U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Safety Evaluation Report

Related to the Subsequent License Renewal
of Surry Power Station, Units 1 and 2

Docket Nos. 50-280 and 50-281

Virginia Electric and Power Company

FINAL REPORT

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ABSTRACT

This safety evaluation report (SER) documents the technical review of the Surry Power Station, Units 1 and 2 (Surry) subsequent license renewal application by the U.S. Nuclear Regulatory Commission (NRC) staff.

By letter dated October 15, 2018 (Agencywide Documents Access and Management System (ADAMS) Package Accession No. ML18291A842), Virginia Electric and Power Company (Dominion or the applicant) submitted an application for subsequent license renewal, requesting reactor operation from 60 to 80 years. Dominion requested renewal for a period of 20 years beyond the current expiration at midnight on May 25, 2032, for Unit 1 (Facility Operating License No. DPR32) and at midnight on January 29, 2033, for Unit 2 (Facility Operating License No. DPR37).

Surry Units 1 and 2 are located in Surry County, Virginia, adjacent to the James River. Each unit includes a three-coolant-loop, pressurized light water reactor nuclear steam supply system with licensed thermal power of 2,587 MWt. The NRC issued the initial operating licenses on May 25, 1972, for Unit 1 and January 29, 1973, for Unit 2. The NRC issued the first renewed operating licenses for these units on March 20, 2003.

This SER presents the status of the NRC staff's review of information submitted by Dominion through February 20, 2020. On the basis of its review of the subsequent license renewal application, the NRC staff has determined that Dominion has met the requirements of Title 10 of the *Code of Federal Regulations* Section 54.29(a).

TABLE OF CONTENTS

ABSTRACT .... **iii**

TABLE OF CONTENTS .... **v**

LIST OF TABLES .... **ix**

ABBREVIATIONS AND ACRONYMS .... **xi**

1 INTRODUCTION AND GENERAL DISCUSSION **1-1**
- 1.1 Introduction 1-1
- 1.2 License Renewal Background 1-2
  - 1.2.1 Preparations for Subsequent License Renewal 1-2
  - 1.2.2 Safety Review 1-5
  - 1.2.3 Environmental Review 1-6
- 1.3 Principal Review Matters 1-7
- 1.4 Interim Staff Guidance 1-8
- 1.5 Summary of Open Items 1-9
- 1.6 Summary of Confirmatory Items 1-9
- 1.7 Summary of Proposed License Conditions 1-9

2 STRUCTURES AND COMPONENTS SUBJECT TO AGING MANAGEMENT REVIEW **2-1**
- 2.1 Scoping and Screening Methodology 2-1
  - 2.1.1 Introduction 2-1
  - 2.1.2 Summary of Technical Information in the Application 2-1
  - 2.1.3 Scoping and Screening Program Review 2-1
  - 2.1.4 Plant Systems, Structures, and Components Scoping Methodology 2-3
  - 2.1.5 Screening Methodology 2-13
  - 2.1.6 Summary of Evaluation Findings 2-16
- 2.2 Plant-Level Scoping Results 2-16
  - 2.2.1 Introduction 2-16
  - 2.2.2 Summary of Technical Information in the Application 2-16
  - 2.2.3 Staff Evaluation 2-17
  - 2.2.4 Conclusion 2-17
- 2.3 Scoping and Screening Results: Mechanical Systems 2-17
  - 2.3.1 Reactor Vessel, Internals, and Reactor Coolant System 2-18
  - 2.3.2 Engineered Safety Features 2-22
  - 2.3.3 Auxiliary Systems 2-26
  - 2.3.4 Steam and Power Conversion Systems 2-58
- 2.4 Scoping and Screening Results: Structures 2-68
  - 2.4.1 Summary of Technical Information in the Application 2-68
  - 2.4.2 Staff Evaluation 2-69
  - 2.4.3 Conclusion 2-70
- 2.5 Scoping and Screening Results: Electrical and Instrumentation and Control Systems 2-70
  - 2.5.1 Summary of Technical Information in the Application 2-73
  - 2.5.2 Staff Evaluation 2-73
  - 2.5.3 Conclusion 2-73

2.6 Conclusion for Scoping and Screening 2-73

3 AGING MANAGEMENT REVIEW RESULTS 3-1
3.0 Applicant's Use of the Generic Aging Lessons Learned for Subsequent License Renewal Report 3-1
3.0.1 Format of the Subsequent License Renewal Application 3-2
3.0.2 Staff's Review Process 3-2
3.0.3 Aging Management Programs 3-6
3.0.4 QA Program Attributes Integral to Aging Management Programs 3-161
3.0.5 Operating Experience for Aging Management Programs 3-164
3.1 Aging Management of Reactor Vessels, Internals, and Reactor Coolant System 3-169
3.1.1 Summary of Technical Information in the Application 3-169
3.1.2 Staff Evaluation 3-170
3.2 Aging Management of Engineered Safety Features 3-190
3.2.1 Summary of Technical Information in the Application 3-190
3.2.2 Staff Evaluation 3-190
3.3 Aging Management of Auxiliary Systems 3-202
3.3.1 Summary of Technical Information in the Application 3-202
3.3.2 Staff Evaluation 3-202
3.4 Aging Management of Steam and Power Conversion Systems 3-225
3.4.1 Summary of Technical Information in the Application 3-225
3.4.2 Staff Evaluation 3-225
3.5 Aging Management of Containment, Structures, and Component Supports 3-234
3.5.1 Summary of Technical Information in the Application 3-234
3.5.2 Staff Evaluation 3-234
3.6 Aging Management of Electrical and Instrumentation and Controls 3-269
3.6.1 Summary of Technical Information in the Application 3-269
3.6.2 Staff Evaluation 3-269
3.7 Conclusion for Aging Management Review Results 3-276

4 TIME-LIMITED AGING ANALYSES 4-1
4.1 Identification of Time-Limited Aging Analyses and Exemptions 4-1
4.1.1 Summary of Technical Information in the Application 4-2
4.1.2 Staff Evaluation 4-2
4.1.3 Conclusion 4-5
4.2 Reactor Vessel Neutron Embrittlement Analysis 4-6
4.2.1 Neutron Fluence Projections 4-6
4.2.2 Upper-Shelf Energy 4-8
4.2.3 Pressurized Thermal Shock 4-11
4.2.4 Adjusted Reference Temperature 4-13
4.2.5 Pressure-Temperature Limits 4-15
4.2.6 Low Temperature Overpressure Protection 4-16
4.3 Metal Fatigue 4-17
4.3.1 Transient Cycle Projections for 80 Years 4-17
4.3.2 ASME Code, Section III, Class 1 Fatigue Analyses 4-19
4.3.3 ANSI B31.1 Allowable Stress Analyses 4-22
4.3.4 Environmentally-Assisted Fatigue 4-23
4.3.5 Reactor Vessel Internals Fatigue Analyses 4-28
4.4 Environmental Qualification (EQ) of Electric Equipment 4-30
4.4.1 Summary of Technical Information in the Application 4-30
4.4.2 Staff Evaluation 4-30

4.4.3 UFSAR Supplement 4-31
4.4.4 Conclusion 4-31
4.5 Concrete Containment Tendon Prestress 4-31
4.5.1 Summary of Technical Information in the Application 4-31
4.6 Containment Liner Plate, Metal Containments, and Penetrations Fatigue Analysis 4-32
4.6.1 Containment Liner Plate 4-32
4.6.2 Metal Containment 4-33
4.6.3 Containment Penetrations Fatigue Analyses 4-33
4.7 Other Plant-Specific TLAAs 4-34
4.7.1 Crane Load Cycle Limits 4-34
4.7.2 Reactor Coolant Pump Flywheel Fatigue Crack Growth Analysis 4-35
4.7.3 Leak-Before-Break Analysis 4-37
4.7.4 Spent Fuel Pool Liner Fatigue Analysis 4-42
4.7.5 Piping Subsurface Indications 4-43
4.7.6 Reactor Coolant Pump Code Case N-481 4-44
4.7.7 Cracking Associated with Weld Deposited Cladding 4-46
4.7.8 Steam Generator Tube High Cycle Fatigue Evaluation 4-49
4.7.9 Steam Generator Tube Wear Evaluation 4-51
4.8 Conclusion for TLAAs 4-53

5 REVIEW BY THE ADVISORY COMMITTEE ON REACTOR SAFEGUARDS 5-1

6 CONCLUSION 6-1

APPENDIX A LICENSE RENEWAL COMMITMENTS A-1

APPENDIX B CHRONOLOGY B-1

APPENDIX C PRINCIPAL CONTRIBUTORS C-1

APPENDIX D REFERENCES D-1

LIST OF TABLES

Table 3.0-1 Surry Aging Management Programs ... 3-6
Table 3.0-2 Comparison of Concrete Components ... 3-111
Table 3.1-1 Staff Evaluation for Reactor Vessel, Internals, and Reactor Coolant System Components Evaluated in the GALL-SLR Report ... 3-170
Table 3.2-1 Staff Evaluation for Engineered Safety Features Components Evaluated in the GALL-SLR Report ... 3-190
Table 3.3-1 Staff Evaluation for Auxiliary Systems Components Evaluated in the GALL-SLR Report ... 3-202
Table 3.4-1 Staff Evaluation for Steam and Power Conversion System Components in the GALL-SLR Report ... 3-225
Table 3.5-1 Staff Evaluation for Containments, Structures, and Component Supports Components in the GALL-SLR Report ... 3-234
Table 3.6-1 Staff Evaluation for Electrical Components Evaluated in the GALL-SLR Report ... 3-269
Table A-1 Surry License Renewal Commitments ... A-2
Table B-1 Chronology ... B-1
Table C-1 Principal Contributors ... C-1
Table D-1 References ... D-1

ABBREVIATIONS AND ACRONYMS

AAC	all aluminum conductor
AC	alternating current
ACI	American Concrete Institute
ACRS	Advisory Committee on Reactor Safeguards
ADAMS	Agencywide Documents Access and Management System
AEA	Atomic Energy Act of 1954, as amended
AERM	aging effect requiring management
A/LAI	applicant/licensee action item
AMA	aging management activity
AMP	aging management program
AMR	aging management review
ANP-XXX	AREVA Report
ANSI	American National Standards Institute
API	American Petroleum Institute
AREVA	Company name
ART	adjusted reference temperature
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ASR	alkali-silica reaction
ATWS	anticipated transient without scram
AVB	antivibration bars
B&W	Babcock & Wilcox
BAW-XXXX	B&W Report
BFB	baffle-former bolt
BMI	bottom-mounted instrumentation
BTP	Branch Technical Position
BUGLE	name of cross-section library
BWR	boiling water reactor
BWRVIP	Boiling Water Reactor Vessel Internals Program
°C	degrees Celsius
CAP	corrective action program
CASS	cast austenitic stainless steel
CAT	chemical addition tank
CBS	concrete biological shield
CBSE	common basis stress evaluation
CCW	closed cooling water
CFR	Code of Federal Regulations

CFPR	carbon fiber reinforced polymer
CLB	current licensing basis
CMAA	Crane Manufacturers Association of America
CMTR	certified materials test report(s)
CRD	control rod drive
CRDM	control rod drive mechanism
CRGT	control rod guide tubes
CUF	cumulative usage factor
CUF_{en}	environmentally adjusted cumulative usage factor
CVCS	chemical volume and control system
DBE	design basis event
DO	dissolved oxygen
DOE	U. S. Department of Energy
DORT	name of code.
DPR	docket, power reactor
EAF	environmentally assisted fatigue
ECCS	emergency containment cooling system
ECSTs	emergency condensate storage tanks
ECMT	emergency conduit makeup tanks
EFPY	effective full power years
EMA	equivalent margins analyses
EMDA	Expanded Materials Degradation Assessment
EPFM	elastic-plastic fracture mechanics
EPRI	Electric Power Research Institute
ESE	erosion susceptibility evaluation
ESW	emergency service water
EQ	environmental qualification
EVT-1	enhanced VT-1
°F	degrees Fahrenheit
FAC	flow-accelerated corrosion
FBX	firebox steel based
FCG	fatigue crack growth
FMECA	failure modes, effects, and criticality analysis
FRP	fiberglass reinforced plastic
FSAR	Final Safety Analysis Report
GALL-SLR	Generic Aging Lessons-Learned for Subsequent License Renewal (NUREG–2191)

GDC	general design criteria or general design criterion
GEIS	Generic Environmental Impact Statement (NUREG-1437)
IAEA	International Atomic Energy Agency
I&C	instrumentation and controls
IASCC	irradiation-assisted stress corrosion cracking
IGSCC	intergranular stress corrosion cracking
INPO	Institute of Nuclear Power Operations
IPA	integrated plant assessment
IQMB	Quality Assurance, Vendor Inspection, Maintenance, and Allegations Branch
ISI	in-service inspection
ISR/IC	irradiation-enhanced stress relaxation/irradiation-enhanced creep
KIC	fracture toughness coefficient
ksi	kilopound-force per square inch
LAW	lower axial welds
LBB	Leak-Before-Break
LEFM	linear elastic fracture mechanics
LGW	lower girth welds
LFW	lower flange welds
LOCA	loss of coolant accident
LR	license renewal
LTOP	low-temperature overpressure protection
LWR	light water reactor
MAW	middle axial welds
MEB	metal enclosed bus
MIC	microbiologically influenced corrosion
MRP	Materials Reliability Program
MSLB	main steam line break
MUR	measurement uncertainty recapture
n/cm^2	neutrons per square centimeter
NACE	National Association of Corrosion Engineers
NDE	non-destructive examination
NEA	Nuclear Energy Agency
NEI	Nuclear Energy Institute
NEPA	National Environmental Policy Act of 1969, as amended
NFPA	National Fire Protection Association
NPP	nuclear power plant

NRC	United States Nuclear Regulatory Commission
NSAL	Nuclear Safety Advisory Letter (Westinghouse)
NSAC	Nuclear Safety Analysis Council
NSR	non-safety related
NSSS	nuclear steam supply system
NST	neutron shield tank
NUREG	denotes publication by the Nuclear Regulatory Commission
OBE	operating basis earthquake
OE	operating experience
OECD	Organisation for Economic Co-operation and Development
PAMS	plant asset monitoring system
PORV	power operated relief valves
PTR	Project Topical Report
PTS	pressurized thermal shock
PVC	polyvinyl chloride
PWR	pressurized water reactor
PWROG	Pressurized Water Reactor Owners' Group
PWSCC	primary water stress corrosion cracking
QA	quality assurance
RAI	request for additional information
RCI	request for clarification of information
RCP	reactor coolant pump
RCS	reactor coolant system
RCSC	Research Council on Structural Connections
RFO	refueling outage
RG	Regulatory Guide
RLSB	name of a branch in a Branch Technical Position title
RPV	reactor pressure vessel
RSHXs	recirculation spray heat exchangers
RSST	reserve station service transformer
RT_{NDT}	reference temperature for nil-ductility transition
RT_{PTS}	reference temperature for pressurized thermal shock
RVI	reactor vessel internal
RWST	refueling water storage tank
SAW	submerged arc welding
SBO	station blackout

SC	structures and components
SCC	stress corrosion cracking
SE	safety evaluation
SER	safety evaluation report
SEE IN	Significant Event Evaluation and Information Network
SFP	spent fuel pool
SLR	subsequent license renewal
SLRA	subsequent license renewal application
SMAW	shielded metal arc welding
SNM	susceptible non-modeled
SPE	solid particle erosion
SPEO	subsequent period of extended operation
SPS	Surry Power Station, Units 1 and 2
SRM	Staff Requirements Memorandum
SRP-SLR	NUREG-2192, Revision 0, “Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants,” dated July 2017
SSC	structures, systems, and components
SSE	safe shutdown earthquake
TDH	total dynamic head
TLAA	time-limited aging analysis
TR	topical report
TS	technical specifications
UFSAR	Updated Final Safety Analysis Report
UAW	upper axial welds
USDA	United States Department of Agriculture
USE	upper shelf energy
UT	ultrasonic testing
UV	ultraviolet
WCAP	Westinghouse Commercial Atomic Power
WGPFE	Working Group Pipe Flaw Evaluation (ASME working group)

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 Surry Power Station, Units 1 and 2 (Surry), as filed by Virginia Electric and Power Company (Dominion Energy Virginia or the applicant), by letters dated October 15, 2018, (Agencywide Documents Access and Management System (ADAMS) Package Accession No. ML18291A842), January 29, 2019 (ADAMS Accession No. ML19042A137), April 2, 2019 (ADAMS Accession No. ML19095A666), June 10, 2019 (ADAMS Accession No. ML19168A028), October 14, 2019 (ADAMS Accession No. ML19294A044), October 31, 2019 (ADAMS Accession No. ML19310E716), November 19, 2019 (ADAMS Accession No. ML19329A287), and February 20, 2020 (ADAMS Accession No. ML20054B996).

Dominion's application seeks to renew Surry Renewed Facility Operating License Nos. DPR-32 and DPR-37 for an additional 20 years beyond the current expiration of their renewed licenses on May 25, 2032, for Unit 1, and January 29, 2033, for Unit 2. The NRC staff performed a safety review of Dominion'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 managers for the SLRA review are Ms. Lauren Gibson, who can be contacted by email at Lauren.Gibson@nrc.gov or by telephone at 301-415-1056, and Ms. Angela Wu, who can be contacted by email at Angela.Wu@nrc.gov or by telephone at 301-415-2995. Alternatively, send written correspondence to the following address:

Division of New and Renewed Licenses
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001
Attention: Lauren Gibson/Angela Wu, Mail Stop O11-F1

Surry Units 1 and 2 are located in Surry County, VA. Each unit consists of a Westinghouse three-loop pressurized-water reactor with licensed thermal power of 2,587 megawatts thermal. The NRC issued the initial operating licenses on May 25, 1972 for Unit 1, and January 29, 1973, for Unit 2. The NRC issued renewed operating licenses for Surry Units 1 and 2 on March 20, 2003. The Surry updated final safety analysis report (UFSAR) describes the plant and the site (ADAMS Accession Nos. ML19058A584 and ML19058A583).

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 Surry subsequent license renewal is based on Dominion's SLRA, the NRC staff's audits, and responses to the staff's requests for additional information (RAIs). Dominion 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 February 20, 2020.

The public may view 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 Williamsburg Library, 515 Scotland St., Williamsburg, VA 23185.

This SER summarizes the results of the 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 staff's evaluation of license renewal issues considered during its review of the application. SER Section 5 discusses the role of the Advisory Committee on Reactor Safeguards (ACRS). The conclusions of this SER are in Section 6.

SER Appendix A, "License Renewal Commitments," contains a table showing Dominion'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 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 staff's license renewal safety review is to verify that the applicant has identified aging effects that could impair the ability of structures and components within the scope of license renewal to perform their intended functions, and to demonstrate that these effects will be adequately managed during a period of extended operation. The regulations of 10 CFR Part 54 establish the regulatory requirements for both initial license renewal and 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 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 boiling water reactor (BWR) and pressurized water reactor (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 systems, structures, and components (SSCs), as well as a few other safety-related issues, during the period of extended operation.

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

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

(1) Safety-related systems, structures, and components which are those relied upon to remain functional during and following design-basis events (as defined in 10 CFR 50.49 (b)(1)) to ensure the following functions --

   i. The integrity of the reactor coolant pressure boundary;

   ii. The capability to shut down the reactor and maintain it in a safe shutdown condition; or

   iii. The capability to prevent or mitigate the consequences of accidents which could result in potential offsite exposures comparable to those referred to in § 50.34(a)(1), § 50.67(b)(2), or § 100.11 of [10 CFR Chapter I], as applicable.

(2) All 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 Updated Final Safety Analysis Report (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 Surry SLRA, Dominion 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 Surry 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 January 8, 2019, near the Surry site in Surry, VA, to assist the staff in identifying plant-specific environmental issues (ADAMS Accession No. ML19024A386). The staff issued an environmental scoping summary report in May 15, 2019, which included the comments received during the scoping process and the NRC staff's responses to those comments (ADAMS Accession No. ML19135A197).

The NRC staff issued its draft plant-specific supplement to the GEIS (Supplement 6, Second Renewal) in October 2019. Draft, plant-specific GEIS Supplement 6-SLR, documents the results of the NRC staff's environmental review and makes a preliminary recommendation on the license renewal action based on environmental considerations. A public webinar was held on the Surry DSEIS on November 7, 2019. After considering comments on the draft GEIS supplement, the staff will publish the final, plant-specific GEIS Supplement 6-SLR, 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 staff's technical review of the Surry 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.

As required by 10 CFR 54.19(a), the NRC requires a license renewal applicant to submit general information as specified in 10 CFR 50.22(a) through (e), (h), and (i), which Dominion provided in SLRA Section 1. The staff reviewed SLRA Section 1 and finds that Dominion 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, Dominion stated in SLRA Section 1.1.10:

> 10 CFR 54.19(b) requires that license renewal applications include "conforming changes to the standard indemnity agreement, 10 CFR 140.92, Appendix B, to account for the expiration term of the proposed renewed license." The current Indemnity Agreement (No. B-45) for SPS [Surry] states in Article VII that the Agreement shall terminate at the time of expiration of the license specified in Item 3 of the Attachment (to the Agreement). Item 3 of the Attachment to the Indemnity Agreement, as revised through Amendment No. 12, lists SPS operating license numbers DPR-32 and DPR-37. Dominion Energy Virginia has reviewed the original Indemnity Agreement and the Amendments. Neither Article VII nor Item 3 of the Attachment specifies an expiration date for license numbers DPR-32 and DPR-37. Therefore, no changes to the Indemnity Agreement are deemed necessary as part of this application. Should the license numbers be changed by NRC upon issuance of the subsequent renewed licenses, Dominion Energy

> Virginia requests that NRC amend the Indemnity Agreement to include conforming changes to Item 3 of the Attachment and other affected sections of the Agreement

The 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. Surry SLRA Sections 3 and 4 and Appendix B address the license renewal requirements of 10 CFR 54.21(a), (b), and (c). Surry 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. By letter dated October 14, 2019, Dominion submitted an SLRA update that summarizes the CLB changes that have occurred during the staff’s review of the SLRA. This submission satisfies 10 CFR 54.21(b) requirements.

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 Surry SLRA Appendix D, Dominion states that it had not identified any technical specifications changes necessary for issuance of the Surry 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 issues a report documenting its evaluation of the staff’s SLRA review and SER. SER Section 5 describes the role of the ACRS. SER Section 6 documents the findings required by 10 CFR 54.29.

1.4 Interim Staff Guidance

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

As of December 1, 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 Surry SLRA, including additional information Dominion submitted through February 20, 2020, the staff identified no open items.

1.6 Summary of Confirmatory Items

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 Surry SLRA, including additional information Dominion submitted through February 20, 2020, the staff has determined that no confirmatory items exist that require a formal response from Dominion.

1.7 Summary of Proposed License Conditions

After reviewing the Surry SLRA, including additional information and clarifications from Dominion submitted or provided through February 20, 2020, the NRC staff identified two proposed license conditions.

The first license condition requires Dominion, 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." Dominion may make changes to the programs and activities described in the UFSAR update and supplement provided Dominion 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 Dominion to complete future activities described in the UFSAR supplement before the beginning of the subsequent period of extended operation. Dominion 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) must 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, that perform an intended function as described in 10 CFR 54.4 and are subject to aging management review (AMR). 10 CFR 54.21 further requires that the application must describe and justify the methods used to identify the SSCs within the scope of subsequent license renewal and the SCs subject to 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 January 31, 2018 (ML18029A368)

SLRA Section 2.1, “Scoping and Screening Methodology,” describes the methodology used by Surry Power Station Units 1 and 2 (Surry or the applicant) to identify the SSCs within the scope of subsequent license renewal (scoping) and the SCs subject to 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 NUREG-2192, “Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants” (SRP-SLR), Section 2.1, “Scoping and Screening Methodology.” The following regulations provide the basis for the acceptance criteria that the staff uses to assess the adequacy of the applicant’s SLRA scoping and screening methodology:

- 10 CFR 54.4(a), as it relates to the identification of SSCs within the scope of the Rule
- 10 CFR 54.4(b), as it relates to the identification of the intended functions of SSCs within the scope of the Rule

- 10 CFR 54.21(a), as it relates to the methods used by the applicant to identify SCs subject to AMR

The staff reviewed the information in SLRA Section 2.1 to confirm that the applicant described a process—the methodology—for identifying SSCs that are within the scope of subsequent license renewal in accordance with the requirements of 10 CFR 54.4(a) and SCs that are subject to 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 (see Surry SLRA In-Office Audit Report ML19128A079).

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)
- Engineering drawings
- Controlled plant component database
- Fire protection report
- Maintenance rule system basis database
- Environmental qualification master list
- NRC safety evaluation reports
- Engineering evaluations and calculations
- Licensing correspondence
- Site walkdowns

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 determined 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 determined that the scoping and screening methodology implementing procedures are consistent with the methodology described in SLRA Section 2.1. The staff also determined that the methodology is sufficiently detailed in the implementing procedures to provide the applicant's staff with concise guidance on the scoping and screening process for SLRA activities.

Sources of Current Licensing Basis Information

Title 10 of the CFR Section 54.3(a), “Definitions,” defines the current licensing basis (CLB) as the set of NRC requirements applicable to a specific plant and a licensee's written commitments for ensuring compliance with and operation within applicable NRC requirements and the plant specific design basis (including all modifications and additions to such commitments over the life of the license) that are docketed and in effect. The CLB includes the NRC regulations contained in 10 CFR Parts 2, 19, 20, 21, 26, 30, 40, 50, 51, 52, 54, 55, 70, 72, 73, 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 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, and 2.1.2, the staff finds that the applicant’s consideration of document sources, including CLB information, is consistent with the SRP-SLR, and NEI 17-01 guidance and is in compliance with the Rule, and, therefore, is acceptable.

2.1.4 Plant Systems, Structures, and Components Scoping Methodology

SLRA Section 2.1.4, “Scoping Methodology,” states that the scoping process is the systematic process used to identify the 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 2.1.4.1, “Safety-Related – 10 CFR 54.4(a)(1),” which states:

> At SPS [Surry], the safety-related plant components are identified in controlled engineering drawings and in the PAMS [plant asset monitoring system] database.

> The safety-related classifications in the SPS PAMS database were populated and maintained using a controlled procedure, with classification criteria consistent with the above 10 CFR 54.4(a)(1) criteria, as described in [SLRA] Section 2.1.3.2.
>
> Safety-related classifications for systems and structures are based on PAMS safety classification, system and structure descriptions and analyses in the UFSAR, or on design basis documents such as engineering drawings, 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 subsequent license renewal.
>
> Plant conditions required per SLR-SRP, including conditions of normal operation, internal events, anticipated operational occurrences, design basis accidents, external events, and natural phenomena as described in the CLB, were considered for subsequent 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 Part 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 UFSAR and 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) (documented in the Surry In-Office Audit Report (ML19128A079)). The UFSAR and basis documents discuss events, such as internal and external flooding, tornadoes, and missiles. The staff determined that the applicant’s evaluation of DBEs is consistent with the SRP-SLR. The staff reviewed SLRA Section 2.1.5.1, 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 compliance 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 2.1.4.2, "Nonsafety-Related Affecting Safety-Related – 10 CFR 54.4(a)(2)," and associated 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 Systems, Structures, and Components Supporting Safety Functions</u>

SLRA Section 2.1.4.2, subsection, "Functional Support for Safety-Related SSC 10 CFR 54.4(a)(1) Functions," states, "The SPS UFSAR, CLB and other design basis documents were reviewed to identify nonsafety-related systems or structures required to support satisfactory accomplishment of a safety-related function. Nonsafety-related systems or structures credited in CLB documents to support a safety-related function have been included within the scope of subsequent license renewal." The applicant identified portions of nonsafety-related SSCs that were credited in CLB documents to support a safety-related (10 CFR 54.4(a)) function and included the portions of the nonsafety-related SSCs within the scope of license renewal in accordance with the requirements of 10 CFR 54.4(2).

<u>Nonsafety-Related Systems, Structures, and Components Attached to Safety-Related Systems, Structures, and Components</u>

SLRA Section 2.1.4.2, subsection, "Connected to and Provide Structural Support for Safety Related SSCs," states the following:

> The guidance of NEI 95-10, Appendix F (as referenced in NEI 17-01) was used to identify the endpoints of nonsafety-related piping components that are directly attached to, and [that] provide support for safety-related piping components. The attached nonsafety-related piping components must be included within scope up to and including the first seismic or equivalent anchor. NEI 95-10, Appendix F (as referenced in NEI 17-01) lists the following configurations that correspond to this requirement:
>
> - A seismic anchor is defined as a device or structure that ensures that forces and moments are restrained in three orthogonal directions.
> - An equivalent anchor may be defined in the CLB and can be credited for the 10 CFR 54.4(a)(2) evaluation.

- An equivalent anchor may also consist of a large piece of plant equipment (e.g., a heat exchanger) or a series of supports that have been evaluated as a part of a plant-specific piping design analysis to ensure that forces and moments are restrained in three orthogonal directions.
- There may be isolated cases where an equivalent anchor per a particular piping segment is not clearly described within the existing CLB information or original design basis. In those instances, a combination of restraints or supports such that the NSR piping and associated structures and components attached to the safety-related piping is included in scope up to a boundary point that encompasses at least two supports in each of three orthogonal directions.

In addition, SLRA Section 2.1.4.2, subsection, “Connected to and Provide Structural Support for Safety-Related SSCs,” states:

> An alternative to specifically identifying a seismic anchor or equivalent anchor is to include enough of the nonsafety-related piping run to ensure that these anchors are included and thereby ensure the piping and anchor intended functions are maintained. The following methods provide assurance that the included piping encompasses the nonsafety-related piping included in the design basis seismic analysis and is consistent with the current licensing basis:
>
> a) 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 subsequent license renewal scope should include the base-mounted component as it has a support function for the safety-related piping.
>
> b) A flexible connection is considered a pipe stress analysis model end point when the flexible connection effectively decouples the piping systems (i.e., does not support loads or transfer loads across it to connecting piping).
>
> c) A free end of nonsafety-related piping.
>
> d) For nonsafety-related piping runs that are connected at both ends to safety-related piping include the entire run of nonsafety-related piping.
>
> e) A point where the buried piping exits the ground. The buried portion of the piping should be included in the scope of subsequent license renewal.
>
> f) 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 (ten, at Surry), because significantly smaller piping does not impose loads on larger piping and does not support larger piping.

<u>Nonsafety-Related Systems, Structures, and Components with the Potential for Spatial Interaction with Safety-Related Systems, Structures, and Components</u>

SLRA Section 2.1.4.2, subsection, “Potential for Spatial Interactions with Safety-Related SSCs,” states:

> Nonsafety-related systems that are not connected to safety-related piping or components or are outside the structural support boundary for the attached safety-related piping system and have a spatial relationship such that their failure could adversely impact the performance of a safety-related SSC intended function, must

be included within the scope of subsequent license renewal in accordance with 10 CFR 54.4(a)(2) requirements. As described in NEI 95-10, Appendix F, there are two options when performing this scoping evaluation: a mitigative option and a preventive option.

SLRA Section 2.1.4.2, subsection, “Potential for Spatial Interactions with Safety-Related SSCs,” further states:

> 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 subsequent license renewal without consideration of plant mitigative features. SPS applied the preventive option for 10 CFR 54.4(a)(2) scoping.
>
> The preventive option as implemented at SPS is based upon a “spaces” approach for determining potential for spatial interactions with safety-related SSCs. The boundaries for the “spaces” are structure boundaries that act as physical barriers and separate safety-related targets from nonsafety-related hazards.
>
> Nonsafety-related piping and components that contain water, oil, or steam, and are located inside structures that contain safety-related SSCs, are included within the scope of subsequent license renewal for potential spatial interaction in accordance with the requirements of criterion 10 CFR 54.4(a)(2).

<u>Scoping of Abandoned Equipment</u>

SLRA Section 2.1.4.2, subsection, “Scoping of Abandoned Mechanical Components,” states:

> There are mechanical fluid components at SPS that have been abandoned. Abandoned piping components within structures containing safety-related components were excluded from scope when the following conditions were met:
>
> - The abandoned piping components do not provide structural or seismic support to attached safety-related piping, and
> - The abandoned piping is separated from sources of water by blanks, blind flanges or pipe caps. Closed valves are not credited to keep fluid from abandoned components, and
> - The abandoned piping is empty of fluid. Piping was verified to be empty by establishing configuration (such as the piping being open-ended at the low point), by review of documents that abandoned the equipment, or by ultrasonic testing or other method that is capable of confirming the absence of trapped fluid. If the above conditions are not met, the abandoned systems or portions thereof are included within the scope of LR for aging management. Abandoned equipment is not relied on to perform any function delineated in 10 CFR 54.4(a)(1) or (a)(3) as it is non-operational.

2.1.4.2.2 Staff Evaluation

The staff reviewed SLRA Section 2.1.4.2 in which the applicant described the scoping methodology for 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 Support a Safety-Related Function

The staff reviewed SLRA Section 2.1.4.2 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 their 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 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, which 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, is 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 2.1.4.2 that 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), and the bounding conditions identified in NEI 17-01.

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, is in accordance with the guidance of the SLR-SRP and the requirements of 10 CFR 54.4(a)(2).

Nonsafety-Related Systems, Structures, and Components with the Potential for Spatial Interaction with Safety-Related SSCs

The staff reviewed SLRA Section 2.1.4.2, which describes the method, a preventative approach, 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 applicant had used a preventive approach and 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 is in accordance with the guidance of the SRP-SLR and the requirements of 10 CFR 54.4(a)(2).

Scoping of Abandoned Equipment

The staff reviewed SLRA Section 2.1.4.2, which describes the method, a preventative approach, used to identify abandoned equipment providing structural or seismic support to safety-related SSCs or fluid-filled components 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 applicant had used three criteria to evaluate abandoned equipment, which, if met, provided the determination that the abandoned equipment would not be required to be included within the scope of subsequent license renewal in accordance with 10 CFR 54.4(a)(2).

The criteria used were that the abandoned equipment (1) did not provide structural or seismic support to safety-related SSCs, (2) was separated from water sources by blanks, flanges or pipe caps, and (3) was verified to not contain fluid. These criteria were applied to all abandoned equipment attached to, or in the vicinity of, safety-related SSCs. If the abandoned equipment did not meet each of the three criteria, the equipment was included within the scope of license renewal in accordance with 10 CFR 54.4(a)(2).

The staff finds that the applicant's methodology for identifying and including abandoned equipment, providing structural or seismic support to safety-related SSCs or with the potential for spatial interaction with safety-related SSCs, within the scope of subsequent license renewal is in accordance with the guidance of the SRP-SLR and the requirements of 10 CFR 54.4(a)(2).

2.1.4.2.3 Conclusion

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 compliance 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 2.1.4.3, "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 54.4(a)(3), the systems, structures, and components 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 2.1.4.3 further states:

> For each of the five regulations, a technical basis document was prepared to provide input into the scoping process. Each of the regulated event technical basis documents (described in [SLRA] Section 2.1.3.4) identify the systems and structures that are relied upon to demonstrate compliance with the applicable regulation. The technical basis documents also identify the source documentation used to determine the scope of components within the system that are credited to demonstrate compliance with each of the applicable regulated events. Guidance provided by the technical basis documents was incorporated into the system and structure scoping evaluations, to determine the SSCs credited for each of the regulated events. SSCs credited in the regulated events have been classified as satisfying criteria of 10 CFR 54.4(a)(3) and have been included within the scope of subsequent license renewal.

2.1.4.3.2 Staff Evaluation

The staff reviewed SLRA Section 2.1.4.3, which describes the method used to identify, and to include within the scope of subsequent license renewal, those SSCs relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48, "Fire Protection"); 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); 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 CFR50.63, "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 the 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.

The staff reviewed implementing procedures, subsequent license renewal drawings, and selected scoping results documentation. The staff determined that the applicant had evaluated the current licensing basis information to identify SSCs that perform the 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 is 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 2.1.4.3, the staff finds that the applicant's methodology for identifying and including SSCs that are relied on to remain functional during regulated events is in compliance 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 implemented in accordance with NEI 17-01, "Industry Guideline for Implementing the Requirements of 10 CFR Part 54 for Subsequent License Renewal."

SLRA Section 2.1.1 states:

> The initial step in the scoping process was to define the entire plant in terms of systems and structures. Each of these identified plant systems and structures were then evaluated against the scoping criteria in 10 CFR 54.4(a)(1), (a)(2), and (a)(3), to determine if the system or structure performs or supports a safety-related intended function, if the system or structure failure could prevent the satisfactory accomplishment of a safety-related function, or if the system or structure performs functions that demonstrate compliance with the requirements of 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 subsequent license renewal if any portion of the system met the scoping criteria in 10 CFR 54.4(a)(1), (a)(2), or (a)(3). Mechanical systems determined to be within the scope of subsequent 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 subsequent license renewal if any portion of the structure met the scoping criteria in 10 CFR 54.4(a)(1), (a)(2), or (a)(3). Structures were then further evaluated to determine those structural components that are required to perform or support the identified structure intended function(s).

> Systems that contain Electrical and Instrumentation and Control (I&C) components, but do not contain mechanical components, are addressed as electrical and I&C systems. Electrical and I&C systems were included within the scope of subsequent license renewal if any portion of the system met the scoping criteria in 10 CFR 54.4(a)(1), (a)(2), or (a)(3). Electrical and I&C components within the in-scope electrical and I&C systems were included within the scope of subsequent license renewal. Likewise, electrical and I&C components within in-scope mechanical systems were included within the scope of subsequent license renewal.

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

> The scoping process is the systematic process used to identify the SPS systems, structures, and components within the scope of the license renewal rule. 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 intended functions were identified from a review of the CLB and design basis documents. In-scope boundaries were established and documented in the scoping evaluations, based on the identified intended functions.

2.1.4.4.2 Staff Evaluation

The staff reviewed SLRA Sections 2.0, 2.1.1, and 2.1.4 and the associated subsections, which described 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 states that the applicant had defined the plant in terms of systems and structures and ensured that the entire plant was assessed for the scope of subsequent license renewal.

The staff reviewed SLRA Section 2.1.4 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 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 Systems"; SLRA Section 2.4, "Scoping and Screening Results: Structures"; and SLRA Section 2.5, "Scoping and Screening Results: Electrical and Instrumentation and Control Systems." 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 component types subject to aging management review. The staff determined that the applicant's process is consistent with the description provided in SLRA Sections 2.0, 2.1 through 2.1.4 and the guidance in SRP-SLR Section 2.1.

2.1.4.4.3 Conclusion

On the basis of its review of the information contained in the SLRA, the staff finds that the applicant's scoping methodology is consistent with the guidance contained in the SRP-SLR and identified those SSCs (1) that are safety-related, (2) 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, pressurized thermal shock, anticipated transient without scram, and station blackout. The staff finds that the applicant's methodology is in compliance 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, 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 Aging Management Review (AMR). In addition, the passive intended functions of structures and components subject to AMR were identified.

SLRA Section 2.1.1 further states:

> Selected components, such as equipment supports, structural items (e.g., fire barriers), and passive electrical components, were scoped and screened as commodities. As such, they were not evaluated with the individual system or structure, but were evaluated collectively as a commodity group.

SLRA Section 2.1.5.1, "Identification of Structures and Components Subject to AMR," states:

> The mechanical system screening process began with the results from the scoping process. For in-scope mechanical systems, the written descriptions and marked up system piping and instrumentation diagrams clearly identify the in-scope system boundary of passive components for subsequent license renewal. The marked up system piping and instrumentation diagrams are called subsequent license renewal boundary drawings. These system boundary drawings were reviewed to identify the passive, long-lived components, and the identified components were entered into the subsequent license renewal database. Component listings from the PAMS database were also reviewed to confirm that system components were considered during the process. In cases where the system piping and instrumentation diagram did not provide sufficient detail, such as for some large vendor supplied components (e.g., compressors, emergency diesel generators), the associated component drawings or vendor manuals were also reviewed. Plant

> walkdowns were performed when required for confirmation. Short-lived components were excluded from aging management review. The bases for their exclusion were documented and notes were added to the system boundary drawings to identify their status.

SLRA Section 2.1.5.1 further states:

> Structures and structural components typically perform their functions without moving parts and without a change in configuration or properties. When a structure or structural component was determined to be within the scope of subsequent license renewal by the scoping process described in [SLRA] Section 2.1.4.5, the structure screening methodology classified the component as active or passive. Active components do not require aging management. This is consistent with guidance found in NEI 95-10, Appendix B, as referenced by NEI 17-01. During the structure screening process, the intended function(s) of passive structural components were documented. In the structure screening process, an evaluation was made to determine whether in-scope structural components were subject to replacement based on a qualified life or specified time period. If an in-scope structural component was determined to be subject to replacement based on a qualified life or specified time period, the component was identified as short-lived and was excluded from an AMR. In such a case, the basis for determining that the structural component was short-lived was documented.

SLRA Section 2.1.5.1 further states:

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

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

Mechanical

The staff reviewed the applicant's methodology used for mechanical component screening as described in SLRA Sections 2.1.1 and 2.1.5.1. 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 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 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 AMR.

Structural

The staff reviewed the applicant's methodology used for structural component screening as described in SLRA Sections 2.1.1 and 2.1.5.1. 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 structural SCs subject to 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 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 AMR.

Electrical

The staff reviewed the applicant's methodology used for electrical component screening as described in SLRA Section 2.1.1 and Section 2.1.5.1. 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 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 AMR.

2.1.5.3 Conclusion

On the basis of its review of the SLRA, the staff finds that the applicant's screening methodology is 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 AMR. The staff concludes that the applicant's methodology is in compliance 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 SSCs subject to an AMR, as described, are in compliance 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, "Plant-Level Scoping Results," described how the applicant applied the scoping methodology to determine which systems and structures were 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) Safety-related systems, structures, and components that 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), and station blackout (10 CFR 50.63).

2.2.2 Summary of Technical Information in the Application

SLRA Section 2.2 states:

> Table 2.2-1 ["Plant-Level Scoping Results"] lists the SPS systems, structures and commodity groups that were evaluated to determine if they were within the scope of license renewal, using the methodology described in Section 2.1. A reference to the section of the application that contains the scoping and screening results is provided for each in-scope mechanical system, structure and commodity group in the Table. For electrical systems, a relevant UFSAR reference is provided, if one exists.

SLRA Table 2.2-1, "Plant-Level Scoping Results," lists the systems, structures, and commodity groups within the scope of subsequent license renewal.

2.2.3 Staff Evaluation

The staff evaluated the plant-level scoping implementation results 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."

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 sampled the contents of the UFSAR based on the systems and structures listed in SLRA Table 2.2-1.

The staff determined there were no systems or structures with intended functions requiring inclusion 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 determined that the applicant had properly identified the systems and structures within the scope of license renewal in accordance with 10 CFR 54.4.

2.2.4 Conclusion

The NRC staff reviewed SLRA Section 2.2, SLRA Table 2.2-1, and 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. On the basis of its review of the SLRA, the staff finds that the applicant, within the scope of subsequent license renewal, is in compliance with the requirements of 10 CFR 54.4, and, therefore, is acceptable.

2.3 Scoping and Screening Results: Mechanical Systems

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

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

In accordance with the requirements of 10 CFR 54.21(a)(1), the applicant must list 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 Section 2.3.1, "Reactor Vessel, Internals, and Reactor Coolant System," identifies the reactor vessel, internals, and reactor coolant system, and steam generators 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 Vessel"
- SLRA Section 2.3.1.2, "Reactor Vessel Internals"
- SLRA Section 2.3.1.3, "Reactor Coolant"
- SLRA Section 2.3.1.4, "Steam Generator"

SER Sections 2.3.1.1–2.3.1.4 include the staff's findings on its review of SLRA Sections 2.3.1.1–2.3.1.4, respectively.

2.3.1.1 Reactor Vessel

2.3.1.1.1 Summary of Technical Information in the Application

SLRA Section 2.3.1.1 describes the reactor pressure vessel 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 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 being 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, the staff reviewed the following:

- SLRA Section 2.3.1.1
- SLRA Table 2.3.1-1
- SLRA Table 3.1.2-1
- UFSAR Sections 3.5, 4.2.2.1, 4.3.3.2, 14.5.1, 14.5.2, 14.5.3

The staff's review identified an area in which the SLRA information should be confirmed to complete the review of the applicant's scoping and screening results, which resulted in the issuance of Request for Confirmation of Information (RCI) No. 5 on SLRA Table 2.3.1-1. The RCI and the applicant's response is documented in ADAMS Accession No. ML19198A059.

In RCI No. 5, the staff identified that the intended function for "Seal table" in Reactor Vessel (SLRA Table 2.3.1-1) is "Structural Support," not the more often invoked "Pressure Boundary." The applicant confirmed that the seal table welded to the thimble tube conduits is not wetted and does not perform a pressure boundary function but does provide support to the thimble tube conduits.

The staff finds the applicant's response acceptable, and the concern is resolved because the intended function for the subject component has been appropriately specified/confirmed and meets the requirements of 10 CFR 54.4.

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 and UFSAR, and license renewal boundary drawings, and the applicant's response to RCI No. 5, the staff concludes that the applicant identified the reactor vessel components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant identified the system components subject to an aging management review in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.1.2 Reactor Vessel Internals

2.3.1.2.1 Summary of Technical Information in the Application

SLRA Section 2.3.1.2 describes the reactor vessel internals 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 vessel internals 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 being 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, the staff reviewed the following:

- SLRA Section 2.3.1.2
- SLRA Table 2.3.1-2
- SLRA Table 3.1.2-2
- UFSAR Sections 3.5.1, 3.5.2, 3.5.6, 3.5.7, 14.5.3

The staff's review identified an area in which the SLRA information should be confirmed to complete the review of the applicant's scoping and screening results, which resulted in the issuance of RCI No. 6 on SLRA Table 2.3.1-2. The RCI and the applicant's response is documented in ADAMS Accession No. ML19204A357.

In RCI No. 6, the staff identified that the following components were not included in the SLRA Table 2.3.1-2: diffuser plate, head and vessel alignment pins, head cooling spray nozzles, and upper instrumentation conduit and support (tubes, conduits, flange base, locking caps and support tubes). The applicant confirmed that all the subject components are categorized as "No additional measures" components that will be required for aging management.

The staff finds the applicant's response acceptable, and the concern is resolved because the subject components have been appropriately categorized/confirmed and meet the requirements of 10 CFR 54.4.

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, license renewal boundary drawings, and the applicant's response to RCI No. 6, the staff concludes that the applicant identified the reactor vessel internals components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant identified the system components subject to an aging management review in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.1.3 Reactor Coolant

2.3.1.3.1 Summary of Technical Information in the Application

SLRA Section 2.3.1.3 describes the reactor coolant 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 coolant 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 being 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, the staff reviewed the following:

- SLRA Section 2.3.1.3
- SLRA Table 2.3.1-3
- SLRA Table 3.1.2-3
- UFSAR Sections 3.2.2.3, 3.2.2.4, 4.1.2, 4.2, 7.1.2, 7.5.3.5, 14.5.1, 14.5.2, Table 5.2-1, Table 5.2-2

The staff's review identified an area in which the SLRA information should be confirmed to complete the review of the applicant's scoping and screening results, which resulted in the issuance of RCI Nos. 7 and 8 regarding SLRA Table 2.3.1-3. The RCIs and the applicant's response are documented in ADAMS Accession No. ML19198A059.

In RCI No.7 on Reactor Coolant-Heat Exchanger (Tube), the staff identified that the intended function for heat exchanger (reactor coolant pump motor upper bearing oil cooler – tubes and tube sheet) is specified as "Pressure Boundary" and not "Heat Transfer." The applicant confirmed that the reactor coolant pump lubricating oil heat exchangers are not required to remove heat to satisfy the requirements of 10 CFR 54.21(a)(1).

In RCI No.8 on Reactor Coolant-Pressurizer (Thermal Sleeve), the staff identified that the intended function for both Pressurizer (spray nozzle thermal sleeve) and Pressurizer (surge nozzle thermal sleeve) is specified with "Limit Thermal Cycling" and not "Pressure Boundary." The applicant confirmed that the thermal sleeves do not perform a pressure boundary function.

The staff finds the applicant's responses acceptable, and the concerns are resolved because the intended functions for the subject components have been appropriately specified/confirmed and meet the requirements of 10 CFR 54.4.

The applicant stated that the pressurizer spray head does not form part of the reactor coolant pressure boundary or provide structural support of reactor coolant pressure boundary components and is, therefore, excluded from scope. Staff found that this statement is not sufficient to determine if the pressurizer spray head should be excluded from scope. As noted in Table 2.3-1 of NUREG-2192, "Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants," some plants rely on the pressurizer spray for pressure control to achieve cold shutdown during certain fire events. In addition, failure of the spray head should be evaluated in terms of any possible damage to surrounding safety grade components; therefore, this component should be evaluated on a plant-specific basis. Staff requested that the applicant provide additional information in RAI 2.3.1.3 to justify exclusion of the pressurizer spray head from the scope of AMR by specifically addressing the concerns as noted in Table 2.3-1 of NUREG-2192, as well as the specific criteria of 10 CFR 54.4 (a)(1) - (3).

In its response to RAI 2.3.1.3 (ML19204A357), the applicant stated that the pressurizer spray head does not perform any license renewal intended function as defined in 10 CFR 54.4(b). The applicant stated that the pressurizer spray head does not form part of the reactor coolant pressure boundary and is not credited for mitigation of the accidents addressed in UFSAR Chapter 14. The pressurizer spray head does not provide structural support to reactor coolant pressure boundary components and does not have a (nonsafety-related) leakage boundary function, since it is not designed to retain water and is entirely contained within the pressurizer. The spray head is not relied upon during fire events and is not otherwise credited for compliance with any regulated event. The staff finds the applicant's response acceptable since

the concerns as noted in Table 2.3-1 of NUREG-2192 have been resolved and the requirements of 10 CFR 54.4 are satisfied.

