1.15 7/10/2018 ML18193A689
16	Fire Protection	Fire Protection is an existing program that will be enhanced to: 1 Perform periodic visual inspection every 18 months for identification of corrosion that may lead to loss of material on the external surfaces of the low pressure carbon dioxide fire suppression systems. 2 Perform periodic visual inspection of combustible liquid spill retaining curbs every 24 months.	Program will be enhanced no later than six months prior to the second period of extended operation.	Subsequent License Renewal Application Section A.2.1.16 7/10/2018 ML18193A689

Item No.	FSAR Supplement Section	Commitment	Implementation Schedule	Source
17	Fire Water System	Fire Water System is an existing program that will be enhanced to: 1 Revise flow test procedures to include: a. Inspector test flush acceptance criteria for wet pipe sprinkler systems that currently do not include the requirement to record time to flow from the opened test valve. b. Acceptance criteria for wet pipe main drain tests. Flowing pressures from test to test will be monitored to determine if there is a 10 percent reduction in full flow pressure when compared to previously performed tests. An issue report shall be generated in the corrective action program to determine the cause and corrective actions. c. If flow test acceptance criteria are not met, perform an investigation within the corrective action program that includes review for increased testing and perform at least two successful additional tests. Additional tests shall be completed within the interval in which the original test was conducted. If acceptance criteria are not met during follow-up testing, an extent of condition and extent of cause analysis shall be conducted to determine the further extent of tests which includes testing on the same system, on the other unit. 2 Perform air flow tests on the hydrogen seal oil and reactor building water curtains every two years to ensure deluge piping and nozzles are unobstructed and there are no flow blockages. 3 Increase the frequency of air flow tests through the standby gas treatment and recombiner system deluge piping and nozzles to every two years to ensure piping and nozzles are unobstructed and there are no flow blockages. 4 Revise procedures to improve guidance for external visual inspections of the in scope sprinkler systems piping and sprinklers at least every two years to inspect for corrosion, loss of material, leaks, and proper sprinkler orientation. Corroded, leaking or damaged sprinklers shall be replaced. 5 Perform external visual inspections of the in scope above ground fire main piping every two years to identify excessive corrosion, loss of material, leaks, and physical damage. 6 Perform internal visual inspections of sprinkler and deluge system piping to identify internal corrosion, foreign material, and obstructions to flow. 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. If organic or foreign material, or internal flow blockage that could result in failure of system function is identified, then an obstruction investigation will be performed within the corrective action program that includes removal of the material, an extent of condition determination, review for increased inspections, extent of follow-up examinations, and a flush in accordance with NFPA 25 Appendix D.5,	Program will be enhanced no later than six months prior to the second period of extended operation. Inspections that are to be completed prior to the second period of extended operation will be completed no later than six months prior to the second period of extended operation, or no later than the last refueling outage prior to the second period of extended operation.	Subsequent License Renewal Application Section A.2.1.17 7/10/2018 ML18193A689 Exelon Letter PBAPS SLRA Supplement No. 2 1/23/2019 ML19023A015 Exelon Letter PBAPS SLRA RAI Response 5/2/2019 ML19122A289 Exelon Letter PBAPS SLRA Revised Fire Water System RAI Response 5/30/2019 ML19150A297

Item No.	FSAR Supplement Section	Commitment	Implementation Schedule	Source
17 (Cont'd)		Flushing Procedures. The internal visual inspections will consist of the following: a. Wet pipe sprinkler systems – 50 percent of the wet pipe sprinkler systems in scope for license renewal will have visual internal inspections of piping by removing a hydraulically remote sprinkler, performed every five years, consistent with NFPA 25, 2011 Edition, Section 14.2. During the next five-year inspection period, the alternate systems previously not inspected shall be inspected. b. Pre-action sprinkler systems - pre-action sprinkler systems in scope for license renewal will have visual internal inspections of piping by removing a hydraulically remote nozzle, performed every five years, consistent with NFPA 25, 2011 Edition, Section 14.2. c. Deluge systems - Yard transformer deluge systems in scope for license renewal will have visual internal inspections of piping by removing a hydraulically remote nozzle, performed every five years, consistent with NFPA 25, 2011 Edition, Section 14.2. 7 Perform a one-time volumetric wall thickness inspection, prior to the second period of extended operation, on a sample of the original yard transformer deluge system supply piping that was not replaced during transformer replacements and is periodically subjected to flow during functional testing. 8 Revise service water bay inspection procedures to include inspection of the motor driven fire pump intake strainer. 9 Perform flow tests for hose stations at the hydraulically most limiting locations for each zone of the system on a five-year frequency to demonstrate the capability to provide the design pressure at required flow. 10 Flush deluge system mainline supply basket strainers until clear, following functional testing of yard deluge systems. 11 Perform a one-time inspection of the auxiliary boiler fuel oil storage tank internal foam nozzle and deflector, prior to the second period of extended operation, to ensure proper configuration and orientation and no indication of flow blockage. 12 Perform an internal inspection of the auxiliary boiler oil storage tank foam system foam concentrate tank every 10 years to ensure it is free of corrosion, debris, or foreign material that could cause flow blockage, and to ensure there are no cracks or leaks and it is in good condition. 13 Revise restoration procedures for the hydrogen seal oil and reactor building water curtain systems to utilize low point drains following control valve actuations to ensure there is no trapped water in the system. 14 Revise restoration procedures for the yard transformer deluge systems to utilize low point drains after functional testing.		

Item No.	FSAR Supplement Section	Commitment	Implementation Schedule	Source
17 (Cont'd)		15 Revise the fire hydrant inspection and flush test procedure to include a minimum flow duration of one (1) minute after the hydrant valve is fully open to remove all foreign material. 16 Revise the underground fire main flow test to utilize the corrective action program to determine an increased test frequency when established test criteria is not met or when significant degraded trends that could adversely affect system intended function are identified. When test results pass the established test criteria, the test frequency may be extended to a five (5) year frequency IAW NFPA 25. 17 Perform at least five additional ultrasonic test inspections on the fire water supply piping for each Fire Water System pipe wall inspection that does not meet acceptance criteria. 18 Provide procedural direction to require the use of a mill tolerance of 12.5% for added conservatism when determining corrosion rates at new inspection locations if corrosion rates from other locations with nearly identical operating conditions, material, size, and configuration cannot be used.		
18	Outdoor and Large Atmospheric Metallic Storage Tanks	Outdoor and Large Atmospheric Metallic Storage Tanks is an existing program that will be enhanced to: 1 Perform a visual inspection of the sealant at the perimeter of the condensate storage tanks and refueling water storage tank bases for signs of degradation every two years. The visual inspections of sealant and caulking are supplemented with physical manipulation to detect degradation. 2 Perform a pre-inspection review of the previous two inspections of the internal tank coatings, when available, that includes review of results of inspections and any subsequent repair activities. 3 Conduct training and qualification of individuals involved in internal coating or lining inspections and evaluating degraded conditions in accordance with an ASTM International standard endorsed in RG 1.54. 4 Perform volumetric inspection of Unit 2 and 3 condensate storage tanks and refueling water storage tank bottoms at least once during the 10-year period prior to the second period of extended operation, and at least once every 10 years during the second period of extended operation. Volumetric inspections are performed at representative sample locations to include 25 one square foot locations or 20 percent coverage conducted in different locations unless the program states the basis for why repeated inspections are conducted in the same location (i.e. previous findings). Additionally, a minimum of 10 of the random one square foot sample locations will be performed within the 30-inch band at the perimeter of the shell. The scope of subsequent examinations may be adjusted based upon the results of previous examinations.	Program will be enhanced no later than six months prior to the second period of extended operation, unless a more specific schedule is described within the enhancement (i.e., Enhancement 4). Inspections that are to be completed prior to the second period of extended operation will be completed no later than six months prior to the second period of extended operation, or no later than the last refueling outage prior to the second period of extended operation.	Subsequent License Renewal Application Section A.2.1.18 7/10/2018 ML18193A689

Item No.	FSAR Supplement Section	Commitment	Implementation Schedule	Source
19	Fuel Oil Chemistry	Fuel Oil Chemistry is an existing program that will be enhanced to: 1 Perform periodic internal inspection of the diesel fire pump fuel oil storage tank (00T041) and the diesel fire pump day tank (00T543) at least once during the 10-year period prior to the second period of extended operation, and at least once every 10 years during the second period of extended operation. Each diesel fuel tank will be drained and cleaned, the internal surfaces visually inspected (if physically possible), and, if evidence of degradation is observed during inspections, or if visual inspection is not possible, these diesel fuel tanks will be volumetrically inspected. 2 Perform periodic (quarterly) removal of water collected at the bottom of the diesel fire pump fuel oil storage tank (00T041) and the diesel fire pump day tank (00T543). 3 Perform receipt testing of new fuel oil for particulate concentration and the levels of microbiological organisms for the diesel generator fuel oil day tanks (0A(B,C,D)T040), diesel generator fuel oil storage tanks (0A(B,C,D)T038), and diesel fire pump fuel oil storage tank (00T041). 4 Perform periodic (quarterly) sampling and analysis for water and sediment content, particulate concentration, and the levels of microbiological organisms for the diesel generator fuel oil day tanks (0A(B,C,D)T040). Sampling activities will include a sampling methodology that includes a representative sample from the lowest point in the tank. 5 Perform periodic (quarterly) sampling and analysis for water and sediment and the levels of microbiological organisms for the diesel generator fuel oil storage tanks (0A(B,C,D)T038). 6 Perform periodic (quarterly) sampling and analysis for particulate concentration and the levels of microbiological organisms for the diesel fire pump fuel oil storage tank (00T041) and the diesel fire pump day tank (00T543). 7 Perform periodic (quarterly) trending of water and sediment content, particulate concentration, and the levels of microbiological organisms for all fuel oil tanks within the scope of the program. 8 Evaluate the need for biocide or corrosion inhibitor addition if periodic testing indicates biological activity or evidence of corrosion. 9 Evaluate degradation identified during tank internal inspections against acceptance criteria to confirm that the timing of subsequent inspections will maintain the components' intended function throughout the second period of extended operation based on the projected rate of degradation.	Program will be enhanced no later than six months prior to the second period of extended operation unless a more specific schedule is described within the enhancement (i.e., Enhancement 1). Inspections that are to be completed prior to the second period of extended operation will be completed no later than six months prior to the second period of extended operation, or no later than the last refueling outage prior to the second period of extended operation.	Subsequent License Renewal Application Section A.2.1.19 7/10/2018 ML18193A689

<table>
<tr><th>Item No.</th><th>FSAR Supplement Section</th><th>Commitment</th><th>Implementation Schedule</th><th>Source</th></tr>
<tr>
<td>20</td>
<td>Reactor Vessel Material Surveillance</td>
<td>Reactor Vessel Material Surveillance is an existing program that will be enhanced to:
1 Withdraw and test the Unit 2, 120 degree reconstituted capsule and the Unit 3, 120 degree capsule per the capsule withdrawal schedules below. A technical summary report containing the test results shall be submitted to the NRC per the requirements of 10 CFR Part 50, Appendix H. Any changes to the Reactor Vessel Material Surveillance program must be submitted for NRC review and approval in accordance with 10 CFR Part 50, Appendix H.
<table>
<tr><th colspan="3">Peach Bottom Unit 2 Capsule Withdrawal Schedule</th></tr>
<tr><th>Capsule</th><th>Capsule Lead Factor (0T/¼T)</th><th>Capsule Withdrawal EFPY</th></tr>
<tr><td>30°</td><td>0.95/1.38</td><td>Per BWRVIP-86-R1-A</td></tr>
<tr><td>120°</td><td>0.95/1.38</td><td>7.53 (actual)</td></tr>
<tr><td>120° Reconstituted</td><td>0.95/1.38</td><td>60 - 62[(1)]</td></tr>
<tr><td>300°</td><td>0.95/1.38</td><td>Per BWRVIP-86-R1-A</td></tr>
</table>
1. Capsule 120° was withdrawn, tested, and reconstituted after Cycle 7 and re-inserted after Cycle 8, therefore capsule EFPY is 1.21 EFPY less than plant operating EFPY.
<table>
<tr><th colspan="3">Peach Bottom Unit 3 Capsule Withdrawal Schedule</th></tr>
<tr><th>Capsule</th><th>Capsule Lead Factor (0T/¼T)</th><th>Capsule Withdrawal EFPY</th></tr>
<tr><td>30°</td><td>0.95/1.38</td><td>7.57 (actual)</td></tr>
<tr><td>30° Reconstituted</td><td>0.95/1.38</td><td>Spare[(1)]</td></tr>
<tr><td>120°</td><td>0.95/1.38</td><td>60 - 62</td></tr>
<tr><td>300°</td><td>0.95/1.38</td><td>Spare[(2)]</td></tr>
</table>
1. Capsule 30° was withdrawn, tested, and reconstituted after Cycle 7 and re-inserted after Cycle 8, therefore capsule EFPY is 1.41 EFPY less than plant operating EFPY.
2. Capsule 300° was withdrawn after Cycle 7 and re-inserted after Cycle 8, therefore capsule EFPY is 1.41 EFPY less than plant operating EFPY.</td>
<td>Enhancement 1 will be implemented in accordance with the schedules defined in the commitment.</td>
<td>Subsequent License Renewal Application Section A.2.1.20
7/10/2018
ML18193A689</td>
</tr>
</table>