2.3.1.3.3 Conclusion

Based on the staff's evaluation in SER Section 2.3.1.3 and on a review of the SLRA, UFSAR, license renewal boundary drawings, the applicant's response to RCI Nos. 7 and 8, and the applicant's response to RAI 2.3.1.3, the staff concludes that the applicant identified the reactor coolant components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant identified the system components subject to an aging management review in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.1.4 Steam Generator

2.3.1.4.1 Summary of Technical Information in the Application

SLRA Section 2.3.1.4 describes the steam generator 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 steam generator system 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 being 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, the staff reviewed the following:

- SLRA Section 2.3.1.4
- SLRA Table 2.3.1-4
- SLRA Table 3.1.2-4
- UFSAR Sections 4.1.2.5, 4.1.2.7, 4.2.2.3, 10.3.1.2, 10.3.3, 14.3.2, 14.5.1, 14.5.2

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 and UFSAR, and license renewal boundary drawings, the staff concludes that the applicant identified the steam generator components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant identified the system components subject to an aging management review in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.2 Engineered Safety Features

SLRA Sections 2.3.2, "Engineered Safety Features," identifies the containment spray, recirculation spray, residual heat removal, and safety injection SCs subject to an AMR for

license renewal. The applicant described the supporting SCs of the engineered safety features in the following SLRA sections:

- SLRA Section 2.3.2.1, “Containment Spray”
- SLRA Section 2.3.2.2, “Recirculation Spray”
- SLRA Section 2.3.2.3, “Residual Heat Removal”
- SLRA Section 2.3.2.4, “Safety Injection”

SER Sections 2.3.2.1–2.3.2.4 include the staff’s findings on its review of SLRA Sections 2.3.2.1–2.3.2.4, respectively.

2.3.2.1 Containment Spray

2.3.2.1.1 Summary of Technical Information in the Application

SLRA Section 2.3.2.1 describes the containment spray 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 spray 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 being 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, the staff reviewed the following:

- SLRA Section 2.3.2.1
- SLRA Table 2.3.2-1
- SLRA Table 3.2.2-1
- UFSAR Section 6.3.1, Tables 5.2.-1, 5.2-2, 6.2-12

The staff’s review identified an area in which the SLRA information should be confirmed to complete the review of the applicant’s scoping and screening results, which resulted in the issuance of RCI No. 9 on SLRA Table 2.3.2-1. The RCI and the applicant’s response are documented in ADAMS Accession No. ML19198A059.

In RCI No. 9, the staff identified that the intended function for the containment spray flow element is “Structure Integrity” and not the function of “Restrict flow.” The applicant confirmed that these flow elements and the associated piping are outdoors and function to provide structural support to the attached safety-related piping that connects to the refueling water storage tanks.

The staff finds the applicant’s response acceptable, and the concern is resolved because the subject components have been appropriately specified/confirmed and meet the requirements of 10 CFR 54.4.

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 and UFSAR, the staff concludes that the applicant identified the containment spray components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant identified the system components subject to an aging management review in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.2.2 Recirculation Spray

2.3.2.2.1 Summary of Technical Information in the Application

SLRA Section 2.3.2.2 describes the recirculation spray 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 recirculation 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 being 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, the staff reviewed the following:

- SLRA Section 2.3.2.2
- SLRA Table 2.3.2-2
- SLRA Table 3.2.2-2
- UFSAR Section 6.3.1, Tables 5.2.-1, 5.2-2

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 and UFSAR, the staff concludes that the applicant identified the recirculation spray components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant identified the system components subject to an aging management review in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.2.3 Residual Heat Removal

2.3.2.3.1 Summary of Technical Information in the Application

SLRA Section 2.3.2.3 describes the residual heat removal 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 residual heat removal 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 being 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, the staff reviewed the following:

- SLRA Section 2.3.2.3
- SLRA Table 2.3.2-3
- SLRA Table 3.2.2-3
- UFSAR Section 9.3, Tables 5.2-1, 5.2-2

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 and the applicant's response to RAI 2.3.1.3, the staff concludes that the applicant identified the residual heat removal components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant identified the system components subject to an aging management review in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.2.4 Safety Injection

2.3.2.4.1 Summary of Technical Information in the Application

SLRA Section 2.3.2.4 describes the safety injection 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 safety injection 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 being 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, the staff reviewed the following:

- SLRA Section 2.3.2.4
- SLRA Table 2.3.2-4
- SLRA Table 3.2.2-4
- UFSAR Section 6.2, Tables 5.2-1 and 5.2-2

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 identified the safety injection components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant identified the system components subject to an aging management review 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, "Fuel Handling System"
- SLRA Section 2.3.3.2, "Fuel Pool Cooling"
- SLRA Section 2.3.3.3, "Cranes and Hoists"
- SLRA Section 2.3.3.4, "Service Water"
- SLRA Section 2.3.3.5, "Circulating Water"
- SLRA Section 2.3.3.6, "Bearing Cooling"
- SLRA Section 2.3.3.7, "Chilled Water"
- SLRA Section 2.3.3.8, "Component Cooling"
- SLRA Section 2.3.3.9, "Neutron Shield Tank Cooling"
- SLRA Section 2.3.3.10, "Primary Grade Water"
- SLRA Section 2.3.3.11, "Instrument Air"
- SLRA Section 2.3.3.12, "Primary and Secondary Plant Gas Supply"
- SLRA Section 2.3.3.13, "Service Air"
- SLRA Section 2.3.3.14, "Boron Recovery"
- SLRA Section 2.3.3.15, "Chemical and Volume Control"
- SLRA Section 2.3.3.16, "Incore Instrumentation"
- SLRA Section 2.3.3.17, "Reactor Cavity Purification"
- SLRA Section 2.3.3.18, "Sampling System"
- SLRA Section 2.3.3.19, "Decontamination"
- SLRA Section 2.3.3.20, "Drains Aerated"
- SLRA Section 2.3.3.21, "Drains Gaseous"
- SLRA Section 2.3.3.22, "Gaseous Waste"
- SLRA Section 2.3.3.23, "Liquid and Solid Waste"
- SLRA Section 2.3.3.24, "Plumbing"
- SLRA Section 2.3.3.25, "Radiation Monitoring"
- SLRA Section 2.3.3.26, "Vents Aerated"
- SLRA Section 2.3.3.27, "Vents Gaseous"
- SLRA Section 2.3.3.28, "Water Treatment"
- SLRA Section 2.3.3.29, "Ventilation"
- SLRA Section 2.3.3.30, "Leakage Monitoring"
- SLRA Section 2.3.3.31, "Secondary Vents"
- SLRA Section 2.3.3.32, "Vacuum Priming"
- SLRA Section 2.3.3.33, "Containment Vacuum"
- SLRA Section 2.3.3.34, "Fire Protection"
- SLRA Section 2.3.3.35, "Hydrogen Gas"

- SLRA Section 2.3.3.36, “Emergency Diesel Generator System”
- SLRA Section 2.3.3.37, “Alternate AC”
- SLRA Section 2.3.3.38, “Security”
- SLRA Section 2.3.3.39, “Building and Structures”
- SLRA Section 2.3.3.40, “Containment Access”
- SLRA Section 2.3.3.41, “Electrical Power”
- SLRA Section 2.3.3.42, “Helium Vacuum Drying”
- SLRA Section 2.3.3.43, “Reactor Building Penetrations”

SER Sections 2.3.3.1–2.3.3.43 include the staff’s findings on its review of SLRA Sections 2.3.3.1–2.3.3.43, respectively.

2.3.3.1 Fuel Handling System

2.3.3.1.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.1 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 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 fuel handling 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 being 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, the staff reviewed the following:

- SLRA Section 2.3.3.1
- SLRA Table 2.3.3-1
- SLRA Table 3.3.2-1
- UFSAR Sections 5.2, 9.12

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 identified the fuel handling components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant identified the system components subject to an aging management review in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.2 Fuel Pool Cooling

2.3.3.2.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.2 describes the fuel pool cooling 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 3.3.2-1 provides the results of the applicant's AMR for fuel pool cooling 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 NUREG-2192, Section 2.3, "Scoping and Screening Results: Mechanical Systems," the staff reviewed:

- SLRA Section 2.3.3.2
- SLRA Table 2.3.3-2
- SLRA Table 3.3.2-2
- UFSAR Section 9.5

2.3.3.2.3 Conclusion

Based on the staff's evaluation in SER Section 2.3.3.2 and on a review of the SLRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant identified the fuel pool cooling components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant identified the system components subject to an aging management review in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.3 Cranes and Hoists

2.3.3.3.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.3 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 2.3.3-3 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 cranes and hoists 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 NUREG-2192, Section 2.3, the staff reviewed:

- SLRA Section 2.3.3.3
- SLRA Table 2.3.3-3
- SLRA Table 3.3.2-3
- UFSAR Section 9.12.4, Appendix 9B

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 identified the cranes and hoists components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant identified the system components subject to an aging management review in compliance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.4 Service Water

2.3.3.4.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.4 describes the service water system components subject to an AMR and lists the license renewal boundary drawings that show the system boundaries. SLRA Table 2.3.3-4 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 service 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 NUREG-2192, Section 2.3, the staff reviewed:

- SLRA Section 2.3.3.4
- SLRA Table 2.3.3-4
- SLRA Table 3.3.2-4
- UFSAR Section 9.9, Tables 5.2-1, 5.2-2, Appendix 9C.1.1

The staff noted that the emergency service water (ESW) pump diesel heat exchangers and ESW pump right angle gear oil cooler were not excluded from the scope of license renewal; however, the applicant determined that they did not screen in and were not subject to an aging

management review. Therefore, there are no Table 2 items identifying the component, component material, applicable aging effects and the aging management program used to manage these aging effects. The staff considers Dominion's exclusion of these components from an aging management review as a staff-identified exception (further discussed in SER Section 3.0.3.2.7).

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 identified the service water components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant identified the system components subject to an aging management review in compliance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.5 Circulating Water

2.3.3.5.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.5 describes the circulating water 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 circulating water 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 NUREG-2192, Section 2.3, the staff reviewed:

- SLRA Section 2.3.3.5
- SLRA Table 2.3.3-5
- SLRA Table 3.3.2-5
- UFSAR Sections 9.9, 10.3.4, Appendix 9C.1.1

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 identified the circulating water components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant identified the system components subject to an aging management review in compliance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.6 Bearing Cooling

2.3.3.6.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.6 describes the bearing cooler 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 bearing cooling 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 NUREG-2192, Section 2.3, the staff reviewed:

- SLRA Section 2.3.3.6
- SLRA Table 2.3.3-6
- SLRA Table 3.3.2-6
- UFSAR Section 10.3.9

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 identified the bearing cooling components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant identified the system components subject to an aging management review in compliance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.7 Chilled Water

2.3.3.7.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.7 describes the chilled water system components subject to an AMR and lists the license renewal boundary drawings that show the system boundaries. SLRA Table 2.3.3-7 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 chilled water 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 NUREG-2192, Section 2.3, the staff reviewed:

- SLRA Section 2.3.3.7
- SLRA Table 2.3.3-7
- SLRA Table 3.3.2-7
- UFSAR Sections 9.4.1.3, 9.4.3.3

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, the staff concludes that the applicant 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 identified the system components subject to an aging management review in compliance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.8 Component Cooling

2.3.3.8.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.8 describes the component cooling 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 component cooling 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 NUREG-2192, Section 2.3, the staff reviewed:

- SLRA Section 2.3.3.8
- SLRA Table 2.3.3-8
- SLRA Table 3.3.2-8
- UFSAR Section 9.4

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 identified the

component cooling system components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant identified the system components subject to an aging management review in compliance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.9 Neutron Shield Tank Cooling

2.3.3.9.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.9 describes the neutron shield tank cooling 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 neutron shield tank cooling 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 NUREG-2192, Section 2.3, the staff reviewed:

- SLRA Section 2.3.3.9
- SLRA Table 2.3.3-9
- SLRA Table 3.3.2-9
- UFSAR Section 2.3.3.9

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 identified the neutron shield tank cooling components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant identified the system components subject to an aging management review in compliance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.10 Primary Grade Water

2.3.3.10.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.10 describes the primary grade 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 primary grade 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 NUREG-2192, Section 2.3, the staff reviewed:

- SLRA Section 2.3.3.10
- SLRA Table 2.3.3-10
- SLRA Table 3.3.2-10
- UFSAR Sections 9.2, 9.5

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 identified the primary grade water components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant identified the system components subject to an aging management review in compliance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.11 Instrument Air

2.3.3.11.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.11 describes the instrument air 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 instrument air 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 NUREG-2192, Section 2.3, the staff reviewed:

- SLRA Section 2.3.3.11
- SLRA Table 2.3.3-11

- SLRA Table 3.3.2-11
- UFSAR Section 9.8

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 identified the instrument air components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant identified the system components subject to an aging management review in compliance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.12 Primary and Secondary Plant Gas Supply

2.3.3.12.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.12 describes the primary and secondary plant gas supply 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 primary and secondary plant gas supply 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 NUREG-2192, Section 2.3, the staff reviewed:

- SLRA Section 2.3.3.12
- SLRA Table 2.3.3-12
- SLRA Table 3.3.2-12
- UFSAR Sections 6.2, 10.3.1

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 identified the primary and secondary plant gas system components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant identified the system components subject to an aging management review in compliance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.13 Service Air

2.3.3.13.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.13 describes the service air 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 service air 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 NUREG-2192, Section 2.3, the staff reviewed:

- SLRA Section 2.3.3.13
- SLRA Table 2.3.3-13
- SLRA Table 3.3.2-13
- UFSAR Sections 5.2, 9.8

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 identified the service air system components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant identified the system components subject to an aging management review in compliance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.14 Boron Recovery

2.3.3.14.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.14 describes the boron recovery 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 boron recovery 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 NUREG-2192, Section 2.3, the staff reviewed:

- SLRA Section 2.3.3.14
- SLRA Table 2.3.3-14
- SLRA Table 3.3.2-14
- UFSAR Section 9.2

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, and license renewal boundary drawings, the staff concludes that the applicant identified the boron recovery system components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant identified the system components subject to an aging management review in compliance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.15 Chemical and Volume Control

2.3.3.15.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.15 describes the chemical and volume control 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 chemical and volume control 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 NUREG-2192, Section 2.3, the staff reviewed:

- SLRA Section 2.3.3.15
- SLRA Table 2.3.3-15
- SLRA Table 3.3.2-15
- UFSAR Section 9.1

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 identified the chemical and volume control system components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant identified the system components subject to an aging management review in compliance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.16 Incore Instrumentation

2.3.3.16.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.16 describes the incore instrumentation 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 incore instrumentation 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 NUREG-2192, Section 2.3, the staff reviewed:

- SLRA Section 2.3.3.16
- SLRA Table 2.3.3-16
- SLRA Table 3.3.2-16
- UFSAR Section 7.6

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 identified the incore instrumentation system components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant identified the system components subject to an aging management review in compliance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.17 Reactor Cavity Purification

2.3.3.17.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.17 describes the reactor cavity purification 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 reactor cavity purification 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 NUREG-2192, Section 2.3, the staff reviewed:

- SLRA Section 2.3.3.17
- SLRA Table 2.3.3-17
- SLRA Table 3.3.2-17
- UFSAR Sections 5.2, 9.12.5

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 identified the reactor cavity purification components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant identified the system components subject to an aging management review in compliance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.18 Sampling System

2.3.3.18.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.18 describes the sampling 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 sampling 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 NUREG-2192, Section 2.3, the staff reviewed:

- SLRA Section 2.3.3.18
- SLRA Table 2.3.3-18
- SLRA Table 3.3.2-18
- UFSAR Sections 5.2, 9.6

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 identified the sampling system components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant identified the system components subject to an aging management review in compliance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.19 Decontamination

2.3.3.19.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.19 describes the decontamination 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 decontamination 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 NUREG-2192, Section 2.3, the staff reviewed:

- SLRA Section 2.3.3.19
- SLRA Table 2.3.3-19
- SLRA Table 3.3.2-19
- UFSAR Section 9.14

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 identified the decontamination system components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant identified the system

components subject to an aging management review in compliance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.20 Drains Aerated

2.3.3.20.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.20 describes the drains aerated 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 drains aerated 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 NUREG-2192, Section 2.3, the staff reviewed:

- SLRA Section 2.3.3.20
- SLRA Table 2.3.3-20
- SLRA Table 3.3.2-20
- UFSAR Sections 5.2, 9.7

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 identified the drains aerated system components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant identified the system components subject to an aging management review in compliance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.21 Drains Gaseous

2.3.3.21.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.21 describes the drains gaseous 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 drains gaseous 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 NUREG-2192, Section 2.3, the staff reviewed:

- SLRA Section 2.3.3.21
- SLRA Table 2.3.3-21
- SLRA Table 3.3.2-21
- UFSAR Section 5.2, 9.7

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 identified the drains gaseous system components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant identified the system components subject to an aging management review in compliance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.22 Gaseous Waste

2.3.3.22.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.22 describes the gaseous waste 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 gaseous waste 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 NUREG-2192, Section 2.3, the staff reviewed:

- SLRA Section 2.3.3.22
- SLRA Table 2.3.3-22

* SLRA Table 3.3.2-22
* UFSAR Sections 5.2, 11.2.5, 5.3.5, 6.2.3.12

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 identified the gaseous waste system components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant identified the system components subject to an aging management review in compliance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.23 Liquid and Solid Waste

2.3.3.23.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.23 describes the liquid and solid waste 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 liquid and solid waste 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 NUREG-2192, Section 2.3, the staff reviewed:

* SLRA Section 2.3.3.23
* SLRA Table 2.3.3-23
* SLRA Table 3.3.2-23
* UFSAR Sections 11.2.3, 11.2.24

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 identified the liquid and solid waste system components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant identified the system components subject to an aging management review in compliance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.24 Plumbing

2.3.3.24.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.24 describes the plumbing 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 plumbing 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 NUREG-2192, Section 2.3, the staff reviewed:

- SLRA Section 2.3.3.24
- SLRA Table 2.3.3-24
- SLRA Table 3.3.2-24
- UFSAR Section 15.5.1, Appendix 9c

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 identified the plumbing system components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant identified the system components subject to an aging management review in compliance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.25 Radiation Monitoring

2.3.3.25.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.25 describes the radiation monitoring system components subject to an AMR and lists the license renewal boundary drawings that show the system boundaries. SLRA Table 2.3.3-25 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 radiation monitoring 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 NUREG-2192, Section 2.3, the staff reviewed:

- SLRA Section 2.3.3.25
- SLRA Table 2.3.3-25
- SLRA Table 3.3.2-25
- UFSAR Sections 11.3.3, 11.3.4

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 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 identified the system components subject to an aging management review in compliance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.26 Vents Aerated

2.3.3.26.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.26 describes the vents aerated 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 vents aerated 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 NUREG-2192, Section 2.3, the staff reviewed:

- SLRA Section 2.3.3.26
- SLRA Table 2.3.3-26
- SLRA Table 3.3.2-26
- UFSAR Section 9.7, Tables 5.2-1, 5.2-2

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

identified the vents aerated system components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant identified the system components subject to an aging management review in compliance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.27 Vents Gaseous

2.3.3.27.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.27 describes the vents gaseous 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 vents gaseous 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 NUREG-2192, Section 2.3, the staff reviewed:

- SLRA Section 2.3.3.27
- SLRA Table 2.3.3-27
- SLRA Table 3.3.2-27
- UFSAR Section 9.7

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 identified the vents gaseous system components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant identified the system components subject to an aging management review in compliance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.28 Water Treatment

2.3.3.28.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.28 describes the water treatment system components subject to an AMR and lists the license renewal boundary drawings that show the system boundaries. SLRA Table 2.3.3-28 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 water treatment 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 NUREG-2192, Section 2.3, the staff reviewed:

- SLRA Section 2.3.3.28
- SLRA Table 2.3.3-28
- SLRA Table 3.3.2-28
- UFSAR Section 9.11

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 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 identified the system components subject to an aging management review in compliance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.29 Ventilation

2.3.3.29.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.29 describes the ventilation 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 ventilation 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 NUREG-2192, Section 2.3, the staff reviewed:

- SLRA Section 2.3.3.29
- SLRA Table 2.3.3-29

- SLRA Table 3.3.2-29
- UFSAR Sections 9.13, 9.10.4.4, 9.13

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 identified the ventilation system components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant identified the system components subject to an aging management review in compliance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.30 Leakage Monitoring

2.3.3.30.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.30 describes the leakage monitoring 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 leakage monitoring 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 NUREG-2192, Section 2.3, the staff reviewed:

- SLRA Section 2.3.3.30
- SLRA Table 2.3.3-30
- SLRA Table 3.3.2-30
- UFSAR Sections 5.3.2, 7.5.1.2

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 identified the leakage monitoring system components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant identified the system components subject to an aging management review in compliance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.31 Secondary Vents

2.3.3.31.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.31 describes the secondary vents 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 secondary vents 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 NUREG-2192, Section 2.3, the staff reviewed:

- SLRA Section 2.3.3.31
- SLRA Table 2.3.3-31
- SLRA Table 3.3.2-31
- UFSAR Section 10.3.8

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 identified the secondary vents system components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant identified the system components subject to an aging management review in compliance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.32 Vacuum Priming

2.3.3.32.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.32 describes the vacuum priming 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 vacuum priming 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 NUREG-2192, Section 2.3, the staff reviewed:

- SLRA Section 2.3.3.32
- SLRA Table 2.3.3-32
- SLRA Table 3.3.2-32
- UFSAR Sections 9.4.1.1

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 identified the vacuum priming system components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant identified the system components subject to an aging management review in compliance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.33 Containment Vacuum

2.3.3.33.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.33 describes the containment vacuum 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 containment vacuum 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 NUREG-2192, Section 2.3, the staff reviewed:

- SLRA Section 2.3.3.33
- SLRA Table 2.3.3-33
- SLRA Table 3.3.2-33
- UFSAR Section 5.3.4, Tables 4.3.3-1, 5.2-1, 5.2-2

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 identified the containment vacuum system components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant identified the system components subject to an aging management review in compliance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.34 Fire Protection

2.3.3.34.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.34 describes the fire protection system components subject to an AMR and lists the license renewal boundary drawings that show the system boundaries. SLRA Table 2.3.3-34 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 fire protection 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 NUREG-2192, Section 2.3, the staff reviewed:

- SLRA Section 2.3.3.33
- SLRA Table 2.3.3-33
- SLRA Table 3.3.2-33
- UFSAR Section 9.10, 18.27

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 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 identified the system components subject to an aging management review in compliance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.35 Hydrogen Gas

2.3.3.35.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.35 describes the hydrogen gas 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 hydrogen gas 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 NUREG-2192, Section 2.3, the staff reviewed:

- SLRA Section 2.3.3.35
- SLRA Table 2.3.3-35
- SLRA Table 3.3.2-35
- UFSAR Section 10.3.3.2

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 identified the hydrogen gas system components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant identified the system components subject to an aging management review in compliance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.36 Emergency Diesel Generator System

2.3.3.36.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.36 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 2.3.3-36 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 emergency diesel generator 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 NUREG-2192, Section 2.3, the staff reviewed:

- SLRA Section 2.3.3.36
- SLRA Table 2.3.3-36
- SLRA Table 3.3.2-36
- UFSAR Section 8.5

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 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 identified the system components subject to an aging management review in compliance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.37 Alternate AC

2.3.3.37.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.37 describes the alternate AC system components subject to an AMR and lists the license renewal boundary drawings that show the system boundaries. SLRA Table 2.3.3-37 provides a list of the component types subject to an AMR and their intended functions. SLRA Table 3.3.2-37 provides the results of the applicant's AMR alternate AC system SCs.

2.3.3.37.2 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 NUREG-2192, Section 2.3, the staff reviewed:

- SLRA Section 2.3.3.37
- SLRA Table 2.3.3-37
- SLRA Table 3.3.2-37
- UFSAR Section 8.4.6

2.3.3.37.3 Conclusion

Based on the staff's evaluation in SER Section 2.3.3.37.2 and on a review of the SLRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant identified the alternate AC system components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant identified the system

components subject to an aging management review in compliance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.38 Security

2.3.3.38.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.38 describes the security system components subject to an AMR and lists the license renewal boundary drawings that show the system boundaries. SLRA Table 2.3.3-38 provides a list of the component types subject to an AMR and their intended functions. SLRA Table 3.3.2-38 provides the results of the applicant's AMR for security system SCs.

2.3.3.38.2 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 NUREG-2192, Section 2.3, the staff reviewed:

- SLRA Section 2.3.3.38
- SLRA Table 2.3.3-38
- SLRA Table 3.3.2-38
- UFSAR Section 8.4.5, 8.4.6

2.3.3.38.3 Conclusion

Based on the staff's evaluation in SER Section 2.3.3.38.2 and on a review of the SLRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant identified the security system components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant identified the system components subject to an aging management review in compliance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.39 Buildings and Structures

2.3.3.39.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.39 describes the building and structures system components subject to an AMR and lists the license renewal boundary drawings that show the system boundaries. SLRA Table 2.3.3-39 provides a list of the component types subject to an AMR and their intended functions. SLRA Table 3.3.2-39 provides the results of the applicant's AMR for buildings and structures system SCs.

2.3.3.39.2 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 NUREG-2192, Section 2.3, the staff reviewed:

- SLRA Section 2.3.3.39
- SLRA Table 2.3.3-39
- SLRA Table 3.3.2-39
- UFSAR Sections 5.5.4, 5.5.6, 15.5.1.8

2.3.3.39.3 Conclusion

Based on the staff's evaluation in SER Section 2.3.3.39.2 and on a review of the SLRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant identified the building and structures system components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant identified the system components subject to an aging management review in compliance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.40 Containment Access

2.3.3.40.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.40 describes the containment access system components subject to an AMR and lists the license renewal boundary drawings that show the system boundaries. SLRA Table 2.3.3-40 provides a list of the component types subject to an AMR and their intended functions. SLRA Table 3.3.2-40 provides the results of the applicant's AMR for containment access system SCs.

2.3.3.40.2 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 NUREG-2192, Section 2.3, the staff reviewed:

- SLRA Section 2.3.3.40
- SLRA Table 2.3.3-40

- SLRA Table 3.3.2-40
- UFSAR Sections 5.5.4, 5.5.6

2.3.3.40.3 Conclusion

Based on the staff's evaluation in SER Section 2.3.3.40.2 and on a review of the SLRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant identified the containment access system components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant identified the system components subject to an aging management review in compliance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.41 Electrical Power

2.3.3.41.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.41 describes the electrical power system mechanical component (exciter air coolers) subject to an AMR and lists the license renewal boundary drawings that show the system boundaries. SLRA Table 2.3.3-41 provides a list of the component types subject to an AMR and their intended functions. SLRA Table 3.3.2-41 provides the results of the applicant's AMR for electrical power system SCs.

2.3.3.41.2 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 NUREG-2192, Section 2.3, the staff reviewed:

- SLRA Section 2.3.3.41
- SLRA Table 2.3.3-41
- SLRA Table 3.3.2-41
- UFSAR Section 8

2.3.3.41.3 Conclusion

Based on the staff's evaluation in SER Section 2.3.3.41.2 and on a review of the SLRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant identified the electrical power system components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant identified the system components subject to an aging management review in compliance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.42 Helium Vacuum Drying

2.3.3.42.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.42 describes the helium vacuum drying system components subject to an AMR and lists the license renewal boundary drawings that show the system boundaries. SLRA Table 2.3.3-42 provides a list of the component types subject to an AMR and their intended functions. SLRA Table 3.3.2-42 provides the results of the applicant's AMR for helium vacuum drying system SCs.

2.3.3.42.2 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 NUREG-2192, Section 2.3, the staff reviewed:

- SLRA Section 2.3.3.42
- SLRA Table 2.3.3-42
- SLRA Table 3.3.2-42
- UFSAR Section 9.14

2.3.3.42.3 Conclusion

Based on the staff's evaluation in SER Section 2.3.3.42.2 and on a review of the SLRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant identified the helium vacuum drying system components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant identified the system components subject to an aging management review in compliance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.43 Reactor Building Penetrations

2.3.3.43.1 Summary of Technical Information in the Application

SLRA Section 2.3.3.43 describes the reactor building penetrations system components subject to an AMR and lists the license renewal boundary drawings that show the system boundaries. SLRA Table 2.3.3-43 provides a list of the component types subject to an AMR and their intended functions. SLRA Table 3.3.2-43 provides the results of the applicant's AMR for reactor building penetrations system SCs.

2.3.3.43.2 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 NUREG-2192, Section 2.3, the staff reviewed:

- SLRA Section 2.3.3.43
- SLRA Table 2.3.3-43
- SLRA Table 3.3.2-43
- UFSAR Section 5.5

2.3.3.43.3 Conclusion

Based on the staff's evaluation in SER Section 2.3.3.43.2 and on a review of the SLRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant identified the reactor building penetrations system components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant identified the system components subject to an aging management review in compliance with the requirements in 10 CFR 54.21(a)(1).

2.3.4 Steam and Power Conversion Systems

SLRA Section 2.3.4, "Steam and Power Conversion Systems," identifies the steam and power conversion systems 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, "Main Turbine"
- SLRA Section 2.3.4.2, "Electro-Hydraulic Control"
- SLRA Section 2.3.4.3, "Lubricating Oil"
- SLRA Section 2.3.4.4, "Main Steam"
- SLRA Section 2.3.4.5, "Heating"
- SLRA Section 2.3.4.6, "Extraction Steam"
- SLRA Section 2.3.4.7, "Auxiliary Steam"
- SLRA Section 2.3.4.8, "Feedwater"
- SLRA Section 2.3.4.9, "Condensate"
- SLRA Section 2.3.4.10, "Condensate Polishing"
- SLRA Section 2.3.4.11, "Steam Drains"
- SLRA Section 2.3.4.12, "Blowdown"
- SLRA Section 2.3.4.13, "Steam Generator Recirculation and Transfer"

2.3.4.1 Main Turbine

2.3.4.1.1 Summary of Technical Information in the Application

SLRA Section 2.3.4.1 describes the main turbine 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 the main turbine 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 NUREG-2192, Section 2.3, the staff reviewed:

- SLRA Section 2.3.4.1
- SLRA Table 2.3.4-1
- SLRA Table 3.4.2-1
- UFSAR Section 10.3.3.1

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 identified the main turbine system components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant identified the system components subject to an aging management review in compliance with the requirements in 10 CFR 54.21(a)(1).

2.3.4.2 Electro-Hydraulic Control

2.3.4.2.1 Summary of Technical Information in the Application

SLRA Section 2.3.4.2 describes the electro-hydraulic control 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 electro-hydraulic control 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 NUREG-2192, Section 2.3, the staff reviewed:

- SLRA Section 2.3.4.2
- SLRA Table 2.3.4-2

- SLRA Table 3.4.2-2
- UFSAR Section 10.3.3

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 identified the electro-hydraulic control system components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant identified the system components subject to an aging management review in compliance with the requirements in 10 CFR 54.21(a)(1).

2.3.4.3 Lubricating Oil

2.3.4.3.1 Summary of Technical Information in the Application

SLRA Section 2.3.4.3 describes the lubricating oil 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 lubricating oil 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 NUREG-2192, Section 2.3, the staff reviewed:

- SLRA Section 2.3.4.3
- SLRA Table 2.3.4-3
- SLRA Table 3.4.2-3
- UFSAR Sections 8.5, 9.10.4.19, 10.3.3.2, 10.3.7

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 identified the lubricating oil system components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant identified the system components subject to an aging management review in compliance with the requirements in 10 CFR 54.21(a)(1).

2.3.4.4 Main Steam

2.3.4.4.1 Summary of Technical Information in the Application

SLRA Section 2.3.4.4 describes the main steam system components subject to an AMR and lists the license renewal boundary drawings that show the system boundaries. SLRA Table 2.3.4-4 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 steam 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 NUREG-2192, Section 2.3, the staff reviewed:

- SLRA Section 2.3.4.4
- SLRA Table 2.3.4-4
- SLRA Table 3.4.2-4
- UFSAR Sections 4.3.2, 14.2.10.1, 10.3.1

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 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 identified the system components subject to an aging management review in compliance with the requirements in 10 CFR 54.21(a)(1).

2.3.4.5 Heating

2.3.4.5.1 Summary of Technical Information in the Application

SLRA Section 2.3.4.5 describes the heating 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 for heating 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 NUREG-2192, Section 2.3, the staff reviewed:

- SLRA Section 2.3.4.5
- SLRA Table 2.3.4-5
- SLRA Table 3.4.2-5
- UFSAR Section 10.3.2

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 identified the heating system components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant identified the system components subject to an aging management review in compliance with the requirements in 10 CFR 54.21(a)(1).

2.3.4.6 Extraction Steam

2.3.4.6.1 Summary of Technical Information in the Application

SLRA Section 2.3.4.6 describes the extraction steam system components subject to an AMR and lists the license renewal boundary drawings that show the system boundaries. SLRA Table 2.3.4-6 provides a list of the component types subject to an AMR and their intended functions. SLRA Table 3.4.2-6 provides the results of the applicant's AMR for extraction steam system SCs.

2.3.4.6.2 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 NUREG-2192, Section 2.3, the staff reviewed:

- SLRA Section 2.3.4.6
- SLRA Table 2.3.4-6
- SLRA Table 3.4.2-6
- UFSAR Section 10.3.2.2

2.3.4.6.3 Conclusion

Based on the staff's evaluation in SER Section 2.3.4.6.2 and on a review of the SLRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant identified the extraction steam system components within the scope of license renewal as required by

10 CFR 54.4(a). The staff also concludes that the applicant identified the system components subject to an aging management review in compliance with the requirements in 10 CFR 54.21(a)(1).

2.3.4.7 Auxiliary Steam

2.3.4.7.1 Summary of Technical Information in the Application

SLRA Section 2.3.4.7 describes the auxiliary steam system components subject to an AMR and lists the license renewal boundary drawings that show the system boundaries. SLRA Table 2.3.4-7 provides a list of the component types subject to an AMR and their intended functions. SLRA Table 3.4.2-7 provides the results of the applicant's AMR for auxiliary steam system SCs.

2.3.4.7.2 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 NUREG-2192, Section 2.3, the staff reviewed:

- SLRA Section 2.3.4.7
- SLRA Table 2.3.4-7
- SLRA Table 3.4.2-7
- UFSAR Section 10.3.2

2.3.4.7.3 Conclusion

Based on the staff's evaluation in SER Section 2.3.4.7.2 and on a review of the SLRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant 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 identified the system components subject to an aging management review in compliance with the requirements in 10 CFR 54.21(a)(1).

2.3.4.8 Feedwater

2.3.4.8.1 Summary of Technical Information in the Application

SLRA Section 2.3.4.8 describes the feedwater system components subject to an AMR and lists the license renewal boundary drawings that show the system boundaries. SLRA Table 2.3.4-8 provides a list of the component types subject to an AMR and their intended functions. SLRA Table 3.4.2-8 provides the results of the applicant's AMR for feedwater system SCs.

2.3.4.8.2 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 NUREG-2192, Section 2.3, the staff reviewed:

- SLRA Section 2.3.4.8
- SLRA Table 2.3.4-8
- SLRA Table 3.4.2-8
- UFSAR Section 10.3.5

2.3.4.8.3 Conclusion

Based on the staff's evaluation in SER Section 2.3.4.8.2 and on a review of the SLRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant 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 identified the system components subject to an aging management review in compliance with the requirements in 10 CFR 54.21(a)(1).

2.3.4.9 Condensate

2.3.4.9.1 Summary of Technical Information in the Application

SLRA Section 2.3.4.9 describes the condensate system components subject to an AMR and lists the license renewal boundary drawings that show the system boundaries. SLRA Table 2.3.4-9 provides a list of the component types subject to an AMR and their intended functions. SLRA Table 3.4.2-9 provides the results of the applicant's AMR for condensate system SCs.

2.3.4.9.2 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 NUREG-2192, Section 2.3, the staff reviewed:

- SLRA Section 2.3.4.9
- SLRA Table 2.3.4-9

- SLRA Table 3.4.2-9
- UFSAR Sections 10.3.5, 10.3.6, 14B.5.1.7

2.3.4.9.3 Conclusion

Based on the staff's evaluation in SER Section 2.3.4.9.2 and on a review of the SLRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant 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 identified the system components subject to an aging management review in compliance with the requirements in 10 CFR 54.21(a)(1).

2.3.4.10 Condensate Polishing

2.3.4.10.1 Summary of Technical Information in the Application

SLRA Section 2.3.4.10 describes the condensate polishing system components subject to an AMR and lists the license renewal boundary drawings that show the system boundaries. SLRA Table 2.3.4-10 provides a list of the component types subject to an AMR and their intended functions. SLRA Table 3.4.2-10 provides the results of the applicant's AMR for condensate polishing system SCs.

2.3.4.10.2 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 NUREG-2192, Section 2.3, the staff reviewed:

- SLRA Section 2.3.4.10
- SLRA Table 2.3.4-10
- SLRA Table 3.4.2-10
- UFSAR Section 10.3.5.2

2.3.4.10.3 Conclusion

Based on the staff's evaluation in SER Section 2.3.4.10.2 and on a review of the SLRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant identified the condensate polishing system components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant identified the system components subject to an aging management review in compliance with the requirements in 10 CFR 54.21(a)(1).

2.3.4.11 Steam Drains

2.3.4.11.1 Summary of Technical Information in the Application

SLRA Section 2.3.4.11 describes the steam drains system components subject to an AMR and lists the license renewal boundary drawings that show the system boundaries. SLRA Table 2.3.4-11 provides a list of the component types subject to an AMR and their intended functions. SLRA Table 3.4.2-11 provides the results of the applicant's AMR for steam drains system SCs.

2.3.4.11.2 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 NUREG-2192, Section 2.3, the staff reviewed:

- SLRA Section 2.3.4.11
- SLRA Table 2.3.4-11
- SLRA Table 3.4.2-11
- UFSAR Section 10.3.5.2

2.3.4.11.3 Conclusion

Based on the staff's evaluation in SER Section 2.3.4.11.2 and on a review of the SLRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant identified the steam drains system components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant identified the system components subject to an aging management review in compliance with the requirements in 10 CFR 54.21(a)(1).

2.3.4.12 Blowdown

2.3.4.12.1 Summary of Technical Information in the Application

SLRA Section 2.3.4.12 describes the blowdown system components subject to an AMR and lists the license renewal boundary drawings that show the system boundaries. SLRA Table 2.3.4-12 provides a list of the component types subject to an AMR and their intended functions. SLRA Table 3.4.2-12 provides the results of the applicant's AMR for blowdown system SCs.

2.3.4.12.2 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 NUREG-2192, Section 2.3, the staff reviewed:

- SLRA Section 2.3.4.12
- SLRA Table 2.3.4-12
- SLRA Table 3.4.2-12
- UFSAR Sections 5.2.2, 7.2.3.2.7, 10.3.1.2, 14B.5.3.3

2.3.4.12.3 Conclusion

Based on the staff's evaluation in SER Section 2.3.4.12.2 and on a review of the SLRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant identified the blowdown system components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant identified the system components subject to an aging management review in compliance with the requirements in 10 CFR 54.21(a)(1).

2.3.4.13 Steam Generator Recirculation and Transfer

2.3.4.13.1 Summary of Technical Information in the Application

SLRA Section 2.3.4.13 describes the steam generator recirculation and transfer system components subject to an AMR and lists the license renewal boundary drawings that show the system boundaries. SLRA Table 2.3.4-13 provides a list of the component types subject to an AMR and their intended functions. SLRA Table 3.4.2-13 provides the results of the applicant's AMR for steam generator recirculation and transfer system SCs.

2.3.4.13.2 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 NUREG-2192, Section 2.3, the staff reviewed:

- SLRA Section 2.3.4.13
- SLRA Table 2.3.4-13
- SLRA Table 3.4.2-13
- UFSAR Section 10.3.1.2, Tables 5.2-1, 5.2-2

2.3.4.13.3 Conclusion

Based on the staff's evaluation in SER Section 2.3.4.13.2 and on a review of the SLRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant identified the steam generator recirculation 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 identified the system components subject to an aging management review in compliance 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 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 components. The objective was to determine whether the applicant has identified, in accordance with 10 CFR 54.4, structures and 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).

2.4.1 Summary of Technical Information in the Application

SLRA Sections 2.4.1.1 through 2.4.1.38, as listed below, describe the structures and structural components subject to an AMR and the boundaries of the structure. SLRA Section 2.4, evaluates fire barrier walls, floors, ceilings, and other structural fire barrier commodities with the individual structures in which they are installed. SLRA Tables 2.4.1-1 through 2.4.1-38 list the structures and structural component types subject to an AMR and their intended functions.

SLRA Tables 3.5.2-1 through 3.5.2-38 provide the results of the applicant’s AMR for structures and components.

- SLRA Section 2.4.1.1, “Containment”
- SLRA Section 2.4.1.2, “Auxiliary Building Structure”
- SLRA Section 2.4.1.3, “Discharge Canal”
- SLRA Section 2.4.1.4, “Intake Canal”
- SLRA Section 2.4.1.5, “Fuel Building”
- SLRA Section 2.4.1.6, “Discharge Tunnel and Seal Pit”
- SLRA Section 2.4.1.7, “High Level Intake Structure”
- SLRA Section 2.4.1.8, “Low Level Intake Structure”
- SLRA Section 2.4.1.9, “Black Battery Building”
- SLRA Section 2.4.1.10, “Central Alarm Station”
- SLRA Section 2.4.1.11, “Condensate Polishing Building”
- SLRA Section 2.4.1.12, “Laundry Facility”
- SLRA Section 2.4.1.13, “Machine Shop”
- SLRA Section 2.4.1.14, “Radwaste Facility”
- SLRA Section 2.4.1.15, “SBO Building”
- SLRA Section 2.4.1.16, “Service Building”
- SLRA Section 2.4.1.17, ‘’Turbine Building”
- SLRA Section 2.4.1.18, “Containment Spray Pump Building”
- SLRA Section 2.4.1.19, “Fire Pump House”
- SLRA Section 2.4.1.20, “Fuel Oil Pump House”
- SLRA Section 2.4.1.21, “Main Steam Valve House”
- SLRA Section 2.4.1.22, “Safeguards Building”
- SLRA Section 2.4.1.23, “Buried Fuel Oil Tank Missile Barrier”
- SLRA Section 2.4.1.24, “Chemical Addition Tank Foundation”
- SLRA Section 2.4.1.25, “Duct Banks”
- SLRA Section 2.4.1.26, “Emergency Condensate Tank Foundations And Missile Barriers”
- SLRA Section 2.4.1.27, “Fire Protection and Domestic Water Tank Foundation”
- SLRA Section 2.4.1.28, “Fuel Oil Line Missile Barrier”
- SLRA Section 2.4.1.29, “Fuel Oil Storage Tank Dike”
- SLRA Section 2.4.1.30, “Manholes”
- SLRA Section 2.4.1.31, “Reactor Containment Subsurface Drainage System Access Shaft”
- SLRA Section 2.4.1.32, “Refueling Water Storage Tank Foundation”
- SLRA Section 2.4.1.33, “SBO Structures for Offsite Power”
- SLRA Section 2.4.1.34, “Security Lighting Poles”
- SLRA Section 2.4.1.35, “Transformer Firewalls and Dikes”
- SLRA Section 2.4.1.36, “Component Supports”
- SLRA Section 2.4.1.37, “Miscellaneous Structural Commodities”
- SLRA Section 2.4.1.38, “NSSS Supports”

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 NUREG-2192, Section 2.4, "Scoping and Screening Results: Structures," the staff reviewed:

- SLRA Section 2.4.1.1 through 2.4.1.38
- SLRA Tables 2.4.1-1 through 2.4.1-38
- SLRA Tables 3.3.1, 3.5.1, 3.5.2-37
- SLRA Tables 3.5.2-1 through 3.5.2-38
- UFSAR sections referenced in SLRA Section 2.4.1

2.4.3 Conclusion

Based on the staff's evaluation in SER Section 2.4.2 and on a review of the SLRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant identified the structures and components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant identified the system components subject to an aging management review in compliance with the requirements in 10 CFR 54.21(a)(1).

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

The staff reviewed SLRA Section 2.5, "Scoping and Screening Results: Electrical and Instrumentation and Controls Systems," to evaluate results of the applicant's activities to identify electrical and I&C systems within the scope of license renewal and components subject to an aging management review (AMR) in accordance with 10 CFR 54.4 and 10 CFR 54.21.

10 CFR 54.4(a) requires a list of plant systems, structures, and components (SSCs) within the scope of the licensee renewal, and 10 CFR 54.4(b), states in part that the intended functions of these SSCs must be shown to fulfill 10 CFR 54.21. In accordance with the requirements of 10 CFR 54.21(a)(1), the applicant must identify and list passive, long-lived SSCs within the scope of the subsequent license renewal and subject to an AMR. Standard Review Plan, NUREG-2192, "Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants (SRP-SLR)," Section 2.1 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.

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).

The staff used the SRP-SLR and NEI 17-01 guidance to evaluate the methodology used by the applicant in performing the scoping and screening for the structures and components within the scope of the 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 NEI 17-01.

The staff finds that the scoping methodology described in the SLRA was consistent with the SRP-SLR and NEI 17-01 guidance.

The scoping criteria in 10 CFR 54.4(a)(3) require, in part, an applicant to consider "all systems, structures, and components relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for station blackout (SBO) (10 CFR 50.63)."

The staff evaluated the system functions described in the Surry 1 and 2 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). In SLRA Section 2.1.1 (Scoping Methodology - Introduction), the applicant explained that electrical and I&C components that are part of in-scope electrical and I&C systems and in-scope mechanical systems are included within the scope of the subsequent license renewal. In addition, the applicant stated in Section 2.1.3.4, "10 CFR 54.4(a)(3) - Regulated Events," that all electrical equipment required to cope with SBO (e.g., alternate ac power sources) and support the requirements of 10 CFR 50.63, is also within the scope of subsequent license renewal. The boundaries for electric equipment for SBO are shown in SLRA Figure 2.1-1, "Surry SBO Coping and Recovery Paths."

The staff reviewed those components that the applicant identified as within the scope of subsequent 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). 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 grouped the electrical and I&C components that were identified to be within the scope of subsequent license renewal into component commodity groups. The applicant 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 identified the following list of passive electrical component and commodity groups that meet the screening criteria of 10 CFR 54.21(a)(1)(i):

- Cables and Connections
  - Cable connections (metallic parts)
  - Connector contacts for electrical connections exposed to borated water leakage
  - Electrical insulation material for electrical cables and connections
  - Fuse Holders - not part of active equipment (insulation material)
  - Fuse Holders - not part of active equipment (metallic clamps)
  - Switchyard bus and connections
  - Transmission conductors
  - Transmission connectors
  - Cable tie wraps
  - Uninsulated ground conductors
- Metal Enclosed Bus
- High Voltage Insulators
- Containment Electrical and I&C Penetrations

The applicant eliminated cable tie wraps from the electrical commodities with intended functions. Cable tie-wraps are used in cable installations as cable ties. Cable tie-wraps hold groups of cables together for restraint and ease of maintenance. Cable tie-wraps are used to bundle wires and cables together to keep the wire and cable runs neat and orderly. Cable tie-wraps are used to restrain wires and cables within raceways to facilitate cable installation. There are no current licensing basis requirements that cable tie-wraps remain functional during and following design basis events. Cable tie-wraps are not credited for maintaining cable ampacity, ensuring maintenance of cable minimum bending radius, or maintaining cables within vertical raceways. The seismic qualification of cable trays does not credit the use of cable tie-wraps. Cable tie-wraps are not credited in the design basis in terms of any 10 CFR 54.4 intended function. Therefore, cable tie-wraps are not within the scope of subsequent license renewal and are not subject to aging management review. 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 from the electrical commodities with intended functions. The uninsulated ground conductor component group is comprised of grounding cable and associated connectors. Ground conductors are provided for equipment and personnel protection. They do not perform an intended function for license renewal. Therefore, uninsulated ground conductors are not within the scope of subsequent license renewal and are 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.

The applicant noted that electrical and I&C components and commodities included in the EQ Program (10 CFR 50.49) are excluded because they have 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 AMR in accordance with the screening criterion of 10 CFR 54.21(a)(1)(ii). The applicant also described the screening analysis for in-scope containment electrical and I&C penetrations which are managed by either the EQ program or fall under the cable and connections commodity group. The pressure boundary and structural support intended functions of electrical penetrations are included in the evaluation of containment in Section 2.4.1.1.

The final results of applying screening criteria per 10 CFR 54.21(a)(1)(i) and 10 CFR 54.21(a)(1)(ii) and component types subject to AMR are listed in the SLRA Table 2.5.1-1, “Cables and Connections,” Table 2.5.1-2, “High Voltage Insulators,” and Table 2.5.1-3, “Metal Enclosed Bus.”

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 by the applicant 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, is in compliance with the requirements of 10 CFR 54.4(a), and therefore, is acceptable.

2.5.1 Summary of Technical Information in the Application

SLRA Section 2.5.1 describes the electrical and instrumentation and control system components (commodity groups) subject to an AMR, and the boundaries of the structure. SLRA Tables 2.5.1-1 lists the electrical and instrumentation component types subject to an AMR and their intended functions. SLRA Table 3.6.2-1 provides the results of the applicant's AMR for structure and structural components.

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 NUREG-2192, Section 2.5, "Scoping and Screening Results: Electrical and Instrumentation and Controls Systems," the staff reviewed:

- SLRA Section 2.5.1
- SLRA Table 2.5.1-1
- SLRA Table 3.6.2-1
- UFSAR Sections 9.10, 18.2.7

2.5.3 Conclusion

Based on the staff's evaluation in SER Section 2.5.2 and on a review of the SLRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant identified the electrical and instrumentation and control components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant identified the components subject to an aging management review in compliance with the requirements in 10 CFR 54.21(a)(1).

2.6 Conclusion for Scoping and Screening

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

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

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 Virginia Electric and Power Company's aging management reviews (AMRs) and aging management programs (AMPs) for Surry Power Station, Units 1 and 2 (Surry).

Virginia Electric and Power Company (Dominion Energy Virginia or the applicant) describes these AMRs and AMPs in its subsequent license renewal application (SLRA) for Surry. SLRA Section 3 provides the results of the applicant's AMRs for those systems and components identified in SLRA Section 2 as within the scope of license renewal and subject to an AMR. SLRA Appendix B lists the 44 AMPs that the applicant will rely on to manage or monitor the aging of passive, long-lived structures and components (SCs).