Item No.	FSAR Supplement Section	Commitment	Implementation Schedule	Source
21	One-Time Inspection	One-Time Inspection aging management program 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 second period of extended operation; (b) the insignificance of an aging effect; and (c) that long-term loss of material will not cause a loss of intended function for steel components exposed to environments that do not include corrosion inhibitors as a preventive action.	Program will be implemented no later than 10 years prior to the second period of extended operation. The one-time inspections are required to be performed within the 10 years prior to the second period of extended operation, and no later than six months prior to the second period of extended operation, or no later than the last refueling outage prior to the second period of extended operation.	Subsequent License Renewal Application Section A.2.1.21 7/10/2018 ML18193A689
22	Selective Leaching	Selective Leaching aging management program 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 closed cycle cooling water and treated water environment since plant-specific operating experience has not revealed selective leaching in these environments, as well as opportunistic and periodic inspections for susceptible components exposed to raw water, waste water, and soil (which may include groundwater) environments.	Program will be implemented no later than 10 years prior to the second period of extended operation. The one-time inspections and initial periodic inspections are required to be performed within the 10 years prior to the second period of extended operation, and no later than six months prior to the second period of extended operation, or no later than the last refueling outage prior to the second period of extended operation.	Subsequent License Renewal Application Section A.2.1.22 7/10/2018 ML18193A689

Item No.	FSAR Supplement Section	Commitment	Implementation Schedule	Source
23	ASME Code Class 1 Small-Bore Piping	ASME Code Class 1 Small-Bore Piping aging management program 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 NPS diameter less than 4 inches and greater than or equal to 1 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. 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 operating experience and whether actions have been implemented that effectively mitigate the cause(s) of any past cracking. The program provides for a one-time inspection of a sample of the population of welds (butt welds or socket welds) for plants that have not experienced cracking or have experienced cracking but have implemented corrective actions, such as a design change, to effectively mitigate the cause(s) of the 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.	Program will be implemented no later than six years prior to the second period of extended operation. The one-time inspections are required to be performed within the six years prior to the second period of extended operation, and no later than six months prior to the second period of extended operation, or no later than the last refueling outage prior to the second period of extended operation.	Subsequent License Renewal Application Section A.2.1.23 7/10/2018 ML18193A689
24	External Surfaces Monitoring of Mechanical Components	External Surfaces Monitoring of Mechanical Components aging management program is a new condition monitoring program that will manage loss of material and cracking of metallic components, as well as loss of material, cracking, and hardening and loss of strength for elastomeric components, loss of preload for HVAC closure bolting, and reduced thermal insulation resistance. Periodic visual inspections, not to exceed a refueling outage interval, of metallic components, elastomers, and insulation jacketing (insulation when not jacketed) will be conducted.	Program will be implemented no later than six months prior to the second period of extended operation.	Subsequent License Renewal Application Section A.2.1.24 7/10/2018 ML18193A689
25	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program is a new condition monitoring program that will manage loss of material and cracking of metallic components, as well as loss of material and hardening and loss of strength of elastomeric materials. Reduction of heat transfer will also be managed. This program will consist of visual inspections of all accessible internal surfaces of piping, piping components, ducting, heat exchanger components, and other mechanical components.	Program will be implemented no later than six months prior to the second period of extended operation.	Subsequent License Renewal Application Section A.2.1.25 7/10/2018 ML18193A689
26	Lubricating Oil Analysis	Existing program is credited.	Ongoing	Subsequent License Renewal Application Section A.2.1.26 7/10/2018 ML18193A689

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27	Monitoring of Neutron-Absorbing Materials Other than Boraflex	Existing program is credited.	Ongoing	Subsequent License Renewal Application Section A.2.1.27 7/10/2018 ML18193A689
28	Buried and Underground Piping and Tanks	Buried and Underground Piping is an existing program that will be enhanced to: 1 Manage cracking for buried stainless steel piping, utilizing a method that has been demonstrated to be capable of detecting cracking, whenever coatings are removed exposing the base material. 2 Perform direct visual inspection of buried piping within the scope of license renewal in accordance with NUREG-2191, Table XI.M41-2, and sections 4.a and 4.b, during each 10-year period, beginning 10 years prior to the second period of extended operation. The number of inspections of buried piping will be based upon the as-found results of cathodic protection system availability and effectiveness. The length of piping for each inspection will be based on the recommendations in section 4.c. 3 Perform extent of condition inspections as follows: When measured pipe wall thickness, projected to the end of the second period of extended operation, does not meet the minimum pipe wall thickness requirements due to external environments, the number of inspections within the affected piping categories will be doubled or increased by five, whichever is smaller. If adverse indications are found in the expanded sample, an analysis will be conducted to determine the extent of condition and extent of cause. The size of the follow-up inspections will be determined based on the analysis. 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 system is 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. 4 Upgrade existing cathodic protection system no later than 5 years prior to the second period of extended operation, in accordance with NACE SP0169-2007, to ensure effective control of external corrosion of underground piping and tanks.	Program will be enhanced no later than 10 years prior to the second period of extended operation, unless a more specific schedule is described within the enhancement (i.e., Enhancement 4). Inspections that are required to be performed in the 10-year period prior to the second period of extended operation will be completed no later than six months prior to the second period of extended operation, or no later than the last refueling outage prior to the second period of extended operation.	Subsequent License Renewal Application Section A.2.1.28 7/10/2018 ML18193A689

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28 (Cont'd)		5 Perform examination of buried emergency diesel generator fuel oil tanks from the internal surface of the tank using volumetric techniques during each 10-year period, beginning 10 years prior to the second period of extended operation. A minimum of 25 percent coverage is required. 6 Perform annual system monitoring of the cathodic protection system to ensure effective protection of buried piping. 7 Apply coating to buried portions of the 10-inch diameter stainless steel line from the torus dewatering tank to the condensate transfer pump suction line in accordance with approved station specifications, during the 10-year period prior to the second period of extended operation.		
29	Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks	Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks aging management program is a new condition monitoring program that manages degradation of internal coatings/linings exposed to raw water, treated water, waste water, condensation, 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.	Program will be implemented no later than 10 years prior to the second period of extended operation. Baseline inspections that may be required in the 10-year period prior to the second period of extended operation will be completed no later than six months prior to the second period of extended operation, or no later than the last refueling outage prior to the second period of extended operation.	Subsequent License Renewal Application Section A.2.1.29 7/10/2018 ML18193A689
30	ASME Section XI, Subsection IWE	ASME Section XI, Subsection IWE is an existing program that will be enhanced to: 1 Perform surface examinations on accessible portions of high temperature drywell mechanical penetrations, in addition to visual examinations, to detect cracking, once per 10-year interval during the second period of extended operation. 2 Clarify that the recommended guidance for proper selection of bolting material and lubricants, and appropriate installation torque or tension to prevent or minimize loss of bolting preload and cracking of high-strength bolting is a requirement at Peach Bottom in accordance with the guidelines provided in EPRI NP-5067 and TR-104213. Clarify that the recommended requirements for storage, lubricant selection, and bolting and coating material selection include the recommendations in Section 2 of Research	Program will be enhanced no later than six months prior to the second period of extended operation.	Subsequent License Renewal Application Section A.2.1.30 7/10/2018 ML18193A689 Exelon Letter PBAPS SLRA Supplement No. 2 1/23/2019 ML19023A015

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30 (Cont'd)		Council on Structural Connections (RCSC) publication "Specification for Structural Joints Using High-Strength Bolts," are a requirement at Peach Bottom. 3 Implement a one-time supplemental volumetric examination of the containment metal shell surfaces that are inaccessible from one side, if triggered by plant-specific OE. The trigger for this supplemental examination is plant-specific occurrence or recurrence of measurable metal shell corrosion (base metal material loss exceeding 10 percent 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 plant-specific OE and/or other relevant considerations such as environment. 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 percent confidence that 95 percent of the accessible portion of the containment liner is not experiencing corrosion degradation with greater than 10 percent loss of nominal thickness.		
31	ASME Section XI, Subsection IWF	ASME Section XI, Subsection IWF 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, buried underground, or encapsulated by 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 10 years during the second period of extended operation. 2 Perform a one-time inspection of an additional five percent of the currently inspected sample size specified in Table IWF-2500-1 for Class 1, 2, and 3 piping supports. Conduct the one-time inspection within the five years prior to entering the second period of extended operation. Select the additional supports from the remaining population of IWF piping supports. Ensure that the sample expansion includes components that are most susceptible to age-related degradation (i.e., based on factors such as time in service, material, and aggressiveness of the environment). 3 Perform VT-3 examinations of all ASTM A-490 bolting materials, used for the reactor vessel support skirts and for the core spray pump supports once per 10-year interval during the second period of extended operation. Perform volumetric examination comparable to that of ASME Code Section XI, Table IWB-2500-1, Examination Category B-G-1, of 12 ASTM A490 bolts at each of the reactor vessel support skirts, once per 10-year interval during the second period of extended operation. If the volumetric	Program will be enhanced in accordance with the schedule described within the enhancements. Inspections that are required to be performed in the five-year period prior to the second period of extended operation will be completed no later than six months prior to the second period of extended operation, or no later than the last refueling outage prior to the second period of extended operation.	Subsequent License Renewal Application Section A.2.1.31 7/10/2018 ML18193A689 Exelon Letter PBAPS SLRA Supplement No. 2 1/23/2019 ML19023A015 Exelon Letter PBAPS SLRA Supplement No. 3 2/11/2019 ML19042A131

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31 (Cont'd)		examination of these ASTM A490 bolts reveals conditions that do not meet acceptance criteria, enter the results into the corrective action program and extend the ASTM A490 bolt examination scope to include other ASTM A490 bolts used in similar joint configurations and subject to similar environmental exposure conditions, which is comparable to the methodology used by the ASME Code, section IWF-2430 for IWF component supports. 4 Clarify that the recommended guidance for proper selection of bolting material and lubricants, and appropriate installation torque or tension to prevent or minimize loss of bolting preload and cracking of high-strength bolting is a requirement at Peach Bottom in accordance with the guidelines provided in EPRI NP-5067 and TR-104213. Clarify that the recommended requirements for storage, lubricant selection, and bolting and coating material selection include the recommendations in Section 2 of Research Council on Structural Connections (RCSC) publication "Specification for Structural Joints Using High-Strength Bolts," are a requirement at Peach Bottom. 5 Enhance engineering procedures to require volumetric examination should high-strength bolting (actual measured yield strength greater than or equal to 150 ksi) in sizes greater than 1-inch nominal diameter (including ASTM A490 and equivalent ASTM F2280) be installed. The examination shall be comparable to that of ASME Code Section XI, Table IWB-2500-1, Examination Category B-G-1, at least once per 10-year interval, to detect cracking, in addition to the VT-3 examination. 6 Provide guidance, regarding the selection of supports to be inspected on subsequent inspections, when a support that does not meet the threshold of "unacceptable for continued service" as defined in IWF-3400, is restored in accordance with the Corrective Action Program. The enhanced guidance will ensure that the sample is increased or modified to include another support that is representative of the remaining population of supports that were not repaired.		
32	10 CFR Part 50, Appendix J	Existing program is credited.	Ongoing	Subsequent License Renewal Application Section A.2.1.32 7/10/2018 ML18193A689
33	Masonry Walls	Masonry Walls is an existing program that will be enhanced to: 1 Expand the program to include masonry walls in the Administration Building and Dewatering Building.	Program will be enhanced no later than six months prior to the second period of extended operation.	Subsequent License Renewal Application Section A.2.1.33 7/10/2018 ML18193A689