The staff evaluated the applicant'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 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 (Agencywide Documents Access and Management System (ADAMS) Accession Nos. ML17187A031 and ML17187A204) (GALL-SLR Report), for programs and AMR items. Per 10 CFR 54.29(a)(1), a renewed license may be issued if the Commission finds that actions have been identified and have been or will be taken with respect to managing the effects of aging during the period of extended operation on the functionality of structures and components that have been identified to require review under 10 CFR 54.21(a)(1). The GALL-SLR Report provides summaries of generic AMPs that the NRC staff has determined would be adequate to manage the effects of aging for related SCs subject to an AMR. 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 Nuclear Energy Institute (NEI) 17-01, “Industry Guideline for Implementing the Requirements of 10 CFR Part 54 for Subsequent License Renewal,” dated March 2017 (ADAMS Accession No. ML17339A599), which the NRC endorsed as acceptable for use in performing AMRs and drafting SLRAs (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 the applicant’s AMRs in the following two table types:

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

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

In its Table 1s, the applicant provided a summary of the alignment between the Surry 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, consistent with the GALL-SLR Report but uses a different AMP to manage aging effects, or whether the item is not applicable at Surry. 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. Table 2 includes a column linking each AMR item to the associated Table 1 summary item.

3.0.2 Staff’s Review Process

The staff conducted the following three types of evaluations of Dominion’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 they determined to be consistent with the GALL-SLR Report.

(2) For items that the applicant stated were consistent with the GALL-SLR Report with exceptions, enhancements, or both, the staff conducted either an audit or a technical review of 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.

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

As part of its SLRA review, the staff conducted an operating experience review audit from December 6–19, 2018, an in-office regulatory audit from February 4–28, 2019, and an onsite regulatory audit from April 22–25, 2019, as detailed in the audit reports dated March 4, 2019 (ADAMS Accession No. ML19046A433), May 30, 2019 (ADAMS Accession No. ML19128A079), and June 20, 2019 (ADAMS Accession No. ML19169A329), respectively.

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

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>" – should include the specific SCs subject to an AMR for SLR.

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

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

(4) "<u>detection of aging effects</u>" – 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) "<u>monitoring and trending</u>" – should provide predictability of the extent of degradation, as well as timely corrective or mitigative actions.

(6) "<u>acceptance criteria</u>" – these 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" – these actions, including root cause determination and prevention of recurrence, should be timely.

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

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

(10) "operating experience" – adding the 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 adequately managed 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 operating experience, 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 operating experience that the effects of aging may not be adequately managed.

Details of the staff's audit evaluation of program elements 1 through 6 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 (program elements 7, 8, and 9).

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

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

assessment and the evaluation of time limited aging analyses. Consistent with the SRP-SLR, the staff reviewed the updated final safety analysis report (UFSAR) supplement.

3.0.2.4 Documentation and Documents Reviewed

In performing its review, the staff used the SLRA, SLRA supplements, SRP-SLR, GALL-SLR Report, and 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 Surry Aging Management Programs

Surry 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	A1.1.1 B2.1.1	Existing	Consistent with Enhancements	XI.M1, ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	3.0.3.2.1
Water Chemistry (Primary and Secondary)	A1.1.2 B2.1.2	Existing	Consistent with Exceptions	XI.M2, Water Chemistry (Primary and Secondary)	3.0.3.2.2
Reactor Head Closure Stud Bolting (addressed by ISI program)	A1.1.3 B2.1.3	Existing	Consistent with Exceptions and Enhancements	XI.M3, Reactor Head Closure Stud Bolting (addressed by ISI program)	3.0.3.2.3
Boric Acid Corrosion	A1.1.4 B2.1.4	Existing	Consistent	XI.M10, Boric Acid Corrosion	3.0.3.1.1
Cracking of Nickel-alloy Components and Loss of Material Due to Boric Acid-induced Corrosion in Reactor Coolant Pressure Boundary Components	A1.1.5 B2.1.5	Existing	Consistent	XI.M11B, Cracking of Nickel-alloy Components and Loss of Material Due to Boric Acid-induced Corrosion in Reactor Coolant Pressure Boundary Components	3.0.3.1.2

Surry 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
Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)	A1.1.6 B2.1.6	Existing	Consistent	XI.M12, Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)	3.0.3.1.3
PWR Vessel Internals	A1.1.7 B2.1.7	Existing	Consistent with Enhancements	XI.M16A, PWR Vessel Internals	3.0.3.2.4
Flow-Accelerated Corrosion	A1.1.8 B2.1.8	Existing	Consistent with Enhancements	XI.M17, Flow-Accelerated Corrosion	3.0.3.2.5
Bolting Integrity	A1.1.9 B2.1.9	Existing	Consistent with Enhancements	XI.M18, Bolting Integrity	3.0.3.2.6
Steam Generators	A1.1.10 B2.1.10	Existing	Consistent	XI.M19, Steam Generators	3.0.3.1.4
Open-Cycle Cooling Water System	A1.1.11 B2.1.11	Existing	Consistent with Exceptions and Enhancements	XI.M20, Open-Cycle Cooling Water System	3.0.3.2.7
Closed Treated Water Systems	A1.1.12 B2.1.12	Existing	Consistent with Exceptions and Enhancements	XI.M21A, Closed Treated Water Systems	3.0.3.2.8
Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems	A1.1.13 B2.1.13	Existing	Consistent with Enhancements	XI.M23, Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems	3.0.3.2.9
Compressed Air Monitoring	A1.1.14 B2.1.14	Existing	Consistent with Enhancements	XI.M24, Compressed Air Monitoring	3.0.3.2.10
Fire Protection	A1.1.15 B2.1.15	Existing	Consistent with Enhancements	XI.M26, Fire Protection	3.0.3.2.11
Fire Water System	A1.1.16 B2.1.16	Existing	Consistent with Exceptions and Enhancements	XI.M27, Fire Water System	3.0.3.2.12
Outdoor and Large Atmospheric Metallic Storage Tanks	A1.1.17 B2.1.17	Existing	Consistent with Exceptions and Enhancements	XI.M29, Outdoor and Large Atmospheric Metallic Storage Tanks	3.0.3.2.13
Fuel Oil Chemistry	A1.1.18 B2.1.18	Existing	Consistent with Exceptions and Enhancements	XI.M30, Fuel Oil Chemistry	3.0.3.2.14
Reactor Vessel Material Surveillance	A1.1.19 B2.1.19	Existing	Consistent with Enhancements	XI.M31, Reactor Vessel Material Surveillance	3.0.3.2.15
One-Time Inspection	A1.1.20 B2.1.20	New	Consistent	XI.M32, One-Time Inspection	3.0.3.1.5
Selective Leaching	A1.1.21 B2.1.21	New	Consistent	XI.M33, Selective Leaching	3.0.3.1.6
ASME Code Class 1 Small-Bore Piping	A1.1.22 B2.1.22	New	Consistent with Exceptions	XI.M35, ASME Code Class 1 Small-Bore Piping	3.0.3.2.16

Surry 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
External Surfaces Monitoring of Mechanical Components	A1.1.23 B2.1.23	Existing	Consistent with Enhancements	XI.M36, External Surfaces Monitoring of Mechanical Components	3.0.3.2.17
Flux Thimble Tube Inspection	A1.1.24 B2.1.24	Existing	Consistent with Enhancements	XI.M37, Flux Thimble Tube Inspection	3.0.3.2.18
Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	A1.1.25 B2.1.25	Existing	Consistent with Enhancements	XI.M38, Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	3.0.3.2.19
Lubricating Oil Analysis	A1.1.26 B2.1.26	Existing	Consistent with Enhancements	XI.M39, Lubricating Oil Analysis	3.0.3.2.20
Buried and Underground Piping and Tanks	A1.1.27 B2.1.27	Existing	Consistent with Enhancements	XI.M41, Buried and Underground Piping and Tanks	3.0.3.2.21
Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks	A1.1.28 B2.1.28	Existing	Consistent with Exceptions and Enhancements	XI.M42, Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks	3.0.3.2.22
ASME Section XI, Subsection IWE	A1.1.29 B2.1.29	Existing	Consistent with Exceptions and Enhancements	XI.S1, ASME Section XI, Subsection IWE	3.0.3.2.23
ASME Section XI, Subsection IWL	A1.1.30 B2.1.30	Existing	Consistent with Enhancements	XI.S2, ASME Section XI, Subsection IWL	3.0.3.2.24
ASME Section XI, Subsection IWF	A1.1.31 B2.1.31	Existing	Consistent with Enhancements	XI.S3, ASME Section XI, Subsection IWF	3.0.3.2.25
10 CFR Part 50, Appendix J	A1.1.32 B2.1.32	Existing	Consistent	XI.S4, 10 CFR Part 50, Appendix J	3.0.3.1.7
Masonry Walls	A1.1.33 B2.1.33	Existing	Consistent with Enhancements	XI.S5, Masonry Walls	3.0.3.2.26
Structures Monitoring	A1.1.34 B2.1.34	Existing	Consistent with Enhancements	XI.S6, Structures Monitoring	3.0.3.2.27
Inspection of Water-Control Structures Associated with Nuclear Power Plants	A1.1.35 B2.1.35	Existing	Consistent with Enhancements	XI.S7, Inspection of Water-Control Structures Associated with Nuclear Power Plants	3.0.3.2.28
Protective Coating Monitoring and Maintenance	A1.1.36 B2.1.36	Existing	Consistent with Enhancements	XI.S8, Protective Coating Monitoring and Maintenance	3.0.3.2.29

Surry 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 Insulation for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	A1.1.37 B2.1.37	Existing	Consistent with Enhancements	XI.E1, Electrical Insulation for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	3.0.3.2.30
Electrical Insulation for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits	A1.1.38 B2.1.38	Existing	Consistent with Enhancements	XI.E2, Electrical Insulation for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits	3.0.3.2.31
Electrical Insulation for Inaccessible Medium-Voltage Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	A1.1.39 B2.1.39	Existing	Consistent with Enhancements	XI.E3A, Electrical Insulation for Inaccessible Medium-Voltage Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	3.0.3.2.32
Electrical Insulation for Inaccessible Instrument and Control Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	A1.1.40 B2.1.40	New	Consistent	XI.E3B, Electrical Insulation for Inaccessible Instrument and Control Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	3.0.3.1.8
Electrical Insulation for Inaccessible Low-Voltage Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	A1.1.41 B2.1.41	New	Consistent	XI.E3C, Electrical Insulation for Inaccessible Low-Voltage Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	3.0.3.1.9
Metal-Enclosed Bus	A1.1.42 B2.1.42	Existing	Consistent with Exceptions and Enhancements	XI.E4, Metal-Enclosed Bus	3.0.3.2.33

Surry 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	A1.1.43 B2.1.43	New	Consistent	XI.E6, Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	3.0.3.1.10
High-Voltage Insulators	A1.1.44 B2.1.44	New	Consistent with Exceptions	XI.E7, High-Voltage Insulators	3.0.3.2.34
Fatigue Monitoring	A2.1 B3.1	Existing	Consistent with Enhancements	X.M1, Fatigue Monitoring	3.0.3.2.35
Neutron Fluence Monitoring	A2.2 B3.2	Existing	Consistent	X.M2, Neutron Fluence Monitoring	3.0.3.1.11
Environmental Qualification of Electric Equipment	A2.3 B3.3	Existing	Consistent with Enhancements	X.E1, Environmental Qualification of Electric Equipment	3.0.3.2.36

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:

- Boric Acid Corrosion
- Cracking of Nickel-alloy Components and Loss of Material Due to Boric Acid-induced Corrosion in Reactor Coolant Pressure Boundary Components
- Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)
- Steam Generators
- One-Time Inspection
- Selective Leaching
- 10 CFR Part 50, Appendix J
- 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
- Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements
- Neutron Fluence Monitoring

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

3.0.3.1.1 Boric Acid Corrosion

SLRA Section B2.1.4 describes the existing Boric Acid Corrosion program as consistent with GALL-SLR Report AMP XI.M10, “Boric Acid Corrosion.”

Staff Evaluation. During its audit (ADAMS Accession No. ML19128A079), the staff reviewed Dominion’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.M10. The staff concluded the application was consistent with AMP XI.M10.

Operating Experience. SLRA Section B2.1.4 summarizes the operating experience related to the Boric Acid Corrosion program. The staff evaluated operating experience information by reviewing the subsequent license renewal application and conducting an audit (ADAMS Accession No. ML19046A433). 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 Dominion should modify its proposed program beyond that incorporated.

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

UFSAR Supplement. SLRA Section A1.4 provides the UFSAR supplement for the Boric Acid Corrosion program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in GALL-SLR Report Table XI-01. The staff also noted that Dominion committed to ongoing implementation of the existing Boric Acid Corrosion program for managing the effects of aging for applicable components during the subsequent period of extended operation. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. On the basis of its review of Dominion’s Boric Acid Corrosion program, the staff concludes that those program elements for which Dominion claimed consistency with the GALL-SLR Report are consistent. The staff concludes that Dominion 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 Cracking of Nickel-Alloy Components and Loss of Material Due to Boric Acid-Induced Corrosion in Reactor Coolant Pressure Boundary Components

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

Staff Evaluation. During its audit (ADAMS Accession No. ML19128A079) the staff reviewed the applicant's claim of consistency with the GALL-SLR Report. The staff compared the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements of Dominion's program to the corresponding program elements of GALL-SLR Report AMP XI.M11B. Based on its review of the SLRA, the staff finds that the program elements 1–7 are consistent with the corresponding program elements of GALL-SLR Report AMP XI.M11B.

Operating Experience. SLRA Section B2.1.5 summarizes the operating experience related to the Cracking of Nickel-Alloy Components and Loss of Material Due to Boric Acid-Induced Corrosion in Reactor Coolant Pressure Boundary Components program.

During the audit (ADAMS Accession No. ML19046A433), the staff independently searched plant-specific operating experience information to determine whether any previously unknown or recurring aging effects were identified. The staff reviewed operating experience information in the application related to reactor vessel head replacement, volumetric inspections, and bare metal visual examinations of bottom-mounted instrumentation nozzles and reactor vessel head penetrations. 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, the applicant's SLRA AMP can be adequate to manage the associated aging effects. The staff did not identify any operating experience indicating that Dominion should modify its proposed program.

Based on its audit and review of the application, the staff finds that the conditions and operating experience at the plant are bounded by those for which the Cracking of Nickel-Alloy Components and Loss of Material Due to Boric Acid-Induced Corrosion in Reactor Coolant Pressure Boundary Components program was evaluated.

UFSAR Supplement. SLRA Section A1.5 provides the UFSAR supplement for the Cracking of Nickel-Alloy Components and Loss of Material Due to Boric Acid-Induced Corrosion in Reactor Coolant Pressure Boundary Components program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in GALL-SLR Report Table XI-01.

Conclusion. On the basis of its review of Dominion's Cracking of Nickel-Alloy Components and Loss of Material Due to Boric Acid-Induced Corrosion in Reactor Coolant Pressure Boundary Components program, the staff concludes that those program elements for which Dominion claimed consistency with the GALL-SLR Report are consistent. The staff concludes that Dominion 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 Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)

SLRA Section B2.1.6 states that the Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS) program is an existing program that will be consistent with GALL-SLR Report AMP XI.M12, "Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)."

Staff Evaluation. As documented in its in-office audit report (ADAMS Accession No. ML19128A079), the staff reviewed Dominion'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.M12. For the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements, the staff finds that AMP B2.1.6 is consistent with the GALL-SLR report.

SLRA Section B2.1.6 states that AMP B2.1.6 is related to evaluating the thermal embrittlement of CASS piping and piping components in reactor coolant pressure boundaries during the operating service for the subsequent period of extended operation. The SLRA further states that the aging management of the susceptible CASS piping and piping components is accomplished through the component-specific flaw tolerance evaluation, WCAP-18258-P, "Flaw Tolerance Evaluation for Susceptible Reactor Coolant Loop Cast Austenitic Elbow Components for Surry Units 1 and 2."

The staff notes that thermal embrittlement is caused by a metallurgical phase change that results from the long-term exposure to operating temperatures greater than 482 °F. GALL-SLR Report AMP XI.M12 states that the extent of thermal embrittlement of CASS depends on several factors: (1) casting method (i.e., static casting or centrifugal casting), (2) molybdenum content, and (3) delta ferrite content. GALL-SLR Report Table XI.M12-1 shows a combination of casting method, molybdenum content, and ferrite content that would cause CASS material to be susceptible to thermal embrittlement.

The staff notes that the current ultrasonic testing is not effective in detecting flaws in CASS material because of the complex microstructure in CASS. Because there is not an effective ultrasonic testing method to examine the CASS material, and considering CASS material may be susceptible to thermal embrittlement, the staff finds that AMP 2.1.6 is consistent with GALL-SLR Report AMP XI-M12 in that the applicant performed an analytical evaluation to demonstrate structural integrity of the CASS piping for the subsequent period of extended operation as documented in the WCAP-18258-P Report.

The staff evaluated the flaw tolerance evaluation in WCAP-18258-P in terms of (1) modeling, (2) material properties used, and (3) delta ferrite content of the CASS material as discussed below. By email dated June 11, 2019, the staff requested additional information (RAI B2.1.6-1 and RAI B2.1.6-2) regarding the applicant's flaw tolerance evaluation (ADAMS Accession No. ML19164A333). By letter dated July 17, 2019 (ADAMS Accession No. ML19204A357), Dominion responded to the staff's RAIs as discussed below.

Flaw Evaluation Modeling in WCAP-18258-P

The staff noted that WCAP-18258-P postulated a fatigue crack in the weld region at the ends of the elbow of the reactor coolant loop piping. The staff noted that there are locations within the elbow (such as the intrados, extrados, and cheek locations) that could have higher stresses than the ends of the elbow and questioned why a fatigue crack was not postulated in the elbow. In addition, the staff notes that CASS pipes and elbows have a higher delta ferrite content (and are thus subject to a greater degree of thermal embrittlement than the locations Dominion selected for evaluation) and a lower strength than the weld metal. If the fatigue crack were to

occur, it is more likely to occur in the lower strength region near the CASS base metal (i.e., in the elbow or pipe) adjacent to the weld rather than in the weld.

In RAI B2.1.6-1, the staff requested that Dominion justify the selection of the weld region at the ends of the elbows as the bounding locations for the flaw evaluation. In response to RAI B2.1.6-1, Dominion stated that it used criteria developed by the ASME Code, Section XI, for assessment of thermal embrittlement of CASS. Dominion chose the weld region at the ends of the elbows as the bounding location for the flaw evaluation because the weld region, including 1/2-inch into the base metal, which is the heat affected zone of the straight pipe (i.e., not at the region of intrados or extrados), is the required area of examination per the ASME Code, Section XI, Figure IWB-2500-8 for similar metal welds in piping. The weld region is classified as examination category B-J in the ASME Code, Section XI, Table IWB-2500-1. Dominion indicated that these weld regions have a higher likelihood of fabrication defects due to welding imperfection at the time of installation. Dominion stated that the higher probability of detecting welding defects is one of the main reasons the ASME Code, Section XI, examination zones are specified for the weldments and the heat affected zones.

Dominion added that the operating experience of CASS components (elbows and pipes) demonstrates that the likelihood of fabrication flaws in the base metal is low. As a result, the flaw is typically postulated in welds and the adjacent heat affected zones. Dominion stated that geometric stress indices for elbow intrados/extrados have been included in the transient stresses for the flaw evaluations of the reactor coolant loop CASS elbows to account for the curvature of the elbow which produces higher stresses within the elbow components. Dominion stated that per NB-3653.2 of the ASME Code, Section III, through-wall stress from thermal loads requires no adjustment as a result of the elbow curvature because the geometric stress indices applied to thermal loading are equal to 1.0 for curved pipe or butt-welding elbows. Dominion explained that the time-history through-wall transient stress profiles used in the flaw evaluations have included the effects of the elbow geometry and locations (such as the intrados, extrados, and cheek locations) that could have higher stresses than the ends of the elbow.

The staff finds acceptable that Dominion postulated a fatigue crack in the weld rather than in the pipe or elbow because the weld is more likely to contain cracks than the pipe or elbow. Therefore, the staff finds acceptable that Dominion modeled a crack in the weld and analyzed its growth to demonstrate structural integrity of the CASS piping.

During the audit (ADAMS Accession No. ML19128A079), the staff asked Dominion to discuss (1) why the stress for straight pipe is adequate for the stress of the elbows in the CASS assessment in WCAP-18258-P, and (2) the assessment of the cold leg circumferential flaw as shown in Table 6-1 and Figure 6-6 of WCAP-18258-P. In its letter of July 17, 2019, Dominion addressed these two items as part of its response to RAI B2.1.6-2.

In response to item 1, Dominion stated that the stress intensity factors for surface flaws in cylinders (i.e., straight pipe) can be used for elbows as long as the stresses include the geometric factors associated with the curvature of the elbow. Dominion further stated that American Petroleum Institute (API) document, API-579-1, “Fitness-For Service,” Annex C.7 states that the stress intensity factor solutions for cylinders can be used for elbows and pipe bends if the stress at the location of the crack is determined considering the bend geometry and applied loads. Dominion explained that the fracture mechanics analysis performed for CASS already includes the stress indices of the elbow’s curvature in the development of the stresses, which are then used to calculate the stress intensity factors in a pipe geometry.

Dominion indicated that the reactor coolant loop CASS flaw tolerance evaluation contains other conservatisms that make the flaw evaluation bounding:

(1) Bounding loads from both Units 1 and 2.

(2) Bounding loads within each hot, crossover, and cold leg elbows.

(3) Absolute summation of the loads from deadweight, thermal expansions, seismic, and loss-of-coolant accident (LOCA).

(4) Use of conservative Z-factor for submerged arc welding (SAW) welds to determine the maximum allowable flaw sizes for elbows (which is a base metal) for the end-of-evaluation period.

(5) Delta ferrite content based on all susceptible elbows are considered from both Units 1 and 2.

(6) Use of LOCA loads based on residual heat removal, surge, and accumulator pipe break.

(7) It has been established through testing and operating history that the most likely location for the initiation of a flaw is in the weld region and not the base metal.

(8) Elbows are rigorously inspected during pre-service with multiple levels of liquid penetrant examinations and radiographic examinations.

Dominion noted that the ASME Code, Section XI inspection requirement for CASS components (pipe/elbows) is restricted to pressure-retaining welds in piping including ½ inch into the base metal (straight pipe) on either side of the weld. Based on the inspection requirement, the flaw tolerance analysis is restricted to the region of the weld and the adjacent base metal. The K solutions in the region of interest in the flaw tolerance analysis are, therefore, based on a straight pipe, and not an elbow.

Dominion stated that the same guidance for flaw postulation and evaluation of CASS piping (including elbows) is also provided in ASME Section XI Code Case N-838, "Flaw Tolerance Evaluation of Cast Austenitic Stainless Steel Piping." Dominion indicated that as discussed in Section 1(b) of Code Case N-838, the scope of the flaw tolerance evaluations includes postulated flaws in CASS base metal adjacent to welds. Section 3(b)(1) of Code Case N-838, states that: "…Select locations for postulating flaws in susceptible CASS piping adjacent to welds in accordance with the defined volume in Figure IWB-2500-8..." Dominion explained that with the use of this code case, the flaws are always postulated in straight pipes and not in the elbow intrados/extrados. Dominion stated that the NRC has reviewed Code Case N-838 without any condition on flaw postulation guidelines as discussed in Proposed Rule, "Approval of American Society of Mechanical Engineers' Code Classes," in the *Federal Register* (FR) (83 FR 40685), dated August 16, 2018.

The staff finds that the stress for the straight pipe is adequate for the stress of the elbow in the CASS assessment in WCAP-18258-P because the stress used for straight pipe in the flaw evaluation includes the stress in the elbow by applying stress indices. In addition, the staff finds that WCAP-18258-P includes bounding loads in the flaw evaluation.

In response to item 2, Dominion stated that Figures 6-1 through 6-6 of WCAP-18258-P are flaw tolerance charts for the susceptible piping components in the hot leg, crossover leg, and cold leg for both axial and circumferential flaws. Dominion indicated that the purpose of these flaw tolerance charts is to identify the maximum acceptable initial flaw size for a given plant

operation duration (80 years). Any flaw that falls below the allowable flaw size curve in Figures 6-1 through 6-6 is acceptable in accordance with the acceptance criteria of the ASME Code, Section XI, IWB-3640 for 80 years. Dominion explained that the difference between the acceptable initial flaw size and the maximum allowable end of evaluation flaw sizes is the amount of crack growth in 80 years.

Dominion first calculated the maximum allowable flaw size in the axial and circumferential orientation for the end-of-evaluation period for the hot leg, crossover leg, and cold leg. The maximum allowable end-of-evaluation period flaw size is the largest final flaw size for which the pipe can theoretically fail based on the ASME Code, Section XI guidance. Based on the allowable flaw size, Dominion back-calculated the acceptable initial flaw size by fatigue crack growth for the axial and circumferential flaws in the hot leg, crossover leg, and cold leg.

Table 6-1 of WCAP-18258-P shows the acceptable initial flaw size and maximum allowable flaw size in the axial and circumferential direction for the hot leg, crossover leg, and cold leg. As shown in Table 6-1 of WCAP-18258-P, the acceptable initial flaw depths are from 46 percent to 68 percent of the pipe wall thickness, depending on the flaw orientation and the piping system. The data show that the reactor coolant piping can tolerate a large initial flaw size even though the industry has not detected flaws in CASS piping in pressurized-water reactor plants. The staff finds that the limiting case is the circumferential flaw in the cold leg where the acceptable initial flaw depth is 49 percent and the maximum allowable flaw size is 50 percent depth. This case shows that the fatigue crack growth in 80 years is 1 percent of the pipe wall thickness.

The staff finds that Dominion has demonstrated that the acceptable initial flaw sizes are relatively large and that it would take 80 years to grow 1 percent of the pipe wall thickness. Based on this data, the staff finds that the flaw tolerance analysis provides reasonable assurance that if the CASS piping had an undetected flaw at present, and if the flaw grew with time, the flaw would not affect structural integrity of the pipe significantly at the end of subsequent period of extended operation.

<u>Material Properties Used in WCAP-18258-P</u>

Dominion indicated that even though the weld region is selected for the postulation of flaws (with the applied geometric indices for elbows), the percent delta ferrite content calculations and the subsequent thermal aging susceptibility screening determination as discussed in Section 3 of WCAP-18258-P was completed based on Surry-specific certified material test reports' chemistry values of the CASS elbow base metal. Thus, the percent delta ferrite content calculations have included the effects of the higher delta ferrite content of the CASS elbows.

Dominion explained that as for the material properties, the limiting yield and ultimate strength of the base metal are used in the flaw tolerance evaluations. Per the guidelines in the ASME Code, Section IX, QW-153, the stainless steel weld material is stronger than the CASS elbow (base metal). Dominion stated that elbow base metal material, A-351, Grade CF8M, has lower material properties (yield and ultimate strength) than that of the weld. Dominion has used the specific yield and ultimate strength of the base metal to calculate the maximum allowable end-of-evaluation period flaw size. Thus, Dominion used the limiting material properties in the CASS flaw evaluations.

The staff determines that Dominion has used appropriate material properties in the flaw evaluation because the limiting material properties from the elbow were used.

Delta Ferrite Content Used in WCAP-18258-P

GALL-SLR Report AMP XI.M12 states that CASS with greater than 20 percent ferrite (delta ferrite) is subject to a greater degree of thermal embrittlement and thus lower fracture toughness than CASS with lower than 20 percent ferrite content. In RAI B2.1.6-2, the staff requested that Dominion address the applicability of the limit load methodology for CASS having greater than 20 percent ferrite content and the use of Z-factor in the flaw evaluation. In its response to RAI B2.1.6-2, Dominion stated that the NRC provided guidance to the industry on the evaluation of thermal aging embrittlement of CASS material in a letter from Christopher I. Grimes to Douglas J. Walters, Nuclear Energy Institute, License Renewal Issue No. 98-0030, "Thermal Aging Embrittlement of Cast Stainless Steel Components," (ADAMS Accession No. ML003717179), May 19, 2000 ("Grimes' letter"), and in NUREG-1801, Revision 2, "Generic Aging Lessons Learned (GALL) Report." Dominion indicated that the aforementioned Grimes' letter and NUREG-1801 specifically stated that: "…Flaw tolerance evaluation for components with ferrite content up to 25% is performed according to the principles associated with ASME Code, Section XI, IWB-3640 procedures for SAWs, disregarding the ASME Code restriction of 20% ferrite. Extensive research data indicate that the lower-bound fracture toughness of thermally-aged CASS materials with up to 25% ferrite is similar to that for SAWs with up to 20% ferrite…"

In its response to RAI B2.1.6-2, Dominion stated that to evaluate the thermal aging embrittlement of CASS material with delta ferrite content greater than 20 percent, it used two ASME Code-approved documents: (1) Code Case N-838, and (2) the 2019 Edition of the ASME Code, Section XI updates ASME Codes and Standards (C&S Connect), Record #16-2757, Code Change (in the [Working Group Pipe Flaw Evaluation] WGPFE)) for Flaw Evaluation of CASS Piping," Record Established on November 9, 2016. The technical basis of the updates is documented in the paper by D.J. Shim, et al., "Technical Basis for Flaw Acceptance Criteria for Cast Austenitic Stainless Steel Piping," Proceedings of the ASME 2017 Pressure Vessels and Piping Conference, PVP2017- 66100, July 16-20, 2017.

ASME Code Case N-838

In its response to RAI B2.1.6-2, Dominion stated that Code Case N-838 is the first ASME-approved guidance for flaw tolerance evaluation of CASS piping components with delta ferrite greater than 20 percent. Dominion stated that the main purpose of Code Case N-838 is to help utilities performing flaw tolerance evaluations for CASS components with delta ferrite greater than 20 percent, because the flaw evaluation guidance in the 2017 Edition of the ASME Code, Section XI, Appendix C (Figure C-4210-1) is limited to CASS materials with delta ferrite less than 20 percent. Code Case N-838 methodology is applicable to ASME Class 1 and 2 piping components operating between 500 °F to 662 °F for SA-351 static or centrifugal components composed of Grades CF3, CF3A, CF3M, CF8, CF8A, and CF8M with delta ferrite values exceeding 20 percent. Per Code Case N-838, WCAP-18258-P calculates the delta ferrite for Surry-specific elbows per the Hull's equivalent factors based on an NRC report by O.K. Chopra, "Estimation of Fracture Toughness of Cast Stainless Steels During Thermal Aging in LWR Systems," NUREG/CR-4513, Revision 2, May 2016.

The staff noted that WCAP-18258-P states that based on NUREG/CR-4513, Revision 2, the delta ferrite correlations used for the full aged condition is applicable for plants operating at and beyond 15 EFPY (effective full-power years) for the CF8M materials. Dominion stated that as of January 2017, Surry Units 1 and 2 are operating at 33.78 and 33.69 EPFY, respectively.

Therefore, CASS CF8M materials of the reactor coolant loop piping at Surry Units 1 and 2 are currently in the fully aged condition.

In its response to RAI B2.1.6-2, Dominion stated that it postulated an axial and circumferential surface flaw with a depth of one-quarter wall thickness (1/4T) and a length of six times its depth at the welds adjacent to the CASS elbows per Code Case N-838. Dominion performed a fatigue crack growth analysis and determined the final flaw size after 80 years of growth to be minimal.

Although the staff has proposed a condition to prohibit the use of Code Case N-838 on CASS components with delta ferrite greater than 25 percent as documented in the Proposed Rule, (83 FR 40685), dated August 16, 2018, the staff verified that the NRC proposed condition on Code Case N-838 does not affect Dominion's flaw evaluation of the reactor coolant loop piping at Surry in terms of the delta ferrite content. The staff finds that Dominion has demonstrated that the final flaw size for the reactor coolant loop piping at Surry after 80 years remains below the maximum tolerable flaw size in Tables 1 through 4 of Code Case N-838.

<u>Updates for Appendix C of the 2019 Edition of the ASME Code Section XI</u>

In its response to RAI B2.1.6-2, Dominion stated that the updated 2019 Edition of the ASME Code, Section XI, Appendix C permits the use of SAW Z-factor with the limit load methodology for CASS piping components with delta ferrite levels greater than 20 percent (as performed in WCAP-18258-P). Dominion indicated that the updated Appendix C and Figure C-4210-1 provide flaw evaluation guidance for CASS materials with different levels of delta ferrite content, using the limit load method with SAW Z-factors. Dominion stated that for ferrite levels below 14 percent, limit load is sufficient without the use of Z-factors, while for ferrite levels greater than 25 percent, the flaw acceptance criteria for ferritic steel Category 2 welds as provided in Appendix C-6000 can be used. Dominion claimed that the use of SAW Z-factors with limit load method for CASS material with delta ferrite between 14 percent and 25 percent is an acceptable methodology.

Dominion stated that Figures 10 and 11 from PVP2017-66100 compare the normalized Z-factor to flow strength (flow stress) as a function of nominal pipe sizes for Grade CF8M and CF3/CF8 CASS materials. Figures 10 and 11 of PVP2017-66100 present the Z-factors for wrought stainless steel (base metal), SAW/shielded metal arc weld (SMAW), and the ferritic steel Category 2 piping material in the ASME Code, Section XI. Dominion stated PVP2017-66100 concluded that:

<u>For Grade CF3/CF8 or equivalent CASS piping:</u>

a) For ferrite content less than or equal to 14 percent, use the flaw acceptance criteria for wrought stainless steel provided in the ASME Code, Section XI, Appendix C, Subsection C-5000 (limit load, with no Z-factors).
b) For ferrite content greater than 14 percent, use the flaw acceptance criteria for SAW/SMAW stainless steel welds provided in the ASME Code, Section XI, Appendix C, Subsection C- 6000 (limit load with Z-factor per SAW/SMAW).

For Grade CF8M or equivalent CASS piping:

a) For ferrite content less than or equal to 14 percent, use the flaw acceptance criteria for wrought stainless steel provided in the ASME Code, Section XI, Appendix C, Subsection C-5000 (limit load, with no Z-factors).
b) For ferrite content greater than 14 percent and less than or equal to 25 percent, use the flaw acceptance criteria for SAW/SMAW stainless steel welds provided in the ASME Code, Section XI, Appendix C, Subsection C- 6000 (limit load with Z-factor per SAW/SMAW).
c) For ferrite content greater than 25 percent, use the flaw acceptance criteria for ferritic steel Category 2 welds provided in the ASME Code, Section XI, Appendix C, Subsection C-6000 (limit load with Z-factors for ferritic steel Category 2 welds).

The staff determines that Dominion has adequately addressed the staff’s concern regarding modeling, material properties, and delta ferrite contents in WCAP-18258-P. The staff further determines that Dominion has demonstrated that the CASS elbows in reactor coolant loop piping have shown sufficient fracture toughness for the subsequent period of extended operation. The staff concludes that Dominion’s flaw evaluation has provided reasonable assurance that structural integrity of the reactor coolant loop piping will be maintained during the subsequent period of extended operation.

The staff has not officially approved either the 2019 Edition of the ASME Code, Section XI, or Code Case N-838. This safety evaluation does not imply or infer NRC approval of the 2019 Edition of the ASME Code, Section XI, nor Code Case N-838 for generic use at this time.

Operating Experience. SLRA Section B2.1.6 summarizes the operating experience related to the Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS) program. The staff evaluated operating experience by reviewing the SLRA and conducting an audit (ADAMS Accession No. ML191046A433). During the audit, the staff independently searched plant-specific operating experience information to determine whether Dominion identified any previously unknown or recurring aging effects.

SLRA Section B2.1.6 stated that during the Unit 1 spring 2015 refueling outage, Dominion performed a VT-3 visual examination on the “C” reactor coolant pump casing following removal of the pump for overhaul and turning-vane bolt replacement. The SLRA stated that the VT-3 visual examination was satisfactory with no indications observed. Dominion did find a small quantity of loose debris in the discharge nozzle, satisfactorily removed it, and documented the loose debris in a condition report. During the Unit 2 fall 2015 outage, Dominion performed a VT-3 visual examination on the “A” reactor coolant pump casing following the removal of the pump for overhaul and turning-vane bolt replacement. The SLRA stated that the VT-3 visual examination was satisfactory with no indications observed. The staff finds acceptable that Dominion has performed the required examinations to periodically monitor structural integrity of reactor coolant pump casings, which are constructed of CASS and that there is no active degradation in the pump casings.

UFSAR Supplement. SLRA Section A1.6 provides the UFSAR supplement for AMP B2.1.6. The staff reviewed the UFSAR supplement description of the program and noted that it is consistent with the recommended description in GALL-SLR Report Table XI-01. The UFSAR supplement in SLRA Section A1.6 states that AMP B2.1.6 is an existing condition monitoring program that manages loss of fracture toughness of reactor coolant pressure boundary

components that are made of cast austenitic stainless steel with service conditions above 250 °C (Celsius) (482 °F (Fahrenheit)). The program determines the susceptibility of CASS piping and piping components in reactor coolant pressure boundaries regarding thermal aging embrittlement based on the casting method, molybdenum content, and ferrite content. The UFSAR supplement further states that aging management of potentially susceptible piping and piping components is accomplished through either a component-specific flaw tolerance evaluation or examination in accordance with the ASME Code, Section XI. The staff finds that the information in the UFSAR supplement is an adequate summary description of the AMP B2.1.6.

Conclusion. On the basis of its review of Dominion's Thermal Aging Embrittlement of Cast Austenitic Stainless Steel program, the staff determines that those program elements for which Dominion claimed consistency with the GALL-SLR Report are consistent. The staff concludes that Dominion 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).

3.0.3.1.4 Steam Generators

SLRA Section B2.1.10 describes the existing Steam Generators program as consistent with GALL-SLR Report AMP XI.M19, "Steam Generators."

Staff Evaluation. During its audit (ADAMS Accession No. ML19128A079), the staff reviewed Dominion'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 Dominion's program to the corresponding program elements of GALL-SLR Report AMP XI.M19.

The staff conducted an audit to verify Dominion'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 GALL-SLR Report AMP XI.M19.

Operating Experience. SLRA Section B2.1.10 summarizes the operating experience related to the Steam Generators program. The staff evaluated operating experience information by reviewing the SLRA and conducting an audit (ADAMS Accession No. ML19046A433). 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 Dominion should modify its proposed program.

Based on its audit and review of the application, the staff finds that the conditions and operating experience at the plant are bounded by those for which the Steam Generators program was evaluated.

UFSAR Supplement. SLRA Section A1.1.10 provides the UFSAR supplement for the Steam Generators program.

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

Conclusion. On the basis of its review of Dominion's Steam Generators program, the staff concludes that those program elements for which Dominion claimed consistency with the GALL-SLR Report are consistent. The staff concludes that Dominion 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).

3.0.3.1.5 One-Time Inspection

SLRA Section B2.1.20 describes the new One-Time Inspection program as consistent with GALL-SLR Report AMP XI.M32, "One-Time Inspection." Dominion amended this SLRA section by letters dated April 2, 2019 (ADAMS Accession No. ML19095A666), and June 27, 2019 (ADAMS Accession No. ML19183A440).

Staff Evaluation. As documented in its in-office audit report (ADAMS Accession No. ML19128A079), the staff reviewed Dominion'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 Dominion's program to the corresponding program elements of GALL-SLR Report AMP XI.M32, "One-Time Inspection."

For the "detection of aging effects" program element, the staff needed additional information, and issued RAIs. RAI B2.1.1-4 and Dominion's response are documented in ADAMS Accession Nos. ML19155A050 and ML19183A440, respectively.

In its response to RAI B2.1.1-4, Dominion revised SLRA Section B.2.1.20. The program was changed to specify that a magnetic particle test inspection of susceptible locations of the continuous circumferential transition cone closure welds on each steam generator prior to the subsequent period of extended operation will be performed to cover essentially 100 percent of each weld.

During its evaluation of Dominion's response to RAI B2.1.1-4, the staff noted that GALL-SLR Report AMP XI.M32, "One-Time Inspection," recommends a technical justification for the methodology and sample size for selecting components; AMP XI.M32 also recommends inspections and tests follow procedures consistent with the ASME Code. Since Dominion's changes to the SLRA require essentially 100 percent coverage for each of the welds with magnetic particle testing and the inspections are consistent with the ASME Code, the staff concludes there is reasonable assurance that degradation will be detected prior to a loss of intended function. The staff finds Dominion's response and changes to SLRA Section B.2.1.20 acceptable because the inspections are capable of detecting loss of material in the continuous circumferential transition cone closure welds on each steam generator.

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.M32, One-Time Inspection.

Operating Experience. SLRA Section B2.1.20 summarizes operating experience related to the One-Time Inspection program. The staff evaluated operating experience information by reviewing the subsequent license renewal application and conducting an audit (ADAMS Accession No. ML19046A433). 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 Dominion should modify its proposed program.

Based on its audit and review of the application, 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 A1.20 provides the UFSAR supplement for the One-Time Inspection program.

The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in GALL-SLR Report Table XI-01. The staff also noted Dominion committed to implement the new One-Time Inspection program 10 years before 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 Dominion's One-Time Inspection program, the staff concludes that those program elements for which Dominion claimed consistency with the GALL-SLR Report are consistent. The staff concludes that Dominion has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.6 Selective Leaching

SLRA Section B2.1.21 describes the new Selective Leaching program, which is consistent with GALL-SLR Report AMP XI.M33, "Selective Leaching." Dominion amended this SLRA section by letters dated September 3, 2019 (ADAMS Accession No. ML19253B330); October 14, 2019 (ADAMS Accession No. ML19294A044); October 31, 2019 (ADAMS Accession No. ML19310E716), and November 19, 2019 (ADAMS Accession No. ML19329A287).

Staff Evaluation. During its in-office audit (ADAMS Accession No. ML19128A079), the staff reviewed Dominion's claim of consistency with the GALL-SLR Report. The staff compared the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements of the SLRA of Dominion's program to the corresponding program elements of GALL-SLR Report AMP XI.M33.

For the "scope of program" program element, the staff determined the need for additional information regarding why the external surfaces of buried components that are coated consistent with the Buried and Underground Piping and Tanks program are excluded from the sample population, which resulted in the issuance of an RAI. By letter dated October 14, 2019, Dominion provided additional clarification regarding the staff's concerns, which superseded the information provided in the response to RAI B2.1.21-1.

In its response dated October 14, 2019, Dominion revised the Selective Leaching program to remove the inspection exclusion for the external surfaces of buried components that are coated consistent with the Buried and Underground Piping and Tanks program. The staff finds Dominion's revision acceptable because the external surfaces of buried components will be included in the inspection population for selective leaching, which is consistent with GALL-SLR Report AMP XI.M33 recommendations.

The staff conducted an audit to verify Dominion'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 GALL-SLR Report AMP XI.M33.

Operating Experience. SLRA Section B2.1.21, as modified by letters dated October 31, 2019, and November 19, 2019, summarizes the operating experience related to the Selective Leaching program. The staff evaluated the operating experience information by reviewing the information in the subsequent license renewal application and by conducting an audit (ADAMS Accession No. ML19046A433). 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 also reviewed the revised operating experience summary of SLRA Section B2.1.16, "Fire Water System," provided in Dominion's October 14, 2019, annual update. The operating experience discussed two ruptures of the buried fire protection system piping, which occurred in July 2019. In the annual update, Dominion stated that external corrosion from long-standing exposure to moist or wet soil resulted in wall thickness reductions at several locations. Consequently, the staff determined the need for additional information, which resulted in the issuance of draft RAIs, as documented in NRC letter dated November 20, 2019 (ADAMS Accession No. ML19305C846). Dominion's responses to the staff's draft RAIs are documented in letters dated October 31, 2019, and November 19, 2019 (ADAMS Accession Nos. ML19310E716 and ML19329A287, respectively).

In the responses to the staff's draft RAIs referenced above, Dominion provided additional details regarding the operating experience identified in the October 14, 2019, letter as follows:

- Metallurgical analysis concluded the failure was a result of graphitic corrosion (i.e., selective leaching) and determined that it was a result of groundwater exposure of the cast iron fire protection piping between roughly the 5 o'clock to 7 o'clock positions.
- Because graphitic corrosion is a long-term corrosion mechanism, it is believed the corrosion resulted from extended contact with groundwater and was not due to the packing leak identified 1 year earlier.

Dominion also augmented the Selective Leaching program for buried cast iron piping in three areas: exploratory holes for groundwater, corrective actions for presence of groundwater, and sample expansion (selective leaching due to elevated groundwater). The focus of these augmented requirements of the program is to identify suspected system leakage or elevated groundwater in 25 holes to be dug along the fire protection loop piping.

The staff noted that the buried cast iron piping ruptures have been entered into Dominion's corrective action program (CAP). Dominion is identifying necessary corrective actions as part of the program. The staff reviewed Dominion's responses to the staff's draft RAIs and finds them acceptable as follows: the identified activities (e.g., drilling exploratory holes to confirm the presence of groundwater, excavating and inspecting fire protection loop piping at each hole where groundwater has been confirmed, and drilling additional exploratory holes to determine the extent of any identified elevated groundwater, along with the noted sample expansion activities) are capable of detecting adverse conditions due to groundwater immersion that may lead to graphitic corrosion and identifying ongoing degradation of the buried gray cast iron fire protection loop piping. Changes to the aging management program(s) to address other possible issues (e.g., long-standing exposure to moist corrosive soil, soil parameter consistency across the site), if necessary, will be identified as Dominion completes its development of corrective actions.

The staff did not identify any operating experience, other than that noted above for buried fire protection piping, to indicate that Dominion should modify its proposed program beyond those modifications incorporated into the Selective Leaching program. Based on its audit and review of the application, 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 A1.21 provides the UFSAR supplement for the Selective Leaching program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in GALL-SLR Report Table XI-01. The staff also noted that Dominion committed to implement the new Selective Leaching program 10 years before 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 Dominion's Selective Leaching program, the staff concludes that those program elements for which Dominion claimed consistency with the GALL-SLR Report are consistent. The staff concludes that Dominion 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 10 CFR Part 50, Appendix J

SLRA Section B2.1.32 describes the existing 10 CFR Part 50, Appendix J program as consistent with GALL-SLR Report AMP XI.S4, "10 CFR Part 50, Appendix J."

Staff Evaluation. During its audit (ADAMS Accession No. ML19128A079), the staff reviewed Dominion'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 Dominion’s program to the corresponding program elements of GALL-SLR Report AMP XI.S4.

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.S4.

Operating Experience. SLRA Section B2.1.32 summarizes the operating experience related to the 10 CFR Part 50, Appendix J program. The staff evaluated operating experience information by reviewing the subsequent license renewal application and conducting an audit (ADAMS Accession No. ML19046A433). 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 Dominion should modify its proposed program.

Based on its audit and review of the application, 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 A1.32 as amended by letter dated June 10, 2019 (ADAMS Accession No. ML19164A333), provides the UFSAR supplement for the 10 CFR Part 50, Appendix J program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in GALL-SLR Report Table XI-01.

The staff also noted that Dominion 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, as amended by letter dated June 10, 2019, is an adequate summary description of the program.

Conclusion. On the basis of its review of Dominion’s 10 CFR Part 50, Appendix J AMP, the staff concludes that those program elements for which Dominion claimed consistency with the GALL-SLR Report are consistent. The staff concludes that Dominion 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 Electrical Insulation for Inaccessible Instrument and Control Cables Not Subject to 10 CFR 50.49 Environmental Qualifications Requirements

SLRA Section B2.3.40 describes the new Electrical Insulation for Inaccessible Instrument and Control Cables Not Subject to 10 CFR 50.49 Environmental Qualification [EQ] Requirements program as consistent with GALL-SLR Report AMP XI.E3B, “Electrical Insulation for Inaccessible Instrument and Control Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements.”

Staff Evaluation. During its audit (ADAMS Accession No. ML19128A079), the staff reviewed Dominion's claim of consistency with the GALL-SLR Report. The staff compared the "scope of program," "preventive actions," "parameters monitored/inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements of Dominion's program to the corresponding program elements of GALL-SLR Report AMP XI.E3B.

Based on its audit and review of the SLRA, the staff finds that the "scope of program," "preventive actions," "parameters monitored/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.E3B.

Operating Experience. SLRA Section B2.3.40 summarizes the operating experience related to the Electrical Insulation for Inaccessible Instrument and Control Cables Not Subject to 10 CFR 50.49 EQ Requirements program. The staff evaluated operating experience information by reviewing the subsequent license renewal application and conducting an audit (ADAMS Accession No. ML19046A433). During the audit, the staff independently searched plant-specific operating experience information to determine whether any previously unknown or recurring aging effects were identified. Based on its audit and review of the application, 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 EQ Requirements was evaluated.

UFSAR Supplement. SLRA Section A1.40 provides the UFSAR supplement for the Electrical Insulation for Inaccessible Instrument and Control Cables Not Subject to 10 CFR 50.49 EQ Requirements. 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 Dominion committed to implement the Electrical Insulation for Inaccessible Instrument and Control Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program 6 months prior to the subsequent period of extended operation for managing the effects of aging.

Conclusion. On the basis of its review of Dominion's Electrical Insulation for Inaccessible Instrument and Control Cables Not Subject to 10 CFR 50.49 EQ Requirements program, the staff concludes that those program elements for which Dominion claimed consistency with the GALL-SLR Report are consistent. The staff concludes that Dominion has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the 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 Electrical Insulation for Inaccessible Low-Voltage Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements

SLRA Section B2.3.41 describes the new Electrical Insulation for Inaccessible Low-Voltage Power Cables Not Subject to 10 CFR 50.49 EQ Requirements program as 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."

Staff Evaluation. During its audit (ADAMS Accession No. ML19128A079), the staff reviewed Dominion's claim of consistency with the GALL-SLR Report. The staff compared the "scope of

program,” “preventive actions,” “parameters monitored/inspected,” “detection of aging effects,” “monitoring and trending,” “acceptance criteria,” and “corrective actions” program elements of Dominion’s program to the corresponding program elements of GALL-SLR Report AMP XI.E3C.

Based on its audit and review of the SLRA, the staff finds that the “scope of program,” “preventive actions,” “parameters monitored/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.E3C.

Operating Experience. SLRA Section B2.3.41 summarizes the operating experience related to the Electrical Insulation for Inaccessible Low-Voltage Power Cables Not Subject to 10 CFR 50.49 EQ Requirements program. The staff evaluated operating experience information by reviewing the subsequent license renewal application and conducting an audit (ADAMS Accession No. ML19046A433). During the audit, the staff independently searched plant-specific operating experience information to determine whether any previously unknown or recurring aging effects were identified. Based on its audit and review of the application, 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 EQ Requirements was evaluated.

UFSAR Supplement. SLRA Section A1.41 provides the UFSAR supplement for the Electrical Insulation for Inaccessible Low-Voltage Power Cables Not Subject to 10 CFR 50.49 EQ Requirements. 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 Dominion committed to implement the Electrical Insulation for Inaccessible Low-Voltage Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program 6 months prior to the subsequent period of extended operation for managing the effects of aging.

Conclusion. On the basis of its review of Dominion’s Electrical Insulation for Inaccessible Low-Voltage Power Cables Not Subject to 10 CFR 50.49 EQ Requirements program, the staff concludes that those program elements for which Dominion claimed consistency with the GALL-SLR Report are consistent. The staff concludes that Dominion has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the 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 Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements

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

Staff Evaluation. During its audit (ADAMS Accession No. ML19128A079), the staff reviewed Dominion’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 Dominion's program to the corresponding program elements of GALL-SLR Report AMP XI.E6.

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.E6.

Operating Experience. SLRA Section B2.1.43 summarizes the 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 subsequent license renewal application and conducting an audit (ADAMS Accession No. ML19046A433). 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 Dominion should modify its proposed program. Based on its audit and review of the application, 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.

UFSAR Supplement. SLRA Section A1.43 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 Dominion committed to implement the Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program 6 months prior to the subsequent period of extended operation for managing the effects of aging for applicable components. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

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

3.0.3.1.11 Neutron Fluence Monitoring

SLRA Section B3.2 describes the existing Neutron Fluence Monitoring AMP as consistent with GALL-SLR Report AMP X.M2, "Neutron Fluence Monitoring."

Staff Evaluation. During the in-office audit (ADAMS Accession No. ML19128A079), the staff reviewed Dominion'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 Dominion's AMP to the corresponding program elements of GALL-SLR Report AMP X.M2.

Staff-Identified Exception

During its review of SLRA Section B3.2, the staff identified a difference in the programmatic criteria of the “scope of program,” “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” and “monitoring and trending” program elements from those specified in the corresponding program elements in GALL-SLR Report AMP X.M2. In this difference (programmatic exception), the staff noted that Dominion will not monitor for changes in the neutron fluence values of the reactor vessel internal (RVI) components during the subsequent period of extended operation.[1]

The staff reviewed SLRA Sections B3.2 and 4.2.1, and information in SLRA Appendix C, to determine whether the SLRA included any discussion of Dominion’s basis for projecting RVI component-specific neutron fluence values to the end of the subsequent period of extended operation.[2] The staff performed this review to determine whether the Neutron Fluence Monitoring AMP (as applied to the subsequent period of extended operation) would need to include neutron fluence monitoring activities for RVI component-specific locations contrary to the position taken by the applicant on omitting these types of activities from the scope of the AMP. The staff’s rationale was that Dominion’s Neutron Fluence Monitoring AMP might not need to include neutron fluence monitoring activities for RVI component-specific locations if the SLRA included the neutron fluence values or ranges projected to 72 EFPY for the RVI component-specific locations and a valid, conservative basis for the projections.

The staff did not identify any neutron fluence projection bases for the RVI component-specific fluence ranges provided in SLRA Appendix C. To address this matter, the staff needed additional information, and issued two RAIs. RAI B3.2-1 and supplemental RAI B3.2-1-a (and Dominion’s responses to both RAIs) are documented in ADAMS Accession Nos. ML19183A386 and ML19253B330, respectively.

In its responses to these RAIs, Dominion stated that the 80-year (72 EFPY) neutron fluence assessment for RVI components was performed and documented in the Westinghouse Report No. WCAP-18205-NP, Revision 0 (provided as proprietary enclosure to the September 3, 2019, supplement).

Using information from these RAI responses, the staff determined that information pertinent to the current inquiry for locations above and below the core is contained in WCAP-18205-NP. The staff also determined that the information contained, and the models used, in WCAP-18205-NP are derived from a detailed representation of reactor internals for a selected Westinghouse 3-loop plant. Further, the staff determined that the characteristics of the reactors at Surry are consistent with the Westinghouse 3-loop plant selected for analysis in WCAP-18205-NP. Specifically, the staff noted that the information in Tables 2.2-1 and 2.2-2 of WCAP-18205-NP includes the neutron transport calculation results for reactor pressure vessel (RPV) components in comparison to those specified in WCAP-18028-NP for the RPV inner surfaces in the beltline region. The staff noted that the comparisons in Tables 2.2-1 and 2.2-2

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[1] Per the guidelines in Nuclear Energy Institute Report No. NEI-17-01, this difference constitutes an exception to the GALL-SLR Report for the stated AMP program elements.

[2] In the SLRA, Dominion identifies that the end of the subsequent period of extended operation is associated with 68 effective full-power years (EFPY) of plant operations at full power, as licensed in the plant-specific technical specifications (i.e., 2,587 MWt rated power). For the neutron fluence projections used for the RVI component-specific locations, Dominion conservatively used 72 EFPY as being associated with the end of the subsequent period of extended operation for the components.

demonstrate that the methods presented in WCAP-18205-NP for projecting the fluences to 72 EFPY are consistent with those for the Surry units at 72 EFPY in WCAP-18028-NP.

Based on its review of WCAP-18028-NP and WCAP-18205-NP, the staff finds that Westinghouse's NRC-approved methodology (i.e., WCAP-14040-A, Revision 4 (ADAMS Accession No. ML050120209)), for calculating component-specific neutron fluence values had been consistently incorporated, used, and described in the reports.

Specifically, the staff observed that the NRC-approved methodology described in WCAP-14040-A, Revision 4, is based on use of the DORT discrete ordinates code and the BUGLE-96 cross-section library. In performing the fast neutron exposure evaluations for the selected Westinghouse 3-loop plant RVI components, Dominion conducted a series of fuel-cycle-specific forward transport calculations by following the three-dimensional flux synthesis technique as specified in Regulatory Guide (RG) 1.190, "Calculational and Dosimetry Methods for Determining Reactor Pressure Vessel Neutron Fluence" (ADAMS Accession No. ML010890301). This synthesis procedure was carried out for each operating cycle at the two Surry units.

The other pertinent parameters used in the neutron transport calculations in WCAP-18205-NP are in conformance with RG 1.190. To determine the neutron source for use in the transport calculations, Dominion performed core calculations using an actual power level of 2,546 MWt for cycle-emitted neutron fluxes through Cycle 23 and a power level of 2,597 MWt for fluxes in Cycle 24 and beyond; for the flux derivations for future cycles, the use of a power level of 2,597 MWt is greater, and therefore more conservative, than the derivation of the neutron fluxes using the rated power for the two Surry units (i.e., 2,587 MWt). Hence, the application of WCAP-18205-NP neutron fluence projections to Surry for 80 years of licensed operation will be conservative.

The staff reviewed the neutron source description in WCAP-18205-NP for each fuel cycle calculation and finds that the preparation of core neutron source for the transport calculation is in conformance with RG 1.190.

The staff noted from WCAP-14040-A, Revision 4, that uncertainties in the neutron fluence methodology applied in WCAP-18205-NP met the RG 1.190 criterion. In Section 4.2.1 of this safety evaluation report, the staff confirmed that the dosimetry sensor sets from three of the first four surveillance capsules withdrawn from Surry Unit 1 and the first five surveillance capsules withdrawn from Surry Unit 2 met the ±20% (1σ) uncertainty acceptance criterion specified for fluence assessments in RG 1.190.

The staff also noted that the methodology in WCAP-18205-NP that Dominion used to determine a fast neutron fluence range (E > 1.0 MeV) for each RVI component-specific locations analyzed in the gap analysis and to confirm that the component-specific fluence ranges are within the fluence ranges specified for the components in MRP-191, Revision 2. The staff noted that the fluence results were used for subsequent screening; failure modes, effects, and criticality analysis (FMECA); functionality analysis; and categorization of the RVI components for the 80-year operation (72 EFPY) in support of SLR. The results are presented in WCAP-18205-NP, Tables 2.7-2 and 2.7-4.

Based on the above evaluation, the staff determined that the response to RAI B3.2-1-a is adequate because the methods used to calculate the neutron fluence are consistent with the NRC-approved methodology in WCAP-14040-A, which in turn adheres to the guidance in

RG 1.190, and Dominion provided the neutron fluence projections for each RVI component at the end of subsequent period of extended operation.

Therefore, the staff finds Dominion's responses to RAI B3.2-1 and RAI B3.2-1-a acceptable because: (a) Dominion projected neutron fluence values for Surry-specific RVI components to 80 years of licensed operation using NRC-approved methodologies, (b) the neutron fluence ranges for each Surry-specific RVI component cited in WCAP-18205-NP fall within the range of values for the components cited in the SLRA Appendix C gap analysis, and (c) Dominion has amended the SLRA by including WCAP-18205-NP, Revision 0, in the dockets for Units 1 and 2.

Based on a review of SLRA Section B3.2, the staff finds that for those programmatic criteria in the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements claimed as being consistent with GALL-SLR Report AMP X.M2, the criteria are consistent with the corresponding program element criteria defined in the GALL-SLR Report AMP. For the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," and "monitoring and trending" program element criteria that cite a difference from the GALL-SLR Report AMP X.M2 and establish Dominion's position that neutron fluence monitoring activities are not necessary for RVI components, the staff finds that the applicant's alternate 72 EFPY fluence projections for the RVI components serve as an acceptable basis for deriving the neutron fluence values for the components at the end of the subsequent period of extended operation. Accordingly, the staff finds that Dominion's alternative is acceptable to manage fluence-impacted aging effects in the Surry-specific RVI components in accordance with the criterion in 10 CFR 54.21(a)(3).

Operating Experience. SLRA Section B3.2 summarizes the operating experience related to the Neutron Fluence Monitoring AMP. The staff evaluated operating experience information by reviewing the subsequent license renewal application and conducting an audit (ADAMS Accession No. ML19046A433). 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 Dominion should modify its proposed program. Based on its audit and review of the application, the staff finds that the conditions and operating experience at the plant are bounded by those for which the Neutron Fluence Monitoring AMP was evaluated.

UFSAR Supplement. SLRA Section A2.2 provides the UFSAR supplement for the Neutron Fluence 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 Dominion committed to ongoing implementation of the existing Neutron Fluence Monitoring AMP for managing the effects of aging for applicable components during the subsequent period of extended operation (Commitment No. 46 in SLRA Table A4.0-1, "Subsequent License Renewal Commitments"). Thus, the staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

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

concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2 AMPs Consistent with the GALL-SLR Report with Exceptions and/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:

- ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD
- Water Chemistry
- Reactor Head Closure Stud Bolting
- PWR Vessel Internals
- Flow-Accelerated Corrosion
- Bolting Integrity
- Open-Cycle Cooling Water System
- Closed Treated Water Systems
- Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems
- Compressed Air Monitoring
- Fire Protection System
- Fire Water System
- Outdoor and Large Atmospheric Metallic Storage Tanks
- Fuel Oil Chemistry
- Reactor Vessel Material Surveillance
- ASME Code Class 1 Small-Bore Piping
- External Surfaces Monitoring of Mechanical Components
- Flux Thimble Tube Inspection
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components
- Lubricating Oil Analysis
- Buried and Underground Piping and Tanks
- Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks
- ASME Section XI, Subsection IWE
- ASME Section XI, Subsection IWL
- ASME Section XI, Subsection IWF
- Masonry Walls
- Structures Monitoring
- Inspection of Water-Control Structures Associated with Nuclear Power Plants

- Protective Coating Monitoring and Maintenance
- Electrical Insulation for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements
- Electrical Insulation for 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
- Metal-Enclosed Bus
- High-Voltage Insulators
- Fatigue 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 indeed consistent. The staff reviewed the exceptions to the GALL-SLR Report to determine whether they are acceptable and adequate. The staff also reviewed the enhancements to determine whether they will make the AMP consistent with the GALL-SLR Report AMP to which it is compared. The results of the staff's audits and reviews are documented in the following sections.

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

SLRA Section B2.1.1 states that the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program is an existing program with an enhancement that will be consistent with the program elements in the GALL-SLR Report AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD."

Staff Evaluation. During its audit (ADAMS Accession No. ML19128A079), the staff reviewed Dominion's claim of consistency with the GALL-SLR Report. The staff compared the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements of the SLRA to the corresponding program elements of GALL-SLR Report AMP XI.M1.

For the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements, the staff finds that the SLRA AMP B2.1.1 is consistent with the GALL-SLR Report. The staff also reviewed the portions of the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements associated with the enhancement to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of the enhancement is as follows.

Enhancement 1. SLRA Section B2.1.1 includes an enhancement to the "detection of aging effects" program element related to requiring inspections to be performed for welds associated with sentinel locations assessed under the ASME Code, Section XI, Appendix L, "Operating Plant Fatigue Assessment," for the following auxiliary lines: safety injection, residual heat

removal, spray, charging, accumulator, and surge. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M1. The staff finds that although GALL-SLR Report AMP XI.M1 does not mention the inspection of this piping with respect to fatigue, this enhancement is an improvement in monitoring structural integrity of the subject piping. Therefore, the staff finds that this enhancement is acceptable because it will ensure structural integrity of the subject piping by inspecting welds in the sentinel locations in accordance with ASME Code, Section XI, Appendix L.

Operating Experience. SLRA Section B2.1.1 summarizes the operating experience related to the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program. The staff evaluated operating experience information by reviewing the SLRA and conducting an audit (ADAMS Accession No. ML19046A433). During the audit, the staff independently searched plant-specific operating experience information to determine whether any previously unknown or recurring aging effects were identified.

SLRA AMP B2.1.1 states that in May 2005, during its spring refueling outage, Dominion detected an embedded circumferential indication in a Unit 2 reactor vessel inlet nozzle-to-shell weld region. The indication is classified as an embedded flaw because it meets the ASME Code, Section XI, IWA-3300 guidelines. The embedded indication is located near the outside surface. The SLRA stated that it can detect the flaw from outside the reactor vessel shell and the inlet nozzle bore region. The dimensions of the embedded flaw exceeded the allowable flaw size given in the ASME Code, Section XI, Table IWB-3512. Dominion evaluated the embedded flaw to demonstrate that the flaw is acceptable for continuing plant operation without repair using the ASME Code, Section XI, IWB-3600 flaw evaluation guidelines.

For the above operating experience, the staff needed additional information regarding the embedded flaw and issued RAI B2.1.1-1 (ADAMS Accession No. ML19155A050) dated May 30, 2019. In its response dated June 27, 2019 (ADAMS Accession No. ML19183A440), Dominion stated that the embedded flaw is in weld RC-R-1.1/2-15 (reactor vessel inlet nozzle-to-shell weld region). Dominion stated that it evaluated the flaw to justify returning Unit 2 to service until the next scheduled inspection, which was anticipated to be in 10 years. After the flaw evaluation, by letter dated April 25, 2012 (ADAMS Accession No. ML12130A217), Dominion submitted a relief request to support the alternate inspection interval of 20 years in lieu of the 10-year inspection interval for the subject weld. By letter dated April 30, 2013 (ADAMS Accession No. ML13106A140), the NRC approved Relief Request CMP-007 and CMP-009, permitting Dominion to postpone inspection of the reactor vessel inlet nozzle-to-shell weld until December 13, 2023, for Unit 1; and May 9, 2024, for Unit 2.

Dominion stated that it has not evaluated the flaw in weld RC-R-1.1/2-15 to 80 years of operation. Dominion indicated that weld RC-R-1.1/2-15 is currently scheduled to be examined during the next 10-year inservice inspection (ISI) activity in spring 2023 (ISI Interval 5, Period 3), which is likely the last inspection prior to the subsequent period of extended operation. Dominion explained that any flaw indication found in the weld during the 2023 inspection would require evaluation of the examination results consistent with the ASME Code, Section XI. Dominion stated that the evaluation of the embedded flaw is not part of a time-limited aging analysis (TLAA) because the flaw was dispositioned as acceptable per ASME Code Case N-526, “Alternative Requirements for Successive Inspections of Class 1 and 2 Vessels.”

According to Dominion, ASME Code Case N-526 had been implemented for Surry prior to 2005. Dominion confirmed that the three conditions listed below are met for the applicability of Code Case N-526 for the evaluation of the embedded flaw: (1) The flaw is characterized as

subsurface in accordance with Figure 1 of Code Case N-526; (2) the nondestructive examination technique and evaluation that detected the flaw with respect to both sizing and location shall be documented in the flaw evaluation report; and (3) the vessel containing the flaw is acceptable for continued service in accordance with ASME Code, Section XI, IWB-3600, and the flaw is demonstrated acceptable for the intended service. Dominion stated that the use of ASME Code Case N-526 provided an alternative to the ASME Code, Section XI, Subsection IWB-2420(b) requirement to re-examine the vessel examination volume containing the subsurface flaw. The staff finds that Dominion appropriately dispositioned the embedded flaw in Unit 2 weld RC-R-1.1/2-15 per ASME Code Case N-526 and the NRC-approved relief request. The staff further finds that Dominion will examine weld RC-R-1.1/2-15 as required by the NRC-approved relief request. In addition, the embedded flaw is acceptable by Dominion's flaw evaluation performed in accordance with the ASME Code, Section XI, IWB-3600. Therefore, this issue is closed.

The staff notes that Dominion also discussed other indications detected in welds based on inspections performed in accordance with the ASME Code, Section XI. Dominion removed the indications from these welds. The staff finds that the plant-specific operating experience at Surry has demonstrated that Dominion follows the ASME Code, Section XI in the inspection of the safety-related welds and dispositions detected flaws appropriately.

The staff notes that although not directly affecting AMP B2.1.1, Dominion has implemented a Risk-Informed ISI program that is based on the NRC-approved plant-specific relief request and NRC-approved ASME Code Case N-716-1, "Alternative Classification and Examination Requirements Section XI, Division 1." This Code Case allows selection of examination components most important to safety in regard to core damage frequency and large early release frequency while eliminating examinations on less safety significant components.

The staff finds that Dominion evaluated the occurrences identified under AMP B2.1.1 to ensure that there is no significant impact to the safe operation of the plant and corrective actions will be taken to prevent recurrence. The staff notes that Dominion's AMP B2.1.1 contains guidance or corrective actions for additional inspections, reevaluation, repairs, or replacements for locations where aging effects are found. The staff determines that AMP B2.1.1 is enhanced based on the systematic and ongoing review of both plant-specific and industry operating experience.

The staff finds that Surry AMP B2.1.1 program follows (1) the provisions of the ASME Code, Section XI, (2) various conditions that 10 CFR 50.55a has imposed on ASME Code, Section XI, such as Code Cases N-722-1, "Additional Examinations for PWR Pressure Retaining Welds in Class 1 Components Fabricated with Alloy 600/82/182 Materials," and N-729-4, "Alternative Examination Requirements for PWR Reactor Vessel Upper Heads With Nozzles Having Pressure-Retaining Partial-Penetration Welds;" and (3) additional examinations per the industry guidance (e.g., MRP-227-A, "Pressurized Water Reactor (PWR) Internals Inspection and Evaluation Guidelines," and MRP-146, "MRP 146 Thermal Stratification Inspections").

Based on the audit, the review of AMP B2.1.1 and Dominion's responses to RAI B2.1.1-1, 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 program was evaluated.

<u>UFSAR Supplement</u>. SLRA Section A1.1 provides the UFSAR supplement for the AMP B2.1.1, 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 with enhancement. The staff notes that the UFSAR supplement in SLRA Section A1.1 includes the augmented inspection for various safety-related components. The staff finds that the augmented inspection is an improvement to monitor structural integrity of the safety-related components and is, therefore, acceptable. The staff noted that the applicant committed to ongoing implementation of the existing ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD 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 AMP B2.1.1.

Conclusion. On the basis of its review of Dominion's ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program, the staff concludes that those program elements for which Dominion claimed consistency with the GALL-SLR Report are consistent. The staff reviewed the one 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 Dominion 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).

3.0.3.2.2 Water Chemistry

SLRA Section B2.1.2 states that the Water Chemistry program is an existing program that will be 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 audit (ADAMS Accession No. ML19128A079), the staff reviewed Dominion's claim of consistency with the GALL-SLR Report. The staff compared the "scope of program" and "preventive actions" program elements of the SLRA to the corresponding program elements of GALL-SLR Report AMP XI.M2. 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 an 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 B2.1.2 includes an exception to the "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements related to the use of Revision 8 of the "Pressurized Water Reactor Secondary Water Chemistry Guidelines," which is EPRI Report 3002010645. The staff reviewed this exception against the corresponding program elements in GALL-SLR Report AMP XI.M2 and finds it acceptable because the changes from the GALL-SLR Report recommendation to the updated version were based on operating experience and available data on secondary water chemistry and secondary cycle corrosion and provided either clarifications, specificity, or conservatism to the Secondary Water Chemistry Guidelines.

Based on its audit and review of the SLRA, the staff finds that the "scope of program" and "preventive actions" program elements for which Dominion claimed consistency with the GALL-SLR Report are consistent with the corresponding program elements of GALL-SLR Report AMP XI.M2. The staff also reviewed the exception associated with the "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance

criteria," and "corrective actions" program elements, and its justification, and finds that the AMP, with the exception, is adequate to manage the applicable aging effects.

<u>Operating Experience</u>. SLRA Section B2.1.2 summarizes the operating experience related to the Water Chemistry program. The staff evaluated operating experience information by reviewing the subsequent license renewal application and conducting an audit (ADAMS Accession No. ML19046A433). 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 Dominion should modify its proposed program. Based on its audit and review of the application, the staff finds that the conditions and operating experience at the plant are bounded by those for which the Water Chemistry program was evaluated.

<u>UFSAR Supplement</u>. SLRA Section A1.2 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 Dominion 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.

<u>Conclusion</u>. On the basis of its review of Dominion's Water Chemistry program, the staff concludes that those program elements for which Dominion claimed consistency with the GALL-SLR Report are consistent. In addition, the staff reviewed the exception and its justification and concludes that the AMP, with the exception, is adequate to manage the applicable aging effects. The staff concludes that Dominion 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 Reactor Head Closure Stud Bolting

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

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

<u>*Enhancement 1*</u>. SLRA Section B.2.1.3 includes an enhancement to the "preventive actions" and "corrective actions" program elements. Dominion will revised procurement documents in its program to ensure replacement studs are fabricated from bolting materials with maximum measured yield strength less than 150 ksi and maximum tensile strength of 170 ksi, as consistent with the GALL-SLR Report program guidance and RG 1.65, "Materials and Inspections for Reactor Vessel Closure Studs," Revision 1. The staff reviewed this

enhancement against the corresponding program element in GALL-SLR Report AMP XI.M3 and finds it acceptable, because when it is implemented, it will be consistent with the GALL-SLR Report AMP XI.M3 guidance.

Enhancement 2. SLRA Section B.2.1.3 includes an enhancement to the “detection of aging effects” program element. Dominion will revise procedures to require that a one-time visual inspection be performed on the bottom plates in Unit 2 vessel flange closure stud holes No. 36 and No. 37 to confirm that there is no evidence of corrosion, cracking, or degradation. These stud holes were originally fabricated exceeding the design length, however. Westinghouse evaluated the deviation and concluded that the holes, with an insert installed to correct the hole depth, were acceptable to use. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.M3 and finds it acceptable, because when it is implemented, it will be consistent with the GALL-SLR Report AMP XI.M3 guidance.

Exception. SLRA Section B.2.3.3 includes an exception to the “preventive actions” and “corrective actions” program elements related to the yield strength of replacement bolts. The GALL-SLR program relies on the guidance set forth in RG 1.65, Revision 1, which recommends that actual measured yield strength should not exceed 150 ksi for newly installed studs, or 170 ksi ultimate tensile strength for existing studs. Stud materials that have a yield strength less than 150 ksi are known to be resistant to stress corrosion cracking (SCC). Both units were licensed prior to the issuance of RG 1.65, Revision 0, in 1973, and do not have a specification for limiting measured maximum yield strength. Dominion’s program states that two of the three spare reactor head closure studs have measured yield strengths exceeding 150 ksi. Therefore, Dominion’s program takes exception to this program element.

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 yield strength exceeding the 150 ksi may be susceptible to stress corrosion cracking (SCC) degradation. The three spare reactor head closure studs have a maximum tensile strength of less than 170 ksi, indicating consistency with the limit identified in RG 1.65 for existing reactor head closure studs. Based on industry operating experience and previous inspections, there have been no indications of cracking in stud bolting when the materials have met either the 150 ksi yield stress or the 170 ksi ultimate tensile stress. In addition, Dominion provided enhancements to the program to ensure that the measured yield strength and the maximum tensile strength of newly procured bolting materials will meet the 150 ksi and 170 ksi criteria, respectively. Lastly, ultrasonic examinations that are capable of detecting degradation due to SCC will continue to be performed in accordance with the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program as applicable. Therefore, the staff finds this exception acceptable because there will be reasonable assurance that the intended functions of the stud bolting will be maintained.

The staff finds that program elements 1 through 7 for which Dominion 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 exception associated with the “preventive actions” and “corrective actions” program elements, and its justification, and finds that the AMP, with the exception, is adequate to manage the applicable aging effects. In addition, the staff reviewed the enhancements associated with the “preventive actions,” “corrective actions,” and “detection of aging effects” program elements and finds that, when implemented, they will make the AMP consistent with the GALL-SLR Report AMP.

Operating Experience. SLRA Section B.2.3.3 summarizes the operating experience related to the Reactor Head Closure Stud Bolting program. The staff evaluated operating experience information by reviewing the subsequent license renewal application and conducting an audit (ADAMS Accession No. ML19046A433), 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 SLRA stated that the Reactor Head Closure Stud Bolting program will be effective in ensuring that intended functions will be maintained consistent with the current licensing basis (CLB) through the subsequent period of extended operation.

The staff reviewed operating experience information in the application and during the operating experience audit. 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 Dominion's SLRA AMP will be adequate to manage the associated aging effects. Some of the operating experience reviewed by the staff were related to an arc strike identified on a reactor vessel closure stud nut, a reactor vessel closure stud that cannot be tested with UT, a reactor vessel closure stud that experienced minor wear, and the plug design for Unit 1 reactor vessel flange holes. The staff did not identify any operating experience indicating that Dominion should modify its proposed program.

Based on its audit and review of the application, 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 A1.3 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 finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. On the basis of its review of Dominion's Reactor Head Closure Stud Bolting program, the staff concludes that those program elements for which Dominion claimed consistency with the GALL-SLR Report are consistent. In addition, the staff reviewed the exception and enhancements, and their justifications, and concludes that the AMP, with the exception and the enhancements, is adequate to manage the applicable aging effects. 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 Dominion 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 PWR Vessel Internals

SLRA Section B2.1.7 states that the PWR Vessel Internals program is an existing program that, with enhancements, will be consistent with the program elements in the GALL-SLR Report, AMP XI.M16A, "PWR Vessel Internals." The applicant includes its related aging management review (AMR) further evaluation assessment and the gap analysis related to this AMP in SLRA

Section 3.1.2.2.9 and in SLRA Appendix C, respectively. Dominion amended the gap analysis in a letter dated April 2, 2019 (ADAMS Accession No. ML19095A666). By letter dated July 17, 2019 (ADAMS Accession No. ML19204A357), October 14, 2019, (ADAMS Accession No. ML19294A044), and February 20, 2020 (ADAMS Accession No. ML20054B996), the applicant provided additional information regarding its technical basis for projecting reactor vessel internal (RVI) component-specific neutron fluence values to the end of the subsequent period of extended operation. In the October 14, 2019 and February 20, 2020, letters, the applicant also amended the scope of several of the enhancements in the PWR Vessel Internals Program to bring them up to date with the latest EPRI MRP recommendations for inspecting the components that are addressed in the enhancements; this includes the applicant's incorporation of criteria for performing a one-time inspection of the middle axial welds (MAWs) and lower axial welds (LAWs) that are located in the core barrel of the reactor.

Staff Evaluation. During its in-office audit (ADAMS Accession No. ML19128A079), the staff reviewed Dominion's claim of consistency with the GALL-SLR Report. The staff compared the "scope of program," "preventive actions," "acceptance criteria," and "corrective actions" program elements of the SLRA to the corresponding program elements of GALL-SLR Report AMP XI.M16A, as adjusted by the gap analysis results that were included in SLRA Appendix C to satisfy the aging management review (AMR) acceptance criteria provided in Section 3.1.2.2.9 of NUREG-2192 (i.e., SRP-SLR Report).

The staff also reviewed the gap analysis for the RVI components and the portions of the "parameters monitored or inspected," "detection of aging effects," and "monitoring and trending" program elements associated with the 17 programmatic enhancements to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff's evaluations of these aspects of the program are given in the subsections that follow.

Gap Analysis Evaluation. The staff confirmed that the applicant addressed the need for inclusion of an RVI component-specific gap analysis in SLRA Section 3.1.2.2.9 and provided the gap analysis in SLRA Appendix C. The staff noted that the applicant's gap analysis identifies that the PWR Vessel Internals program is based on the updated EPRI MRP program in EPRI Report No. 3002005349, "Materials Reliability Program: Pressurized Water Reactor Internals Inspection and Evaluation Guidelines (MRP-227, Revision 1)," which was approved for use by licensees participating in the EPRI MRP in the staff's safety evaluation of April 25, 2019 (ADAMS Accession No. ML19081A001). However, the staff noted that in the letter dated February 20, 2020, the applicant provide provides sufficient demonstration that the program has been updated to follow the updated criteria in EPRI Report No. 3002017168 (MRP-227, Revision 1-A), as adjusted by the results of the applicant's gap analysis. (The NRC approved the use of MRP-227, Revision 1-A by letter dated February 19, 2020 (ADAMS Accession No. ML20006D152). The staff finds this "scope of program" basis to be acceptable because the "scope of program" program element in GALL-SLR Report AMP XI.M16A permits the applicant's PWR Vessel Internals program to be based on the augmented inspection and evaluation methodology in either EPRI Report No. 1022863, "Materials Reliability Program: Pressurized Water Reactor Internals Inspection and Evaluation Guidelines (MRP-227-A)," or an NRC-approved supplement of the report, as potentially modified by the results of a gap analysis.

By letter dated July 17, 2019, the applicant supplemented the SLRA by including its basis for projecting the neutron fluence values for component-specific RVI locations to the end of the subsequent period of extended operation (i.e., to 68 effective full power years (68 EFPY)) using the methodology in WCAP-18205-NP, Revision 0. By letter dated September 3, 2019 (ADAMS Accession No. ML19253B330), the applicant supplemented the SLRA by including

Westinghouse Report No. WCAP-18205-NP, Revision 0, on the dockets for Units 1 and 2. The staff verified that the neutron fluence methodology in WCAP-18205-NP, Revision 0, provided an acceptable basis for projecting the neutron fluence values for the RVI components to 68 EFPY. The staff also verified that the neutron fluence values reported in WCAP-18205-NP, Revision 0, for RVI component-specific locations at 68 EFPY demonstrate that the neutron fluence values for the components are within the fluence ranges reported for the RVI component-specific locations in the gap analysis.

During the period from February 4–February 8, 2019, the staff performed an audit (ADAMS Accession No. ML19128A079), of the AMP and the gap analysis for the AMP. The staff noted that the gap analysis results in the following changes to the program from the previous, 60-year programmatic basis for the AMP:

(a) added the baffle corner bolts to the scope of designated “Primary” category components for the 80-year programmatic basis

(b) elevated the clevis insert bolts from “Existing Program” components to “Primary” category components and added the RVI clevis bearing stellite wear surfaces and the clevis insert dowel pins to the scope of designated “Primary” category components for the 80-year programmatic basis

(c) added the control rod guide tube (CRGT) thermal sleeves to the scope of designated “Primary” category components for the 80-year programmatic basis

(d) added the radial supports keys (as made from Type 304 stainless steel materials with a stellite surface coat) to the scope of designated “Primary” category components for the 80-year programmatic basis

(e) added the fuel alignment pins in the upper and lower internals assemblies to the scope of designated “Existing Program” category components for the 80-year programmatic basis

The staff noted that that the applicant’s gap analysis provided sufficient information regarding RVI component-specific susceptibility to aging effects; failure modes, effects, and criticality analysis (FMECA) groupings; and risk consequence rankings to justify the final component-specific inspection categorizations (i.e., “Primary,” “Expansion,” “Existing Program,” or “No Additional Measures” categories, as defined in MRP-227, Revision 1-A), except for some informational matters regarding the gap analysis results for components listed in the bullets below, where the component-specific matters needing clarification have been summarized in the staff’s in-office audit report summary for the AMP (ADAMS Accession No. ML19128A079):

- CRGT C-tubes and sheaths
- CRGT flexures in Unit 1
- core barrel flanges
- core barrel lower flange welds (LFWs) and upper girth welds (UGWs)
- core barrel outlet nozzles
- lower support column bodies in the lower internals assembly
- radial support keys in the lower internals assembly

By letters dated April 2, 2019, and June 10, 2019, the applicant amended the gap analysis results provided in Appendix C of the SLRA in order to resolve the gap analysis issues for the components listed in the bullets above. A summary of the applicant’s amendments to the SLRA and the staff’s evaluation of those SLRA amendments are given in the bullets that follow:

- CRGT support pin nuts in Unit 1. The applicant amended Footnote 1 in SLRA Table C3.3-4, “Comparison: Risk Category Designations from MRP-191, Revision 1, and the Results for the SLR Expert Panel Review,” and Footnote 1 for SLRA Table C2.2-1, “Parameter Screening, Results,” to indicate that the Unit 1 CRGT support pin nuts (made from nickel alloy materials) are susceptible to age-related degradation. The applicant also amended Footnote 1 in SLRA Table C3.3-3, “SRP Expert Panel Review Results Table,” to indicate that the Unit 1 CRGT support pin nuts are susceptible to the aging mechanisms of stress corrosion cracking (SCC) and irradiation-enhanced stress relaxation/irradiation-enhanced creep (ISR/IC).

  The staff found these changes to be acceptable because: (a) the Unit 1 CRGT support pins and nuts are made from X750 nickel alloy materials that may be susceptible to SCC and ISR/IC, and (b) the VT-3 visual inspection basis for the CRGT support pins and nuts is consistent with the updated “Existing Program” protocols approved for these components, as given in Section 4.4 of the MRP-227, Revision 1-A report.

- Core barrel flanges. The applicant amended the “Component” column entry for the component-specific item that applies to the core barrel flanges in SLRA Table C3.3-3, “SRP Expert Panel Review Results Table,” to indicate that the item applies to the surfaces of the flanges and to clarify that the associated upper flange welds (UFWs) are addressed by the item for the core barrel girth welds. The applicant also amended the “SLR Inspection Category” ranking for the core barrel flange surfaces item from “P” (i.e., inclusion in the “Primary” inspection category) to “X” (i.e., inclusion in the “Existing Programs” inspection category) and amended the item for the core barrel flanges in SLRA Tables C3.3-4, “Comparison: Risk Category Designations from MRP-191, Revision 1, and the Results from the SLR Expert Panel Review,” and C4.3-3, “Existing Program Component,” by including the word “surface” in the items.

  The staff found the item changes for the core barrel flanges in SLRA Tables C3.3-3, C3.3-4, and C4.3-3 to be acceptable because the changes are consistent with the inspection category for the flanges as given in Table 4.9 of the MRP-227, Revision 1-A report, which designates the core barrel flanges as “Existing Program” category components that will be inspected in accordance with the ASME Section XI inservice inspection requirements for the components.

- Core barrel outlet nozzles. The applicant amended the component-specific item for the core barrel flanges in SLRA Table C3.3-3, “SRP Expert Panel Review Results Table,” to read “No Additional Measures.” This change makes the “SLRA Inspection Category” ranking consistent with that for the core barrel outlet nozzles in the MRP-227, Revision 1-A report.

  The staff verified that, in Table 4.6 of the MRP-227, Revision 1-A report, EPRI amended the component inspection category for Westinghouse-design core barrel outlets nozzles from “Expansion” to “No Additional Measures.” The staff finds that the inclusion of the core barrel outlet nozzles in the “No Additional Measures” category to be acceptable because: (a) the basis is consistent with the latest categorization of the nozzles in MRP-227, Revision 1-A, and (b) the gap analysis assessment for the nozzles does not provide any basis for changing the “SLR Inspection Category” for the nozzles from the most recent component inspection approved for the nozzles in MRP-227, Revision 1-A (i.e., placement in the “No Additional Measures” category).

- Changes to gap analysis results for core barrel assembly weld components. The applicant amended the item in SLRA Table C3.3-3 for the core barrel assembly lower girth welds (LGWs) to remove the term "LFW" (i.e., reference to lower flange welds) from the parenthetical phrase in the item. The applicant also amended the item in SLRA Table C3.3-3 for the core barrel assembly upper girth welds (UGWs) to remove the words "and UGW" from the parenthetical phrase in the line. The applicant also amended SLRA Table C3.3-3 by including Footnote 5, which states, "MRP-227, Revision 1, added expansion links from the upper flange weld (UFW) to the lower flange weld (LFW) and to the upper girth weld (UGW)."

  The staff noted that the changes to the items for the core barrel welds did not change the specified SLR inspection categories for the core barrel assembly UGWs, and LGWs from those as identified for the components in MRP-277, Revision 1-A, or in the gap analysis for the PWR Vessel Internals program. For the assessment of the core barrel assembly UGWs, the gap analysis identifies that the welds have a moderate likelihood of failure, a moderate safety consequence of failure, and a safety consequence risk category ranking of "B." This results in placement of the UGWs in the "Expansion" inspection category of components (with the core barrel assembly upper flange welds (UFWs) being the linked "Primary" components). The gap analysis also identifies that the core barrel assembly LGWs have a moderate likelihood of failure, a moderate safety consequence of failure, and a safety consequence risk category ranking of "B." These welds were placed in the "Primary" inspection category based on economic rather than safety considerations.

  The staff noted that the gap analysis assessment and categorizations for the welds in SLRA Table C3.3-3 provide sufficient justification for the SLR inspection categories for the core barrel assembly UGWs and LGWs to remain as designated and approved for the welds in MRP-227, Revision 1-A. The staff finds the items in SLRA Table C3.3-3 for the core barrel assembly UGWs and LGWs to be acceptable because: (a) the changes to the items are only administrative, and (b) the gap analysis basis for the core barrel assembly UGWs and LGWs in SLRA Table C3.3-3 supports a conclusion that the component inspection category designations for core barrel assembly UGWs and LGWs may remain the same as those designated for the welds in the MRP-227, Revision 1-A report.

- Radial support keys. The applicant amended the item for the 304 stainless steel portions of the support keys to indicate that these stainless steel portions are "No Additional Measure" components. The applicant clarified that the stellite surfaces of the support keys are the surfaces that will be inspected as part of "Primary" component inspections for the program, and that this is already incorporated in the existing gap analysis item for the radial support key stellite surfaces.

  The staff found these changes to be acceptable because: (a) SLRA Table C4.3-1 indicates that the stellite surfaces in the radial support keys will be visually inspected as "Primary" category components once every 10 years using VT-3 visual techniques, and (b) the outer stellite surfaces of the radial support keys are accessible to the visual inspection equipment.

- Lower support forgings and lower support column bodies. The applicant amended the items for the lower support forgings and lower support column bodies in SLRA Table C4.3-2 to indicate that the visual inspection technique will be a VT-3 method if

"Expansion" category inspections of the components are necessary. The staff found these changes to be acceptable because they are consistent with the bases for performing "Expansion" category inspections of these components in Table 4-6 of the MRP-227, Revision 1-A report.

- CRGT C-tube and sheaths. The applicant amended the items for the CRGT C-tubes and sheaths in SLRA Tables C4.3-1 and C4.3-2 to designate that the components are "Expansion" category components for the PWR Vessel Internals program. The staff finds these changes to be acceptable because: (a) the updated SLR inspection category for the C-tubes and sheaths (i.e., as designated in the "Expansion" category) is consistent with the current proprietary industry report for inspecting CRGT assembly components, (b) the need for inspecting CRGT C-tubes and sheaths will be tied to the results of primary inspections that are performed on the CRGT guide plates (CRGT guide cards), as specified in SLRA Table C4.3-2, and (c) the proprietary industry report defines the proprietary criteria that will be used to establish contingency needs (i.e., Expansion bases) for inspecting the CRGT C-tubes and sheaths.
- CRGT flexures (Unit 1 only). The applicant amended the item for the Unit 1 CRGT flexures in SLRA Table C3.3-3 to indicate that various classification rankings for the flexures are subject to a new note 6 for the table. In note 6, the applicant explained that it replaced the original CRGT flexures in Unit 1 with flexures that were fabricated from an X-750 nickel-based alloy material, and that the analysis by AREVA for the flexures in Section 4.1 of AREVA Report No. ANP-3574, Revision 0, placed the flexures into a Safety Consequence Risk Category ranking of "A." The SLRA stated the Safety Consequence Risk Category ranking of "A" for the flexures supports placement of the flexures into a "No Additional Measures" based inspection category. The staff finds this basis to be acceptable due to the replacement of the flexures in the unit and the low safety consequence ranking for the flexures, and because the basis is consistent with the component inspection category basis for CRGT flexures in MRP-227, Revision 1-A, which places them in the "No Addition Measures" category of components.

Enhancement 1. SLRA Section B2.1.7 includes an enhancement to the "parameters monitored or inspected" program element. In this enhancement, the applicant states that "procedures will be revised for each reload to summarize the average power density, the heat generation figure-of-merit, and the dimensional parameter for the distance between the active fuel and the upper core plate." The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.M16A and EPRI's generic basis for resolving Applicant/Licensee Action Item (A/LAI) No. 1 on the methodology for EPRI Report No. 1022863, "Materials Reliability Program: Pressurized Water Reactor Internals Inspection and Evaluation Guidelines (MRP-227-A)," where EPRI's generic basis for resolving the action item is established in EPRI Letter No. MRP 2013-025, dated October 14, 2013 (ADAMS Accession No. ML13322A454).

In A/LAI No. 1 on the MRP-227-A report, the staff requested applicant-demonstration that the design and evaluation of RVI components in the MRP-227-A report was bounding for the design and evaluation of RVI components at the site-specific PWR facilities. EPRI's generic basis for resolving A/LAI No. 1 in Letter No. MRP 2013-025 called for owners of Westinghouse-designed PWRs to verify that past operations of the plants would meet specific limits set by EPRI on the following operational or design parameters: (1) heat generation figure of merit parameter, (2) average core power density, and (3) top of active fuel-to-upper core plate distance. The applicant's basis for using the guidance in EPRI Letter No. 2013-025 is given in Appendix B of the MRP-227, Revision 1-A report.

The staff noted that the activities the applicant will perform to monitor plant operations against the three programmatic parameters in Letter No. MRP 2013-025 go beyond those activities that are defined for implementation in the “parameters monitored or inspected” program element of GALL-SLR Report AMP XI.M16A, “PWR Vessel Internals.” However, Dominion provided its bases for resolving all past A/LAIs issued on the MRP-227-A methodology as part of the in-office audit information that Dominion provided to the staff in support of the staff’s audit of the PWR Vessel Internals Program. Section SLRA AMP B.2.1.7, “PWR Vessel Internals,” of the in-office audit report for the SLRA (ADAMS Accession ML19128A079) summarizes the staff’s audit assessment of relevant information in the source document entitled “ALAI 1 thru 8 Evaluations.” The staff confirmed that the site-specific record demonstrates that past fuel changes and power operations of the Surry units were within the confines of the programmatic parameter limits defined in EPRI Letter No. MRP 2013-025. This further demonstrates that the assessment of Westinghouse-designed RVI components in the MRP-227, Revision 1-A report would be bounding for the design of RVI components in the Surry Station during past operations of the units. However, the staff closed A/LAI No. 1 on the MRP-227-A report based its review of activities defined in the MRP-227, Revision 1-A report and the staff’s endorsement of the generic methods for resolving A/LAI No. 1 in EPRI Letter No. 2013-025. Thus, per the enhancement, the staff considers the applicant’s basis to continue these programmatic parameter confirmations during future operations of the units to be an acceptable, conservative practice by the applicant, where the confirmations will be used to demonstrate that the I&E methodology and guidelines in the MRP-227, Revision 1-A report will remain bounding for power operations of the units and the design of the RVI components at Surry Station.

Based on its review, the staff finds Enhancement 1 acceptable because: (a) the enhancement will ensure that the program will continue to be implemented in accordance with the staff-approved guidelines in MRP-227, Revision 1-A and EPRI Technical Letter No. 2013-025, and (b) the applicant will continue to perform the programmatic parameter confirmations recommended in MRP 2013-025 to demonstrate that the methodology and guidance in in MRP-227, Revision 1-A will remain bounding for design of the RVI components and operations of the reactor units at Surry Station.

Enhancement 2. SLRA Section B2.1.7 includes an enhancement to the “detection of aging effects” program element. In this enhancement, the applicant states that “procedures will be revised to require performance of a 100% visual inspection (EVT-1) of the outer control rod guide tube (CRGT) assembly lower flange weld (LFW) surfaces and 0.25-inch of the base metal material adjacent to the weld.” The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.M16A and the criteria for inspecting CRGT LFWs in the MRP-227, Revision 1-A report.[3] In relation to this element, the applicable GALL-SLR Report AMP criterion identifies that EVT-1 visual inspection methods are an acceptable means of detecting cracks in RVI weld components.

The staff noted that the enhancement will make the basis for inspecting the CRGT LFWs consistent with the protocols for performing EVT-1 type visual inspections of these weld components in Table 4-6 in the MRP-227, Revision 1-A report. The staff also verified that the applicant’s gap analysis did not identify any need to inspect these components in a manner different from that described in MRP-227, Revision 1-A. Based on its review, the staff finds the enhancement acceptable because, when the enhancement is implemented, it will: (a) make the

[3] For bolted assemblies assigned to as Primary” or “Expansion” category bolted assemblies, the MRP-227, Revision 1-A report sets a minimum 75 percent sample size for the bolt inspections, unless an alternate sample size is referenced for a specific RVI bolted assembly in the MRP report.

AMP's basis for inspecting the CRGT LFWs consistent with the protocols for inspecting these welds in Table 4-6 of the MRP-227, Revision 1-A report, and (b) make this aspect of "detection of aging effects" program element consistent with the criteria for performing EVT-1 visual examinations of non-redundant, non-bolted reactor internal locations, as specified in the "detection of aging effects" program element of GALL-SLR Report AMP XI.M16A.

Enhancement 3. SLRA Section B2.1.7 includes an enhancement to the "detection of aging effects" program element. In this enhancement, the applicant states that "procedures will be revised to require the visual inspection (VT-3) of the accessible surfaces for the CRGT support pins and the support pin nuts in Unit 1 only (i.e., a Unit 1-specific component)." The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.M16A and the criteria for inspecting CRGT support pins in the MRP-227, Revision 1-A report. In relation to this element, the applicable GALL-SLR Report AMP criterion identifies that VT-3 visual inspection methods are an acceptable means of detecting cracks in RVI mechanical assemblies that are secured by a redundant number of fasteners (e.g., bolts, pins, keys, or screws).

The staff noted that the enhancement will make the basis for inspecting the CRGT support pins consistent with the protocols for performing VT-3 type visual inspections of the support pins, as referenced in Section 4.4 of the MRP-227, Revision 1-A report. The staff also verified that the applicant's gap analysis did not identify any need to amend the basis for inspecting the CRGT support pins differently from the basis for inspecting these components in the MRP-227, Revision 1-A report. Based on its review, the staff finds the enhancement acceptable because, when the enhancement is implemented, it will: (a) make the AMP's basis for inspecting the CRGT support pins (and for Unit 1, the support pin nuts) consistent with the protocols for performing inspections of these components in the MRP-227, Revision 1-A report, and (b) make this aspect of the "detection of aging effects" program element consistent with the criteria for performing VT-3 type visual examinations of redundant, fastened RVI locations, as specified in the "detection of aging effects" program element of GALL-SLR Report AMP XI.M16A.

Enhancement 4. SLRA Section B2.1.7 includes an enhancement to the "detection of aging effects" program element. In this enhancement, the applicant states that "procedures will be revised to require the addition of a note indicating that a bolting inspection can be credited only if at least 75% of the total bolt population is examined." The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.M16A and the updated basis for establishing a minimum sample size of RVI bolt inspections in the MRP-227, Revision 1-A report. In relation to this element, the applicable GALL-SLR Report criterion states that the inspection coverages for "Primary" and "Expansion" category components are implemented consistent with Sections 3.3.1 and 3.3.2 of the NRC safety evaluation that is included with MRP-227-A, or as modified by a gap analysis.

The staff noted that the enhancement will make the basis for inspecting a minimum sample of bolts in "Primary" category or "Expansion" category bolted assemblies consistent with those specified for the bolt assemblies in either Table 4-3 or 4-6 of the MRP-227, Revision 1-A report. The staff also verified that the applicant's gap analysis did not identify any need to vary the minimum bolt sample size criterion from the minimum 75 percent or population criterion stated for the bolts in the MRP-227, Revision 1-A report (as approved by the staff for implementation in

ADAMS Accession No. ML19081A001).[4] Based on its review, the staff finds the enhancement acceptable because, when the enhancement is implemented, it will: (a) make the AMP's basis for establishing minimum sample size of bolt inspections consistent with those specified for the location-specific bolt assemblies in the MRP-227, Revision 1-A, report, and (b) make this aspect of the "detection of aging effects" program element consistent with the criteria for setting component inspection coverage through the use of a gap analysis, as specified in the "detection of aging effects" program element of GALL-SLR Report AMP XI.M16A.

Enhancement 5. SLRA Section B2.1.7 includes an enhancement to the "detection of aging effects" program element. In this enhancement, the applicant states that "procedures will be revised to require visual inspection (VT-3) for 100 percent of the baffle-edge bolts that are accessible from the core side." The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.M16A and the updated basis for inspecting Westinghouse-designed baffle edge bolts in the MRP-227, Revision 1-A report. In relation to this element, the applicable GALL-SLR Report AMP criterion identifies that VT-3 visual inspection methods are an acceptable means of detecting cracks in RVI mechanical assemblies that are secured by a redundant number of fasteners (e.g., bolts, pins, keys, or screws).