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34	Structures Monitoring	Structures Monitoring is an existing program that will be enhanced to: 1 Explicitly include the following components and commodities within the scope of the program: a. Bearing pads for supports b. Electrical duct banks c. Electrical raceway such as cable tray, conduit, and wireway gutter d. Hatches and plugs e. Manholes and handholes f. Miscellaneous components such as louvers g. Panels, racks, frames, cabinets, and other enclosures h. Permanent shielding blankets 2 Add the following structures to the scope of the program: a. Administration Building b. Boiler House c. Dewatering Building 3 Perform inspections under the enhanced program in order to establish quantitative baseline inspection data prior to the second period of extended operation. 4 Provide evaluation criteria for structural concrete using quantitative second tier criteria of Chapter 5 in ACI 349.3R. 5 Monitor for reduction in concrete anchor capacity if local concrete degradation such as cracking and loss of material is identified. 6 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 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 second license renewal. 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 license renewal, 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	Program will be enhanced no later than six months prior to the second period of extended operation. Baseline inspections will be completed no later than six months prior to the second period of extended operation, or no later than the last refueling outage prior to the second period of extended operation.	Subsequent License Renewal Application Section A.2.1.34 7/10/2018 ML18193A689 Exelon Letter PBAPS SLRA Supplement No. 2 1/23/2019 ML19023A015 Exelon Letter PBAPS SLRA RAI Set 2 Response 5/23/2019 ML19143A053

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34 (Cont'd)		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. d. Develop the initial engineering evaluations prior to the second period of extended operation. 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 tier 2 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. 7 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. 8 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. 9 Evaluate the acceptability of inaccessible areas when conditions exist in accessible areas that could indicate the presence of, or result in, degradation to such inaccessible areas 10 Expand the program to monitor elastomeric vibration isolators and bearing pads for cracking, loss of material, and hardening. Supplement visual inspection of elastomeric elements with tactile inspection to detect		

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34 (Cont'd)		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 loss of isolation or support function. 11 Clarify that loose bolts and nuts and cracked bolts are not acceptable unless accepted by engineering evaluations. 12 Expand the program to inspect the fiberglass outer covering of permanent shielding blankets for signs of tears. If a tear is found, enter the condition into the corrective action program for evaluation. Repair or replace the permanent shielding, unless an evaluation determines that the condition is acceptable. 13 Clarify that the recommended guidance for proper selection of bolting material and lubricants, and appropriate installation torque or tension to prevent or minimize loss of bolting preload and cracking of high-strength bolting is a requirement at Peach Bottom in accordance with the guidelines provided in EPRI NP-5067 and TR-104213. Clarify that the recommended requirements for storage, lubricant selection, and bolting and coating material selection include the recommendations in Section 2 of Research Council on Structural Connections (RCSC) publication "Specification for Structural Joints Using High-Strength Bolts," are a requirement at Peach Bottom.		
35	Inspection of Water-Control Structures Associated with Nuclear Power Plants	Inspection of Water-Control Structures Associated with Nuclear Power Plants is an existing program that will be enhanced to: 1 Explicitly include the sluice gates at the Circulating Water Pump Structure within the scope of the program. 2 Clarify parameters to be monitored and inspected at the Emergency Cooling Tower and Reservoir to include visual inspection for loss of material and reduction of heat transfer due to fouling for the cooling tower fill, and visual inspection of the drift eliminators. 3 Monitor for reduction in concrete anchor capacity if local concrete degradation such as cracking and loss of material is identified. 4 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. 5 Include provisions for special inspections following significant natural phenomena, such as large floods, hurricanes, tornadoes, or intense local rainfall as part of the guidelines for severe weather and natural disasters. 6 Develop a new implementing procedure or revise an existing implementing procedure to address aging management of inaccessible areas exposed to	Program will be enhanced no later than six months prior to the second period of extended operation. Baseline inspections will be completed no later than six months prior to the second period of extended operation, or no later than the last refueling outage prior to the second period of extended operation.	Subsequent License Renewal Application Section A.2.1.35 7/10/2018 ML18193A689 Exelon Letter PBAPS SLRA Supplement No. 2 1/23/2019 ML19023A015 Exelon Letter PBAPS SLRA RAI Set 2 Response 5/23/2019 ML19143A053

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35 (Cont'd)		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 second license renewal. 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 license renewal, 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 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 second period of extended operation. 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 tier 2 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.		

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35 (Cont'd)		7 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. 8 Evaluate the acceptability of inaccessible areas when conditions exist in accessible areas that could indicate the presence of, or result in, degradation to such inaccessible areas. 9 Document the concrete conditions of submerged concrete structures. 10 Specify a six-year frequency for the inspection of the submerged portions of the traveling screen bays to match the inspection frequency of the submerged portions of the Circulating Water Pump Structure bays. 11 Perform inspections under the enhanced program in order to establish quantitative baseline inspection data prior to the second period of extended operation. 12 Provide evaluation criteria for structural concrete using quantitative second tier criteria of Chapter 5 in ACI 349.3R. 13 Clarify that loose bolts and nuts and cracked bolts are not acceptable unless accepted by engineering evaluations. 14 Clarify that the recommended guidance for proper selection of bolting material and lubricants, and appropriate installation torque or tension to prevent or minimize loss of bolting preload and cracking of high-strength bolting is a requirement at Peach Bottom in accordance with the guidelines provided in EPRI-NP-5067 and TR-104213. Clarify that the recommended requirements for storage, lubricant selection, and bolting and coating material selection include the recommendations in Section 2 of Research Council on Structural Connections (RCSC) publication “Specification for Structural Joints Using High-Strength Bolts,” are a requirement at Peach Bottom.		

Item No.	FSAR Supplement Section	Commitment	Implementation Schedule	Source
36	Protective Coating Monitoring and Maintenance Program	Protective Coating Monitoring and Maintenance Program is an existing program that will be enhanced to: 1 Use Level II or Level III coating inspectors, certified to ANSI N45.2.6, for inspection of Service Level I coatings.	Program will be enhanced no later than six months prior to the second period of extended operation.	Subsequent License Renewal Application Section A.2.1.36 7/10/2018 ML18193A689 Exelon Letter PBAPS SLRA RAI Response 5/2/2019 ML19122A289
37	Electrical Insulation for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	Electrical Insulation for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements is an existing program that will be enhanced to: 1 Include potential follow-up actions when visual inspections identify degraded or damaged conditions that may impact the performance of intended functions: a. Perform tests, for condition monitoring when visual inspections identify damaged or degraded insulation of in scope cables and connections. When a large number of cables are identified as damaged or 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. b. Document the basis for the samples selected for testing when visual inspections identify damaged or degraded insulation conditions for in scope cables and connections. 2 Visually inspect and evaluate cables and connections that were exposed to adverse localized environments (ALEs), which have since been mitigated, on an at least once every 10-year frequency, to assure the cumulative aging effects for electrical insulation, in remedied ALEs are not impacting the ongoing ability of the cables and connections to perform their intended function during the second period of extended operation.	Program will be enhanced no later than six months prior to the second period of extended operation. In addition, the first inspections incorporating enhancements will be completed no later than six months prior to the second period of extended operation, or no later than the last refueling outage prior to the second period of extended operation.	Subsequent License Renewal Application Section A.2.1.37 7/10/2018 ML18193A689