The staff noted that the enhancement will make the program element applicant's criteria for inspecting the baffle edge bolts consistent with those specified for Westinghouse-designed baffle edge bolts in Table 4-3 of the MRP-227, Revision 1-A report. The staff also verified that the applicant's gap analysis did not identify any need to vary the minimum bolt sample size criterion from the minimum 75 percent population criterion stated for the bolts in the MRP-227, Revision 1-A report. Based on its review, the staff finds the enhancement acceptable because, when the enhancement is implemented, it will: (a) make the AMP's program element criteria for inspecting the baffle edge bolts consistent with those specified for bolts in Table 4-3 of the MRP-227, Revision 1-A report, and (b) make this aspect of "detection of aging effects" program element consistent with the criteria for performing bolted component inspections and establishing bolted component inspection coverages using the results of a gap analysis, as specified in the "detection of aging effects" program element of GALL-SLR Report AMP XI.M16A.

Enhancement 6. SLRA Section B2.1.7 includes an enhancement to the "detection of aging effects" program element. In this enhancement, the applicant states that "procedures will be revised to require volumetric (UT) examinations of 100 percent of accessible baffle-former bolts (including corner bolts) at least every 10 years." The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.M16A and the updated basis for inspecting Westinghouse-designed baffle-former bolts in the MRP-227, Revision 1-A report, as supplemented in Westinghouse Nuclear Safety Advisory Letter No. 16-1, Revision 1 (NSAL-16-1, Revision 1).

In relation to this element, the applicable GALL-SLR Report criteria state that: (a) UT methods may be used as a method for detecting cracking in bolted mechanical assemblies, and (b) the inspection coverages for "Primary" and "Expansion" category components are implemented consistent with Section 3.3.1 and 3.3.2 of the NRC SE, Revision 1, on MRP-227-A, or as modified by the basis and results of a gap analysis.

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[4] The 100 percent accessible bolt criterion stated in Enhancement 5 for the sample size that applies to UT baffle edge bolt inspections is an exception to the 75 percent minimum population criterion stated for general bolt population inspections in MRP-227, Revision 1-A.

The staff noted that Enhancement 6 and the operating experience section of the AMP summarize the results of the past UT baseline inspections that were performed on the baffle-former bolts in Unit 1 in 2010, and in Unit 2 in 2011. The staff noted that the applicant performed these inspections to meet the supplemental criteria for baffle-former bolt inspections that are established in EPRI Letter No. MRP-2017-009 (ADAMS Accession No. ML17087A106) and NSAL-16-1, Revision 1, for Tier 2 PWRs with downflow configurations. The staff noted that the results demonstrate that the baffle-former assemblies have met the acceptance criteria contained in NSAL-16-1, Revision 1, for baffle-former bolts in Tier 2 PWRs with down flow configurations. Specifically, the inspections demonstrate that there has been little degradation in the baffle-former bolts (i.e., cracking has been detected in less than 3 percent of the bolts with no evidence of cracking in adjacent, clustered groups of bolts) and the results demonstrate that a 10-year re-inspection interval is an acceptable basis for performing UT re-inspections of the baffle-former bolts in the Surry reactor units.

The staff also noted that the enhancement will make the basis for inspecting the baffle-former bolts (including those in corner locations) consistent with those specified for Westinghouse-designed baffle-former bolts in Table 4-3 of the MRP-227, Revision 1-A report. The staff also verified that the applicant's gap analysis did not identify any need to vary the criteria for performing re-inspections of the baffle-former bolts from those recommended for the bolts in the MRP-227, Revision 1-A report because the inspection results support UT re-inspections of the baffle-former bolts consistent with the 10-year frequency specified for the bolts in MRP-227, Revision 1-A. Based on its review, the staff finds the enhancement acceptable because, when the enhancement is implemented, it will: (a) make the AMP's basis for inspecting the baffle-former bolts consistent with those specified for bolts in Table 4-3 of the MRP-227, Revision 1-A report, and (b) make this aspect of "detection of aging effects" program element consistent with the criteria in GALL-SLR Report AMP XI.M16A for performing bolted component inspections and establishing bolted component population coverages using the results of a gap analysis.

Enhancement 7. SLRA Section B2.1.7, as amended in letter dated February 20, 2020, includes an enhancement to the "detection of aging effects" program element. In this enhancement, the applicant states that "procedures will be revised to address expansion criteria when degradation occurs for clusters of baffle-former bolts." The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.M16A, the basis for inspecting baffle-former bolts and barrel-former bolts in MRP-227, Revision 1-A, and EPRI's updated basis for evaluating clusters of potentially degraded baffle-former bolts, as given in EPRI Letter No. MRP 2017-009.

The staff determined that the applicant would need to provide additional clarification regarding this enhancement because the enhancement does not clearly establish which EPRI MRP-issued reports or documents would be used to establish the acceptance criteria for scheduling contingency inspections (e.g., UT inspections or other types of nondestructive inspections) of the barrel-former bolts as designated "Expansion" category components for the baffle-former bolt inspections. RAI B2.1.7-2 and the applicant's response are documented in ADAMS Accession No. ML19204A357.

In its RAI response, Dominion explained that the expansion criteria discussed in Enhancement 7 establish the applicant's basis for performing a one-time contingent visual VT-3 inspection of the barrel-former bolts (if necessary) in accordance with the criteria established in EPRI Letter No. MRP 2018-002. The staff reviewed EPRI Letter No. MRP 2018-002 as part of its in-office audit activities for the AMP and determined that the augmented guidelines in the

letter provide an acceptable basis for implementing a one-time visual examination of the barrel-former bolts. This is in addition to the expansion criteria that are set in EPRI Report No. MRP-227, Revision 1-A for performing expanded UT inspections of the barrel-former bolts based on the results of the "Primary" component inspections that will be applied to the baffle-former bolts and the results of any "Expansion" component inspections that may be performed on the plant's lower support column bolts. The staff finds that the applicant's RAI response is acceptable because it clarifies that the applicant will be using the guidelines in EPRI Letter No. MRP 2018-002 to determine whether a one-time visual inspection will need to be performed on the barrel-former bolts during the subsequent period of extended operation. The matter raised in RAI B2.1.7-2 is resolved.

Based on its review, the staff finds the enhancement acceptable because: (a) when the enhancement is implemented, the scope of the AMP will be augmented to include the criteria in EPRI Letter No. 2018-002, (b) the applicant will use the criteria in Letter No. 2018-002 to determine whether a contingent, one-time visual inspection will need to be performed on the barrel-former bolts during the subsequent period of extended operation, (c) the applicant will continue to use the expansion criteria in EPRI Report No. MRP-227, Revision 1-A to determine whether the scope of UT inspections performed on baffle-former assembly bolting will need to be expanded to include UT inspections of the barrel-former bolts during the subsequent period of extended operation, and (c) the applicant's enhancement will make this aspect of the "detection of aging effects" program element consistent with the criteria for performing bolted component inspections using the results of a gap analysis, as specified in the "detection of aging effects" program element of GALL-SLR Report AMP XI.M16A.

<u>*Enhancements 8 and 15*</u>. SLRA Section B2.1.7 includes two enhancements (Enhancements 8 and 15) to the "detection of aging effects" program element that relate to the procedural criteria that will be used to perform "Primary" EVT-1 visual inspections of the core barrel assembly upper flange welds (UFWs) and lower girth welds (LGWs). These welds are identified as "Primary" category components for Westinghouse-designed PWRs in MRP-227, Revision 1-A. Collectively, in these enhancements, the SLRA stated that "procedures will be revised to require EVT-1 visual examinations of 100% of the accessible inside or outside weld surfaces (minimum 50% examination coverage) and ¾" of the adjacent weld metal." The staff reviewed enhancement against the corresponding program element in GALL-SLR Report AMP XI.M16A and the updated basis for inspecting Westinghouse-designed UFWs and LGWs in the MRP-227, Revision 1-A report. In relation to this program element, the applicable GALL-SLR Report criteria state that EVT-1 visual methods may be used as a method for detecting cracking in RVI structural weld components. The staff noted that the criteria (including coverage requirements) for inspecting these welds are given in the MRP-227, Revision 1-A report.

The staff noted that the EVT-1 visual inspection methods and minimum inspection coverages specified in Enhancements 8 and 15 for the core barrel assembly UFWs and LGWs were consistent with those specified for the UFWs and LGWS in EPRI's response to RAI No. 29, as given in EPRI Letter No. 2018-026. These criteria have been incorporated into the bases for the UFWs and LGWs in the MRP-227, Revision 1-A. The staff noted that the enhancement will make the basis for inspecting the core barrel assembly UFWs and LGWs consistent with the protocols for inspecting these welds in the MRP-227, Revision 1-A report.

Based on its review, the staff finds the enhancement acceptable because, when the enhancement is implemented, it will: (a) make the AMP's basis for inspecting the core barrel assembly UFWs and LGWs consistent with those specified for welds in the MRP-227, Revision 1-A report, and (b) make this aspect of the "detection of aging effects" program

element consistent with the criteria for performing EVT-1 visual inspections of the UFWs and LGWs using the results of a gap analysis, as specified in the “detection of aging effects” program element of GALL-SLR Report AMP XI.M16A.

Enhancement 9. SLRA Section B2.1.7 includes an enhancement to the “detection of aging effects” program element. In this enhancement, the SLRA stated that “procedures will be revised to require EVT-1 visual examinations for 100% [of the outside surfaces] of the core barrel assembly lower flange welds (LFWs, with a minimum 50% weld length examination coverage criterion) and ¾” of the adjacent weld metal.” The staff reviewed the enhancement against the corresponding program element in GALL-SLR Report AMP XI.M16A and the updated basis for inspecting Westinghouse-designed core barrel assembly LFWs in the MRP-227, Revision 1-A report. In relation to this element, the applicable GALL-SLR Report criteria state that EVT-1 visual methods may be used as a method for detecting cracking in RVI structural weld components. Criteria (including coverage requirements) for inspecting these welds are given in MRP-227, Revision 1-A.

The staff noted that the guidelines in the MRP-227, Revision 1-A report account for the possibility that the core barrel LFWs could have restricted accessibility due to the presence of thermal shields or thermal panels that are included in the plant design and currently establish that the EVT-1 inspections of the LFWs will achieve a minimum 75 percent of the weld length for the outside weld surface being examined (and ¾ inch of the adjacent base metal), with the exception that 50 percent of the weld length may set as the minimum coverage requirement if the welds that have limited access. The staff noted that the applicant’s enhancement did not firmly establish that the core barrel assembly LFWs have limited access such that a 50 percent coverage could be established and justified as the minimum EVT-1 inspection coverage basis for the welds. RAI B2.1.7-3, Part 2, regarding this issue, and the applicant’s response are documented in ADAMS Accession No. ML19204A357.

In its RAI response, Dominion stated that the previous EVT-1 inspections of the core barrel assembly LFWs achieved a minimum of 81.5 percent to 82 percent coverage of the weld lengths for inspections performed on the welds in Units 1 and 2. The applicant explained that the narrow gap between the exterior surface of core barrel and the inside reactor cavity wall surface may restrict access to the LFW weld surfaces. The staff noted that the applicant’s response indicates that it is performing EVT-1 inspections of the core barrel assembly LFWs over the maximum accessible surfaces of welds and that past inspections of the welds demonstrate that the applicant is meeting the minimum 75 percent weld length coverages specified for the LFW inspections in the MRP-227, Revision 1-A report. The staff finds the applicant’s response and enhancement basis acceptable because: (a) the past EVT-1 inspections of the LFWs demonstrate that the applicant is meeting the minimum coverage set for core barrel assembly LFW inspections in MRP-227, Revision 1-A, and (b) this demonstrates that, for future EVT-1 inspections of the welds, the applicant will only move to a reduced inspection coverage (i.e., 50 percent of weld lengths) if the gap dimensions between outside core barrel surfaces and inside reactor cavity wall surface are sufficient to prevent EVT-1 equipment from achieving a minimum visual inspection coverage of 75 percent of the LFW lengths. Based on this rationale, the staff finds Enhancement 9 acceptable for implementation.

Enhancement 10. SLRA Section B2.1.7 includes an enhancement to the “detection of aging effects” program element. In this enhancement, the applicant states that “procedures will be revised to perform inspections of CRGT thermal sleeves” as indicated in MRP 2018-027. The staff reviewed the enhancement against the corresponding program element in GALL-SLR Report AMP XI.M16A and the updated basis for inspecting Westinghouse-designed CRGT

thermal sleeves in Westinghouse Safety Advisory Letter No. 18-1 (NSAL-18-1), which is referenced for use in EPRI MRP Letter No. MRP-2018-027.

The staff noted that NSAL-18-1 includes appropriate visual inspection criteria to monitor for loss of material (i.e., wear) or changes in configuration that may occur in the thermal sleeves. The staff also noted that the applicant's enhancement defines the portions of the thermal sleeves that will be inspected using the NSAL-18-1 guidelines. Based on its review, the staff finds the enhancement acceptable because, when the enhancement is implemented, it will: (a) make the AMP's basis for inspecting the CRGT thermal sleeves consistent with the latest industry guidelines used to address CRGT thermal sleeve degradation, and (b) make this aspect of the "detection of aging effects" program element consistent with the criteria for inspecting CRGT thermal sleeves using the results of a gap analysis, as specified in the "detection of aging effects" program element of GALL-SLR Report AMP XI.M16A.

Enhancement 11. SLRA Section B2.1.7 includes an enhancement to the "detection of aging effects" program element. In this enhancement, the applicant states that procedures will be revised to require VT-3 visual inspections of the following "Primary" category or "Existing Program" components: (a) baffle plates, (b) fuel alignment pins in the upper internal assemblies and the lower internals assemblies, and (c) clevis inserts and clevis insert dowels. The staff reviewed the enhancement against the corresponding program element in GALL-SLR Report AMP XI.M16A and the updated basis for inspecting these components in the MRP-227, Revision 1-A report. In relation to this element, the applicable GALL-SLR Report criteria state that VT-3 visual methods may be used as a method for detecting loss of material, distortion, or changes in dimensions that may be occurring in the components.

The staff noted that the applicant's basis for performing VT-3 visual examinations of these components is consistent with the criteria in GALL-SLR Report AMP XI.M16A, which state that VT-3 visual methods are an acceptable means of detecting the general conditions of a component (including loss of material, distortion, or changes of configuration in the components), and for detecting cracking in redundant fastened connection components (e.g., bolts, pins, screws, or keys). The staff also noted that the applicant's basis is consistent with the criteria for performing VT-3 visual inspections of these components in the MRP-227, Revision 1-A report.

The staff also verified that the applicant's gap analysis did not identify any need to vary the criteria for performing inspections of the baffle plates, fuel alignment pins, and the stated clevis insert components from those recommended for the components in the MRP-227, Revision 1-A report. Based on its review, the staff finds the enhancement acceptable because, when the enhancement is implemented, it will: (a) make the AMP's basis for inspecting the baffle plates, fuel alignment pins, clevis inserts (including clevis insert bolts and dowels) consistent with the criteria for inspecting these components in either Table 4-3 or 4-9 of the MRP-227, Revision 1-A report, and (b) make this aspect of the "detection of aging effects" program element consistent with the criteria for performing inspection of these components using the results of a gap analysis, as specified in the "detection of aging effects" program element of GALL-SLR Report AMP XI.M16A.

Enhancement 12. SLRA Section B2.1.7 includes an enhancement to the "detection of aging effects" program element. In this enhancement, the applicant states that procedures will be revised to require inspections of the following "Expansion" category components if necessitated by relevant indications being found in associated "Primary" category components: (a) EVT-1 visual inspections of the remaining CRGT LFWs not previously inspected as "Primary"

components, (b) control rod guide tube (CRGT) sheaths and C-tubes in accordance with the criteria in Proprietary Report No. WCAP-17451-P, Revision 2, (c) VT-3 visual inspections of 100 percent of those bottom-mounted instrumentation (BMI) column bodies for which difficulty is detected during flux thimble tube insertion or withdrawal activities, (d) VT-3 visual inspections of 25 percent of the lower support column bodies as visible from above the core plate, (e) UT inspections of 100 percent of the barrel-former bolts that are accessible to inspection (minimum 75 percent of the total population of barrel-former bolts), and (f) UT inspections of 100 percent of the lower support column bolts that are accessible to inspection (minimum 75 percent of the total population of lower support column bolts). The staff reviewed the enhancement against the corresponding program element in GALL-SLR Report AMP XI.M16A and the updated basis for inspecting these components in the MRP-227, Revision 1-A report. In relation to this program element, the GALL-SLR Report AMP establishes guidance on when (ultrasonic testing (UT), EVT-1, and VT-3 inspection techniques may be used for the detection of cracking or other aging effects, such as loss of material, loss of preload in fastened components, or distortion or changes in dimension.

The staff noted that the inspection methods, scope of inspections, and inspection sample sizes for the specific “Expansion” category components referenced in Enhancement 12 are consistent with those specified for the components in Table 4-6 of the MRP-227, Revision 1-A report. The staff also verified that the applicant’s gap analysis did not identify any need to vary the criteria for performing inspections of these “Expansion” category components from those recommended for these “Expansion” components in the MRP-227, Revision 1-A report. Based on its review, the staff finds the enhancement acceptable because, when the enhancement is implemented, it will: (a) make the AMP’s basis for inspecting these “Expansion” category components consistent with the criteria for inspecting these components in Table 4-6 of the MRP-227, Revision 1-A report, and (b) make this aspect of the “detection of aging effects” program element consistent with the criteria for performing inspection of these components using the results of a gap analysis, as specified in the “detection of aging effects” program element of GALL-SLR Report AMP XI.M16A.

Enhancement 13. SLRA Section B2.1.7 includes an enhancement to the “detection of aging effects” program element. In this enhancement, the applicant states that procedures will be revised to require that the “Primary” inspections of the radial support keys and clevis inserts will include the stellite material surfaces of the components. The staff reviewed the enhancement against the corresponding program element in GALL-SLR Report AMP XI.M16A and the updated basis for inspecting these components in the MRP-227, Revision 1-A report, as subject to the results of the gap analysis in SLRA Appendix C.

The staff noted that the results of the applicant’s gap analysis, as amended in the applicant’s letter of April 2, 2019, upgraded the SLR Inspection Categories for the radial support keys from “No Additional Measures” to “Primary.” The program relies on VT-3 visual examinations of the radial support key stellite surfaces to monitor for cracking and wear effects that may occur in the components. Similarly, the staff noted that the results of the applicant’s gap analysis, as amended in the applicant’s letter of April 2, 2019, upgraded the SLR Inspection Categories for the clevis insert bolts and clevis insert dowel pins from “Existing Programs” to “Primary.” The program relies on VT-3 visual examinations of the clevis insert outer stellite surfaces and the clevis insert bolts and dowel pins to monitor for cracking and wear effects in the components. The staff found these bases to be acceptable because: (a) the bases for inspecting these clevis insert components and the radial support keys are consistent with or more conservative than those established for inspecting these components in the MRP-227, Revision 1-A report, and (b) the applicant’s basis is consistent with the criteria in the “detection of aging effects” program

element in GALL-SLR Report AMP XI.M16A, which indicates that VT-3 visual inspection methods may be used for detection of wear and for the detection of cracking in a set of redundant components.

Based on its review, the staff finds the enhancement acceptable because, when the enhancement is implemented, it will: (a) make the AMP's basis for inspecting these "Primary" category components consistent with the results of the applicant's gap analysis, which provides an acceptable basis for examining the clevis insert components and radial support keys during the subsequent period of extended operation, and (b) make this aspect of the "detection of aging effects" program element consistent with the criteria for performing VT-3 inspections of these components using the results of a gap analysis, as specified in the "detection of aging effects" program element of GALL-SLR Report AMP XI.M16A.

Enhancement 14. SLRA Section B2.1.7 includes an enhancement to the "detection of aging effects" program element. In this enhancement, the applicant states that procedures will be revised to require visual VT-3 inspections of the CRGT guide cards in at least 77 percent (i.e., 37 out of 48) of the CRGT assemblies in the units and will include associated acceptance criteria.

The enhancement also states that guidance from WCAP-17451-P and EPRI Letter No. MRP 2018-07 will be included for the inspection of the CRGT guide cards. The staff reviewed the enhancement against the corresponding program element in GALL-SLR Report AMP XI.M16A and the updated basis for inspecting these components in the MRP-227, Revision 1-A report, and in Westinghouse Proprietary Report No. WCAP-17451-P. In relation to this program element, the GALL-SLR Report AMP establishes guidance on when VT-3 inspection techniques may be used for detection of cracking and for other aging effects, such as loss of material due to wear.

The staff noted that the sample size stated for CRGT guide card inspections in the enhancement was at least as large as that specified for the guide cards in EPRI Proprietary Report No. WCAP-17451-P. The staff also noted that the GALL-SLR Report AMP XI.M16A identifies that VT-3 visual inspection methods may be used to detect evidence of wear in RVI components and evidence of cracking in a redundant set of RVI components. Based on its review, the staff finds the enhancement acceptable because, when the enhancement is implemented, it will: (a) make the AMP's basis for inspecting CRGT guide cards at least as conservative as the bases for inspecting the guide cards in the WCAP-17451-P, Revision 1 report, and (b) make this aspect of the "detection of aging effects" program element consistent with the criteria for performing VT-3 inspections of these components using the results of a gap analysis, as specified in the "detection of aging effects" program element of GALL-SLR Report AMP XI.M16A.

Enhancement 16. SLRA Section B2.1.7 includes an enhancement to the "parameters monitored or inspected" program element. In this enhancement, the applicant states that procedures will be revised for "Expansion" contingency tasks to inspect the following components if necessitated by relevant conditions found for associated "Primary" category components: (a) core barrel assembly upper axial welds (UAWs), middle axial welds (MAWs), and lower axial welds (LAWs); (b) core barrel assembly UGWs; (c) core barrel assembly LFWs; (d) lower support forgings; and (e) upper core plates. For these welds, the SLRA stated that the minimum inspection coverage for the EVT-1 inspections applied to the weld components would be set at 50 percent of the weld surface being inspected. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.M16A and the

updated basis for inspecting these "Expansion" category components in Table 4-6 of the MRP-227, Revision 1-A report.

The staff noted that, prior to the programmatic changes discussed in the February 20, 2020, letter, the applicant's proposed minimum visual inspection coverages (VT-3 method) for the lower support forgings and upper core plates that are consistent with those specified for these components in Table 4-6 of the MRP-227, Revision 1 report. However, staff noted that the applicant's minimum EVT-1 inspection coverage of 50 percent for the core barrel assembly UAWs, MAWs, LAWs, UGWs, and LFWs was slightly different from the minimum EVT-1 inspection coverage basis for the welds, as established in EPRI Letter No. MRP 2018-026 using the following footnotes included in the EPRI letter:

(1) A minimum coverage of 75% of the weld length on the surface being examined shall be achieved; however, for welds with limited access (Note 4), a minimum examination coverage of 50% of the weld length on the surface being examined shall be achieved.

(2) Accessibility to the MAW and LAW may be limited by the thermal shield or neutron panels-no disassembly to achieve higher weld length coverage is required.

Therefore, for this matter, the staff issued an RAI. RAI B2.1.7-3, Parts 1 and 2, and the applicant's responses are given in ADAMS Accession No. ML19204A357.

In its response to RAI B2.1.7-3, Part 1, Dominion stated that, like the restricted access provisions set for the core barrel assembly lower girth welds (LGWs), the core barrel assembly MAWs and LAWs are expected to be restricted by interference caused by the presence and proximity of the thermal shield to the weld locations. The applicant stated that past inspections of the core barrel LGWs in Unit 1 in 2013 and in Unit 2 in 2015 only achieved 70.4−71.6 percent coverage of the LGW lengths. The applicant stated that, in contrast, past EVT-1 inspections of the upper girth welds (UGWs) in the core barrel assemblies did not experience this type of interference because they were performed from the interior surfaces of the core barrel. However, the applicant clarified that EVT-1 inspections of the core barrel assembly MAWs and LAWs are not feasible from the inside surfaces of the core barrel assembly due to the presence of the baffle plate structure near the welds. For the inspections that apply to the core barrel assembly MAWs and LAWs, the staff finds the applicant's response and enhancement basis acceptable because: (a) EVT-1 inspections of the core barrel assembly MAWs and LAWs are not feasible from the inside surface of the core barrel due the proximity of the baffle plate structure to the welds, and (b) similar to the proximity of the thermal shield to the core barrel assembly LGWs, the proximity of the thermal shield to the outside surfaces of the MAWs and LAWs may reduce the EVT-1 accessibility to the weld surfaces to lengths that are between 50 percent and 75 percent of the total lengths of the welds. Based on this rationale, the staff finds Enhancement 16 acceptable for implementation because when the enhancement is implemented it will make the applicant set appropriate acceptance criteria for the weld examinations if the welds are restricted for inspection. RAI B2.1.7-3, Part 1 is resolved with respect to setting appropriate inspection criteria for potential contingency inspections that may be applied to the core barrel assembly MAWs and LAWs.

In its response to RAI B2.1.7-3, Part 2, Dominion stated that past inspections of the UGWs in 2013 for Unit 1 and 2014 for Unit 2 achieved 100 percent coverage because the inspections were performed from the inside surfaces of the core barrel assembly, which permitted full access of the visual inspection equipment to the weld surfaces. The applicant stated that past inspections of the LFWs in 2013 for Unit 1 and 2014 for Unit 2 achieved approximately

81-82 percent of the weld lengths. The applicant stated that the UAWs in the core barrel assemblies have not yet been examined but clarified that access to the UAWs may be restricted due to the narrow gap between the core barrel and the reactor cavity wall at the height of the UAWs. The staff finds the applicant's response and enhancement basis acceptable because: (a) past inspections performed on the UGWs and LFWs demonstrate that the applicant can achieve the minimum EVT-1 inspection coverages stated for the welds in the MRP-227, Revision 1-A report, and (b) for contingency inspections of the UGWs, LFWs, and UAWs going forward, the applicant will only adjust the inspection coverages of the welds if the welds are sufficiently restricted such that it would be difficult to achieve the specified 75 percent weld length criteria set for the weld examinations in the MRP-227, Revision 1-A report. Based on this rationale, the staff finds Enhancement 16 acceptable for implementation because when the enhancement is implemented it will make the applicant set appropriate acceptance criteria for the weld examinations if the welds are restricted for inspection. RAI B2.1.7-3, Part 2 is resolved with respect to setting appropriate inspection criteria for potential contingency inspections that may be applied to the core barrel assembly UGWs, LFWs, and UAWs.

Additionally, in the applicant's letter of October 14, 2019, the applicant amended this enhancement by including a one-time inspection basis for the core barrel MAWs and LAWs. Dominion stated that a one-time inspection, a VT-3 visual examination, will be performed on the LAWs and MAWs during the sixth inservice inspection interval (6^{th} ISI interval) no later than 6 months prior to entering the subsequent period of extended operation. The applicant also defined the minimum inspection coverage criteria that will be applied to the one-time visual inspection of the LAWs and MAWs.

The staff noted that the supplement of Enhancement 16 was based on recent generic operating experience with cracking in PWR core barrel or core shroud axial welds, as discussed and evaluated in the interim guidelines of EPRI MRP Letter No. 2019-023, dated September 3, 2019 (ADAMS Accession No. ML19249B102). The staff also noted that the applicant's one-time inspection bases for the core barrel MAWs and LAWs are consistent with those defined in MRP Letter No. 2019-023 for Westinghouse-designed PWRs whose core barrel MAW and LAW locations are known but are partially inaccessible for inspection. The staff also noted that the new interim guidelines for the MAWs and LAWs provide additional condition monitoring criteria that will be used to monitor for potential cracking in the welds during the subsequent period of extended operation and provide an additional measure that will be used to manage aging in the core barrel MAWs and LAWs in accordance with the requirement in 10 CFR 54.21(a)(3).

The staff also verified that the applicant's inspection criteria for other "Expansion" category components listed in AMP Enhancement 16 were consistent with those defined for the components in the MRP-227, Revision 1-A report. Therefore, the staff finds AMP Enhancement 16 (as supplemented) to be acceptable because: (a) the criteria for the "Expansion" category components within the scope of the AMP enhancement are either consistent with the criteria for the components in the MRP-227, Revision 1-A report or with the interim guidance criteria in EPRI MRP Letter No. MRP 2019-023, and (b) this provides an acceptable basis for demonstrating that the applicable referenced "Expansion" category components in Enhancement 16 will be adequately managed during the subsequent period of operation in accordance with 10 CFR 54.21(a)(3).

Enhancement 17. SLRA Section B2.1.7 includes an enhancement to the "monitoring and trending" program element. In this enhancement, the applicant states that a "procedure for visual examinations will be revised to identify examiner qualifications which are applicable to EVT-1 examination." The staff reviewed this enhancement against the corresponding program

element and the “administrative controls” program element in GALL-SLR Report AMP XI.M16A and the requirements for ensuring the nondestructive testing activities in accordance with 10 CFR Part 50, Appendix B, Criterion IX, “Control of Special Processes.”

The staff noted that Criterion IX, “Control of Special Processes,” in 10 CFR Part 50, Appendix B, “Quality Assurance Activities for Nuclear Power Plants and Fuel Reprocessing Plants,” requires special quality processes (e.g., those for welding, heat treatments, or nondestructive testing) to be performed using qualified personnel and qualified procedures. The staff considered these types of activities to fall within the “administrative controls” program element of the PWR Vessel Internals program. The staff finds this enhancement to be acceptable because, when the enhancement is implemented, it will ensure that the applicant’s procedure for performing EVT-1 visual inspections will be updated by including personnel qualification criteria for those examiners that will perform EVT-1 examinations of the designated “Primary” or “Expansion” RVI components that are subject to EPRI MRP-defined EVT-1 inspection criteria.

<u>Review of License Renewal Applicant/Licensee Action Items (A/LAIs)</u>

In the staff’s safety evaluation for Topical Report No. MRP-227, Revision 1-A, the staff issued the following license renewal applicant/licensee action item (A/LAI) on the report:

- A/LAI No. 1 – “If the table in MRP 2017-009 indicates that the subsequent inspection interval is not to exceed 6 years (e.g., downflow plants with ≥ 3 percent BFBs [baffle-former bolts] with indications or clustering, or upflow plants with ≥ 5 percent of BFBs with indications or clustering), the plant-specific evaluation to determine a subsequent inspection interval shall be submitted to the NRC for information within one year following the outage in which the degradation was found. Any evaluation to lengthen the determined inspection interval or to exceed the maximum inspection interval recommended in MRP-2017-009 shall be submitted to the NRC for information at least one year prior to the end of the current applicable interval for BFB subsequent examination.”

The staff’s basis for addressing this A/LAI is provided in the staff’s evaluation of the operating experience that is relevant to the PWR Vessel Internals program, as given in the following section.

<u>Operating Experience</u>. SLRA Section B2.1.7 summarizes the operating experience related to the PWR Vessel Internals program. The staff evaluated operating experience information by reviewing the subsequent license renewal application and conducting an audit (ADAMS Accession No. ML19046A433 for the operating experience audit report). During the audit, the staff independently searched plant-specific operating experience information to determine whether any previously unknown or recurring aging effects were identified for RVI components included in the PWR Vessel Internals program.

The staff noted that the applicant completed its baseline inspections of “Primary” category and “Existing Program” category RVI components, with the baseline inspections of the Unit 1 components being completed in 2010 or 2013, and the baseline inspections of the Unit 2 components being completed in 2011 or 2014. This includes inspections of those RVI components for which generic operating experience is known, including operating experience associated with cracking of baffle-former bolts, wear in CRGT guide cards, and cracking of clevis insert bolts or radial support keys. The staff also noted that, for the previous UT inspections performed on the baffle-former bolts, the results of the inspections do not warrant

any submittal of a supplemental evaluation under A/LAI 1 because: (a) the inspections of baffle-former bolts in the Surry units (as Tier 2 downflow plants) did not reveal evidence of cracking or wear in more than 3 percent of the baffle-former bolts, (b) the inspections did not reveal any evidence of degraded baffle-former bolts in clustered groupings, (c) the inspection results did not identify sufficient degradation in the baffle-former bolts to justify expanded inspections of the lower support column bolts or barrel-former bolts in the units, and (d) based on the inspection results and the criteria in NSAL-16-1, Revision 1, a 10-year inspection interval remains an acceptable reinspection interval for performing inspections of the baffle-former bolts in the units.

The staff observed that the applicant appropriately addressed relevant generic operating experience related to cracking of the PWR core barrel MAWs and LAWs in its October 14, 2019, amendment of Enhancement 16 to the PWR Vessel Internals Program. As has been evaluated in the staff's review of this enhancement, the program has been amended by including a one-time visual inspection of the core barrel MAWs and LAWs during the 6th ISI interval for the units in manner that is consistent with the interim guidance in EPRI MRP Letter No. 2019-023. The staff finds this to be acceptable because it demonstrates that Dominion is treating the PWR Vessel Internals Program as a living program that incorporates lessons learned and needed programmatic changes that are recommended by the EPRI MRP in response to relevant industry experience.

Thus, based on this review, the staff did not identify any operating experience indicating that Dominion should modify its proposed program beyond that incorporated into the AMP during the development of the SLRA or as amended during the SLRA review as a result of incorporating additional programmatic changes recommended by the EPRI MRP. The staff also considers the applicant's actions to incorporate gap analysis into the scope of the program and to adjust the condition monitoring aspects of the program for designated RVI components (e.g., incorporation of the gap analysis changes to the RVI component inspection categories, as discussed above) to be reasonable for managing the effects of aging.

<u>UFSAR Supplement</u>. SLRA Section A1.7 provides the UFSAR supplement for the PWR Vessel Internals 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, in Commitment No. 7 of SLRA Table A4.0-1, "Subsequent License Renewal Commitments," as supplemented in Dominion's letters of October 14, 2019 (ADAMS Accession No. ML19294A044) and February 20, 2020 (ADAMS Accession No. ML20054B996), Dominion committed to ongoing implementation of the existing PWR Vessel Internals program to manage the effects of aging for applicable RVI components during the subsequent period of extended operation, including implementation of the 17 programmatic enhancements for the program as stated in SLRA AMP B2.1.7 and in Commitment No. 7.

Specifically, the staff noted that, in the letter of October 14, 2019, the applicant amended Commitment No. 7 by including a number of programmatic changes to the set of 17 enhancements that were originally included in the PWR Vessel Internals Program and in the scope of Commitment No. 7:

- The applicant amended Part 7 of Commitment No. 7 (i.e., the part that correlates to Enhancement 7) by including the applicant's criteria for establishing when a one-time VT-3 visual examination would need to be performed on the barrel-to-former bolts in the barrel-former assembly.

- The applicant amended Part 9 of Commitment No. 7 (i.e., the part that correlates to Enhancement 9) by including updated inspection and inspection coverage bases for performing inspections of the core barrel lower flange welds in the units.
- The applicant amended Part 12.b of Commitment No. 7 (i.e., the part that correlates to Section b. of Enhancement 12) by including the industry report bases that will be used to perform expanded inspections of the CRGT assembly sheath and C-tube components.
- The applicant amended Part 16.a of Commitment No. 7 (i.e., the part that correlates to Section a. of Enhancement 16) by: (a) including additional clarifications on the inspection coverages that will be applied to “Expansion” based inspections of the core barrel assembly MAWs and LAWs, and (b) including the new criteria for performing a one-time VT-3 visual inspection of the core barrel MAWs and LAWs during the 6th ISI interval for the units.
- The applicant amended Parts 16.b, 16.d, and 16.e of Commitment No. 7 (i.e., the parts that correlate to Sections b., d., and e. of Enhancement 16) by including additional clarifications on the inspection coverages that will be applied to “Expansion” based inspections of the core barrel assembly UGWs, the lower support forgings, and the upper core plates in the units.

The staff noted that, in the letter dated February 20, 2020, the applicant amended Commitment No. 7, Part 15 to redefine and make the inspection coverage criteria for EVT-1 visual inspections that will be performed on the core barrel assembly lower girth welds (LGWs) consistent with those specified for the welds in the MRP-227, Revision 1-A, where the applicant has selected and designated the outer surfaces of the welds and 0.75 inches of the outer surfaces of adjacent base metal as the component surfaces for inspection.

The staff has evaluated the applicant’s 17 enhancements of the PWR Vessel Internals Program (as amended in the applicant’s letter of October 14, 2019) in the “Evaluation” section of this SER Section and has found them to be acceptable for implementation.

Therefore, the staff finds that the information in the FSAR supplement is an adequate summary description of the program and appropriately reflects the 17 enhancements in Commitment No. 7 that will be implemented in accordance with the program.

Conclusion. Based on its review of Dominion’s PWR Vessel Internals program, the staff concludes that those program elements for which Dominion 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 Dominion 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 Flow-Accelerated Corrosion

SLRA Section B2.1.8 states that the Flow-Accelerated Corrosion program is an existing program with enhancements that will be consistent with the program elements in the GALL-SLR

Report AMP XI.M17, “Flow-Accelerated Corrosion.” Dominion amended this SLRA section by letters dated April 2, July 17, and September 3, 2019.

Staff Evaluation. During its audit (ADAMS Accession No. ML19128A079), the staff reviewed Dominion’s claim of consistency with the GALL-SLR Report. The staff compared the “scope of program,” “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” “acceptance criteria,” and “corrective actions” program elements of the SLRA to the corresponding program elements of GALL-SLR Report AMP XI.M17. During the audit, and as confirmed by the applicant (ADAMS Accession No. ML19198A059), the staff noted that applicant procedures ER-AA-FAC-10, “Flow-Accelerated Corrosion Program,” Revision 7, and ER-AA-FAC-102, “Flow-Accelerated Corrosion (FAC) Inspection and Evaluation Activities,” Revision 0, contain aspects of the applicant’s erosion program and the requirements of these procedures also apply to the site erosion program.

For the “parameters monitored or inspected,” “detection of aging effects,” and “monitoring and trending” program elements, the staff needed additional information, which resulted in the issuance of RAIs. RAIs B2.1.8-1 and B2.1.8-1a and Dominion’s responses are documented in ADAMS Accession Nos. ML19204A357 and ML19253B330.

In its responses to the RAIs, Dominion stated that the Flow-Accelerated Corrosion program implements guidance in EPRI Report 3002005530, “Recommendations for an Effective Program Against Erosive Attack,” regarding erosion susceptibility evaluations, wear rate calculations, inspection planning, monitoring and trending, and CHECWORKS erosion module features. Dominion also revised SLRA Section B2.1.8 by including an Erosion Control Program Description discussion within the program description section of the Flow-Accelerated Corrosion program. Additionally, the applicant stated that the CHECWORKS erosion module evaluates three types of erosion (cavitation, flashing, and liquid droplet impingement). Solid particle erosion (SPE) is considered outside of the erosion module and components deemed to be susceptible to SPE will be incorporated into the inspection scope in accordance with the applicant’s procedures for other susceptible non-modeled (SNM) lines. The applicant also noted that the erosion module does not calculate a remaining life or projected wall thickness for these types of erosion and only predicts the occurrence of erosion. The erosion module does not incorporate inspection results into the outputs of erosion modeling. However, the applicant stated that results from erosion inspections are used to update the site Erosion Susceptibility Evaluation (ESE), which identifies components to be inspected.

Also, the applicant stated that the erosion module isn’t used to determine erosion susceptibility (all modeled lines in the erosion module were previously determined to be susceptible through the site ESE), but it is used to help predict erosion locations to be inspected on susceptible lines. The applicant also stated that predicted magnitudes of erosive damage (where applicable) are not considered because erosion will be inspected at any location where the module predicts it. The applicant stated that outputs from the erosion module will not be used to exclude lines from the inspection scope but will be used to inform the priority of inspections. The primary source for selecting inspection locations will be the site ESE.

During its evaluation of Dominion’s responses to RAIs B2.1.8-1 and B2.1.8-1a, the staff noted that the erosion portions of the program described by the applicant are consistent with GALL-SLR Report recommendations to determine erosion susceptibility, trend wear rate, and select components for inspection. The staff also noted the portions of the erosion program for which the CHECWORKS erosion module will and will not be used are described above. The

staff finds Dominion's responses and changes to SLRA Section B2.1.8 acceptable because, as described above, the applicant only uses the results of the CHECWORKS erosion module to inform the locations and priority of wall thickness measurements on lines previously determined to be susceptible to erosion. The primary source for selecting inspection locations is the site ESE and the results of the erosion module will not be used to exclude lines from the erosion inspection scope. Other elements of the erosion program, such as (a) using previous inspection results to inform future inspections, (b) calculating remaining life or projected wall thickness, (c) evaluating wall thickness readings to determine the need for component replacement, and (d) dispositioning of inspected components (e.g., whether component requires immediate replacement, will be re-inspected in a future outage, or requires no further inspection), will be done outside of the CHECWORKS erosion module. Also, SPE will be incorporated into the erosion inspection scope using the SNM risk ranking process.

For the "detection of aging effects" program element, the staff needed additional information, which resulted in the issuance of an RAI. RAI B2.1.8-2 and Dominion's response are documented in ADAMS Accession No ML19204A357.

In its RAI response, Dominion revised SLRA Section B2.1.8 and Table A4.0-1, item 8, and added Enhancement 4 to the Flow-Accelerated Corrosion program. The enhancement includes: (a) performing independent reviews of inspection scope expansions by a qualified flow-accelerated corrosion engineer; (b) inspecting two pipe diameters downstream (or upstream if that component is an expander or expanding elbow) of any component displaying significant wear; (c) inspecting the next two most susceptible components from the CHECWORKS relative wear rate ranking in the same train as the component with significant wear; (d) inspecting corresponding components from other trains; and (e) continuing inspections of additional components until no components with significant wear are detected.

During its evaluation of Dominion's response to RAI B2.1.8-2, the staff noted that the changes to the Flow-Accelerated Corrosion program are consistent with the guidelines in NSAC-202L, Revision 4, "Recommendations for an Effective Flow-Accelerated Corrosion Program." The staff finds Dominion's response and the changes noted above acceptable because scope expansion criteria that are consistent with the industry guidance and independently reviewed will provide measures to ensure that the associated effects of aging are adequately managed.

For the "parameters monitored or inspected" program element, the staff needed additional information, which resulted in the issuance of RAIs. RAIs B2.1.8-3 and B2.1.8-3a and Dominion's responses are documented in ADAMS Accession Nos. ML19204A357 and ML19253B330.

In its RAI responses, Dominion revised SLRA Section B2.1.8 and Table A4.0-1, item 8, and added Enhancements 2 and 3 to the Flow-Accelerated Corrosion program. Dominion stated that the plant ESE has been revised to incorporate the bearing cooling system as a system that is susceptible to erosion. Additionally, the applicant added Enhancement 2 to re-evaluate erosion susceptibility of systems that were previously excluded to re-affirm that there is an appropriate basis for their exclusion. The applicant also added Enhancement 3 to provide additional confirmation that changes in plant configuration or operation have not increased the susceptibility to erosion for plant systems within the scope of subsequent license renewal.

During its evaluation of Dominion's responses to RAI B2.1.8-3 and RAI B2.1.8-3a, the staff noted that the bearing cooling system is now identified as a system susceptible to erosion. The staff also noted that, although the recent EPRI Report 3002005530 includes a usage exclusion

time of 2 percent (similar to the flow-accelerated corrosion guidance in NSAC-202L), Dominion will use a lower value of 100 hours per year, consistent with the guidance from EPRI Report TR-112657, "Revised Risk-Informed Inservice Inspection Evaluation Procedure," included in GALL-SLR Report AMP XI.M17. The staff finds Dominion's response acceptable for the following reasons: (1) the bearing cooling system is identified as being susceptible to erosion; (2) the applicant will implement enhancements to re-evaluate erosion susceptibility of systems that experience flow for less than 100 hours per year, unless there is a technical evaluation specifically developed to exclude a system; and (3) the applicant will perform a reevaluation to determine if plant conditions (e.g., valve throttling) have changed in a manner that would increase erosion susceptibility for plant systems within the scope of subsequent license renewal.

The staff also reviewed the portions of the "scope of program" and "detection of aging effects" 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 enhancement is as follows.

Enhancement 1. SLRA Section B2.1.8, as amended by letter dated April 2, 2019, includes an enhancement to the "scope of program" and "detection of aging effects" program elements, which relates to reevaluation of systems currently excluded from the Flow-Accelerated Corrosion program due to no flow or infrequently used lines. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M17 and finds the enhancement acceptable because when it is implemented it will develop the basis for excluding certain piping systems from wall thickness monitoring due to limited operating time.

Enhancement 2. SLRA Section B2.1.8, as amended by letter dated September 3, 2019, includes an enhancement to the "scope of program" and "detection of aging effects" program elements regarding a reevaluation of the ESE to determine whether the basis for excluding certain systems from monitoring due to service time considerations is appropriate. This enhancement is described in the response to RAI 2.1.8-3a, as discussed above. The staff reviewed this enhancement against the guidance in the "scope of program" and "detection of aging effects" program elements in the GALL-SLR Report AMP XI.M17 and finds it acceptable because when it is implemented it will be consistent with GALL-SLR Report guidance regarding exclusion of certain components from wall thickness monitoring under this program.

Enhancement 3. SLRA Section B2.1.8, as amended by letter dated September 3, 2019, includes an enhancement to the "scope of program" program element, regarding a reevaluation of the ESE to determine if changes in plant conditions (e.g., valve throttling) have increased erosion susceptibility for certain plant systems within the scope of subsequent license renewal. This enhancement is described in the response to RAI 2.1.8-3a, as discussed above. The staff reviewed this enhancement against the guidance in the "detection of aging effects" program element in the GALL-SLR Report AMP XI.M17 and finds it acceptable because when it is implemented it will be consistent with GALL-SLR Report guidance regarding exclusion of certain components from wall thickness monitoring under this program.

Enhancement 4. SLRA Section B2.1.8, as amended by letter dated July 17, 2019, includes an enhancement to the "detection of aging effects" program element which relates to inspection scope expansion requirements when flow-accelerated corrosion is detected. This enhancement is described in the response to RAI B2.1.8-2, as discussed above. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.M17

and finds it acceptable because when it is implemented it will be consistent with the GALL-SLR Report guidance regarding inspection scope expansions when flow-accelerated corrosion is detected.

Based on its audit and review of the SLRA, Change Notices, and Dominion's responses to RAIs B2.1.8-1, B2.1.8-1a, B2.1.8-2, B2.1.8-3, and B2.1.8-3a, 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 Dominion claimed consistency with the GALL-SLR Report are consistent with the corresponding program elements of GALL-SLR Report AMP XI.M17. In addition, the staff reviewed the enhancements associated with the "scope of program" and "detection of aging effects" program elements and finds that when implemented, they will make the AMP adequate to manage the applicable aging effects

Operating Experience. SLRA Section B2.1.8 summarizes the 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. ML19046A433). 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 needed additional information, which resulted in the issuance of RAIs B2.1.8-3 and B2.1.8-3a. The RAIs and responses are discussed above. Based on its audit and review of the application, and review of Dominion's responses to RAIs B2.1.8-3 and B2.1.8-3a, 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 A1.8 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 Dominion committed to implement the four enhancements described above at least 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 review of Dominion's Flow-Accelerated Corrosion program, the staff concludes that those program elements for which Dominion claimed consistency with the GALL-SLR Report are consistent. Also, the staff reviewed the enhancements 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 Dominion 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 Bolting Integrity

SLRA Section B2.1.9 states that the Bolting Integrity program is an existing program with enhancements that will be consistent with the program elements in the GALL-SLR Report AMP XI.M18, "Bolting Integrity." Dominion amended this SLRA section by letter dated April 2, 2019.

Staff Evaluation. During its audit (ADAMS Accession No. ML19128A079), the staff reviewed Dominion's claim of consistency with the GALL-SLR Report. The staff compared the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria" and "corrective actions" program elements of the SLRA to the corresponding program elements of GALL-SLR Report AMP XI.M18. The staff also reviewed the portions of the "detection of aging effects" and "corrective actions" program elements associated with enhancements to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of the enhancements is as follows.

Enhancement 1. SLRA Section B2.1.9 includes an enhancement to the "detection of aging effects" program element which relates to the revision of site procedures to provide inspection guidance on lighting, distance, offset, surface coverage, presence of protective coatings, and cleaning processes. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.M18 and finds it acceptable because when it is implemented, inspections performed under the Bolting Integrity program will follow site procedures for inspection parameters (e.g., lighting, distance, offset), consistent with the recommendations in the GALL-SLR Report AMP X1.M18.

Enhancement 2. SLRA Section B2.1.9 includes an enhancement to the "detection of aging effects" program element, which relates to the revision of procedures, by including inspection of submerged pressure-retaining bolting and closure bolting that contain air or gas, which makes leakage detection difficult. 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) incorporate the inspection of closure bolting that is located in submerged environments; and closure bolting in systems that contain air or gas; (2) include inspections for loss of material of bolt heads and threads when these are made accessible; and (3) perform inspections at an interval not to exceed 10 years on a representative sample of at least 20 percent of the population (up to a maximum of 19 bolt heads and threads), consistent with the recommendations in GALL-SLR Report AMP XI.M18.

Enhancement 3. SLRA Section B2.1.9 includes an enhancement to the "corrective actions" program element which relates to the revision of site procedures to provide guidance for additional inspection to be performed when inspections do not meet the acceptance criteria for degradation and the cause of the aging effect is not corrected by repair or replacement. 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 include increased inspections of closure bolts with (1) no fewer than five additional inspections 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; (2) additional inspections including inspections at all of the units with the same material, environment, and aging effect combination; (3) inspections completed within the same interval (e.g., refueling outage interval, 10-year inspection interval) in which the original inspection was conducted; and (4) sampling frequencies to be determined by the site's corrective action program when projected inspection results do not meet the acceptance criteria prior to the next scheduled inspections, consistent with the recommendations in GALL-SLR Report AMP XI.M18.

Based on its audit and 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 for which Dominion claimed consistency with the GALL-SLR Report are consistent

with the corresponding program elements of GALL-SLR Report AMP XI.M18. In addition, the staff reviewed the enhancements associated with the “detection of aging effects” and the “corrective actions” program elements and finds that when implemented, they will make the AMP adequate to manage the applicable aging effects.

Operating Experience. SLRA Section B2.1.9 summarizes the operating experience related to the Bolting Integrity program. The staff evaluated operating experience information by reviewing the subsequent license renewal application and conducting an audit (ADAMS Accession No. ML19046A433). 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 Dominion should modify its proposed program. Based on its audit and review of the application, 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 A1.9 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 also noted that Dominion committed to enhance the Bolting Integrity program 6 months prior to the subsequent period of extended operation as follows:

(1) Procedures will be revised to provide inspection guidance related to lighting, distance, offset, surface coverage, presence of protective coatings, and cleaning processes. The procedure will specify adequate lighting be verified at the inspection location to detect degradation. Lighting may be permanently installed, temporary, or portable (e.g., flashlight), as appropriate. For accessible surface inspections, inspecting from a distance of two feet to four feet (or less) will be appropriate. For viewing angles which may prevent adequate inspection, a viewing aid such as an inspection mirror or boroscope should be used.

(2) Procedures will be revised for inspections of pressure-retaining closure bolting in locations that preclude detection of joint leakage, such as in submerged environments or where the piping system contains air for which leakage is difficult to detect. The inspections will be performed to detect loss of material. A requirement will be included to inspect bolt heads when made accessible, and bolt threads if joints are disassembled. At a minimum, in each 10-year interval during the subsequent period of extended operation, inspections shall be completed for a representative sample of at least 20% of the population, up to a maximum of nineteen, for each material/environment combination.

(3) A new procedure will be developed to provide guidance for a situation in which an acceptance criterion for allowable degradation is exceeded, and the aging effect causing the degradation for the material/environment combination is not corrected by repair or replacement, thus requiring that additional inspections be performed. The number of additional inspections will be determined in accordance with the Corrective Action Program; however, no fewer than five additional (or 20%, whichever is less) inspections of different components having the same material/environment/aging effect combination are required for each inspection that did not meet the acceptance criterion. For a two-unit site, the additional inspections include inspections at the same unit, and at the opposite unit, for components having the same material, environment, and aging effect combination. The additional inspections are to be completed within the same interval (e.g., refueling outage or 10-year inspection interval). If any

projected inspection results will not meet acceptance criteria prior to the next scheduled inspection, sampling frequencies are adjusted as determined by the Corrective Action Program.

The staff finds that the information in the UFSAR supplement, as amended by letter dated April 2, 2019, is an adequate summary description of the program.

Conclusion. On the basis of its review of Dominion's Bolting Integrity program, the staff concludes that those program elements for which Dominion 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 Dominion 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 Open Cycle Cooling Water System

SLRA Section B2.1.11 states that the Open-Cycle Cooling Water System program is an existing program with enhancements that, excluding exceptions identified in the SLRA and by the staff, will be consistent with the program elements in the GALL-SLR Report AMP XI.M20, "Open-Cycle Cooling Water System." Dominion amended this SLRA section by letters dated January 29, 2019; April 2, 2019; June 27, 2019; July 17, 2019; September 19, 2019; October 14, 2019; and October 31, 2019.

Staff Evaluation. During its audit (ADAMS Accession No. ML19128A079), the staff reviewed Dominion'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.M20.

For the "detection of aging effects" program element, the staff needed additional information, resulting in RAI B2.1.11-1. The staff's request and Dominion's response are documented in ADAMS Accession No. ML19204A357. In its response, Dominion clarified that its letter dated October 2, 1991 (ADAMS Accession No. ML18153C767), is the source of Surry's Generic Letter (GL) 89-13 commitments and that a commitment change evaluation for changing the charging pump lube oil coolers from a periodic replacement approach to an inspection and maintenance approach was a valid commitment change.

During its evaluation of Dominion's response to RAI B2.1.11-1, the staff noted that the Surry condition report, CR10911365, had incorrectly documented that the commitment change evaluation discussed above was not valid and consequently should have been included in the annual commitment evaluation report (ADAMS Accession No. ML18093A387). The staff finds Dominion's response acceptable because it clarified the source document of the commitments used to establish the scope, methods, and frequencies that are the basis of the Open-Cycle Cooling Water System program. In accordance with 10 CFR 54.30, the resolution of the apparent discrepancy in the annual regulatory commitment evaluation report (ADAMS

Accession No. ML18093A387, where the commitment change was not reported to the NRC) is not within the scope of license renewal.

The staff also reviewed the portions of the “scope of program,” “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” “acceptance criteria,” and “corrective actions” program elements associated with the exceptions and enhancements to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff’s evaluations of the three exceptions and 22 enhancements follows.

Exception 1. SLRA Section B2.1.11 includes an exception to the “detection of aging effects” program element regarding the frequency for testing the recirculation spray heat exchangers (RSHXs). Based on previous test results, Dominion changed the frequency of flow tests and visual inspections of the RSHXs to 12 years instead of the recommended 5-year frequency in the GALL-SLR Report AMP XI.M20. The staff noted that Dominion documented this change to its GL 89-13 commitments by letter dated March 27, 2015 (ADAMS Accession No. ML15097A258).

The staff reviewed the justification for the exception against the corresponding program element in GALL-SLR Report AMP XI.M20. The staff noted that portions of the RSHX piping are maintained in either a dry layup condition or a wet layup condition with treated water to minimize corrosion. The staff finds the exception acceptable because Dominion’s test frequency adjustments, based on the evaluation of previous testing and inspection results and layup conditions, provide reasonable assurance that the RSHXs will continue to perform their intended functions during the subsequent period of extended operation.

Exception 2. During its review of SLRA Section B2.1.11, the staff identified a difference in the “scope of program” and “detection of aging effects” program elements that the applicant did not address. Although Dominion included the emergency service water (ESW) pump engine heat exchangers and ESW pump right angle gear oil coolers within the scope of license renewal, there were no corresponding aging management review items for these components to demonstrate how any applicable aging effects would be managed. Dominion’s approach was ambiguous because the program currently includes Enhancement 13 to require trending of the ESW pump engine heat exchanger inspection results; however, the SLRA did not include any AMR items for these heat exchangers.

Based on the above, the staff identified a need for additional information, resulting in the issuance of RAI B2.1.11-2. The staff’s request and Dominion’s response are documented in ADAMS Accession No. ML19204A357. In its response, Dominion stated that the ESW pump engines are treated as active skid-mounted assemblies and because the pump engine heat exchangers and the pump right angle gear oil coolers are integral components that are either internal or mounted directly to the active assemblies, aging management review, in accordance with 10 CFR 54.21(a)(1)(i), is not required.

The staff further assessed the issue to compare Dominion’s docketed response to GL 89-13 to information in the SLRA. SLRA Section B2.1.11 states that the program is comprised of the aging management aspects of Dominion’s response to GL 89-13, which includes tests to verify heat transfer of safety-related heat exchangers, with routine inspection and maintenance so that loss of material, corrosion, erosion, cracking, fouling, and biofouling cannot degrade the performance of systems serviced by the open-cycle cooling water system. The staff noted the following during its review of Dominion’s docketed response to GL 89-13:

- Normal heat loads and design tube side temperature differentials for the ESW pump engine heat exchangers and ESW pump right angle gear oil coolers are insufficient to achieve accurate results in heat transfer performance testing.
- ESW pump engine heat exchanger maintenance is performed routinely, consisting of removal, inspection, and cleaning of the cooler core.
- ESW pump right angle gear oil cooler maintenance is performed routinely, consisting of cooler oil replacement and water flow verification at the gearbox cooler outlet.

The staff concluded that, given Dominion's description of the Open Cycle Cooling Water System program, the additional inspections and maintenance activities included in its response to GL 89-13 are aging management activities that were not included in the integrated plant assessment required by 10 CFR 54.21(a); however, see the staff's below further evaluation of this gap as compared to CLB requirements for managing aging effects of these components. In addition, Dominion's use of the term "active assembly" to describe the engines and the heat exchangers or coolers associated with the ESW pumps is inconsistent with the guidance in SRP-SLR Table 2.3-2, "Examples of Mechanical Components Screening and Basis for Disposition." The staff also noted that Dominion's description of the "evaluation boundary" for the ESW pump engine heat exchangers in its RAI response is consistent with the designation of "complex assemblies" described in SRP-SLR Table 2.1-2, "Specific Staff Guidance on Scoping," which concludes that the associated heat exchangers would be subject to an AMR.

The staff viewed the above inconsistencies as a staff-identified difference and reviewed the difference against the corresponding program elements in GALL-SLR Report AMP XI.M20. Dominion's CLB regarding GL 89-13 includes additional inspections and maintenance for the ESW pump engine heat exchangers and ESW pump right angle gear oil coolers. These additional inspections and maintenance are capable of identifying flow blockage and reduction of heat transfer due to fouling. The removal of the ESW pump engine heat exchanger cooler cores can provide access to determine if loss of material is occurring. Even though the internals of the ESW pump right angle gear oil coolers are not visually inspected, the conditions inside of the ESW pump engine heat exchangers can provide insights regarding loss of material for this component. The staff determined that, given the CLB requirements for the inspections and maintenance of the ESW pump engine heat exchangers and ESW pump right angle gear oil coolers, there is reasonable assurance that they will perform their intended function during the subsequent period of extended operation as follows. Based on the above discussion, the staff finds this exception acceptable.

Exception 3. During its review of SLRA Section B2.1.11, the staff identified a difference in 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 use of carbon fiber reinforced polymer (CFRP) lining as pressure boundary material that the applicant did not identify. The staff noted that the GALL-SLR Report AMP XI.M20 addresses loss of coating integrity provided that the program includes guidance from AMP XI.M42, "Internal Coating/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks." However, the use of CFRP as pressure boundary material is beyond the conditions and operating experience of those for which AMP XI.M42 were evaluated.

The staff noted, by letter dated December 14, 2016 (ADAMS Accession No. ML16355A346), that Dominion requested approval of an alternative to American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section XI requirements for repair/replacement of service water system piping using CFRP lining. At the time of the staff's

approval (ADAMS Accession No. ML17303A037), there were no provisions in an approved ASME Code Case for using CFRP as a replacement for carbon steel piping. However, since that approval, ASME issued Code Case N-871, “Repair of Class 2 & 3 Piping Using Carbon Fiber Reinforced Polymer Composites,” which includes a mandatory appendix for inservice inspections (ISI). The staff considers the required ISI activities from Code Case N-871 as sufficient to adequately manage the effects of aging for the CFRP-lined piping. In lieu of reviewing any program enhancements against the program elements in GALL-SLR Report AMP XI.M20, the staff compared the enhancements associated with CFRP-lined piping against the ISI requirements from ASME Code Case N-871. The staff’s evaluation of the ISI requirements as compared to Dominion’s SLRA are documented below in Enhancements 6, 9, 10, 11, 15, 19, and 20.

Enhancement 1. SLRA Section B2.1.11 includes an enhancement to the “preventive actions” program element for the replacement of selected fiberglass reinforced plastic (FRP) piping with more degradation-resistant material such as copper-nickel. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.M20 and finds it acceptable because the installation of an alternate degradation-resistant piping material will resolve past issues associated with leaks caused by cracking in FRP service water piping.

Enhancement 2. SLRA Section B2.1.11 includes an enhancement to the “preventive actions” program element for modifying service water piping by including new chemical injection sites upstream of the rotating strainers in the service water system. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.M20 and finds it acceptable because chemical treatment to address biofouling has been identified as an effective preventive measure in service water systems.

Enhancement 3. SLRA Section B2.1.11, as amended by letter dated July 17, 2019, includes an enhancement to the “preventive actions” program element for installing CFRP lining in portions of 30-inch and larger service water piping. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.M20 and finds it acceptable because the application of degradation-resistant linings will address past issues associated with recurring internal corrosion of service water piping.

Enhancement 4. (Completed per Change Notice 1 (ADAMS Accession No. ML19042A137)). During the audit (ADAMS Accession No. ML19128A079), the staff confirmed Dominion’s claim by reviewing revised procedures that removed references to the carbon steel piping that had been replaced with a different material.

Enhancement 5. SLRA Section B2.1.11 includes an enhancement to the “parameters monitored or inspected” program element to provide additional guidance in procedures for identifying and evaluating applicable concrete aging effects. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.M20 and finds it acceptable because the additional guidance in the program’s procedures can ensure that the effects of aging for concrete piping will be adequately managed.

Enhancement 6. SLRA Section B2.1.11, as amended by letter dated July 17, 2019, includes an enhancement to the “parameters monitored or inspected” program element to provide additional inspection guidance for identifying aging effects associated with CFRP-lined piping such as voids, blistering, bubbles, cracking, crazing, and delamination during internal inspections. The staff reviewed this enhancement against the comparable requirements in ASME Code

Case N-871 and finds it acceptable because the additional guidance in the program's procedures can ensure that the effects of aging for the CFRP-lined piping will be adequately managed.

Enhancement 7. (Deleted by Change Notice 5 (ADAMS Accession No. ML19310E716))

Enhancement 8. SLRA Section B2.1.11, as amended by letter dated September 19, 2019, includes an enhancement to the "detection of aging effects" program element for revising procedures to require that personnel performing inspections and evaluations of concrete components are qualified in accordance with the qualifications in the Structures Monitoring program. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.M20 and finds it acceptable because the program's procedures will be consistent with the personnel qualification guidance in the GALL-SLR Report.

Enhancement 9. SLRA Section B2.1.11, as amended by letter dated October 14, 2019, includes an enhancement to the "detection of aging effects" program element for revising procedures to require that visual inspections and evaluations of CFRP-lined piping are done by personnel qualified in accordance with ASME Code Section XI, Part IWA-2300 and mandatory Appendix II of ASME Code Case N-871. In addition, the performance of acoustic examinations of CFRP-lined piping are to be done by personnel, using procedures, that are qualified in accordance with mandatory Appendix VI and Section 5400 of ASME Code Case N-871. The staff reviewed this enhancement against the comparable requirements in ASME Code Case N-871 and finds it acceptable because the additional guidance in the program's procedures can ensure that the effects of aging for the CFRP-lined piping will be adequately managed.

Enhancement 10. SLRA Section B2.1.11, as amended by letter dated October 14, 2019, includes an enhancement to the "detection of aging effects" program element for revising procedures to require CFRP-lined piping to be 100 percent visually examined between 3 to 6 years following return to service of the repaired area and a minimum of once per 10-year ISI interval, in accordance with ASME Code Case N-871. The staff reviewed this enhancement against the comparable requirements in ASME Code Case N-871 and finds it acceptable because the additional guidance in the program's procedures can ensure that the effects of aging for the CFRP-lined piping will be adequately managed.

Enhancement 11. SLRA Section B2.1.11, as amended by letter dated October 31, 2019, includes an enhancement to the "detection of aging effects" program element for revising procedures to require each terminal end of the CFRP linings to be examined with an acoustic impact tap examination in accordance with ASME Code Case N-871, Sections 5250(a), 5250(c), and 5350. In addition, the acoustic examination will be capable of detecting and sizing delaminations and voids with dimensions equal to or less than those permitted by Section 4390(b)(3). Also, the qualification testing will be conducted in an area where the ambient noise level is equal to or higher than the noise level where the in-situ testing will be performed. During its review, the staff noted that Section 5250 of Code Case N-871 is for "Acoustic Tap Examination." However, subparagraph 5250(c) addresses ultrasonic or electromagnetic measurement of the steel substrate and is distinctly different than the acoustic tap examination. Despite the ambiguity in subparagraph 5250(c) of the Code Case, it is the staff's understanding of Dominion's enhancement that the exposed substrate at the terminal ends will be ultrasonically or electromagnetically measured to document the steel substrate thickness, consistent with subparagraph 5250(c) and as a result, the Code Case inconsistency is immaterial to this review beyond documenting the ambiguity in the Code Case and the actual actions to be taken by Dominion. The staff reviewed this enhancement against the comparable

requirements in ASME Code Case N-871 and finds it acceptable because the additional inspection guidance in the program's procedures can ensure that the effects of aging for the CFRP-lined piping will be adequately managed.

Enhancement 12. SLRA Section B2.1.11, as amended by letter dated October 14, 2019, includes an enhancement to the "detection of aging effects" program element for revising procedures to require periodic inspections of accessible internal surfaces of concrete circulating water piping for evidence of aging. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.M20 and finds it acceptable because periodic internal inspections can ensure that the effects of aging for the cement piping will be adequately managed.

Enhancement 13. SLRA Section B2.1.11, as amended by letter dated September 19, 2019, includes an enhancement to the "monitoring and trending" program element to require trending of the charging pump lube oil cooler and ESW pump engine heat exchanger inspection results. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.M20 and finds it acceptable because the trending of inspection results can ensure that the associated heat exchangers' intended functions are maintained during the subsequent period of extended operation.

Enhancement 14. SLRA Section B2.1.11, as amended by letter dated September 19, 2019, includes an enhancement to the "monitoring and trending" program element to require the frequency and number of wall thickness measurements to be based on wall thickness measurement trending. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.M20 and finds it acceptable because the trending of wall thickness measurements can ensure that the associated piping intended functions are maintained during the subsequent period of extended operation.

Enhancement 15. SLRA Section B2.1.11, as amended by letter dated September 19, 2019, includes an enhancement to the "monitoring and trending" program element for revising procedures to require that all areas of CFRP previously documented in accordance with ASME Code Case N-871, Section V-1100(b) be reexamined, measured, and compared to previous inspection records. Additionally, any indications of flaw growth will be required to be repaired consistent with ASME Code Case N-871, with documentation of the repair, location, and dimensions, and any new flaws will be evaluated consistent with the code case. The staff reviewed this enhancement against the comparable requirements in ASME Code Case N-871 and finds it acceptable because the additional guidance in the program's procedures can ensure that the effects of aging for the CFRP-lined piping will be adequately managed.

Enhancement 16. SLRA Section B2.1.11, as amended by letter dated September 19, 2019, includes an enhancement to the "acceptance criteria" program element to require that predicted piping wall thickness at the next scheduled inspection will be greater than the minimum required wall thickness. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.M20 and finds it acceptable because predicting wall thicknesses can ensure that the associated piping intended functions are maintained during the subsequent period of extended operation.

Enhancement 17. SLRA Section B2.1.11, as amended by letter dated September 19, 2019, includes an enhancement to the "acceptance criteria" program element by including criteria for prompting additional corrective actions based on the extent and rate of ongoing degradation. The staff reviewed this enhancement against the corresponding program element in GALL-SLR

Report AMP XI.M20 and finds it acceptable because the inclusion of criteria to prompt corrective actions can ensure that the associated component intended functions are maintained during the subsequent period of extended operation.

Enhancement 18. SLRA Section B2.1.11, as amended by letter dated September 19, 2019, includes an enhancement to the "acceptance criteria" program element to revise visual inspection criteria for indications of degradation on concrete piping and components. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.M20 and finds it acceptable because the inclusion of criteria for indications of concrete degradation can ensure that the associated component intended functions are maintained during the subsequent period of extended operation.

Enhancement 19. SLRA Section B2.1.11, as amended by letter dated September 19, 2019, includes an enhancement to the "acceptance criteria" program element for revising procedures by including air voids, bubbles, blisters, delaminations, and other defects associated with CFRP linings. The staff reviewed this enhancement against the comparable requirements in ASME Code Case N-871 and finds it acceptable because the additional guidance in the program's procedures can ensure that the effects of aging for the CFRP-lined piping will be adequately managed.

Enhancement 20. SLRA Section B2.1.11, as amended by letter dated September 19, 2019, includes an enhancement to the "corrective actions" program element for revising procedures by including defect repair criteria for CFRP linings. The staff reviewed this enhancement against the comparable requirements in ASME Code Case N-871 and finds it acceptable because the additional guidance in the program's procedures can ensure that the effects of aging for the CFRP-lined piping will be adequately managed.

Enhancement 21. SLRA Section B2.1.11, as amended by letter dated September 19, 2019, includes an enhancement to the "corrective actions" program element to increase the frequency and extent of wall thickness measurements for ongoing degradation mechanisms, commensurate with the significance of the degradation. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.M20 and finds it acceptable because adjusting corrective actions based on degradation significance can ensure that the associated component intended functions are maintained during the subsequent period of extended operation.

Enhancement 22. SLRA Section B2.1.11, as amended by letter dated September 19, 2019, includes an enhancement to the "corrective actions" program element to perform a minimum number of additional inspections when measured parameters do not meet acceptance criteria, for components with the same material and environment combination. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.M20 and finds it acceptable because the additional inspections can ensure that the intended functions of components susceptible to similar degradation are maintained during 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 Dominion claimed consistency with the GALL-SLR Report, are consistent with the corresponding program elements of GALL-SLR Report AMP XI.M20, with the exception of staff-identified differences between Dominion's program and GALL-SLR Report AMP XI.M20.

The staff also reviewed the exception and the staff-identified differences associated with the "scope of program," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective action" program elements, and their justifications, and finds that the AMP, with the exceptions, is adequate to manage the applicable aging effects. In addition, the staff reviewed the enhancements associated with the "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements and finds that, when implemented, they will make the AMP adequate to manage the applicable aging effects.

Operating Experience. SLRA Section B2.1.11, as modified by letter dated July 17, 2019, summarizes the 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. ML19046A433). 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 noted that Dominion identified recurring internal corrosion in steel service water system components as discussed in SLRA Section 3.3.2.2.7. The staff's associated evaluation is documented in SER Section 3.3.2.2.7. The staff did not identify any operating experience indicating that Dominion should modify its proposed program. Based on its audit and review of the application, 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 A1.11, as amended by letter dated October 14, 2019, 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 also noted that Dominion committed to enhance the program 6 months prior to the subsequent period of extended operation as described in SLRA Table A4.0-1. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. Based on its review of Dominion's Open-Cycle Cooling Water System program, the staff concludes that those program elements for which Dominion claimed consistency with the GALL-SLR Report are consistent, with the exception of staff-identified differences between Dominion's program and GALL-SLR Report AMP XI.M20. In addition, the staff reviewed the exception and its justification and staff-identified differences between Dominion's program and GALL-SLR Report AMP XI.M20 and concludes that the AMP, with the exception and differences, is adequate to manage the applicable aging effects. 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 Dominion 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 Closed Treated Water Systems

SLRA Section B2.1.12 states that the Closed Treated Water Systems program is an existing program with an enhancement that, excluding the exception identified in the SLRA, will be

consistent with the program elements in GALL-SLR Report AMP XI.M21A, “Closed Treated Water Systems.”

Staff Evaluation. During its audit (ADAMS Accession No. ML19128A079), the staff reviewed Dominion’s claim of consistency with the GALL-SLR Report. The staff compared the “scope of program,” “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” “acceptance criteria,” and “corrective actions” program elements of the SLRA to the corresponding program elements of GALL-SLR Report AMP XI.M21A. The staff also reviewed the portions of the “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” and “corrective actions” program elements associated with 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 enhancements follows.

Exception 1. SLRA Section B2.1.12 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 AMP XI.M21A. The SLRA states that the more recent version allows a higher chromate concentration and a lower pH limit for the chromate-based treatment programs used at Surry and provides justifications for the cited differences.

The staff reviewed Dominion’s justification for the different allowable chromate concentration and pH limit and finds this exception acceptable because the updated EPRI guideline represents the latest industry consensus guidance based on reviews of data for closed cooling water systems, including recent industry operating experience. In addition, Dominion’s evaluation of the EPRI recommendation, regarding higher chromate concentration for potential wear of carbon pump seals, determined that any consequent seal degradation would likely be detected by seal leakage during periodic surveillance activities prior to a failure.

Enhancement 1. SLRA Section B2.1.12 includes an enhancement to the “detection of aging effects” program element for including inspection guidance related to lighting, distance, offset, surface coverage, protective coating presence, and cleaning processes. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.M21A and finds it acceptable because, following its implementation, the program will include the guidance for inspection activities provided in the GALL-SLR Report program.

Enhancement 2. SLRA Section B2.1.12 includes an enhancement to the “detection of aging effects” program element for developing a new procedure to require additional inspections for representative samples, if opportunistic inspections do not meet the recommended minimum number during each 10-year period. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.M21A and finds it acceptable because, following its implementation, the program will include the guidance provided in the GALL-SLR Report program for the minimum number of inspections.

Enhancement 3. SLRA Section B2.1.12 includes an enhancement to the “monitoring and trending” program element for developing a new procedure to evaluate and project the rate of any degradation and to adjust sampling selection, size, and frequency based on the projection. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.M21A and finds it acceptable because, following its implementation, the program will include the guidance provided in the GALL-SLR Report program for trending the rate of any degradation that is identified.

Enhancement 4. SLRA Section B2.1.12 includes an enhancement to the "corrective actions" program element for developing a new procedure to specify a minimum number of additional inspections if acceptance criteria are not met. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.M21A and finds it acceptable because, following its implementation, the program will include the guidance provided in the GALL-SLR Report program for corrective actions to be taken if acceptance criteria are not met during inspections.

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 Dominion 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 associated with the "parameters monitored or inspected" and "acceptance criteria" program elements, and its justification, and finds that the AMP, with the exception, is adequate to manage the applicable aging effects. In addition, the staff reviewed the enhancements associated with the "detection of aging effects," "monitoring and trending," and "corrective actions" program elements and finds that, when implemented, they will make the AMP adequate to manage the applicable aging effects.

Operating Experience. SLRA Section B2.1.12 summarizes the operating experience related to the Closed Treated Water Systems program. The staff reviewed operating experience information by reviewing the SLRA and conducting an audit (ADAMS Accession No. ML19046A433). During the audit, the staff independently searched plant-specific 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 noted that the operating experience discussed in the audit report for erosion is addressed through RAI B2.1.8-3 and RAI B2.1.8-3a, and the staff's evaluation of Dominion's response is documented in SER Section 3.0.3.2.5, "Flow-Accelerated Corrosion." The staff did not identify any operating experience indicating that Dominion should modify its proposed program.

UFSAR Supplement. SLRA Section A1.12 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 Dominion committed to enhance the program 6 months prior to the subsequent period of extended operation as described in SLRA Table A4.0-1. 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 Dominion's Closed Treated Water Systems program, the staff concludes that those program elements for which Dominion claimed consistency with the GALL-SLR Report are consistent. In addition, the staff reviewed the exception and its justification and concludes that the AMP, with the exception, is adequate to manage the applicable aging effects. 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 Dominion 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 Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems

SLRA Section B2.1.13 states that the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems program is an existing program with enhancements that will be consistent with the program elements in the GALL-SLR Report AMP XI.M23, "Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems."

Staff Evaluation. During its audit (ADAMS Accession No. ML19128A079), the staff reviewed Dominion's claim of consistency with the GALL-SLR Report. The staff compared the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements of the SLRA to the corresponding program elements of GALL-SLR Report AMP XI.M23. The staff also reviewed the portions of the "scope of program," "parameters monitored or inspected," 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 these two enhancements follows.

Enhancement 1. SLRA Section B2.1.13 includes an enhancement to the "scope of program," "parameters monitored or inspected," and "acceptance criteria" program elements which relates to the revision of plant procedures "to specify visual inspections for the effects of general corrosion, deformation, cracking, and wear on the rails in the rail system." The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M23 and finds it acceptable because when it is implemented it will be consistent with GALL-SLR Report AMP XI.M23 recommendations to perform visual inspections of rail system SCs within the scope of license renewal to provide reasonable assurance that (1) loss of material does not occur due to general corrosion or wear; and (2) structural components do not exhibit deformation or cracking.

Enhancement 2. SLRA Section B2.1.13 includes an enhancement to the "scope of program" program element which relates to revision of plant procedures "to specify visual inspections for general corrosion, deformation, cracking, wear and loose or missing fasteners and other conditions indicative of loss of bolting preload for the new fuel transfer elevator." The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.M23 and finds it acceptable because when it is implemented it will be consistent with GALL-SLR Report AMP XI.M23 recommendations to perform visual inspections of the new fuel transfer elevator SCs within the scope of license renewal to provide reasonable assurance that (1) loss of material does not occur due to general corrosion or wear; (2) structural components do not exhibit deformation or cracking; and (3) bolted connections are monitored for cracking, loose bolts, missing or loose nuts, and other conditions indicative of loss of preload.

Based on its audit and 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 Dominion 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 associated with the "scope of program," "parameters monitored or inspected," and "acceptance criteria"

program elements and finds that, when implemented they will make the AMP adequate to manage the applicable aging effects.

Operating Experience. SLRA Section B2.1.13 summarizes the 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. ML19046A433). 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 Dominion should modify its proposed program.

Based on its audit and review of the application, 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 A1.13 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 Dominion committed to revise plant procedures 6 months prior to the subsequent period of extended operation specifying visual inspections:

(1) for the effects of general corrosion, deformation, cracking, and wear on the rails

(2) for general corrosion, deformation, cracking, wear and loose or missing fasteners and other conditions indicative of loss of bolting preload for the new fuel transfer elevator

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 Dominion's Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems program, the staff concludes that those program elements for which Dominion 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 Dominion 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 Compressed Air Monitoring

SLRA Section B2.1.14 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 audit (ADAMS Accession No. ML19128A079), the staff reviewed Dominion's claim of consistency with the GALL-SLR Report. The staff compared the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program

elements of the SLRA to the corresponding program elements of GALL-SLR Report AMP XI.M24. The staff also reviewed the portions of the “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” “acceptance criteria,” and “corrective actions” program elements 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 B2.1.14 includes an enhancement to the “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” “acceptance criteria,” and “corrective actions” program elements which relates to the revision of procedures by including opportunistic visual inspections of internal surfaces of compressed air system components downstream of the dryers to verify the effectiveness of the compressed air system control of moisture (dewpoint) and particulate. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M24 and finds it acceptable because when it is implemented it will be consistent with the GALL-SLR Report recommendations.

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

Operating Experience. SLRA Section B2.1.14 summarizes the operating experience related to the Compressed Air Monitoring program. The staff evaluated operating experience information by reviewing the subsequent license renewal application and conducting an audit (ADAMS Accession No. ML19046A433). 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 Dominion should modify its proposed program beyond that incorporated. Based on its audit and review of the application, 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 A1.14 provides the UFSAR supplement for the Compressed Air Monitoring program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in GALL-SLR Report Table XI-01. The staff also noted that Dominion committed to ongoing implementation of the existing Compressed Air Monitoring program for managing the effects of aging for applicable components during the subsequent period of extended operation. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. On the basis of its review of Dominion’s Compressed Air Monitoring program, the staff concludes that those program elements for which Dominion 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 Dominion 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 Protection System

As amended by letter dated July 17, 2019, SLRA Section B2.1.15 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 audit (ADAMS Accession No. ML19128A079), the staff reviewed Dominion's claim of consistency with the GALL-SLR Report. The staff compared the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements of the SLRA to the corresponding program elements of GALL-SLR Report AMP XI.M26.

For the "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements, the staff needed additional information and issued RAIs. RAIs B2.1.15-1 and B2.1.15-2 and Dominion's responses are documented in ADAMS Accession Nos. ML19164A333 and ML19204A357.

In its response to RAI B2.1.15-1, Dominion stated that loss of material will be managed for fire damper assemblies using the Fire Protection program and revised SLRA Table 3.3.2-29 by including aging management of loss of material for the steel fire damper assemblies.

During its evaluation of Dominion's response to RAI B2.1.15-1, the staff noted that Dominion did not cite the remaining aging effects listed in NUREG 2191, item A-789 (cracking or hardening, loss of strength, and shrinkage due to elastomer degradation) as applicable aging effects; however, these aging effects are not applicable to steel. The staff also noted that Dominion amended SLRA Section B2.1.15 by adding an enhancement to address management of aging effects for fire damper housings. The staff's evaluation of this enhancement is addressed below. The staff finds Dominion's response and changes to SLRA Table 3.3.2-29 acceptable because it requires management of the applicable aging effects for steel fire damper assemblies (i.e., not just the housing), which is consistent with GALL-SLR Report AMP XI.M26.

In its response to RAI B2.1.15-2, Dominion stated that procedures will be revised to address gaps in the "monitoring and trending," "acceptance criteria," and "corrective actions" program elements. During its evaluation of Dominion's response to RAI B2.1.15-2, the staff noted that Dominion amended Section B2.1.15 by including enhancements to the aforementioned program elements.

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 enhancements to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of these three enhancements follows.

Enhancement 1. SLRA Section B2.1.15, as amended by letter dated July 17, 2019, in response to RAI B2.1.15-2, includes an enhancement to the "parameters monitored or inspected,"

“detection of aging effects,” and “acceptance criteria” program elements that relates to revising procedures to address managing loss of material for fire damper assemblies. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M26 and finds it acceptable because when it is implemented it will include management of loss of material for portions of the fire damper assemblies other than just the fire damper housing.

Enhancement 2. SLRA Section B2.1.15, as amended by letter dated July 17, 2019, in response to RAI B2.1.15-2, includes an enhancement to the “monitoring and trending” and “acceptance criteria” program elements that relates to revising procedures by including trending of air flow test data and specifying acceptance criteria for carbon dioxide and halon systems. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M26 and finds it acceptable because when it is implemented it will require trending of air flow test data and specify acceptance criteria as no indications of excessive loss of material for halon and carbon dioxide systems, which are consistent with GALL-SLR Report AMP XI.M26.

Enhancement 3. SLRA Section B2.1.15, as amended by letter dated July 17, 2019, in response to RAI B2.1.15-2, includes an enhancement to the “monitoring and trending,” “acceptance criteria,” and “corrective actions” program elements that relates to revising procedures to require assessments for additional inspections and criteria for scope expansion. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M26 and finds it acceptable because when it is implemented it will require: (a) additional inspections to be conducted if one of the inspections does not meet acceptance criteria, (b) evaluation of the adequacy of the sampling bases, (c) a scope expansion to include additional seals if degradation is detected within the inspection sample of penetration seals, and (d) inspection frequencies to be adjusted if any projected inspection results will not meet acceptance criteria, which is consistent with GALL-SLR Report AMP XI.M26.

The staff conducted an audit (ADAMS Accession No. ML19128A079) to verify Dominion’s claim of consistency with the GALL-SLR Report. Based on a review of the SLRA, amendments, and Dominion’s responses to RAIs B2.1.15-1 and B2.1.15-2, 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 Dominion 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 “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” “acceptance criteria,” and “corrective actions” program elements and finds that, when implemented, they will make the AMP adequate to manage the applicable aging effects.

Operating Experience. SLRA Section B2.1.15 summarizes the operating experience related to the Fire Protection program. The staff evaluated operating experience information by reviewing the subsequent license renewal application and conducting an audit (ADAMS Accession No. ML19046A433). 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 Dominion should modify its proposed program.

UFSAR Supplement. SLRA Section A1.15, as amended in letter dated September 3, 2019 (ADAMS Accession No. ML19253B330), provides the UFSAR supplement for the Fire Protection program.

The staff reviewed this UFSAR supplement description of the program, as amended, and noted that it is consistent with the recommended description in GALL-SLR Report Table XI-01.The staff also noted that Dominion committed to implement enhancements related to the Fire Protection program 6 months prior to the subsequent period of extended operation. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. On the basis of its review of Dominion's Fire Protection program, the staff concludes that those program elements for which Dominion 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 Dominion 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 Fire Water System

SLRA Section B2.1.16 states that the Fire Water System program is an existing program with enhancements that will be consistent with the program elements in the GALL-SLR Report AMP XI.M27, "Fire Water System," except for the exceptions identified in the SLRA. Dominion amended this SLRA section by letters dated January 29, 2019 (SLRA Change Notice No. 1; ADAMS Accession No. ML19042A137); April 2, 2019 (SLRA Change Notice No. 2; ADAMS Accession No. ML19095A666); June 10, 2019 (SLRA Change Notice No. 3; ADAMS Accession No. ML19168A028); and September 3, 2019 (ADAMS Package Accession No. ML19253B330), which was superseded by a letter dated September 19, 2019 (ADAMS Accession No. ML19269B734), and October 14, 2019 (SLRA Change Notice No. 4; ADAMS Accession No ML19294A044).

Staff Evaluation. During its audit (ADAMS Accession No. ML19128A079), the staff reviewed Dominion's claim of consistency with the GALL-SLR Report. The staff compared the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements of the SLRA to the corresponding program elements of GALL-SLR Report AMP XI.M27.

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 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 17 exceptions and enhancements is as follows.

Exception 1. As amended by letter dated June 10, 2019 (ADAMS Accession No. ML19168A028), this exception was deleted. SLRA Section B2.1.16 included an exception to the "detection of aging effects" program element related to inspection of the insulated carbon

steel fire water storage external surfaces. However, as stated in Enhancement 7, the tank insulation will be removed prior to entry into the subsequent period of extended operation. See the staff's evaluation of examinations of the external surfaces of the tanks in Enhancement 7.

Exception 2. SLRA Section B2.1.16 includes an exception to the "detection of aging effects" program element related to the extent of periodic main drain tests (i.e., 20 percent of the standpipes and risers every refueling outage).

During its review of plant-specific operating experience, the staff noted six instances of flow blockage in the fire water system piping. Based on further reviews during the onsite audit and as confirmed by the applicant (ADAMS Accession No. ML19169A329), in all but two of the examples, the debris accumulated in low point or end of header locations and were associated with small diameter piping. The other two examples were associated with: (a) strainers in a test line with a finer mesh than that recommended for fire water systems with makeup from well water; and (b) a vent location where the weldolet was not properly installed and the connection to the piping had to be drilled out. In all six examples, the function of downstream sprinklers was not impacted.

The staff reviewed this exception against the corresponding program element in GALL-SLR Report AMP XI.M27 and finds it acceptable because: (a) the quantity of tests is consistent with the number of recommended tests or inspections (i.e., 20 percent) in several sampling-based AMPs (e.g., XI.M38); (b) the periodicity is consistent with GALL-SLR Report AMP XI.M27 footnote 10; and (c) the number of main drain tests being conducted on a refueling outage interval in lieu of 12 months is sufficient to establish a trend if potential flow blockage is occurring.

Enhancement 1. SLRA Section B2.1.16 includes an enhancement to the "parameters monitored or inspected," "detection of aging effects," "acceptance criteria," and "corrective actions" program elements related to the criteria for replacement of sprinklers when adverse inspection results are detected. As amended by SLRA Change Notice No. 1, Dominion deleted this enhancement because the procedures have been revised to be consistent with NFPA 25, Section 5.2.1.1. During the audit (ADAMS Accession No. ML19128A079), the staff confirmed Dominion's claim based upon its review of the plant-specific procedure for visual inspections of fire protection sprinklers.

Enhancement 2. SLRA Section B2.1.16 includes an enhancement to the "parameters monitored or inspected," "detection of aging effects," "acceptance criteria," and "corrective actions" program elements related to testing of sprinkler heads. As amended by SLRA Change Notice No. 2, the enhancement states that a one-time inspection will be conducted with either a sample size of 3 percent or a maximum of 10 sprinklers at each unit, with no more than 4 sprinklers per structure being tested. Testing will be based on a minimum time in service of 50 years and severity of operating conditions for each population. The staff noted that the enhancement provides necessary information to AMP XI.M27, Table XI.M27-1, for a one-time inspection of sprinklers exposed to potentially corrosive water (reference NFPA 25 Section 5.3.1.1.2). The staff also noted that NFPA 25 Section 5.3.1.2., states that a representative sample for testing consists of a minimum of not less than four sprinklers or 1 percent of the number of sprinklers per individual sprinkler sample, whichever is greater. The staff further noted testing or inspecting components at 50 years of service is consistent with the recommendations in GALL-SLR Report AMP XI.M32, "One-Time Inspection."

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, coupled with the sprinklers being tested prior to 50 years in service (with additional representative samples tested at 10-year intervals), it will provide a sufficient sample size (3 percent up to maximum of 20 sprinklers between the units) with sufficient inservice time to determine if the fire water system water is corrosive enough to impact the intended function of the sprinklers.

Enhancement 3. SLRA Section B2.1.16 includes an enhancement to the "parameters monitored or inspected," "detection of aging effects," "acceptance criteria," and "corrective actions" program elements related to: (a) standpipe and hose station flow tests; (b) acceptance criteria for main drain tests; (c) criteria for the extent of condition testing when acceptance criteria are not met; and (d) the scope of main drain 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 will be consistent with the recommendations in GALL-SLR Report AMP XI.M27 and, as a result, the tests cited in the enhancement can be capable of detecting and, as necessary, determining the extent of degraded conditions.

Enhancement 4. As amended by SLRA Change Notice No. 2; SLRA Section B2.1.16 includes an enhancement to the "parameters monitored or inspected," "detection of aging effects," "acceptance criteria," and "corrective actions" program elements related to: (a) internal visual inspections of sprinkler and deluge system piping; (b) followup actions related to internal visual inspections; (c) criteria for conducting an obstruction investigation; (d) criteria for conducting followup flushes; and (e) specifying that the scope of internal visual inspections includes portions of the wet pipe sprinkler systems, pre-action sprinkler systems, and deluge systems. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M27 and finds it acceptable because when it is implemented internal visual inspections will be consistent with the recommendations in GALL-SLR Report AMP XI.M27 and, as a result, these inspections can be capable of detecting internal corrosion, foreign material, and obstructions to flow. The originally numbered Enhancement 9 was renumbered as Enhancement 10 and was incorporated into this enhancement by SLRA Change Notice No. 2.

Enhancement 5. (renumbered from Enhancement 4 by SLRA Change Notice No. 2). SLRA Section B2.1.16 includes an enhancement to the "parameters monitored or inspected," "detection of aging effects," and "monitoring and trending" program elements related to flow rates and monitoring a flow resistance factor during system flow 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 it will be consistent with the recommended test procedures for underground and exposed flow tests cited in GALL-SLR Report AMP XI.M27 Table XI.M27-1 and, as a result, the test results will provide consistent trend data.

Enhancement 6. (renumbered from Enhancement 5 by SLRA Change Notice No. 2). SLRA Section B2.1.16 includes an enhancement to the "parameters monitored or inspected," "detection of aging effects," and "monitoring and trending" program elements related to fire hydrant flushing. 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 flushing procedures will be consistent with GALL-SLR Report AMP XI.M27, Table XI.M27-1 and, as a result, the flushes can be capable of clearing potential foreign

material. During the audit (ADAMS Accession No. ML19128A079), the staff reviewed the plant-specific procedures for hydrant flushing to confirm Dominion's claim. The staff noted that the plant-specific procedures had been revised to address hydrant flushing, consistent with AMP XI.M27, except for a requirement to pump down a hydrant if the barrel had not drained in 60 minutes. By letter dated June 10, 2019, Dominion stated:

> Where soil conditions or other factors are such that a hydrant barrel does not drain within 60 minutes, or where groundwater level is above that of the hydrant drain, the hydrant drain shall be plugged and the water in the barrel shall be pumped out. Dry barrel hydrants that will be subject to freezing weather and have plugged drains shall be identified clearly as needing pumping after operation.

The staff finds this change acceptable because it is consistent with GALL-SLR Report AMP XI.M27 and, as a result, it provides adequate freeze protection after hydrant flushes. As amended by SLRA Change Notice No. 1, Dominion deleted this enhancement because the procedures have been revised to be consistent with NFPA 25, Section 7.3.2.

Enhancement 7. (renumbered from Enhancement 6 by SLRA Change Notice No. 2). As amended by letter dated June 10, 2019, SLRA Section B2.1.16 includes an enhancement to the "parameters monitored or inspected," and "detection of aging effects" program elements related to: (a) removing the insulation on the exterior surfaces of the fire water storage tanks prior to the subsequent period of extended operation; (b) conducting external visual inspections of the tank external surfaces on a refueling outage interval; (c) conducting wall thickness measurements on external surfaces exhibiting unexpected degradation; and (d) refurbishing or recoating the external surface of the tanks consistent with the severity of the degradation identified and commensurate with the potential for loss of intended function. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M27 and finds it acceptable as follows. Removing the insulation will provide access for visual inspections to be conducted on the external surfaces of the tanks exposed to outdoor air. Although NFPA 25 states that exterior surface examinations should be conducted on an annual basis, conducting inspections on a refueling outage basis is consistent with GALL-SLR Report AMP XI.M29, "Outdoor and Large Atmospheric Metallic Storage Tanks." The acceptance criterion for conducting wall thickness measurements and followup repairs are consistent with GALL-SLR Report AMPs XI.M27 and XI.M29. As a result, there is reasonable assurance that loss of material will be adequately managed for these tanks.

Enhancement 8. (renumbered from Enhancement 7 by SLRA Change Notice No. 2). SLRA Section B2.1.16 includes an enhancement to the "parameters monitored or inspected" and "detection of aging effects" program elements related to flushing of mainline strainers. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M27 and finds it acceptable because when it is implemented it will be consistent with GALL-SLR Report AMP XI.M27, Table XI.M27-1 and, as a result, the flushes can be capable of clearing potential foreign material. As amended by SLRA Change Notice No. 1, Dominion deleted this enhancement because the procedures have been revised to be consistent with NFPA 25, Sections 10.2.1.7 and 10.2.7, which require mainline strainers to be inspected every 5 years. During the audit, the staff confirmed Dominion's claim based upon its review of the plant-specific procedures.

Enhancement 9. (renumbered from Enhancement 8 by SLRA Change Notice No. 2). SLRA Section B2.1.16 includes an enhancement to the "parameters monitored or inspected" and "detection of aging effects" program elements related to testing of the Turbine Building oil

deluge 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 GALL-SLR Report AMP XI.M27, Table XI.M27-1 and, as a result, will provide assurance that the Turbine Building oil deluge systems will be able to perform their intended function in the event of a building fire. The originally numbered Enhancement 9 was renumbered to 10 and then relocated to Enhancement 4 in SLRA Change Notice No. 2.

<u>Enhancement 10</u>. (renumbered to Enhancement 11 by SLRA Change Notice No. 2 then renumbered back to Enhancement 10 by SLRA Change Notice No. 3). SLRA Section B2.1.16 includes an enhancement to the “detection of aging effects” program element related to inspection parameters. 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: (a) be consistent with the recommendations for inspection parameters cited in GALL-SLR Report AMP XI.M27 and (b) provide additional direction related to viewing aids for inspections conducted at a distance and from unique viewing angles.

<u>Enhancement 11</u>. (renumbered to Enhancement 12 by SLRA Change Notice No. 2 then renumbered back to Enhancement 11 by SLRA Change Notice No. 3). SLRA Section B2.1.16 includes an enhancement to the “detection of aging effects” program element related to reconfiguration of the Unit 1 hydrogen seal oil and main transformer 1A deluge sprinkler piping. As amended by letter dated June 10, 2019, the enhancement states that: (a) during the reconfiguration, visual inspections and wall thickness measurements will be performed on the Unit 1 hydrogen seal oil piping that does not allow drainage; (b) wall thickness examination will be performed of the Unit 1 main transformer deluge sprinkler piping that does not allow drainage; and (c) piping with unexpected degradation will be replaced. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M27 and finds it acceptable as follows. When it is implemented, the piping modifications will result in the piping being able to drain and, as a result, minimize the potential for loss of material and flow blockage. The inspections conducted during the reconfiguration can ensure that potential past degradation due to drainage configuration issues will not impact the ability of the piping to perform its intended function.

<u>Enhancement 12</u>. (renumbered from Enhancement 13 by SLRA Change Notice 3). As amended by SLRA Change Notice No.2, SLRA Section B2.1.16 includes an enhancement to the “detection of aging effects” program element related to qualification requirements for individuals conducting specific inspections and tests. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M27 and finds it acceptable because, consistent with GALL-SLR Report AMP XI.M27, inspections and tests are to be performed by personnel qualified in accordance with plant-specific procedures.

<u>Enhancement 13</u>. *(*renumbered from Enhancement 14 by SLRA Change Notice 3). As amended by SLRA Change Notice No.2, SLRA Section B2.1.16 includes an enhancement to the “detection of aging effects” program element related to followup actions when degraded coatings are detected. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M27 and finds it acceptable because consistent with Table XI.M27 Footnote 4, acceptance criteria and corrective actions of GALL-SLR Report AMP XI.M42 are recommended in lieu of those in NFPA 25 Sections 9.2.7 (1), (2), and (4).

<u>Enhancement 14</u>. As added by letter dated September 3, 2019, SLRA Section B2.1.16 includes an enhancement to the “detection of aging effects” program element related to monitoring the activity of the jockey pump consistent with the “detection of aging effects” program element of

GALL-SLR Report AMP XI.M41, “Buried and Underground Piping and Tanks.” The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M27 and AMP XI.M41 and finds it acceptable because, consistent with AMP XI.M41, monitoring the performance of the jockey pump can provide insights into potential leaks in the Fire Water System.

Enhancement 15. (renumbered from Enhancement 12 to Enhancement 14 by SLRA Change Notice 2 and from Enhancement 14 to 15 by letter dated September 3, 2019). SLRA Section B2.1.16 includes an enhancement to the “detection of aging effects” and “acceptance criteria” program elements related to recurring internal corrosion. This enhancement was renumbered from No. 14 to No. 15 by letter dated September 3, 2019. 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 extent of wall thickness screening (e.g., low frequency electromagnetic testing); followup localized wall thickness measurements based on inspection results; and periodicity of the inspections can provide data that can be trended to detect the potential for degraded wall thickness.

Based on its audit and review of the SLRA, and change notices, 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 Dominion claimed consistency with the GALL-SLR Report are consistent with the corresponding program elements of GALL-SLR Report AMP XI.M27. The staff also reviewed the exception associated with the “detection of aging effects” program element, and their justifications, and finds that the AMP, with the exception, is adequate to manage the applicable aging effects. In addition, the staff reviewed the enhancements associated with the “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” “acceptance criteria,” and “corrective actions” program elements and finds that when implemented, they will make the AMP adequate to manage the applicable aging effects.

<u>Operating Experience</u>. As amended by letter dated October 14, 2019, SLRA Section B2.1.16 summarizes the operating experience related to the Fire Water System program. The staff evaluated the operating experience information by reviewing the subsequent license renewal application and conducting an audit (ADAMS Accession No. ML19046A433). During the audit, the staff independently searched plant-specific operating experience information to determine whether any previously unknown or recurring aging effects were identified.

During the audit, and as confirmed by the applicant (ADAMS Accession No. ML19198A059), the staff noted the following in relation to the operating experience summary describing degradation of the tank bottom surfaces: (a) the wall thickness measurements in 2008 and 2014 did not account for the fact that there were laminations and recorded the thickness of the top lamination layer and not the entire thickness of the tank bottom plates; (b) as a result, the expected life of the tanks was projected to not meet the end of the period of extended operation; (c) in 2019, thickness measurements were obtained on the bottom plates and the bottom course of the tank shell; (d) based on an analysis of the measurements, the expected remaining life of the tanks is 55 years for 01-FP-TK-1A and 66 years for 01-FP-TK-1B. The staff finds that managing the thickness of the tank bottom surfaces with the Outdoor and Large Atmospheric Metallic Storage Tanks program (i.e., tank bottom thickness measurements every 10 years) and conducting internal tank inspections every 5 years with the Fire Water System program is acceptable because the follow-on inspections will occur well before the projected end of life of the tanks.