Item No.	FSAR Supplement Section	Commitment	Implementation Schedule	Source
38	Electrical Insulation for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits	Electrical Insulation for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits is an existing program that will be enhanced to: 1 Add the following radiation monitors to the scope of this program a. Main steam line radiation monitors b. Reactor building ventilation exhaust radiation monitors c. Control room fresh air supply radiation monitors d. Control room emergency ventilation supply radiation monitors e. Main stack radiation monitors. 2 Revise the implementing procedures to include documented periodic review of calibration test results for neutron monitors and radiation monitors within the scope of this program. Perform the first periodic review for second license renewal prior to the second period of extended operation and at least every 10 years thereafter.	Program will be enhanced no later than six months prior to the second period of extended operation. The first documented periodic review will be completed no later than six months prior to the second period of extended operation, or no later than the last refueling outage prior to the second period of extended operation.	Subsequent License Renewal Application Section A.2.1.38 7/10/2018 ML18193A689
39	Electrical Insulation for Inaccessible Medium-Voltage Power Cables 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 is an existing program that will be enhanced to: 1 Add periodic cable testing for additional circuits. 2 Perform cable testing of the circuits in the scope of this program at a frequency of at least once every six years. 3 Add periodic condition monitoring, as a preventive action, for manholes.	Program will be enhanced no later than six months prior to the second period of extended operation. Tests and inspections that are required to be performed prior to the second period of extended operation will be completed no later than six months prior to the second period of extended operation, or no later than the last refueling outage prior to the second period of extended operation.	Subsequent License Renewal Application Section A.2.1.39 7/10/2018 ML18193A689

Item No.	FSAR Supplement Section	Commitment	Implementation Schedule	Source
40	Electrical Insulation for Inaccessible Instrument and Control Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	Electrical Insulation for Inaccessible Instrument and Control Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements aging management program is a new condition monitoring program that will manage the effects of reduced insulation resistance of non-EQ, in scope, inaccessible (e.g., installed in buried conduits, cable trenches, cable troughs, duct banks, underground vaults, or direct buried installations), instrument and control cables, exposed to significant moisture.	Program will be implemented no later than six months prior to the second period of extended operation. One-time cable testing, initial manhole inspections, and initial visual cable inspections will be completed no later than six months prior to the second period of extended operation, or no later than the last refueling outage prior to the second period of extended operation.	Subsequent License Renewal Application Section A.2.1.40 7/10/2018 ML18193A689
41	Electrical Insulation for Inaccessible Low-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 aging management program is a new condition monitoring program that will manage the effects of reduced insulation resistance of non-EQ, in scope, inaccessible (e.g., installed in buried conduits, cable trenches, cable troughs, duct banks, underground vaults, or direct buried installations), low-voltage power cables (operating voltage less than 2 kV), exposed to significant moisture.	Program will be implemented no later than six months prior to the period of extended operation. One-time cable testing, initial manhole inspections, and initial visual cable inspections will be completed no later than six months prior to the second period of extended operation, or no later than the last refueling outage prior to the second period of extended operation.	Subsequent License Renewal Application Section A.2.1.41 7/10/2018 ML18193A689

Item No.	FSAR Supplement Section	Commitment	Implementation Schedule	Source
42	Metal Enclosed Bus	Metal Enclosed Bus aging management program is a new condition monitoring program that uses sampling and will manage the identified aging effects of in scope metal enclosed bus.	Program will be implemented no later than six months prior to the second period of extended operation. Initial inspections and resistance measurements will be completed no later than six months prior to the second period of extended operation, or no later than the last refueling outage prior to the second period of extended operation.	Subsequent License Renewal Application Section A.2.1.42 7/10/2018 ML18193A689
43	Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements aging management program is a new condition monitoring program that consists of a representative sample of electrical connections tested prior to the second period of extended operation. The results will be evaluated to determine if there is a need for subsequent periodic testing on a 10-year frequency.	Program will be implemented no later than six months prior to the second period of extended operation. Testing and evaluation of results will be completed no later than six months prior to the second period of extended operation, or no later than the last refueling outage prior to the second period of extended operation.	Subsequent License Renewal Application Section A.2.1.43 7/10/2018 ML18193A689
44	Wooden Pole	Wooden Pole is an existing program that will be enhanced to: 1 Document results that do not meet the acceptance criteria in the corrective action program.	Program will be enhanced no later than six months prior to the second period of extended operation.	Subsequent License Renewal Application Section A.2.2.1 7/10/2018 ML18193A689

Item No.	FSAR Supplement Section	Commitment	Implementation Schedule	Source
45	Fatigue Monitoring	Fatigue Monitoring is an existing program that will be enhanced to: 1 Update the SI:FatiguePro™ software to include the calculation and tracking of Environmentally Assisted Fatigue (EAF) in accordance NUREG/CR-6909, Revision 1. 2 Update applicable fatigue analyses and monitored component locations based on operating experience, plant modifications, inspection findings, changes to transient definitions, and unanticipated newly discovered fatigue loading events. 3 Provide procedural direction to require periodic validation of chemistry parameters used to determine F_{en} factors used in SI:FatiguePro™. 4 Provide procedural direction to add an additional acceptance criterion associated with HELB exclusion criteria.	Program will be enhanced no later than six months prior to the second period of extended operation.	Subsequent License Renewal Application Section A.3.1.1 7/10/2018 ML18193A689
46	Neutron Fluence Monitoring	Neutron Fluence Monitoring is an existing program that will be enhanced to: 1 Perform periodic monitoring of reactor pressure vessel and reactor vessel internals accumulated neutron fluence, every refueling cycle, to ensure that neutron fluence projections used to support reactor pressure vessel neutron irradiation embrittlement analyses (i.e., TLAAs, pressure-temperature limits) and reactor vessel internals aging effect assessments remain bounding with respect to actual plant operating conditions.	Program will be enhanced no later than six months prior to the second period of extended operation.	Subsequent License Renewal Application Section A.3.1.2 7/10/2018 ML18193A689
47	Environmental Qualification of Electric Equipment	Environmental Qualification of Electric Equipment is an existing program that will be enhanced to: 1 Add activities to visually inspect accessible, passive EQ equipment located in adverse localized environments at least once every 10 years. The first periodic visual inspection will be performed prior to the second period of extended operation. 2 Establish acceptance criteria for the visual inspections of accessible, passive EQ equipment located in adverse localized environments.	Program will be enhanced no later than six months prior to the second period of extended operation. New visual inspections of accessible, passive EQ equipment located in adverse localized environments will be completed no later than six months prior to the second period of extended operation, or no later than the last refueling outage prior to the second period of extended operation.	Subsequent License Renewal Application Section A.3.1.3 7/10/2018 ML18193A689
48	Operating Experience	Existing program is credited.	Ongoing	Subsequent License Renewal Application Section A.1.6 7/10/2018 ML18193A689