During the audit, and as confirmed by Dominion (ADAMS Accession No. ML19198A059), the staff noted the following in relation to the operating experience summary describing adverse test results associated with the motor driven fire pump tests. Based on the staff's review of 5 years of total dynamic head (TDH) testing results for both the motor driven and diesel driven fire pumps, the staff finds that the system pressure anomalies will not result in a challenge to the fire water system meeting its intended function because: (a) for the diesel driven pump tests, the variability of the TDH results at both the 2,500 and 3,050 gallons per minute test runs were not indicative of an increase in flow blockage in the fire main piping; (b) for the motor driven pump tests there were two anomalous results, which were preceded and followed by lower system pressure and therefore not indicative of an increase in flow blockage in the fire main piping; and (c) the changes incorporated in Enhancement 4 (i.e., perform system flow testing at flows representative of those expected during a fire, calculating and trending a flow resistance factor (C-factor)) can be used to demonstrate that adverse flow blockage does not occur in the fire main piping.

During the operating experience audit, the staff noted a significant number of indications of potential underground fire water system piping leaks. During the audit, and as confirmed by the applicant (ADAMS Accession No. ML19046A433), the staff noted that none of the leaks or potential leaks were associated with aging effects managed by the Fire Water System program. The leaks were dispositioned by: (a) replacing O-rings or packing, (b) tightening of joint bolting, (c) or verified not to be occurring based on subsequent walkdowns. Subsequent to the audit, a pipe rupture occurred in the buried piping as result of loss of material due to selective leaching. The corrective actions and the staff's review of these actions are addressed in the Selective Leaching program (SER Section 3.0.3.1.6).

During the operating experience audit, the staff noted six instances of sprinkler head leakage. Based on further reviews during the onsite audit (ADAMS Accession No. ML19169A329) and confirmed by the applicant (ADAMS Accession No. ML19046A433) in all but one of the examples, the staff concluded that none of the examples were related to aging effects. In one example, the sprinkler was replaced under minor maintenance, however, detailed work order documentation was not available.

During its review of the annual update letter dated October 14, 2019, the staff noted that Dominion revised the program's operating experience section by adding a discussion about two ruptures of the fire protection system piping. Based on Dominion's determination that the ruptures were due to external corrosion from long standing exposure of the cast iron piping to moist or wet soil, which is not managed by the Fire Water System program, the staff's evaluation of this operating experience is documented in SER Sections 3.0.3.1.6 (Selective Leaching) and 3.0.3.2.20 (Buried and Underground Piping and Tanks).

Based on its audits and review of the application, the staff finds that the conditions and operating experience at the plant were bounded by those for which the Fire Water System program was evaluated.

UFSAR Supplement. SLRA Section A1.16 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.

As amended by SLRA Change Notice No. 2, the staff also noted that Dominion committed to incorporate the above-cited enhancements into the existing Fire Water System program. As amended by letter dated June 10, 2019, Dominion stated that the training and qualification of

individuals conducting noncementitious coating and lining inspections will be qualified in accordance with ASTM International Standards endorsed in RG 1.54 along with guidance from the staff associated with a particular standard. The staff finds this change acceptable because these qualifications are consistent with AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks."

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 Dominion's Fire Water System program, the staff concludes that those program elements for which Dominion 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. 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 Dominion 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 Outdoor and Large Atmospheric Metallic Storage Tanks

SLRA Section B2.1.17 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," except for the exceptions identified in the SLRA. Dominion amended this SLRA section by letter dated July 17, 2019.

Staff Evaluation. During its audit (ADAMS Accession No. ML19128A079), the staff reviewed Dominion'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.M29.

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 these two exceptions and six enhancements follows.

Exception 1. SLRA Section B2.1.17 includes an exception to the "preventive actions," "parameters monitored or inspected," "detection of aging effects," "acceptance criteria," and "corrective actions" program elements related to sealant or caulking applied at the interface between the tank external surface and concrete or earthen surface. The staff reviewed this exception against the corresponding program elements in GALL-SLR Report AMP XI.M29 and finds it acceptable because the intended function of the sealant or caulking to mitigate corrosion is already met since: (a) the emergency condensate storage tanks (ECSTs) and emergency condensate makeup tanks (ECMTs) are insulated from the outside atmosphere by 2 inches of

expansion joint filler foam and surrounded by a 2-ft thick layer of concrete that provides missile protection, and (b) the refueling water storage tanks (RWSTs) are insulated and jacketed, sealant is used at the interface between the jacketing and concrete foundation, the bottom surface is protected by an oil sand cushion and caulk at the interface between the tank external surface and concrete surface, and an inspection of the caulk at the tank and concrete foundation interface will be included when the RWST external insulation is removed and sampled for external surface visual examinations.

Exception 2. SLRA Section B2.1.17 includes an exception to the “detection of aging effects” program element related to visual and volumetric inspection techniques to identify degradation on the carbon steel tank external surfaces located outdoors on soil or concrete. The ECSTs and ECMTs are encased in 2-ft thick reinforced concrete missile barriers with expansion joint filler foam between the external tank walls and concrete missile barrier. Therefore, the external surfaces of the ECMTs and ECSTs are not readily available for visual and volumetric examinations of their external surfaces. The staff needed additional information, and issued an RAI. RAI B2.1.17-1 and Dominion’s response are documented in ADAMS Accession No. ML19164A333 and ML19204A357.

During the onsite audit (ADAMS Accession No. ML19169A329), the staff identified condensation at one weep hole on each of the ECSTs. Upon investigation, Dominion staff concluded that the condensation was the result of leakage through the access plug on top of the missile barrier down to the weep hole. This resulted in the issuance of RAI B2.1.17-1. In its response, Dominion revised Section B2.1.17 by including one-time thickness measurements of a sample of the vertical wall of the ECSTs prior to the subsequent period of extended operation to assess potential degradation due to removable access plug leakage.

During its evaluation of Dominion’s response to RAI B2.1.17-1, the staff noted that the sample of measurements will examine the vertical steel shell region between the three weep holes at the tank bottom associated with removable access plug leakage and vertically from that tank bottom junction to a distance of 6 ft along the vertical shell at the tank. In addition, the results will be projected to the end of the subsequent period of extended operation and any degradation not meeting acceptance criteria will require periodic 10-year thickness measurements. The staff finds Dominion’s response and changes to Section B2.1.17 acceptable because these inspections provide reasonable assurance that any degradation of the ECSTs due to the access plug leakage is identified prior to a loss of intended function, which is consistent with GALL-SLR Report AMP XI.M29.

The staff reviewed this exception against the corresponding program elements in GALL-SLR Report AMP XI.M29 and finds it acceptable because the missile shielding and expansion joint filler foam on the ECSTs and ECMTs, inspection of the weep holes and accessible external tank surfaces visible from the ECST and ECMT piping penetration houses, bottom thickness measurements of the ECST and ECMTs, and the one-time thickness measurements to address access plug leakage on the ECSTs, can provide reasonable assurance that degradation of the ECSTs and ECMTs is identified prior to a loss of intended function, which is consistent with GALL-SLR Report AMP XI.M29.

Enhancement 1. SLRA Section B2.1.17 includes an enhancement to the “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” “acceptance criteria,” and “corrective actions” program elements which relates to revising procedures to require periodic visual inspections of the RWSTs each refueling outage to confirm that insulation caulking and sealant at the RWST concrete foundation is intact. The staff reviewed this enhancement

against the corresponding program elements in GALL-SLR Report AMP XI.M29 and finds it acceptable because when it is implemented it can provide reasonable assurance that caulking and sealant is intact to mitigate corrosion, which is consistent with GALL-SLR Report AMP XI.M29.

Enhancement 2. SLRA Section B2.1.17 includes an enhancement to the “detection of aging effects” program element which relates to revising procedures to require visual and surface examination of the exterior surfaces of the RWSTs and chemical addition tanks (CATs) to identify any loss of material or cracking. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M29 and finds it acceptable because when it is implemented it will require a sample of inspections of the exterior surfaces of the RWSTs and CATs and subsequent inspections that can identify evidence of moisture intrusion and damage of insulation, which provides reasonable assurance that loss of material and cracking will be managed.

Enhancement 3. SLRA Section B2.1.17 includes an enhancement to the “detection of aging effects” program element which relates to revising procedures to require ECST weep hole inspections for water leakage and condensation each refueling cycle and corrective action if excessive leakage is observed. This enhancement also includes visual inspections of the ECSTs through the piping penetration house each refueling outage and bottom thickness measurements of the ECMTs and ECSTs during each 10-year period starting 10 years prior the subsequent period of extended operation. In response to RAI B2.1.17-1 discussed above, this enhancement was amended by including one-time thickness measurements of the ECSTs to address potential degradation due to removable access plug leakage. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M29 and finds it acceptable because when it is implemented it can provide inspections that are capable of identifying leakage and potential degradation from any leakage.

Enhancement 4. SLRA Section B2.1.17 includes an enhancement to the “detection of aging effects” program element which relates to revising procedures to require bottom thickness measurements of the fire water storage tanks (FWSTs) and RWSTs for each 10-year period during the subsequent period of extended operation starting 10 years 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 when it is implemented it will require periodic bottom thickness measurements of the FWSTs and RWSTs, which can provide reasonable assurance that the intended function of these tanks will be maintained.

Enhancement 5. SLRA Section B2.1.17 includes an enhancement to the “detection of aging effects” program element which relates to revising procedures to provide non-ASME Code inspection guidance related to lighting, distance, offset, and surface condition. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M29 and finds it acceptable because when it is implemented it will require adequate inspection conditions to be established, providing additional assurance that inspections are capable of identifying applicable aging effects.

Enhancement 6. SLRA Section B2.1.17 includes an enhancement to the “corrective actions” program element which relates to developing a new procedure to specify additional inspections, described as follows. If any inspections do not meet acceptance criteria, additional inspections are conducted if one of the inspections does not meet acceptance criteria due to current or projected degradation. For inspections where only one tank of a material, environment, and

aging effect was inspected, all tanks in that grouping are inspected. For other sampling-based inspections, there will be no fewer than five additional inspections for each inspection that did not meet acceptance criteria, or 20 percent of each applicable material, environment, and aging effect combination, whichever is less. The enhancement also includes provisions for revising the timing of future inspections when projected results do not meet acceptance criteria. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M29 and finds it acceptable because when it is implemented it will require corrective actions to be taken that can provide reasonable assurance the inspections will identify degradation in the tanks within the scope of this AMP.

Based on its audits and review of the SLRA and Dominion's response to RAI B2.1.17-1, 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 Dominion claimed consistency with the GALL-SLR Report are consistent with the corresponding program elements of GALL-SLR Report AMP XI.M29. The staff also reviewed the exceptions associated with the "preventive actions," "parameters monitored or inspected," "detection of aging effects," "acceptance criteria," and "corrective actions" program elements, and their justifications, and finds that the AMP, with the exceptions, is adequate to manage the applicable aging effects. In addition, the staff reviewed the enhancements associated with the "preventive actions," "parameters monitored or inspected," "detection of aging effects," "acceptance criteria," and "corrective actions" program elements and finds that, when implemented, they will make the AMP adequate to manage the applicable aging effects.

Operating Experience. SLRA Section B2.1.17 summarizes the operating experience related to the Outdoor and Large Atmospheric Metallic Storage Tanks program. The staff evaluated operating experience information by reviewing the subsequent license renewal application and conducting an audit (ADAMS Accession No. ML19046A433). During the audit, the staff independently searched plant-specific operating experience information to determine whether any previously unknown or recurring aging effects were identified.

Based on its audit and review of the application, and review of Dominion's response to RAI B2.1.17-1, 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 A1.17 provides the UFSAR supplement for the Outdoor and Large Atmospheric Metallic Storage Tanks program.

The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in GALL-SLR Report Table XI-01.

The staff also noted that Dominion committed to implement its proposed enhancements for the Outdoor and Large Atmospheric Metallic Storage Tanks program, to implement the program and begin inspections or test 10 years prior to the subsequent period of extended operation, and to complete inspections or tests that are to be completed prior to the subsequent period of extended operation at least 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 review of Dominion's Outdoor and Large Atmospheric Metallic Storage Tanks program, the staff concludes that those program elements for which Dominion 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. 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 Dominion 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).

3.0.3.2.14 Fuel Oil Chemistry

SLRA Section B2.1.18 states that the Fuel Oil Chemistry program is an existing program with enhancements that will be consistent, with the program elements in the GALL-SLR Report AMP XI.M30, "Fuel Oil Chemistry," except for the exceptions identified in the SLRA. Dominion amended this SLRA section by letters dated April 2, 2019 (ADAMS Accession No. ML19095A666), and June 27, 2019 (ADAMS Accession No. ML19183A440).

Staff Evaluation. During its audit (ADAMS Accession No. ML19128A079), the staff reviewed Dominion's claim of consistency with the GALL-SLR Report. The staff compared the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements of the SLRA to the corresponding program elements of GALL-SLR Report AMP XI.M30.

For the "monitoring and trending" program element, the staff needed additional information, and issued an RAI. RAI B2.1.18-1 and Dominion's response are documented in ADAMS Accession No. ML19183A440.

In its response, Dominion stated that using ASTM standard D1796-83, "Standard Test Method for Water and Sediment in Fuel Oils by the Centrifuge Method (Laboratory Procedure)" to test for water and sediment for Grade No. 2-D fuel oil is acceptable because the use of a higher pre-heat temperature for the sample being tested should improve centrifugal separation and would not invalidate the test results.

During its evaluation of Dominion's response to RAI B2.1.18-1, the staff noted that the higher pre-heat temperature will reduce the density and viscosity for both the fuel oil and water in the sample being tested. Additionally, the higher pre-heat temperature reduces the density and viscosity of the fuel oil more than the water. Therefore, this increases the efficiency of the centrifugal separation of the fuel oil and water. The staff finds Dominion's response acceptable because the higher pre-heat temperatures for samples of fuel oil specified in ASTM standard D1796-83, instead of D2709-16, "Standard Test Method for Water and Sediment in Middle Distillate Fuels by Centrifuge," will provide accurate results with regard to the amount of water and sediment in the sample of fuel oil.

For a discussion of RAIs B2.1.28-5 and B2.1.28-5a regarding the potential degradation of the solvent based rust preventive film, see SER Section 3.0.3.2.22, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks."

The staff also reviewed the portions of the “scope of program,” “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” “acceptance criteria,” and “corrective actions” program elements associated with 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 one exception and seven enhancements is as follows.

Exception 1. SLRA Section B2.1.18 includes an exception to the “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” and “acceptance criteria” program elements related to limited accessibility of certain fuel oil tanks that inhibits internal cleaning and inspection. The staff reviewed this exception against the corresponding program elements in GALL-SLR Report AMP XI.M30 and finds it acceptable because appropriate controls are provided for the applicant to be able to detect and mitigate leakage from the tanks to maintain the function of the tanks.

Enhancement 1. SLRA Section B2.1.18 includes an enhancement to the “scope of program” program element to incorporate the emergency diesel generator (EDG) fuel oil base tanks into the Fuel Oil Chemistry program. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M30 and finds it acceptable because when it is implemented it will include the appropriate scope of tanks to be included within the scope of the program in the GALL-SLR Report.

Enhancement 2. SLRA Section B2.1.18 includes an enhancement to the “parameters monitored or inspected” program element to incorporate quarterly particulates and water sampling of EDG auxiliary fuel oil tanks and base tanks into existing procedures. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M30 and finds it acceptable because when it is implemented it will be consistent with recommendations in the GALL-SLR Report to perform periodic testing for particulates and water.

Enhancement 3. SLRA Section B2.1.18 includes an enhancement to the “detection of aging effects,” “monitoring and trending,” and “acceptance criteria” program elements to require draining, cleaning, and visual inspection on a 10-year interval for the underground fuel oil storage tanks, and the alternate alternating current (AC) diesel generator fuel oil tank. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M30 and finds it acceptable because when it is implemented it will be consistent with recommendations in the GALL-SLR Report to drain, clean, and visually inspect fuel oil tanks.

Enhancement 4. SLRA Section B2.1.18 includes an enhancement to the “detection of aging effects,” “monitoring and trending,” and “acceptance criteria” program elements to perform bottom thickness measurements on the EDG auxiliary fuel oil tanks, diesel fire pump fuel oil tank, and the emergency service water pump fuel oil tank every 10 years. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M30 and finds it acceptable because when it is implemented it will be consistent with recommendations in the GALL-SLR Report to conduct periodic bottom thickness measurements of fuel oil tanks.

Enhancement 5. SLRA Section B2.1.18 includes an enhancement to the “detection of aging effects,” “monitoring and trending,” and “acceptance criteria” program elements to develop a procedure that will require an engineering evaluation to document, evaluate, and trend visual and volumetric inspection results for several fuel oil storage tanks as listed in the SLRA. The

staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M30 and finds it acceptable because when it is implemented it will be consistent with recommendations in the GALL-SLR Report to trend and evaluate results from visual and volumetric inspections of fuel oil tanks.

Enhancement 6. SLRA Section B2.1.18 includes an enhancement to the “detection of aging effects” and “acceptance criteria” program elements to perform a one-time visual inspection on one EDG fuel oil base tank using a borescope or equivalent instrument. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M30 and finds it acceptable because when it is implemented it will be consistent with recommendations in the GALL-SLR Report to visually inspect the interior of an EDG fuel oil base tank to the extent allowed by physical limitations.

Enhancement 7. SLRA Section B2.1.18 includes an enhancement to the “corrective actions” program element to revise procedures to require a biocide be added to a tank when biological activity is detected or there is evidence of internal tank corrosion. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M30 and finds it acceptable because when it is implemented it will be consistent with recommendations in the GALL-SLR Report to add a biocide to the fuel oil when biological activity or microbiologically influenced corrosion (MIC) is detected.

Based on its audit and review of the SLRA, its April 2, 2019 supplement, and Dominion’s response to RAI B2.1.18-1 against the corresponding program elements of GALL-SLR Report AMP XI.M30 the staff finds that the program elements of the Fuel Oil Chemistry program for which Dominion claimed consistency with the GALL-SLR Report are consistent. The staff also reviewed the exception between Dominion’s program and GALL-SLR Report XI.M30 associated with the “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” “acceptance criteria,” and “corrective actions” program elements, and its justification, and finds that the AMP, with the exception, is adequate to manage the applicable aging effects. In addition, the staff reviewed the enhancements associated with the “scope of program,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” “acceptance criteria,” and “corrective actions” program elements and finds that, when implemented, they will make the AMP adequate to manage the applicable aging effects.

Operating Experience. SLRA Section B2.1.18 summarizes operating experience related to the Fuel Oil Chemistry program. The staff evaluated operating experience information by reviewing the subsequent license renewal application and conducting an audit (ADAMS Accession No. ML19046A433). 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 Dominion should modify its proposed program beyond that incorporated. Based on its audit and review of the application, and review of Dominion’s response to RAI B2.1.18-1, 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 A1.18 provides the UFSAR supplement for the Fuel Oil Chemistry program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in GALL-SLR Report Table XI-01. The staff also noted that Dominion committed to ongoing implementation of the existing Fuel Oil Chemistry program for managing the effects of aging for applicable components during the

subsequent period of extended operation. The staff finds that the information in the UFSAR supplement, as amended by letter dated April 2, 2019, is an adequate summary description of the program.

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

3.0.3.2.15 Reactor Vessel Material Surveillance

The SLRA states that AMP B2.1.19 "Reactor Vessel Material Surveillance," is an existing program with enhancements that are consistent with program elements in the GALL-SLR Report AMP XI.M31 "Reactor Vessel Material Surveillance." Dominion amended this SLRA section by letter dated January 29, 2019.

Staff Evaluation. The amended SLRA identifies that Capsule Z from Unit 1 is scheduled to be withdrawn in 2027 and Capsule U from Unit 2 in 2032. These capsules are estimated to achieve a fluence between one and two times the projected peak vessel fluence at the end of the 80-year subsequent period of extended operation for each unit.

During the in-office audit (ADAMS Accession No. ML19128A079), the staff reviewed Dominion'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.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 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.

Enhancements 1 and 2. SLRA Section B2.1.19 includes an enhancement to the "scope of program," "parameters monitored or inspected," "detection of aging effects," and "monitoring and trending" program elements related to Capsule Y from Unit 1, which will be withdrawn and tested during the subsequent license renewal (SLR) period (i.e., in 2044) when the capsule reaches a fluence between one to two times the projected peak vessel neutron fluence at the end of the SLR period.

SLRA Section B2.1.19 also includes an enhancement to the "scope of program," "parameters monitored or inspected," "detection of aging effects," and "monitoring and trending" program elements related to Capsule T from Unit 2, which will be withdrawn and tested during the SLR period (i.e., in 2047) when the capsule reaches a fluence between one to two times the projected peak vessel neutron fluence at the end of the SLR period.

As noted in the in-office audit report, the staff confirmed during the audit that the enhancements above include withdrawing at least one surveillance capsule from each unit during the SLR period, when the capsule is projected to have reached between one to two times the peak reactor pressure vessel fluence at the end of the SLR period. The staff also noted that the capsules scheduled to be withdrawn during the SLR period are not the same as those (i.e., Capsule Z for Unit 1 and Capsule U for Unit 2) scheduled to be withdrawn during the initial license renewal periods that apply to the units.

The staff finds that withdrawal and testing of Capsule Z from Unit 1 in accordance with the timing for its removal in SLRA Table B2.1.19-1 (i.e., in 2027) and Capsule U from Unit 2 in accordance with the timing for its removal in SLRA Table B2.1.19-2 (i.e., in 2032) provides reasonable assurance of adequate aging management of reactor pressure vessel (RPV) embrittlement for Surry, Units 1 and 2 during the SLR period. The staff noted that (1) increasing the time between capsule withdrawals and (2) the difference in neutron fluence between previously tested capsules and the peak projected SLR period neutron fluence levels, increase the uncertainty in embrittlement predictions for the RPV of each unit. Withdrawal and testing of Capsule Z from Unit 1 and Capsule U from Unit 2 in accordance with the schedules provided for these capsules in SLRA Section B2.1.19 provides reasonable assurance that the effects of aging are adequately managed such that the RPV of each unit will continue to perform its intended functions during the SLR period.

In addition, the staff reviewed the applicant’s enhancements to remove and test Capsule Y from Unit 1 in 2044 and Capsule T from Unit 2 in 2047. The staff finds that these enhancements provide additional assurance that loss of fracture toughness due to neutron irradiation embrittlement will be adequately managed in ferritic RPV components during the SLR period.

Based on its audit and review of the SLRA and its supplements, the staff finds that the “scope of program,” “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” “acceptance criteria,” and “corrective actions” program elements for which Dominion claimed consistency with the GALL-SLR Report are consistent with the corresponding program elements of GALL-SLR Report AMP XI.M31. The staff reviewed the enhancements above against the corresponding program elements in GALL-SLR Report AMP XI.M31 and finds them acceptable because, when implemented, the Reactor Vessel Material Surveillance AMP described in SLRA Section B2.1.19 will be consistent with the program element criteria defined in GALL-SLR Report AMP XI.M31.

Operating Experience. SLRA Section B2.1.19 summarizes the operating experience related to the Reactor Vessel Material Surveillance AMP. The staff evaluated operating experience information by reviewing the SLRA and conducting an audit (ADAMS Accession No. ML19046A433). 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 two documents during the audit related to operating experience and determined that these documents do not affect Dominion’s proposed AMP.

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

UFSAR Supplement. SLRA Section A1.19 provides the UFSAR supplement for the Reactor Vessel Material Surveillance AMP. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in GALL-SLR

Report Table XI-01, “FSAR Supplement Summaries for GALL-SLR Report Chapter XI Aging Management Programs.” The staff also noted that Dominion committed to ongoing implementation of the existing Reactor Vessel Material Surveillance AMP with the enhancements described above and in Commitment No. 19 in SLRA Table A4.0-1 for managing the effects of aging for applicable components during the SLR period. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. Based on its review of the Reactor Vessel Material Surveillance AMP, the staff concludes that those program elements for which Dominion claimed consistency with the GALL-SLR Report are consistent. The staff also concludes that the withdrawal and testing of Capsule Z from Unit 1 in 2027, and Capsule U from Unit 2 in 2032, as specified in SLRA Tables B2.1.19-1 and B2.1.19-2, is a necessary part in the staff finding that the AMP is acceptable. In addition, the staff reviewed the enhancements to the AMP, which include Dominion’s proposed withdrawal and testing of Capsule Y from Unit 1 in 2044 and Capsule T from Unit 2 in 2047. The staff concludes that the AMP implementation of these enhancements prior to the SLR period will provide additional benefit for managing loss of fracture toughness due to neutron irradiation embrittlement in the RPV components during the SLR period. The staff concludes that Dominion 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), provided that Capsule Z from Unit 1 and Capsule U from Unit 2 are withdrawn and tested as described in the Reactor Vessel Material Surveillance AMP. 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 ASME Code Class 1 Small-Bore Piping

SLRA Section B.2.1.22 states that the ASME Code Class 1 Small-Bore Piping is a new program that will be consistent, with the program elements in the GALL-SLR Report AMP XI.M35, “ASME Code Class 1 Small-Bore Piping,” except for the exception identified in the SLRA.

Staff Evaluation. During its audit (ADAMS Accession No. ML19128A079), the staff reviewed Dominion’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.M35. The staff also reviewed the portions of the “parameters monitored or inspected” and “detection of aging effects” program elements 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 the exception is as follows.

Exception. SLRA Section B.2.1.22 includes an exception to the “parameters monitored or inspected” and “detection of aging effects” program elements related to the examinations of the reactor coolant pump seal line socket welds. Dominion stated that the exception applies to only three socket welds for each unit. Dominion also stated that as a result of an exceedingly limited space, a meaningful volumetric examination is not possible, as recommended by GALL-SLR Report AMP XI.M35. As an alternate to the volumetric examinations, Dominion will perform surface examinations using the liquid penetrant (LP) examination method. One of the three socket welds will be selected for an LP examination prior to the subsequent period of extended operation. The remaining socket welds for each of the other two coolant loops will be examined, one per inservice inspection interval during the subsequent period of extended

operation. The staff reviewed this exception against the corresponding program elements in GALL-SLR Report AMP XI.M35 and finds it acceptable because the exception is only applicable to a very small subset of Dominion's small bore piping population. This subset was identified due to the operating experience for Unit 1. In May 1998, Dominion detected a through-wall weld crack in the seal injection line. Furthermore, Dominion attributed the 1998 crack to a postulated pre-existing defect on the toe of the socket weld and vibration fatigue due to a loose piping support. The staff finds that the proposed LP examinations will provide adequate assurance of detecting any significant defects at the toe of these welds or degradation due to vibration fatigue.

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 Dominion claimed consistency with the GALL-SLR Report are consistent with the corresponding program elements of GALL-SLR Report AMP XI.M35. In addition, the staff reviewed the exception associated with the "parameters monitored or inspected" and "detection of aging effects" program elements and finds that, when implemented, the AMP will be adequate to manage the applicable aging effects.

<u>Operating Experience</u>. SLRA Section B.2.1.22 summarizes the operating experience related to the ASME Code Class 1 Small-Bore Piping program. The staff evaluated operating experience information by reviewing the subsequent license renewal application and conducting an audit (ADAMS Accession No. ML19046A433). 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 Dominion should modify its proposed program.

Based on its audit and review of the application, 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.

<u>UFSAR Supplement</u>. SLRA Section A1.22 provides the UFSAR supplement for the ASME Code Class 1 Small-Bore Piping program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in GALL-SLR Report Table XI-01. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

<u>Conclusion</u>. On the basis of its review of Dominion's ASME Code Class 1 Small-Bore Piping program, the staff concludes that those program elements for which the applicant claimed consistency with the GALL-SLR Report are consistent. Also, the staff reviewed the exception and its justification and concludes that the AMP, with the exception, is adequate to manage the applicable aging effects. The staff concludes that Dominion 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 External Surfaces Monitoring of Mechanical Components

SLRA Section B2.1.23 states that the External Surfaces Monitoring of Mechanical Components program is an existing program with enhancements that will be consistent with the program elements in the GALL-SLR Report AMP XI.M36, "External Surfaces Monitoring of Mechanical Components."

Staff Evaluation. During its audit (ADAMS Accession No. ML19128A079), the staff reviewed Dominion'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.M36, "External Surfaces Monitoring of Mechanical Components." 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 is as follows.

Enhancement 1. SLRA Section B2.1.23 includes an enhancement to the "preventive actions" program element relating to the inclusion of an item in the walkdown checklist to inspect for damage to metallic insulation jacketing. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.M36 and finds it acceptable because when it is implemented the program's walkdown checklist will include degradation mechanisms for protective covering of insulation that are intended to prevent moisture intrusion.

Enhancement 2. SLRA Section B2.1.23 includes an enhancement to the "parameters monitored or inspected" and "detection of aging effects" program elements relating to revisions of the walkdown procedure by including items for metallic components, elastomers/flexible polymers, metallic insulation jacketing, and bolting for heating, ventilation, and air conditioning components. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.M36 and finds it acceptable because when it is implemented the program's walkdown procedure in include activities to manage aging effects that are consistent with the GALL-SLR Report program.

Enhancement 3. SLRA Section B2.1.23 includes an enhancement to the "detection of aging effects" program element for a revision to the walkdown procedure specifying that walkdowns will be performed on a refueling cycle frequency and that surfaces not readily visible will be inspected when accessible. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.M36 and finds it acceptable because when it is implemented the program's procedure will specify appropriate walkdown frequencies and ensure that surfaces not readily visible will be inspected at intervals that will ensure the components' intended functions are maintained.

Enhancement 4. SLRA Section B2.1.23 includes an enhancement to the "detection of aging effects" program element for a revision to the walkdown procedure to provide guidance related to lighting, distance, and offset for non-ASME Code inspections. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.M36 and finds it acceptable because when it is implemented the program's walkdown procedure will include appropriate guidance for inspections that are not performed in accordance with the ASME Code.

Enhancement 5. SLRA Section B2.1.23 includes an enhancement to the “detection of aging effects” program element for the development of a new procedure specifying the minimum number of inspections associated with cracking for stainless steel, aluminum, and copper alloy (>15% Zn or >8% Al) components; and loss of material and cracking for insulated components exposed to condensation. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.M36 and finds it acceptable because when it is implemented, the program’s implementing procedures will include comparable guidance in the GALL-SLR Report AMP for insulated components and stainless steel and aluminum components.

Enhancement 6. SLRA Section B2.1.23 includes an enhancement to the “detection of aging effects” program element for a revision to the walkdown procedure for supplementing the inspections of elastomers with tactile inspections to detect hardening. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.M36 and finds it acceptable because when it is implemented the program’s walkdown procedure will contain appropriate requirements to detect hardening of flexible components that are consistent with the GALL-SLR Report AMP.

Enhancement 7. SLRA Section B2.1.23 includes an enhancement to the “monitoring and trending” program element for the development of a new procedure to evaluate and project the rate of degradation for adjusting the inspection sampling bases. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.M36 and finds it acceptable because when it is implemented the inclusion of requirements to project the rate of degradation will ensure that components’ intended functions will either be maintained through the period of extended operation or will be re-inspected.

Enhancement 8. SLRA Section B2.1.23 includes an enhancement to the “acceptance criteria” program element for the development of a new procedure to specify that acceptance criteria are quantitative where practical. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.M36 and finds it acceptable because when it is implemented the inclusion of quantitative acceptance criteria, where practical, in the program’s procedures, will facilitate the management of the associated aging effects.

Enhancement 9. SLRA Section B2.1.23 includes an enhancement to the “corrective actions” program element for the development of a new procedure to specify that additional inspections to detect cracking of stainless steel, aluminum, and copper alloy (>15% Zn or >8% Al) components would be performed, if initial sampling-based inspection acceptance criteria were not met. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.M36 and finds it acceptable because when it is implemented the program’s procedures will include additional inspections that are consistent with the GALL-SLR Report.

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 Dominion claimed consistency with the GALL-SLR Report, are consistent with the corresponding program elements of GALL-SLR Report AMP XI.M36. In addition, the staff reviewed the enhancements associated with the “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” “acceptance criteria,” and “corrective actions” program elements and finds that, when implemented, they will make the AMP adequate to manage the applicable aging effects.

Operating Experience. SLRA Section B2.1.23 summarizes the operating experience related to the External Surfaces Monitoring of Mechanical Components program. The staff evaluated operating experience information by reviewing the SLRA and conducting an audit (ADAMS Accession No. ML19046A433). 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 needed additional information and issued RAI B2.1.23-1. The staff's request and Dominion's response are documented in ADAMS Accession No. ML19204A357. In its response, Dominion clarified that extensive corrective actions in the tunnel between the Turbine and Auxiliary buildings have been effective in improving both access within the tunnel and the adverse external environment. Dominion also stated that when the remaining degraded pipe section is replaced, prior to the subsequent period of extended operation, the ongoing yearly wall thickness measurements and increased inspection frequency will no longer be needed.

During its evaluation of the response to RAI B2.1.23-1, the staff noted that Dominion had completed the inspections of other infrequently accessed areas as part of its initial license renewal activities and had not identified other comparable adverse environments requiring corrective actions to address external corrosion. The staff finds the response acceptable because Dominion confirmed that corrective actions have resolved the previously-identified adverse environment and will address the extensive external corrosion so that enhanced inspections will not be required during the subsequent period of extended operation. Based on its audit, review of the application, and review of Dominion's response to RAI B2.1.23-1, the staff finds that the conditions and operating experience at the plant are bounded by those for which the External Surfaces Monitoring of Mechanical Components program was evaluated.

UFSAR Supplement. SLRA Section A1.23 provides the UFSAR supplement for the External Surfaces Monitoring of Mechanical Components program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in GALL-SLR Report Table XI-01. The staff also noted that Dominion committed to enhance the program 6 months prior to the subsequent period of extended operation, as described in SLRA Table A4.0-1. 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 Dominion's External Surfaces Monitoring of Mechanical Components program, the staff concludes that those program elements for which Dominion claimed consistency with the GALL-SLR Report are consistent. In addition, 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 Dominion has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.18 Flux Thimble Tube Inspection

SLRA Section B.2.1.24 states that the Flux Thimble Tube Inspection program is an existing program that, with an enhancement, will be consistent with the program elements defined in GALL-SLR Report AMP XI.M37, "Flux Thimble Tube Inspection."

Staff Evaluation. As documented in its in-office audit report (ADAMS Accession No. ML19128A079), the staff reviewed Dominion's claim of consistency with the GALL-SLR Report. The staff compared the "scope of program," "preventive actions," "parameters monitored or inspected," "monitoring and trending," and "corrective actions" program elements of the SLRA to the corresponding program elements of GALL-SLR Report AMP XI.M37.The staff also reviewed the portions of the "detection of aging effects" and "acceptance criteria" program elements associated with the enhancement to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of this enhancement follows.

Enhancement 1. SLRA Section B.2.1.24 includes an enhancement to the "detection of aging effects" and "acceptance criteria" program elements of the AMP. In this enhancement, the SLRA stated that it would update the implementation procedure to define: (a) the program's basis for evaluating loss of material in inner flux thimble tubes of the doubled-tubed thimble tube assembly design, (b) the acceptance criteria that will be applied to the evaluation of the program's eddy current test (ET) results, and (c) the corrective or remediating actions that will be implemented if the acceptance criteria are exceeded.

Based on its in-office audit review of the program basis document for the AMP and the operating experience summary provided in SLRA AMP B.2.1.24, the staff noted that the applicant is already applying programmatic acceptance criteria to the eddy current tests (ET) that are performed by the AMP on the thimble tubes serving a reactor coolant pressure boundary function for the facility (these are the inner tubes in the double-tubed flux thimble tube assembly design). The staff also noted that the current program already implements appropriate corrective or remedial actions for thimble tubes that do not meet the acceptance criteria of the program. The enhancement will ensure: (a) that the implementation procedure for the AMP will contain and define the programmatic acceptance criteria and corrective action criteria that are already being applied as part of the AMP, and (b) that the program will be consistent with both the guidance in NRC Bulletin 88-09 and in GALL-SLR Report AMP XI.M37, "Flux Thimble Tube Inspection," such that the intended flux mapping and reactor coolant pressure boundary intended functions of the assemblies will be maintained during the subsequent period of extended operation. Therefore, the staff finds this enhancement to be acceptable because when the enhancement is implemented it will make the "detection of aging effects" and "acceptance criteria" program elements (and even the "corrective actions" program element) of the Flux Thimble Tube Inspection program consistent with those defined in GALL-SLR Report AMP XI.M37.

Based on a review of the SLRA and the results of the staff's audit, the staff finds that the "scope of program," "preventive actions," "parameters monitored or inspected," "monitoring and trending," and "corrective actions" program elements for which Dominion claimed consistency with the GALL-SLR Report are consistent with the corresponding program elements of GALL-SLR Report AMP XI.M37, "Flux Thimble Tube Inspection." The staff also reviewed the enhancement associated with the "detection of aging effects" and "acceptance criteria" program elements, and finds that, when implemented, the enhancement will make the program consistent with the program elements defined in GALL-SLR Report AMP XI.M37, "Flux Thimble Tube Inspection."

Operating Experience. SLRA Section B.2.1.24 summarizes the operating experience related to the Flux Thimble Tube Inspection program. The staff evaluated operating experience information by reviewing the subsequent license renewal application and conducting an audit (ADAMS Accession No. ML19046A433). 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 Dominion should modify its proposed program beyond that incorporated during the development of the SLRA.

UFSAR Supplement. SLRA Section A1.24 provides the UFSAR supplement for the Flux Thimble Tube Inspection program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in GALL-SLR Report, Table XI-01. The staff also noted that in SLRA UFSAR Supplement Table A4.0-1, Dominion committed to developing a site-specific procedure for the performance of the eddy current examinations that will be applied to the flux thimble tubes during the subsequent period of extended operation. The SLRA stated that the programmatic enhancement covered by the commitment will be implemented 6 months prior to the subsequent period of extended operation. The staff has reviewed this commitment in its review of the enhancement of the AMP and has determined that, when the commitment is implemented, the commitment will make the program consistent with the program elements defined in GALL-SLR Report AMP XI.M37, “Flux Thimble Tube Inspection.” The staff finds that the information in the UFSAR supplement is an adequate summary description of the program and the enhancement that will be implemented and applied to the program.

Conclusion. On the basis of its review of Dominion’s Flux Thimble Tube Inspection program, the staff concludes that those program elements for which Dominion claimed consistency with the GALL-SLR Report are consistent with those program elements defined in GALL-SLR Report AMP XI.M37, “Flux Thimble Tube Inspection.” 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 Dominion 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 Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components

SLRA Section B2.1.25 states that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program is an existing program with enhancements that will be consistent with the program elements in the GALL-SLR Report AMP XI.M38, “Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components.” Dominion amended this SLRA section by letters dated January 29, 2019 (ADAMS Accession No. ML19042A137), and April 2, 2019 (ADAMS Accession No. ML19095A666).

Staff Evaluation. As documented in its in-office audit (ADAMS Accession No. ML19128A079), the staff reviewed Dominion’s claim of consistency with the GALL-SLR Report. The staff compared the “scope of program,” “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” “acceptance criteria,” and “corrective actions” program elements of the SLRA to the corresponding program elements of GALL-SLR Report AMP XI.M38. For the “detection of aging effects” program element, the staff needed additional information for why methods to detect cracking of titanium and copper alloy with greater than 15 percent zinc components are not addressed in SLRA Sections A1.25 and B2.1.25. In response to clarification discussions on the draft RAI, Dominion provided supplements on January 29, and April 2, 2019 to address the staff’s concern.

In its supplements, Dominion revised SLRA Sections A1.25 and B2.1.25 to reflect that visual (VT-1) or surface examinations will be performed to detect cracking of titanium and copper alloy with greater than 15 percent zinc components. The staff finds Dominion's supplemental responses acceptable because using ASME Code Section XI VT-1 inspections or surfaces examinations to manage cracking is consistent with GALL-SLR Report AMP XI.M38.

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 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.

Enhancement 1. SLRA Section B2.1.25 includes an enhancement to the "parameters monitored or inspected" and "detection of aging effects" program elements, which relates to revising procedures to require inspections of metallic components for flaking or oxide-coated surfaces. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M38 and finds it acceptable because when it is implemented it will make the indicators of aging effects for metallic components consistent with GALL-SLR Report AMP XI.M38.

Enhancement 2. SLRA Section B2.1.25 includes an enhancement to the "parameters monitored or inspected" and "detection of aging effects" program elements, which relates to revising procedures to require inspections of elastomeric and polymeric components for: (a) surface crazing, scuffing, loss of sealing, blistering, and dimensional change; (b) loss of wall thickness; and (c) exposure of internal reinforcement. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M38 and finds it acceptable because when the subject enhancement and Enhancement 3 are implemented, the indicators of aging effects for elastomeric and polymeric components will be consistent with GALL-SLR Report AMP XI.M38.

Enhancement 3. SLRA Section B2.1.25 includes an enhancement to the "parameters monitored or inspected" and "detection of aging effects" program elements, which relates to revising procedures to specify that: (a) visual inspection of elastomeric and flexible polymeric components is supplemented by tactile inspection to detect hardening or loss of suppleness; and (b) the minimum surface area for tactile inspections will be at least 10 percent of the accessible surface area. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M38 and finds it acceptable because when the subject enhancement and Enhancement 2 are implemented, the indicators of aging effects for elastomeric and polymeric components will be consistent with GALL-SLR Report AMP XI.M38.

Enhancement 4. SLRA Section B2.1.25 includes an enhancement to the "detection of aging effects" program element which relates to non-ASME Code inspection guidance related to lighting, distance, offset, surface coverage, presence of protective coatings, and cleaning processes. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M38 and finds it acceptable because providing non-ASME Code inspection guidance related to lighting, distance, offset, surface coverage, presence of protective coatings, and cleaning processes is consistent with GALL-SLR Report AMP XI.M38 recommendations.

Enhancement 5. As amended by letter dated April 2, 2019, SLRA Section B2.1.25 includes an enhancement to the "detection of aging effects" program element which relates to revising

procedures to specify that followup volumetric examinations are performed where irregularities that could be indicative of an unexpected level of degradation are detected for steel components exposed to raw water, raw water (potable), or waste water. The staff reviewed this enhancement and finds it acceptable because the criteria for performing followup volumetric examinations will be consistent with GALL-SLR Report AMP XI.M38 recommendations.

<u>Enhancement 6</u>. SLRA Section B2.1.25 includes an enhancement to the "detection of aging effects" program element which relates to revising procedures to specify that: (a) the minimum number of inspections consists of 20 percent of the population or 19 components per population at each unit; and (b) inspections focus on the bounding or lead components most susceptible to aging. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M38 and finds it acceptable because when it is implemented it will be consistent with GALL-SLR Report AMP XI.M38 recommendations regarding: (a) minimum inspection criteria for two-unit sites where operating conditions at each unit are similar, and (b) inspecting components most susceptible to aging.

<u>Enhancement 7</u>. SLRA Section B2.1.25 includes an enhancement to the "monitoring and trending" and "acceptance criteria" program elements, which relates to a new procedure to evaluate and project the rate of any degradation until the end of the subsequent period of extended operation or the next scheduled inspection, whichever is shorter. The staff reviewed this enhancement and finds it acceptable because when the subject enhancement and Enhancement 8 are implemented, the "monitoring and trending" and "acceptance criteria" program elements will be consistent with the corresponding program elements in GALL-SLR Report AMP XI.M38.

<u>Enhancement 8</u>. SLRA Section B2.1.25 includes an enhancement to the "acceptance criteria" program element which relates to a new procedure to specify that: (a) where practical, acceptance criteria are quantitative; (b) for quantitative analyses, the required minimum wall thickness to meet applicable design standards will be used; and (c) for qualitative evaluations, applicable parameters such as ductility, color, and other indicators will be addressed to ensure a decision is based on observed conditions. The staff reviewed this enhancement and finds it acceptable because when the subject enhancement and Enhancement 7 are implemented, the "acceptance criteria" program element will be consistent with the corresponding program element in GALL-SLR Report AMP XI.M38.

<u>Enhancement 9</u>. SLRA Section B2.1.25 includes an enhancement to the "corrective actions" program element which relates to a new procedure to specify requirements for additional inspections if any sampling-based inspections do not meet the acceptance criteria. The staff reviewed this enhancement and finds it acceptable because when it is implemented the "corrective actions" program element will be consistent with the corresponding program element in GALL-SLR Report AMP XI.M38.

Based on its audit and review of the SLRA, as amended by letters dated January 29 and April 2, 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 Dominion claimed consistency with the GALL-SLR Report are consistent with the corresponding program elements of GALL-SLR Report AMP XI.M38. In addition, the staff reviewed the enhancements, as amended by letter dated April 2, 2019, associated with the "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective

actions" program elements. The staff finds that when implemented, the enhancements will make the AMP adequate to manage the applicable aging effects.

Operating Experience. SLRA Section B2.1.25 summarizes the operating experience related to the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program. The staff evaluated operating experience information by reviewing the subsequent license renewal application and conducting an audit (ADAMS Accession No. ML19046A433). 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 Dominion should modify its proposed program beyond that incorporated. Based on its audit and review of the application, the staff finds that the conditions and operating experience at the plant are bounded by those for which the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program was evaluated.

UFSAR Supplement. As amended by letters dated January 29 and April 2, 2019, SLRA Section A1.25 provides the UFSAR supplement for the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program.

The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in GALL-SLR Report Table XI-01. The staff also noted that Dominion committed to ongoing implementation of the existing Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program for managing the effects of aging for applicable components during the subsequent period of extended operation. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. On the basis of its review of Dominion's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program, the staff concludes that those program elements for which Dominion 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 Dominion 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 Lubricating Oil Analysis

SLRA Section B2.1.26 states that the Lubricating Oil Analysis program is an existing program with enhancements that will be consistent, with the program elements in the GALL-SLR Report AMP XI.M39, "Lubricating Oil Analysis."

Staff Evaluation. During its audit (ADAMS Accession No. ML19128A079), the staff reviewed Dominion's claim of consistency with the GALL-SLR Report. The staff compared the "scope of program," "preventive actions," "detection of aging effects," "monitoring and trending," and "corrective actions" program elements of the SLRA to the corresponding program elements of GALL-SLR Report AMP XI.M39. The staff also reviewed the portions of the "parameters monitored or inspected" 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 is as follows.

Enhancement 1. SLRA Section B2.1.26 includes an enhancement to the "parameters monitored or inspected" program element which relates to the revision of procedures by including guidelines for lube oil and electro-hydraulic control fluids into sampling procedures. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M39 and finds it acceptable because when it is implemented it will be consistent with the GALL-SLR Report.

Enhancement 2. SLRA Section B2.1.26 includes an enhancement to the "acceptance criteria" program element which relates to the revision of procedures by including a statement that phase-separated water in any amount is not acceptable. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.M39 and finds it acceptable because when it is implemented it will be consistent with the GALL-SLR Report.

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

Operating Experience. SLRA Section B2.1.26 summarizes operating experience related to the Lubricating Oil Analysis program. The staff evaluated operating experience information by reviewing the subsequent license renewal application and conducting an audit (ADAMS Accession No. ML19046A433). 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 Dominion should modify its proposed program beyond that incorporated. Based on its audit and review of the application, 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 A1.26 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 Dominion 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 review of the Lubricating Oil Analysis program, the staff concludes that those program elements for which Dominion 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 Dominion 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 Buried and Underground Piping and Tanks

SLRA Section B2.1.27 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.” Dominion amended this SLRA section by letters dated April 2, 2019 (ADAMS Accession No. ML19095A666); June 27, 2019 (ADAMS Accession No. ML19183A440); September 3, 2019 (ADAMS Accession No. ML19253B330); October 14, 2019 (ADAMS Accession No. ML19294A044); October 31, 2019 (ADAMS Accession No. ML19310E716); and November 19, 2019 (ADAMS Accession No. ML19329A287).

Staff Evaluation. During its audit (ADAMS Accession No. ML19128A079), the staff reviewed Dominion’s claim of consistency with the GALL-SLR Report. The staff compared the “scope of program,” “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” “acceptance criteria,” and “corrective actions” program elements of the SLRA to the corresponding program elements of GALL-SLR Report AMP XI.M41.

For the “preventive actions” program element, the staff determined the need for additional information regarding the following: (a) why external corrosion protection is not required for buried cementitious piping; (b) why the balance of buried steel piping and tanks within the scope of SLR are not provided with cathodic protection; (c) clarification regarding if buried and underground metallic piping and tanks are externally coated in accordance with GALL-SLR Report Table XI.M41-1, “Preventive Actions for Buried and Underground Piping and Tanks;” and (d) clarification regarding if external coatings and backfill quality are in accordance with NFPA 24, “Standard for the Installation of Private Fire Service Mains and Their Appurtenances,” for buried fire water system piping. The staff’s evaluation of these four technical areas follows.

External Corrosion Control for Buried Cementitious Piping. The staff determined the need for additional information regarding why external corrosion protection is not required for buried cementitious piping, which resulted in the issuance of RAIs. RAI B2.1.27-1, RAI B2.1.27-1a, and Dominion’s responses are documented in ADAMS Accession Nos. ML19155A050, ML19183A440, ML19217A358, ML19253B330.

In its response to RAI B2.1.27-2a (for buried cementitious piping, Dominion addressed the staff’s concerns in its response to RAI B2.1.27-2a in lieu of responding to RAI B2.1.27-1a), Dominion stated that the March 2019 Structures Monitoring program groundwater sample results at the three locations in the vicinity of buried cementitious piping confirm a nonaggressive groundwater environment (i.e., pH greater than 5.5, chlorides less than 500 parts per million (ppm), and sulfates less than 1,500 ppm).

During its evaluation of Dominion’s response to RAI B2.1.27-2a, the staff noted the following: (a) *Concrete Pressure Pipe - Manual of Water Supply Practices* recommends external corrosion protection for buried concrete piping when pH is less than 5, chlorides are greater than 400 ppm, and sulfates are greater than 5,000 ppm; (b) limits cited by Dominion for sulfates and pH are bounded by recommendations in *Concrete Pressure Pipe - Manual of Water Supply Practices*; (c) limits cited by Dominion for chlorides are not bounded by recommendations in *Concrete Pressure Pipe - Manual of Water Supply Practices*; and (d) GALL-SLR Report

AMP XI.S6, “Structures Monitoring,” states that chloride levels below 500 ppm are considered nonaggressive to below-grade concrete structural elements.