Item No.	FSAR Supplement Section	Commitment	Implementation Schedule	Source
49	Operating Experience Review	Exelon will perform an evaluation of operating experience at extended power uprate (EPU) levels prior to the period of extended operation to ensure that operating experience at EPU levels is properly addressed by the aging management programs. The evaluation will include Peach Bottom and other BWR plants operating at EPU levels.	Evaluation will be completed no later than six months prior to the second period of extended operation.	Subsequent License Renewal Application 7/10/2018 ML18193A689
50	FERC Inspections of the Conowingo Hydroelectric Plant (Dam)	Existing program is credited.	Ongoing	Subsequent License Renewal Application 7/10/2018 ML18193A689

APPENDIX 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 Exelon Generation Company, LLC (Exelon). This appendix also lists other correspondence on Peach Bottom Atomic Power Station (PBAPS) Units 2 and 3, in NRC Docket Nos. 50-277 and 50-278, respectively, related to the staff's review of the PBAPS subsequent license renewal application.

Table B-1 Chronology

Date	ADAMS Accession No.	Subject
7/10/2018	ML18193A689	Application for Subsequent Renewed Operating Licenses
7/24/2018	ML18205A311	Application for Subsequent Renewed Operating Licenses - Update per 10 CFR 2.390
8/1/2018	ML18191B175	Receipt and Availability of the Subsequent License Renewal Application for the Peach Bottom Atomic Power Station Units 2 and 3
8/27/2018	ML18191B280	Peach Bottom Atomic Power Station, Units 2 and 3, Determination of Acceptability and Sufficiency for Docketing, Proposed Review Schedule, and Opportunity for a Hearing Regarding the Exelon Generation Company, LLC, Application for Subsequent License Renewal (EPID No. L-2018-RNW-0012)
9/5/2018	ML18214A383	Peach Bottom Atomic Power Station, Units 2 and 3, Subsequent License Renewal Application Online Reference Portal (EPID No. L-2018-RNW-0012)
9/13/2018	ML18249A280	Peach Bottom Atomic Power Station, Units 2 and 3, Plan for the Operating Experience Audit Regarding the Subsequent License Renewal Application Review
9/14/2018	ML18257A143	Changes to the Peach Bottom Atomic Power Station, Units 2 and 3, Subsequent License Renewal Application [Supplement No. 1]
10/16/2018	ML18282A029	Peach Bottom Atomic Power Station, Units 2 and 3 - Plan for the In-office Regulatory Audit Regarding the Subsequent License Renewal Application Review (EPID No. L-2018-RNW-0012)
1/23/2019	ML19023A015	Supplement No. 2 - Changes to the Peach Bottom Atomic Power Station, Units 2 and 3, Subsequent License Renewal Application
2/11/2019	ML19042A131	Supplement No. 3 - Changes to the Peach Bottom Atomic Power Station, Units 2 and 3, Subsequent License Renewal Application
2/12/2019	ML19232A420	NRC Email (B. Brady to D. Distel), Peach Bottom Atomic Power Station Subsequent License Renewal Application Supplement - Section 4.6, dated February 12, 2019
2/26/2019	ML19029B121	Peach Bottom Atomic Power Station Units 2 and 3 - Report for the Operating Experience Review Audit regarding the Subsequent License Renewal Application Review (EPID No. L-2018-RNW-0012) *[superseded by letter dated June 6, 2019]*
3/5/2019	ML19065A008	Response to NRC Audit Review Information Request - Application for Subsequent Renewed Operating Licenses - Section 4.6 Primary Containment Fatigue Analyses **
3/18/2019	ML19077A253	Supplement No. 4 - Changes to the Peach Bottom Atomic Power Station, Units 2 and 3, Subsequent License Renewal Application

Date	ADAMS Accession No.	Subject
4/10/2019	ML19108A427	Requests for Additional Information for the Safety Review of the Peach Bottom Atomic Power Station, Units 2 and 3 Subsequent License Renewal Application – Set 1
5/2/2019	ML19122A289	Response to NRC Requests for Additional Information, Set 1, dated April 10, 2019, related to the Peach Bottom Atomic Power Station, Units 2 and 3, Subsequent License Renewal Application
5/3/2019	ML19249C725	Requests for Additional Information for the Safety Review of the Peach Bottom Atomic Power Station, Units 2 and 3 Subsequent License Renewal Application – Set 2
5/7/2019	ML19253D292	Request for Clarification of Information [regarding the Water Chemistry Program]
5/13/2019	ML19133A179	Response to NRC Request for Clarification of Information, dated May 7, 2019, related to the Peach Bottom Atomic Power Station, Units 2 and 3, Subsequent License Renewal Application
5/15/2019	ML19140A281	Request for additional information for the safety review of the Peach Bottom subsequent license renewal application - Responses to Set 1 [Second Round] RAIs
5/15/2019	ML19246A145	Clarification call to discuss Exelon's response to NRC requests for additional Information (RAI) 3.3.2.1.1-1
5/23/2019	ML19143A053	Response to NRC Requests for Additional Information, Set 2, dated May 3, 2019, related to the Peach Bottom Atomic Power Station, Units 2 and 3, Subsequent License Renewal Application
5/29/2019	ML19238A303	Public clarification call with Exelon to discuss Exelon's response to NRC Requests for Additional Information on environmental fatigue
5/30/2019	ML19150A297	Revised Responses to NRC Requests for Additional Information, Fire Water System, related to the Peach Bottom Atomic Power Station, Units 2 and 3, Subsequent License Renewal Application
6/5/2019	ML19240A300	Public clarification call with Exelon to discuss questions on their coatings and linings of certain components aging management program and their inspection of buried and underground piping and tanks aging management program for subsequent license renewal
6/6/2019	ML19142A369	Peach Bottom Atomic Power Station Units 2 and 3 – Revised Report for the Operating Experience Review Audit regarding the Subsequent License Renewal Application Review (EPID No. L-2018-RNW-0012)
6/6/2019	ML19157A009	Response to NRC Request for Additional Information, dated May 15, 2019 related to the Peach Bottom Atomic Power Station, Units 2 and 3, Subsequent License Renewal Application
6/12/2019	ML19163A222	Revised Response to NRC Request for Additional Information, Buried Pipe, related to the Peach Bottom Atomic Power Station, Units 2 and 3, Subsequent License Renewal Application
6/12/2019	ML19163A223	Revised Response to NRC Request for Additional Information, Core Shroud Support Fatigue Analysis Reevaluation, related to the Peach Bottom Atomic Power Station, Units 2 and 3, Subsequent License Renewal Application
6/12/2019	ML19163A221	Supplement No. 5 - Changes to the Peach Bottom Atomic Power Station, Units 2 and 3, Subsequent License Renewal Application
7/1/2019	ML19182A112	First 10 CFR 54.21(b) Annual Amendment to the Peach Bottom Atomic Power Station, Units 2 and 3, Subsequent License Renewal Application [Supplement No. 6]
7/12/2019	ML19193A006	Supplement No. 7 - Changes to the Peach Bottom Atomic Power Station, Units 2 and 3, Subsequent License Renewal Application
7/25/2019	ML19206A180	Supplement No. 8 - Changes to the Peach Bottom Atomic Power Station, Units 2 and 3, Subsequent License Renewal Application

Date	ADAMS Accession No.	Subject
7/31/2019	ML19210C571	Schedule Revision for the Review of the Peach Bottom Atomic Power Station Units 2 and 3 Subsequent License Renewal Application (EPID Nos. L-2018-RNW-0012 / L-2018-RNW-0013)
8/13/2019	ML19225B976	Response to NRC Request for Clarification of Information, dated August 1, 2019, related to the Peach Bottom Atomic Power Station, Units 2 and 3, Subsequent License Renewal Application
9/24/2019	ML19205A206	Peach Bottom Atomic Power Station, Units 2 and 3 – Report for the In-Office Regulatory Audit Regarding the Subsequent License Renewal Application Review
10/7/2019	ML19280B255	Peach Bottom SLRA Revision to BWR Vessel Internals Program Enhancement 1
10/7/2019	ML19280D820	Safety Evaluation Report with Confirmatory Item Related to the License Renewal of Peach Bottom Atomic Power Station Units 2 and 3
10/9/2019	ML19283A362	Supplement No. 9 - Changes to the Peach Bottom Atomic Power Station, Units 2 and 3, Subsequent License Renewal Application

APPENDIX C
PRINCIPAL CONTRIBUTORS

This appendix lists the principal contributors for the development of this safety evaluation report and their areas of responsibility.

Table C-1 Principal Contributors

Name	Responsibility
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Anderson, Shaun	Management Oversight
Bloom, Steve	Management Oversight
Buford, Angela	Reviewer—Structural
Brimfield, Terrance	Reviewer—Mechanical and Materials
Casto, Greg	Management Oversight
Chereskin, Alexander	Reviewer—Chemical
Cheruvenki, Ganesh	Reviewer—Mechanical and Materials
Cuadrado DeJesús, Samuel	Reviewer—Structural
Donoghue, Joe	Management Oversight
Fitzpatrick, Robert	Reviewer—Electrical
Fu, Bart	Reviewer—Mechanical and Materials
Gardner, William (Tony)	Reviewer—Mechanical and Materials
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Iqbal, Naeem	Reviewer—Scoping and Screening Methodology
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Prinaris, Andrew	Reviewer—Structural
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Thomas, George	Reviewer—Structural
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Whitman, Jennifer	Management Oversight
Wu, Angela	Operating Experience Audit Assistance
Yoder, Matthew	Reviewer—Mechanical and Materials
Young, Austin	Reviewer—Mechanical and Materials

APPENDIX D
REFERENCES

This appendix lists the references used throughout this safety evaluation report (SER) for review of the Peach Bottom Atomic Power Station (PBAPS) Units 2 and 3 subsequent license renewal application.

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Bennett Brady, Bill Rogers, Lauren Gibson

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U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

9. SPONSORING ORGANIZATION - NAME AND ADDRESS (If NRC, type "Same as above", if contractor, provide NRC Division, Office or Region, U. S. Nuclear Regulatory Commission, and mailing address.)

Same as above

10. SUPPLEMENTARY NOTES

B. Brady

11. ABSTRACT (200 words or less)

This safety evaluation report (SER) documents the technical review of the Peach Bottom Atomic Power Station (PBAPS) Units 2 and 3 subsequent license renewal application by the U.S. Nuclear Regulatory Commission (NRC) staff.

By letter dated July 10, 2018 (Agencywide Documents Access and Management System (ADAMS) Package Accession No. ML18193A689), Exelon Generation Company, LLC (Exelon) submitted an application for subsequent license renewal. Exelon requests renewal for a period of 20 years beyond the current expiration at midnight on August 8, 2033, for Unit 2 and July 2, 2034, for Unit 3.

PBAPS Units 2 and 3 are located partly in Peach Bottom Township, York County, partly in Drumore Township, Lancaster County, and partly in Fulton Township, Lancaster County, in southeastern Pennsylvania on the westerly shore of Conowingo Pond at the mouth of Rock Run Creek. Each unit consists of a General Electric boiling water reactor (BWR)/4 reactor vessel with a Mark I primary containment. Each unit has a licensed power output of 4,016 megawatts thermal. The NRC issued the initial operating licenses on October 25, 1973, for Unit 2 and July 2, 1974, for Unit 3. The NRC issued the first renewed operating licenses on May 7, 2003.

12. KEY WORDS/DESCRIPTORS (List words or phrases that will assist researchers in locating the report.)

Exelon Generation Company, LLC
Peach Bottom Atomic Power Station
PBAPS
Safety Evaluation Report
Safety Evaluation
Subsequent License Renewal
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Requirements of 10 CFR 54.29(a).

13. AVAILABILITY STATEMENT

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14. SECURITY CLASSIFICATION

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Safety Evaluation Report Related to the Subsequent License Renewal of Peach Bottom Atomic Power Station, Units 2 and 3

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