The staff finds Dominion’s basis for not providing external corrosion control for buried cementitious piping acceptable as follows: (a) sulfates and pH in the vicinity of buried cementitious piping are within limits specified in *Concrete Pressure Pipe - Manual of Water Supply Practices*; and (b) although chlorides may not be within the limits specified in *Concrete Pressure Pipe - Manual of Water Supply Practices* (i.e., Dominion’s response states chlorides are less than 500 ppm as opposed to *Concrete Pressure Pipe - Manual of Water Supply Practices* which uses a more conservative value of 400 ppm), chloride levels are below 500 ppm which GALL-SLR Report AMP XI.S6 considers nonaggressive to buried concrete.

Cathodic Protection for Buried Steel Piping. The staff determined the need for additional information regarding why the balance of buried steel piping and tanks within the scope of SLR are not provided with cathodic protection, which resulted in the issuance of RAIs. RAI B2.1.27-1, RAI B2.1.27-1a, and Dominion’s responses are documented in ADAMS Accession Nos. ML19155A050, ML19183A440, ML19217A358, ML19253B330. By letter dated October 14, 2019, (ADAMS Accession No. ML19294A044), Dominion provided clarification regarding the staff’s concerns, which superseded the information provided in the response to RAIs B2.1.27-1 and B2.1.27-1a. The information provided in the October 14, 2019, letter was subsequently superseded by additional clarification in letter dated October 31, 2019 (ADAMS Accession No. ML19310E716). The staff’s evaluation of the October 31, 2019 response follows.

In its response dated October 31, 2019, Dominion revised SLRA Sections B2.1.27 and A1.27 and SLRA Table A4.0-1 to clarify that: (a) cathodic protection will be provided for buried steel piping five years before entering the subsequent period of extended operation; and (b) soil sample results indicating corrosivity of greater than 10 points using the “carbon steel” column in Table 9-4, “Soil Corrosivity Index from BPWORKS,” of EPRI Report 3002005294, “Soil Sampling and Testing Methods to Evaluate the Corrosivity of the Environment for Buried Piping and Tanks at Nuclear Power Plants,” require evaluation of potential scope expansion or category transition.

During its evaluation of Dominion’s response dated October 31, 2019, the staff noted the following: (a) GALL-SLR Report Table XI.M41-2, “Inspection of Buried and Underground Piping and Tanks,” references AWWA C105, “Polyethylene Encasement for Ductile-Iron Pipe Systems,” Table A.1, “Soil-Test Evaluation,” with respect to determining soil corrosivity; (b) AWWA C105, Table A.1, uses the soil parameters of soil resistivity, pH, redox potential, sulfides, and moisture to determine the overall soil corrosivity index; and (c) AWWA C105, Table A.1, indicates that soil is considered corrosive when the soil corrosivity index is greater than 10 points. The staff finds Dominion’s response and changes to SLRA Sections B2.1.27 and A1.27, and SLRA Table A4.0-1 acceptable because (a) providing cathodic protection for buried steel piping at least five years before entering the subsequent period of extended operation is consistent with GALL-SLR Report AMP XI.M41 recommendations; (b) EPRI Report 3002005294, Table 9-4, includes similar guidance when compared to AWWA C105, Table A.1, regarding how the soil parameters of soil resistivity, pH, redox potential, sulfides, and moisture are used to determine the overall soil corrosivity index; and (c) EPRI Report 3002005294, Table 9-4, includes the additional soil parameters of chlorides and soil consortia (bacteria) to determine the overall soil corrosivity index, which will provide more comprehensive input into determining overall soil corrosivity when compared to GALL-SLR Report AMP XI.M41 recommendations (i.e., AWWA C105, Table A.1).

External Coatings for In-Scope Metallic Components. The staff determined the need for additional information regarding if buried and underground metallic piping and tanks are externally coated in accordance with GALL-SLR Report Table XI.M41-1, which resulted in the issuance of RAIs. RAI B2.1.27-2, RAI B2.1.27-2a, and Dominion's responses are documented in ADAMS Accession Nos. ML19155A050, ML19183A440, ML19217A358, and ML19253B330.

In its response to RAI B2.1.27-2, Dominion stated the following: (a) buried and underground steel piping and piping components within the scope of subsequent license renewal are encased in concrete or coated with coal tar enamel, coal tar epoxy, or polyolefin coatings; (b) for buried steel tanks, the Poxitar product data sheet identifies Poxitar as a coal tar based epoxy coating; (c) underground copper alloy piping and piping components within the scope of subsequent license renewal are coated with tape wrap; (d) there is approximately 6.75 feet of uncoated buried stainless steel piping within the scope of subsequent license renewal; (e) there is a total of approximately 1415 feet of buried stainless steel piping within the scope of subsequent license renewal; and (f) stainless steel piping and piping components within the scope of subsequent license renewal, excluding the 6.75 feet of uncoated buried stainless steel piping, are coated with coal tar epoxy or polyolefin. In addition, in its response to RAI B2.1.27-2a, Dominion revised SLRA Section B2.1.27 and Table A4.0-1 to reflect the following: (a) procedures will be revised to require uncoated buried stainless steel tubing segments to be inspected prior to the subsequent period of extended operation; and (b) after inspection, each uncoated stainless steel segment will be coated consistent with Table 1, "Generic External Coating Systems with Material Requirements and Recommended Practices for Application," of NACE SP0169-2007, "Control of External Corrosion on Underground or Submerged Metallic Piping Systems."

The staff finds Dominion's responses acceptable for the following reasons: (a) buried and underground steel and copper alloy piping, piping components, and tanks are coated in accordance with the "preventive actions" program element of GALL-SLR Report AMP XI.M41; (b) approximately 1408 out of 1415 feet of buried stainless steel piping are coated in accordance with the "preventive actions" program element of GALL-SLR Report AMP XI.M41; and (c) although Dominion did not address stress corrosion cracking (i.e., chlorides) in its response regarding uncoated buried stainless steel piping, the staff finds this issue resolved because the uncoated stainless steel piping will be coated in accordance with Table 1 of NACE SP0169-2007 in the 50 to 60 year interval during which precoating inspections would detect indications of cracking.

Buried Fire Water System Piping. The staff determined the need for additional information regarding if external coatings and backfill quality are in accordance with NFPA 24, which resulted in the issuance of an RAI. RAI B2.1.27-3 and Dominion's response are documented in ADAMS Accession Nos. ML19155A050 and ML19183A440.

In its response, Dominion stated the following: (a) specifications required buried cast iron fire protection piping to be coated with a bituminous coating; and (b) backfill material shall be selected material, free from cinders, ashes, refuse, vegetable or organic material frozen material, boulders, rocks or stones. The staff finds Dominion's response acceptable for the following reasons: (a) external coatings used for buried fire protection piping meet the intent of NFPA 24, Section 10.8.3.5; and (c) backfill quality in the vicinity of buried fire protection piping meets the intent of NFPA 24, Section 10.9. As a result, preventive actions for buried fire water system piping are consistent with GALL-SLR Report AMP XI.M41 recommendations.

For the “detection of aging effects” program element, the staff determined the need for additional information regarding the use of EPRI Report 3002005294, which resulted in the issuance of an RAI. RAI B2.1.27-4 and Dominion’s response are documented in ADAMS Accession ML19155A050 and ML19183A440. The staff’s concerns associated with the response to RAI B2.1.27-4 were incorporated into follow-up RAI B2.1.27-1a associated with the basis for why the balance of buried steel piping and tanks within the scope of SLR are not provided with cathodic protection. The staff’s evaluation regarding the use of EPRI Report 3002005294 is documented in the staff’s evaluation of the *Cathodic Protection for Buried Steel Piping* section above.

As amended by letter dated June 27, 2019, regarding the “detection of aging effects” program element, Dominion stated that the effects of aging on the external surfaces of buried cementitious piping would be managed using the Open-Cycle Cooling Water System program in lieu of the Buried and Underground Piping and Tanks program, which resulted in the issuance of an RAI. RAI B2.1.27-2a and Dominion’s response are documented in ADAMS Accession Nos. ML19217A358 and ML19253B330. However, as amended by letters dated October 31, and November 19, 2019, Dominion revised the SLRA to clarify that the Buried and Underground Piping and Tanks and Structures Monitoring programs would manage the effects of aging on the external surfaces of buried cementitious piping. Therefore, the staff’s concerns documented in RAI B2.1.27-2a are no longer applicable.

During its review of the October 31 and November 19, 2019 letters, the staff noted that the applicant proposed to manage the effects of aging on the external surfaces of buried cementitious piping using the following approach:

(1) A one-time inspection; specifically, either
    (a) a one-time inspection of a surrogate concrete structure; or
    (b) a one-time inspection of buried concrete circulating water (CW) piping if the surrogate structure is coated.
(2) Groundwater/soil testing

The staff notes that Dominion’s approach to manage the effects of aging differs from GALL-SLR Report AMP XI.M41 guidance. GALL-SLR Report Table XI.M41-2 recommends periodic inspections (i.e., two inspections in each ten-year period) in lieu of the combined approach of a one-time inspection and groundwater/soil testing. The staff’s evaluation of this alternative approach to manage the effects of aging on the external surfaces of buried cementitious piping follows:

1.a. One-Time Inspection of Surrogate Structure. The staff noted that the applicant proposed to manage the aging effects of cracking; loss of bond; and loss of material (i.e., spalling, scaling) due to corrosion of embedded steel for the external surface of concrete of the CW piping by performing a one-time inspection of the turbine building (i.e., surrogate structure). The one-time inspection will be performed under the Buried and Underground Piping and Tank Program. The applicant stated that these aging effects will also be managed using the guidance for concrete degradation, inspections, and monitoring from the Structures Monitoring Program. In its commitment No 27, Enhancement No. 8, for the one-time inspection of the turbine building, the applicant stated that a minimum of 50 square-ft of concrete surface area below groundwater level will be inspected and the inspection results shall include evaluation of the acceptability of the eight inaccessible 96-inch CW pipes using the guidance in ACI 349.3R, “Evaluation of Existing Nuclear Safety-Related Concrete Structures.” Commitment No. 27, Enhancement

No. 8, also states that if observed age-related degradation exceeds ACI 349.3R Tier-1 criteria, the area containing the degradation will be evaluated by a responsible civil engineer using the Corrective Action Program and the evaluation will include the acceptability of the eight inaccessible 96-inch CW pipes.

To assess the acceptability of the applicant’s proposal to use an one-time inspection for signs of degradation on a surrogate structure (turbine building) concrete to detect and manage the aging effects of the CW piping before there is a loss of intended function, the staff evaluated: (1) whether the concrete material composition and environment on both structures are equivalent; and (2) whether an adequate acceptance criteria for the inspection of the surrogate structure is prescribed such that evaluation of the CW piping would be performed and corrective actions would be taken before there a loss of intended function of the CW pipes.

For a comparison of the designs between the surrogate structure and CW buried piping, the applicant provided the table below:

Table 3.0-2 Comparison of Concrete Components

Component/Properties	96-inch CW Pipe	SPS Concrete Structures
Cement	ASTM C150	ASTM C150
Fine Aggregate	ASTM C33	ASTM C33
Coarse Aggregate	ASTM C33	ASTM C33
Water	Free from injurious amounts of oils, acids, strong alkalis, salts, vegetable matter	Free from injurious amounts of oils, acids, alkalis, salts, organic materials
Air Entrainment	N/A[1]	ASTM C260
Water/Cement Ratio	0.45	0.46
Reinforcing Steel	ASTM A615	ASTM A615
Minimum Specified 28-day Strength	4,500 psi	3,000 psi

Notes:

1 Air entrainment is not required to manage freeze-thaw effects for the CW pipe due to its location well below the frost line.

The applicant stated that the CW pipe was specified to conform to the American Water Works Association (AWWA) C302, “Reinforced Concrete Pressure Pipe, Noncylinder Type.” The applicant described the CW piping as having a 96-inch inside diameter, wall thickness of 9 inches, and “reinforced with rebar longitudinally and circumferentially on both the inside face and the outside face.” The CW piping longitudinal rebars have a maximum spacing of 42 inches while the circumferential rebars have a maximum spacing of 4 inches and minimum clear spacing of 1.25 inches. The applicant stated in the letter dated October 14, 2019 (ADAMS Accession No. ML19294A044) that “[t]his spacing provides a higher degree of crack prevention to ensure the water-tightness of the pipe.” The applicant stated that the CW piping has a minimum depth of 16 ft below ground, the soil frost depth is 18 inches, and the groundwater level is approximately 16.5 ft to 18.5 ft below ground. Groundwater samples results obtained in March 2019 near the CW piping and surrogate structure (turbine building) confirmed that the

groundwater/soil environment to which the concrete is exposed is non-aggressive (i.e., pH greater than 5.5, chlorides less than 500 ppm, and sulfates less than 1,500 ppm). The UFSAR states that exterior wall surfaces of Class I structures with floor levels below elevation 26.5 ft (structures belowground) are covered with a "mopped-on bitumastic coating to establish a water-resistant membrane." The applicant also stated that although the turbine building is not classified as a Class I structure, as shown in UFSAR Table 15.2-1, it "cannot affirm if a coating is applied to below grade concrete of the turbine building." Therefore, by letter dated November 19, 2019, the applicant committed (Commitment No. 27) to confirm "that the south side of the turbine building is bare concrete below grade." The applicant also clarified that "[b]are concrete below grade will confirm that there is no material of any type covering the concrete surface of the [t]urbine [b]uilding." If bare concrete is confirmed, the applicant will perform the one-time inspection of the surrogate structure. If bare concrete is not confirmed, the applicant committed (Commitment No. 27) to excavate and inspect 50 square-ft of the concrete exterior surface of one of the CW pipes at a depth below the groundwater level. Based on the below grade turbine building and buried CW concrete piping being in non-aggressive environments, below the freeze/thaw line, and upon confirmation before the SPEO (Commitment No. 27) that the turbine building concrete has no coating or membrane that isolates the concrete from the soil, the staff finds that is adequate to conclude that both the CW piping and turbine building concrete are exposed to the same environment.

With regard to the concrete of the turbine building and CW piping, the staff notes that both concretes were made to meet the same ASTM standards for cement, aggregates, and reinforcing steel. The staff noted that for the aging effect of cracking; loss of bond; and loss of material (i.e., spalling, scaling) due to corrosion of embedded steel, the durability of the concrete and aggressiveness of the groundwater/soil environment are main factors in the susceptibility and magnitude of this degradation for concrete. The Portland Cement Association (PCA), "Effects of Substances on Concrete and Guide to Protective Treatments," 2007, states that reinforcing steel embedded in concrete is protected from corrosion by the highly alkaline (i.e., pH greater than 12.5) nature of the concrete which "provides a protective oxide film on the steel that is passive and non-corrosive." However, this protective passive film may break down and the steel may corrode if the pH of concrete is reduced by the intrusion of aggressive ions (e.g., chlorides greater than 500 ppm) in the presence of oxygen and moisture. Because the volume of the corrosion product can be more than six times the volume of the consumed iron on the reinforcing steel, this degradation leads to internal expansion stresses that eventually will exceed the concrete tensile strength and result in cracks and spalls of the concrete over the reinforcement steel bars.

The staff notes that PCA's "Specifier's Guide to Durable Concrete," states that permeability is a key factor in the durability of concrete because a concrete with low permeability limits the rate of degradation by increasing the concrete resistance to ingress of harmful substances (e.g., oxygen, water, chlorides, sulfates). The staff notes that the water-to-cement ratio (w/c) ratio of concrete is a considerable factor in the permeability of concrete, and therefore on its durability. The lower w/c ratio of a concrete results in lower permeability, higher density, and higher strength. The staff noted that the CW piping concrete has a specified w/c ratio of 0.45 which is less than the w/c ratio of 0.46 for the turbine building concrete; and therefore, it is reasonable to assume that the CW piping concrete should have a lower permeability than the turbine building concrete. The staff also noted that the concrete compressive strength of the CW piping concrete is 4500 psi which is higher than the 3000 psi concrete strength of the turbine building. Concrete tensile strength is generally about 10 percent of its compressive strength. Based on the higher permeability and lower tensile strength of the turbine building concrete when compared to the CW piping and upon confirmation that the turbine building

concrete is bare, the staff finds that if the groundwater/soil environment conditions were conducive of concrete cracking; loss of bond; and loss of material (i.e., spalling, scaling) due to corrosion of embedded steel of the CW piping, indications of degradation due to this aging effect would also be present at the turbine building surface concrete.

With regard to the acceptance criteria of the one-time inspection of the turbine building concrete, the staff noted that the applicant committed to evaluate the condition of CW piping if degradation of the surrogate structures exceeds the ACI 349.3R Tier-1 criteria. The ACI 349.3R Tier-1 acceptance criteria includes the following:

- Absence of leaching and chemical attack;
- Scaling less than 5 mm (3/16 in.) in depth;
- Spalling less than 10 mm (3/8 in.) in depth and 100 mm (4 in.) in any dimension;
- Absence of any signs of corrosion in the steel reinforcement or anchorage components; and
- Passive cracks less than 0.4 mm (0.015 in.) in maximum width

The staff noted that the American Concrete Pipe Association, "*Significance of Cracks in Concrete Pipe*," 1978, states that concrete pipes in an aggressive environment with surface cracks up to 0.02 inches in width, which do not completely penetrate the pipe wall and have a minimum of 1-inch cover over the reinforcement, will have the same durability as an uncracked pipe. For concrete pipes installed in a noncorrosive environment the 2006 California Department of Transportation Construction Manual for reinforced concrete pipe states that cracks of up to 0.125 inch in width in the installed pipe are acceptable if they are not excessive in number. Based on its review of the AWWA C302 Standard, the staff noted that the minimum reinforcement cover of the CW piping should be approximately 1 inch. The staff noted that most studies estimated product service life for a concrete pipe to be between 70 and 100 years with a service life above 100 years in a non-aggressive environment. The AWWA Manual M9, "*Concrete Pressure Pipe*," 2008, states that the concrete specified in AWWA standards for concrete pressure pipe provide ample corrosion protection in most environments. The American Concrete Pipe Association, "*Precast Concrete Pipe Durability*," states that concrete under a non-aggressive environment have a history of excellent durability due to the high strength, low absorption, and high quality of precast concrete. Based on the above the staff finds the ACI 349.3R Tier-1 acceptance criteria to be acceptable because: (a) the staff finds that if the groundwater/soil environment conditions were conducive of concrete degradation due to corrosion of embedded steel of the CW piping, indications of degradation due to this aging effect would also be present at the turbine building surface concrete; (b) the criteria includes visual inspection for signs of degradation such as chemical attack, spalling, scaling, corrosion of embedded steel, and cracking, all of which are adequate to identify degradation of concrete due to corrosion of embedded steel; (c) the crack width limit of 0.015 inch for the surrogate structure is conservative since a larger crack width would be necessary to cause significant degradation of the concrete pipe; and (d) precast concrete piping has historically shown excellent performance, especially under a non-aggressive environment, such as the one at Surry. Therefore, based on the applicant's Commitment No. 27 to confirm that the below grade concrete of the turbine building is bare, the staff finds the applicant's proposal to use a one-time inspection for signs of degradation on a surrogate concrete structure, in lieu of a one-time inspection of the CW piping, to be acceptable.

In conclusion, the staff finds that Dominion's combined approach of: (a) a one-time inspection of a surrogate structure; and (b) groundwater/soil testing described in *Groundwater/Soil Testing* section below provides the staff reasonable assurance that the effects of aging on the external surfaces of buried cementitious CW piping will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the subsequent period of extended operation.

1.b. One-Time Inspection of Buried Concrete CW Piping. In its Commitment No. 27, Enhancement No. 8, the applicant stated that if the south side of the Turbine Building is coated, excavation of one 96-inch CW pipe will be performed to inspect a surface area of 50 square-ft located below groundwater level. During its review, the staff noted that Dominion's approach is not consistent with recommendations in GALL-SLR Report AMP XI.M41 with respect to inspections of buried cementitious piping as follows:

- GALL-SLR Report Table XI.M41-2 recommends two inspections (for a two-unit site) during each 10-year period, commencing 10 years prior to the subsequent period of extended operation. The staff notes that this would result in a total of six inspections, as opposed to the one-time inspection proposed by Dominion.
- The "detection of aging effects" program element of GALL-SLR Report AMP XI.M41 (specifically section c.i.) recommends that 10 feet of piping is exposed for each inspection. The staff notes that inspecting a 10 foot segment of 96-inch pipe would be more surface area than the 50 square-ft area proposed by Dominion.

Although the inspection quantities and surface area inspected are less than the recommendations provided in GALL-SLR Report AMP XI.M41, the applicant committed to perform groundwater and soil testing, which goes beyond GALL-SLR Report AMP XI.M41 recommendations (i.e., AMP XI.M41 does not recommended performing groundwater or soil testing for buried cementitious piping). The staff's evaluation of groundwater and soil testing is documented in the *Groundwater/Soil Testing* section below. Based on the inclusion of groundwater and soil testing, the staff finds that Dominion's approach to perform a one-time inspection of a buried CW pipe provides the staff reasonable assurance that the external 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.

2. Groundwater/Soil Testing. The applicant committed (Commitment No. 27) to performing soil testing (Enhancement No. 7) and provided corrective actions if an aggressive groundwater/soil environment is confirmed (Enhancement No. 11). Enhancement Nos. 7 and 11 are summarized as follows:

- In its Commitment No. 27, Enhancement No. 7, Dominion stated that procedures will be enhanced to perform one soil corrosivity sample adjacent to the Unit 1 CW inlet piping and another soil corrosivity sample adjacent to the Unit 2 CW inlet piping. In addition, Dominion stated the following: (a) sampling will be performed on a 10-year interval; (b) data collected at each location will include soil resistivity, soil consortia (bacteria), pH, moisture, chlorides, sulfates, and redox potential; and (c) in addition to evaluating each individual parameter, corrosivity of carbon steel reinforcement and concrete degradation in high sulfate, high chlorides, and acidic environments will be evaluated.
- In its Commitment No. 27, Enhancement No. 11, Dominion stated that procedures will be revised to specify that when an aggressive groundwater/soil environment is confirmed, corrective actions are required, including confirmatory groundwater

resampling, as well as groundwater sampling on a quarterly basis for at least 1 year. In addition, Dominion stated the results of the quarterly groundwater samples will be trended, and if groundwater chemistry continues to exceed the aggressive environment thresholds, additional corrective actions will be determined, which may include items such as further sampling, installation of more wells, more frequent inspections of the surrogate structure, and/or the development of a plant-specific aging management activity.

During its review of Enhancement Nos. 7 and 11, the staff noted the following:

- GALL-SLR Report AMP XI.M41 does not recommend performing soil testing (covered under GALL-SLR Report AMP XI.M41) or groundwater testing (covered under GALL-SLR Report AMP XI.S6, "Structures Monitoring") for buried cementitious piping. The staff recognizes that soil and groundwater testing are being performed in lieu of performing periodic inspections (i.e., only a one-time inspection is being performed) of buried cementitious piping.
- GALL-SLR Report AMP XI.S6 states that low pH, high chlorides, and high sulfates (i.e., pH less than 5.5, chlorides greater than 500 ppm, or sulfates greater than 1,500 ppm) are considered aggressive groundwater/soil for below-grade concrete. The staff notes that SLRA Section B2.1.34, "Structures Monitoring," states that samples of groundwater will be taken at intervals not to exceed 5 years to indicate potentially harmful levels of low pH, high chlorides, and high sulfates.
- Two soil corrosivity samples will be taken every 10 years adjacent to buried cementitious CW piping, which will be evaluated for low pH, high chlorides, and high sulfates (i.e., the same parameters which GALL-SLR Report AMP XI.S6 considers aggressive soil for below-grade concrete).
- Dominion provided examples of corrective actions such as more frequent groundwater sampling and/or additional inspections if aggressive groundwater/soil is identified.

The staff finds that the frequency (i.e., every 10 years for soil testing and every 5 years for groundwater testing), acceptance criteria for the threshold of aggressive soil (i.e., pH less than 5.5, chlorides greater than 500 ppm, or sulfates greater than 1,500 ppm), and corrective actions associated groundwater/soil testing; coupled with either a one-time inspection of a surrogate concrete structure (described in the *One-Time Inspection of Surrogate Structure* section above) or of buried concrete CW piping (described in the *One-Time Inspection of Buried Concrete CW Piping* section above), provides the staff reasonable assurance that the external 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.

For the "acceptance criteria" program element, the staff determined the need for additional information, which resulted in the issuance of an RAI. RAI B2.1.27-5 and Dominion's response are documented in ADAMS Accession Nos. ML19155A050 and ML19183A440.

In its response, Dominion stated coating degradation indications such as peeling, delamination, blisters, cracking, flaking, and rusting will be evaluated by a coatings specialist qualified in accordance with ASTM D7108, "Standard Guide for Establishing Qualifications for a Nuclear Coatings Specialist," which is endorsed in Regulatory Guide 1.54, Revision 2. During the audit (ADAMS Accession No. ML19128A079), the staff confirmed Dominion's claim based upon its review of plant-specific procedures related to visual inspections of buried and underground

piping and tanks. The staff finds Dominion's responses acceptable because the qualifications of the individual determining if the type and extent of coating degradation is insignificant will be consistent with GALL-SLR Report AMP XI.M41.

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

Enhancement 1. SLRA Section B2.1.27 includes an enhancement to the "preventive actions" program element which relates to revising procedures to establish an upper limit of -1200 mV for pipe-to-soil potential measurements of coated pipes to preclude potential damage to coatings. The staff reviewed this enhancement and finds it acceptable because including a limiting critical potential of -1,200 mV relative to a copper/copper sulfate electrode (CSE) to prevent damage to coatings is consistent with GALL-SLR Report AMP XI.M41 recommendations.

Enhancement 2. SLRA Section B2.1.27 includes an enhancement to the "parameters monitored or inspected," "detection of aging effects," and "acceptance criteria," program elements which relates to revising procedures to include visual inspection requirements and acceptance criteria for (a) the absence of cracking in fiberglass reinforced plastic components and evaluation of blisters, gouges, or wear; and (b) minor cracking and loss of material in concrete or cementitious material provided there is no evidence of leakage exposed or rust staining from rebar or reinforcing "hoop" bands. The staff reviewed this enhancement and finds it acceptable because the aging effects and acceptance criteria associated with fiberglass and cementitious components are consistent with GALL-SLR Report AMP XI.M41 recommendations.

As amended by letter dated April 2, 2019, (ADAMS Accession No. ML19095A666), Dominion revised SLRA Section B2.1.27 and SLRA Table A4.0-1, Item 27, to reflect that Enhancement No. 2 has been completed. During the audit, the staff confirmed Dominion's claim based upon its review of the plant-specific procedure for visual inspection requirements and acceptance criteria for fiberglass and cementitious components.

Enhancement 3. As amended by letter dated September 3, 2019, SLRA Section B2.1.27 includes an enhancement to the "preventive actions" program element which relates to revising procedures to obtain pipe-to-soil potential measurements for piping in the scope of SLR during the next soil survey within 10 years prior to entering the subsequent period of operation. The staff reviewed this enhancement and finds it acceptable because these measurements will provide input into determining overall soil corrosivity.

Enhancement 4. As amended by letter dated September 3, 2019, SLRA Section B2.1.27 includes an enhancement to the "preventive actions" and "detection of aging effects" program elements which relates to requiring uncoated buried stainless steel tubing segments in the fuel oil system be inspected and coated consistent with Table 1 of NACE SP0169-2007 prior to the subsequent period of extended operation. The staff reviewed this enhancement and finds it acceptable because providing coatings for buried stainless steel in accordance with Table 1 of NACE SP0169-2007 and inspecting buried stainless steel in the 10-year period prior to the subsequent period of extended operation is consistent with GALL-SLR Report AMP XI.M41 recommendations.

Enhancement 5. As amended by letter dated September 3, 2019, SLRA Section B2.1.27 includes an enhancement to the “preventive actions” and “detection of aging effects” program element which relates to installing a cathodic protection system for protection of the 24-inch service water piping at the low level intake structure 5 years before entering the subsequent period of operation. The staff reviewed this enhancement and finds it acceptable because providing cathodic protection for buried steel piping at least 5 years prior to entering the subsequent period of extended operation is consistent with GALL-SLR Report AMP XI.M41 recommendations.

Enhancement 6. As amended by letter dated October 14, 2019, SLRA Section B2.1.27 includes an enhancement to the “preventive actions” and “detection of aging effects” program element which relates to installing a cathodic protection system for protection of each unit’s buried carbon steel condensate system and auxiliary feedwater system piping from the emergency condensate storage tank and the emergency condensate makeup tank to the service building five years before entering the subsequent period of operation. The staff reviewed this enhancement and finds it acceptable because providing cathodic protection for buried steel piping at least 5 years prior to entering the subsequent period of extended operation is consistent with GALL-SLR Report AMP XI.M41 recommendations.

Enhancement 7. As amended by letter dated October 31, 2019, SLRA Section B2.1.27 includes an enhancement to the “parameters monitored or inspected” program element which relates to revising procedures to perform two soil corrosivity samples every ten years (one adjacent to the Unit 1 CW inlet piping and another adjacent to the Unit 2 CW inlet piping) and evaluating corrosivity of carbon steel reinforcement and concrete degradation in high sulfate, high chlorides and acidic environments. The staff’s review of the subject enhancement is documented in the *Groundwater/Soil Testing* section above.

Enhancement 8. As amended by letter dated November 19, 2019, SLRA Section B2.1.27 includes an enhancement to the “detection of aging effects” program element which relates to revising procedures to perform a one-time inspection of either the south side of the Turbine Building (below grade) or a buried 96-inch CW pipe. The staff review of the subject enhancement is documented in the *One-Time Inspection of Surrogate Structure* (for the south side of the Turbine building) and *One-Time Inspection of Buried Concrete CW Piping* (for the 96-inch CW pipe) sections above.

Enhancement 9. As amended by letter dated June 27, 2019 (this enhancement was renumbered to Enhancement No. 9 from No. 5 in the October 31, 2019, letter), SLRA Section B2.1.27 includes an enhancement to the “acceptance criteria” program element which relates to revising procedures to specify that (a) cathodic protection surveys use the -850 mV instant off polarized potential criterion unless a suitable alternative polarization criteria can be demonstrated; and (b) alternative polarization criteria will be demonstrated to be effective through verification of soil resistivity, use of buried coupons, use of electrical resistance probes, or placement of reference cells in the immediate vicinity of the piping being measured.

During its review, the staff determined the need for additional information regarding the following: (a) why the effectiveness of the cathodic protection will be verified every five years when utilizing the 1 mils per year (mpy) and 100 mV minimum polarization cathodic protection acceptance criteria; and (b) how the impact of significant site features and local soil conditions will be factored into placement of the probes and use of probe data. RAI B2.1.27-6 and Dominion’s response are documented in ADAMS Accession Nos. ML19155A050 and ML19183A440.

In its response dated June 27, 2019, Dominion revised the subject enhancement and SLRA Table A4.0-1 to reflect the following: (a) external loss of material rate is verified every year when the effectiveness of the cathodic protection system is verified by measuring the loss of material rate; (b) external loss of material rate is verified every two years when using the 100 mV minimum polarization criterion; and (c) external loss of material rate is verified every five years when using the -750 or -650 criteria and soil resistivity is verified every five years. In addition, in its response dated June 27, 2019, Dominion stated the following: (c) consideration of soil data from the most recent soil survey (e.g., moisture content, pH, and resistivity measurements) will be factored into the placement of soil corrosion probes; (d) consideration of adjacent or neighboring components or systems that might interfere with accurate probe readings will be factored into the placement of soil corrosion probes; and (e) soil corrosion probes should be installed close to the piping locations of interest. The staff finds Dominion's response acceptable for the following reasons: (a) the conditions to utilize alternative polarization criteria are consistent with GALL-SLR Report AMP XI.M41; (b) soil corrosion data will be factored into the placement of soil corrosion probes, which will result in the probe data not being misleading due to potential soil impacts on corrosion rates; (c) the applicant identified appropriate factors to consider for site structure impacts to determine where soil corrosion probes data could be used and should not be used; and (d) soil corrosion probes will be installed in close proximity to the buried pipe of interest; which will result in more accurate corrosion rate data.

Enhancement 10. As amended by letter dated October 31, 2019, SLRA Section B2.1.27 includes an enhancement to the "acceptance criteria" program element which relates to revising procedures will to specify that soil sample results indicating corrosivity of greater than 10 points using the "carbon steel" column in Table 9-4 of EPRI Report 3002005294 require evaluation of potential scope expansion or category transition. The staff's evaluation regarding the use of EPRI Report 3002005294 is documented in the *Cathodic Protection for Buried Steel Piping* section above.

Enhancement 11. As amended by letter dated October 31, 2019, SLRA Section B2.1.27 includes an enhancement to the "acceptance criteria" and "corrective actions" program elements which relates to revising procedures to provide corrective actions if an aggressive groundwater/soil environment is confirmed for below-grade concrete. The staff's review of the subject enhancement is documented in the *Groundwater/Soil Testing* section above.

The staff conducted an audit to verify Dominion's claim of consistency with the GALL-SLR Report. Based on a review of the SLRA, Dominion's responses to RAIs B2.1.27-1, B2.1.27-1a, B2.1.27-2, B2.1.27-2a, B2.1.27-3, B2.1.27-4, B2.1.27-5, and B2.1.27-6, and Dominion's supplemental responses dated October 14, 2019, October 31, 2019, and November 19, 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 Dominion 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," "acceptance criteria," and "corrective actions" program elements and finds that, when implemented, they will make the AMP adequate to manage the applicable aging effects.

Operating Experience. SLRA Section B2.1.27 summarizes the operating experience related to the Buried and Underground Piping and Tanks program. The staff evaluated operating experience information by reviewing the subsequent license renewal application and conducting

an audit (ADAMS Accession No. ML19046A433). 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 also reviewed the revised operating experience summary of SLRA Section B2.1.16, "Fire Water System," provided in Dominion's October 14, 2019, annual update. The operating experience discussed two ruptures of the buried fire protection system piping, which occurred in July 2019. In the annual update, Dominion stated that external corrosion from long standing exposure to moist or wet soil resulted in wall thickness reductions at several locations. The staff noted that Dominion had not revised any programs as a result of the apparent loss of intended function of the fire water system, and as a result, the staff determined the need for additional information, which resulted in the issuance of questions/comments. Dominion's responses to the staff's questions/comments are documented in ADAMS Accession Nos. ML19310E716 and ML19329A287.

By letter dated October 31, 2019, Dominion provided additional details regarding the rupture of the buried fire protection piping discussed in the October 14, 2019, letter. Dominion's metallurgical analysis determined that the cause of the failure was graphitic corrosion (i.e., loss of material due to selective leaching) as a result of groundwater exposure. Based on the operating experience, Dominion augmented its Selective Leaching aging management program. The staff's evaluations of the associated changes are documented in SER Section 3.0.3.1.6.

During its review of a Dominion metallurgical report associated with the rupture of the fire water system, the staff noted significant loss of material (approximately 50 percent) for a buried bell and spigot tie rod amongst those opportunistically inspected as part of the cast iron fire protection piping rupture. The staff also noted that, as an alternative stated in GALL-SLR Report AMP XI.M41, Dominion uses jockey pump activity monitoring as an alternative to visual examinations for managing the effects of aging associated with buried fire main piping.

However, it was unclear to the staff whether the observed loss of material for the buried tie rod was associated with long standing exposure to moist/wet soil and whether monitoring of jockey pump activity in lieu of visual examinations would be enough to demonstrate that the effects of aging would be adequately managed to maintain intended functions of fire protection system piping components. In addition, the staff noted that, similar to the fracture of cast iron fire main piping in 2014 (described in the Fire Water program operating experience in SLRA Section B2.1.16), the recent rupture occurred also during a routine fire pump test.

However, SLRA Section B2.1.27 states:

- "the *Buried and Underground Piping and Tanks* program includes activities to perform volumetric and visual inspections to identify loss of material, cracking, and blistering for buried and underground piping and tanks within the scope of subsequent license renewal, and to initiate corrective actions."
- "corrective actions for additional inspections, re-evaluation, repairs, or replacements is provided for locations where aging effects are found."
- "[t]he program is informed and enhanced when necessary through the systematic and ongoing review of both plant-specific and industry operating experience."

Although Dominion has not proposed any specific corrective actions or changes to the Buried and Underground Piping and Tanks program as a result of the degradation in the bell and spigot tie rods, based on: (a) the tie rod degradation was visually noted during an opportunistic inspection of buried piping and as a result, it was entered into the CAP and the issue is being managed by the applicant; (b) potential leakage from a degraded tie rod would be noted by fire water system jockey pump monitoring; (c) the tie rod degradation did not result in a loss of intended function of a portion of the fire water system; and (d) Dominion's use of its corrective action program as cited in SLRA Section B2.1.27, the staff finds that there is reasonable assurance that the fire water system's intended functions will be met during the subsequent period of extended operation.

The staff did not identify any operating experience, other than that noted above for buried piping, to indicate that Dominion should modify its proposed program beyond that incorporated into the Buried and Underground Piping and Tanks and Selective Leaching programs. Notwithstanding the rupture of the fire water system, for which changes to the Selective Leaching program have been initiated, based on its audit and review of the application, 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>. As amended by letter dated October 31, 2019, SLRA Section A1.27 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 Dominion committed to ongoing implementation of the existing Buried and Underground Piping and Tanks program for managing the effects of aging for applicable components during the subsequent period of extended operation. The staff finds that the information in the UFSAR supplement, as amended by letter dated October 31, 2019, is an adequate summary description of the program.

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

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

SLRA Section B2.1.28 states that the Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks program is an existing program with enhancements 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. Dominion amended this SLRA section by letters dated April 2, 2019 (ADAMS Accession No. ML19095A666); June 27, 2019 (ADAMS

Accession No. ML19183A440); July 17, 2019 (ADAMS Accession No. ML19204A357); and September 3, 2019 (ADAMS Accession No. ML19253B330).

Staff Evaluation. During its audit (ADAMS Accession No. ML19128A079), the staff reviewed Dominion's claim of consistency with the GALL-SLR Report. The staff compared the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements of the SLRA to the corresponding program elements of GALL-SLR Report AMP XI.M42.

For the "scope of program" program element, the staff needed additional information, and issued an RAI. RAI B2.1.28-1 and Dominion's response are documented in ADAMS Accession Nos. ML19155A050 and ML19183A440.

In its response, Dominion stated the following: (a) the internal coating for the pressurizer relief tank is Amercoat 55; (b) it has a temperature rating of 180 °F immersed and 250 °F atmospheric; (c) the tank has a temperature alarm setpoint of 125 °F; and (c) plant-specific operating procedures direct the operator to return the temperature to below 120 °F. The staff finds Dominion's response acceptable because there is reasonable assurance that the coating system will remain within design parameters due to the alarm setpoint for the pressurizer relief tank and operator procedures for intervention. Based on remaining within design parameters, the inspections cited in the Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks program, the staff determined are adequate to manage loss of coating integrity.

For the "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements, the staff needed additional information, and issued an RAI. RAI B2.1.28-2 and Dominion's response are documented in ADAMS Accession Nos. ML19164A333 and ML19204A357. In its response to RAI B2.1.28-2, Dominion stated that the effects of aging for carbon fiber reinforced polymer (CFRP) lined surfaces will be managed using the Open-Cycle Cooling Water System program in lieu of the Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks program. In addition, Dominion added Enhancements 6, 8, 9, 10, 14, 18, and 19 to SLRA Section B2.1.11, "Open-Cycle Cooling Water System," to manage the effects of aging for CFRP lined surfaces. The staff's evaluation of these enhancements is documented in SER Section 3.0.3.2.7.

For the "detection of aging effects" program element, the staff needed additional information, and issued an RAI. RAI B2.1.28-3 and Dominion's response are documented in ADAMS Accession Nos. ML19155A050 and ML19183A440.

In its response, Dominion stated the following: (a) the Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks program inspects 100 percent of all accessible in-scope piping coated surfaces; and (b) the amount of inaccessible piping would be minimal and would not negate NUREG-2191 representative sample requirements of seventy-three 1-ft axial circumferential segments of piping or 50 percent of the total length of each coating/lining material and environment combination. The staff finds Dominion's response acceptable because the minimum inspection sample size for in-scope internally coated piping will be consistent with GALL-SLR Report AMP XI.M42 recommendations.

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 exceptions and enhancements to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff’s evaluation of these three exceptions and 15 enhancements follows.

Exception 1. As amended by letter dated July 17, 2019, in response to RAI B2.1.28-2, Exception No. 1 was deleted to reflect that the effects of aging for CFRP-lined surfaces will be managed using the Open Cycle Cooling Water System program in lieu of the Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks program. In addition, Dominion added Enhancements 6, 8, 9, 10, 14, 18, and 19 to SLRA Section B2.1.11 to manage the effects of aging for CFRP-lined surfaces. The staff’s evaluation of these enhancements is documented in SER Section 3.0.3.2.7.

The staff notes that Dominion’s response to RAI B2.1.28-2 resulted in the deletion of Exception 1; however, Dominion did not renumber Exception 2 based on this deletion. The staff’s evaluation of Exception 2 follows.

Exception 2. *(added by SLRA Change Notice 2)*. As amended by letter dated April 2, 2019, SLRA Section B2.1.28 includes an exception to the “detection of aging effects” program element related to not performing baseline inspections of coated/lined components based upon inspection coverage of all accessible surfaces by the program. The staff needed additional information regarding Exception 2, and issued an RAI. RAI B2.1.28-4 and Dominion’s response are documented in ADAMS Accession Nos. ML19155A050 and ML19183A440.

In its response, Dominion revised SLRA Section B2.1.28 and Table A4.0-1 to state the following: (a) if a baseline inspection has not been previously established, baseline coating/lining inspections will occur in the 10-year period prior to the subsequent period of extended operation; (b) subsequent inspection intervals are established by a coating specialist qualified in accordance with ASTM International Standards endorsed in RG 1.54, “Service Level I, II, and III Protective Coatings Applied to Nuclear Power Plants,” Revision 2; and (c) inspection intervals will not exceed those specified in NUREG-2191, Table XI.M42-1, “Inspection Intervals for Internal Coatings/Linings for Tanks, Piping, Piping Components, and Heat Exchangers.” The staff finds Dominion’s response acceptable for the following reasons: (a) baseline inspections will be performed consistent with GALL-SLR Report AMP XI.M42; (b) subsequent inspection intervals will be established by a coating specialist; and (c) inspection intervals will not exceed those specified in GALL-SLR Report Table XI.M42-1.

The staff notes that Dominion’s response to RAI B2.1.28-4 resulted in the deletion of Exception 2; however, Dominion did not immediately renumber Exception 3 based on this deletion. The staff’s evaluation of Exception 3 follows.

Exception 3. *(added by SLRA Change Notice No. 2 and renumbered to Exception 2 by letter dated September 19, 2019)*. As amended by letter dated April 2, 2019, SLRA Section B2.1.28 includes an exception to the “detection of aging effects” program element related to performing opportunistic inspections, in lieu of periodic inspections as recommended in GALL-SLR Report AMP XI.M42, for buried concrete lined fire protection system main loop piping. The staff reviewed this exception against the corresponding program element in GALL-SLR Report AMP XI.M42 and finds it acceptable because (a) there is reasonable assurance that, with the frequency, number, and multiple locations of flow tests that are conducted, flow blockage would be detected just as effectively as if internal visual inspections were being periodically conducted

on a portion of the piping in accordance with Table XI.M42-1, "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.

Enhancement 1. As amended by letters dated April 2, 2019, and June 27, 2019, SLRA Section B2.1.28 includes an enhancement to the "scope of program" and "detection of aging effects" program elements, which relates to revising procedures to require additional inspections of specific tanks, piping, and miscellaneous components within the scope of subsequent license renewal to ensure consistency with GALL-SLR Report AMP XI.M42. The staff needed additional information regarding Enhancement 1, and issued an RAI. RAI B2.1.28-5, followup RAI B2.1.28-5a, and Dominion's responses are documented in ADAMS Accession Nos. ML19155A050, ML19183A440, ML19231A153, and ML19253B330.

In its response, Dominion stated the following: (a) the solvent-based protective film used on the interior surfaces of the security diesel fuel oil tank was intended as a temporary layer to prevent oxidation of the internal surfaces prior to installation and designed to dissolve when placed inservice in the presence of diesel fuel oil; and (b) a limited borescope inspection confirmed that the security diesel fuel oil tank internal surfaces are bare metal. The staff finds Dominion's basis for not including the security diesel fuel oil tank within the scope of Enhancement 1 acceptable based on the following: (a) the solvent-based protective film was designed to be temporary (i.e., not designed to provide long-term corrosion protection); (b) the solvent-based protective film was designed to dissolve in the presence of diesel fuel; therefore, there is reasonable assurance that the film will not degrade into small particulate or large sheets; and (c) although Dominion did not specify the amount of area covered by the limited borescope inspection, Dominion's observation that the fuel oil tank internal surface is bare metal supports the conclusion that the solvent-based protective film was designed as a temporary protective layer, as opposed to a coating designed to provide long-term corrosion protection.

Based on its responses to RAIs B2.1.28-5 and B2.1.28-5a, the staff finds Enhancement 1 acceptable because when the subject enhancement and Enhancements 5, 6, and 7 are implemented, the "scope of program" and "detection of aging effects" program elements will be consistent with GALL-SLR Report AMP XI.M42.

Enhancement 2. SLRA Section B2.1.28 includes an enhancement to the "parameters monitored or inspected" program element which relates to revising programs to consistently reference coating aging mechanisms and add definitions for rusting, wear/erosion, and physical damage. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.M42 and finds it acceptable because when the subject enhancement and Enhancements 3 and 4 are implemented, the parameters monitored or inspected for coatings/linings will be consistent with GALL-SLR Report AMP XI.M42.

Enhancement 3. SLRA Section B2.1.28 includes an enhancement to the "parameters monitored or inspected" program element which relates to revising procedures to require alignment of the internal coating/lining inspection criteria with the inspection criteria and aging mechanisms specified in the program. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.M42 and finds it acceptable because when the subject enhancement and Enhancements 2 and 4 are implemented, the "parameters monitored or inspected" program element for coatings/linings will be consistent with GALL-SLR Report AMP XI.M42.

Enhancement 4. SLRA Section B2.1.28 includes an enhancement to the “parameters monitored or inspected” program element which relates to revising procedures to require inspections of cementitious coatings/linings and include aging mechanisms associated with cementitious coatings/linings described as (a) cracking due to chemical reaction, weathering, settlement, or corrosion of reinforcement; and (b) loss of material due to delamination, exfoliation, spalling, popout, scaling, or cavitation. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.M42 and finds it acceptable because when the subject enhancement and Enhancements 2 and 3 are implemented, the parameters monitored or inspected for coatings/linings will be consistent with GALL-SLR Report AMP XI.M42.

Enhancement 5. SLRA Section B2.1.28 includes an enhancement to the “detection of aging effects” program element, which relates to requiring cementitious coatings/linings inspectors to have a minimum of 5 years of experience inspecting or testing concrete structures or cementitious coatings/linings or a degree in the civil/structural discipline and a minimum of 1 year of experience. The staff reviewed this enhancement and finds it acceptable because when it is implemented the training and qualification requirements for cementitious coatings/linings inspectors will be consistent with GALL-SLR Report AMP XI.M42.

Enhancement 6. (New enhancement inserted in Change Notice 2; previous Enhancement 6 became Enhancement 7 and ultimately Enhancement 8). As amended by letter dated April 2, 2019, SLRA Section B2.1.28 includes an enhancement to the “detection of aging effects” program element which relates to revising procedures to perform opportunistic inspections of concrete-lined fire protection system piping. The staff’s evaluation regarding performing opportunistic inspections, in lieu of periodic inspections recommended in GALL-SLR Report AMP XI.M42, is documented in Exception 3. Note that the original Enhancement 7 in the SLRA was incorporated into Enhancement 9 by SLRA Change Notice 2.

Enhancement 7. (new enhancement inserted in letter dated September 3, 2019; previous (but not original) Enhancement 7 became Enhancement 8 and then Enhancement 9). As amended by letter dated September 3, 2019, SLRA Section B2.1.28 includes an enhancement to the “detection of aging effects” program element which relates to the inspection frequency for the component cooling heat exchanger channel head coatings. The staff’s evaluation of the subject enhancement in documented in the “operating experience” section below.

Enhancement 8. (renumbered from Enhancement 6 to Enhancement 7 and then to Enhancement 8). As amended by letter dated September 3, 2019, SLRA Section B2.1.28 includes an enhancement to the “monitoring and trending” program element which relates to revising procedures to require a pre-inspection review of the previous two condition assessment reports to review the results of inspections and any subsequent repair activities. During its review, the staff needed additional information on why the subject enhancement does not include the GALL-SLR Report AMP XI.M42 recommendation regarding preparation of a post-inspection report by a coatings specialist, and issued an RAI. RAI B2.1.28-6, RAI B2.1.28-6a, and Dominion’s responses are documented in ADAMS Accession Nos. ML19155A050, ML19183A440, ML19217A358, and ML19253B330. In its response, Dominion revised the enhancement to require a coatings specialist to prepare the coatings post-inspection condition assessment report. The staff finds Dominion’s response and changes to the subject enhancement acceptable because requiring a coatings specialist to prepare the post-inspection report is consistent with GALL-SLR Report AMP XI.M42 recommendations.

Based on its responses to RAI B2.1.28-6 and RAI B2.1.28-6a, the staff finds Enhancement 8 acceptable because when the subject enhancement and Enhancement 9 are implemented, the "monitoring and trending" program element will be consistent with GALL-SLR Report AMP XI.M42.

Enhancement 9. *(inserted as new Enhancement in SLRA Change Notice No 2 as Enhancement 8; renumbered to Enhancement 9 by letter dated September 3, 2019)*. As amended by letter dated September 3, 2019, SLRA Section B2.1.28 includes an enhancement to the "monitoring and trending" program element, which relates to revising procedures to require that inspection results are evaluated against acceptance criteria to confirm that the components' intended functions will be maintained throughout the subsequent period of extended operation based on the projected rate and extent of degradation. The staff reviewed this enhancement and finds it acceptable because when the subject enhancement and Enhancement 8 are implemented, the "monitoring and trending" program element will be consistent with the corresponding program element in GALL-SLR Report AMP XI.M42.

Enhancement 10. (*inserted as Enhancement 9 in Change Notice 2 and renumbered from Enhancement 9 by letter dated September 3, 2019*). As amended by letter dated September 3, 2019, SLRA Section B2.1.28 includes an enhancement to the "acceptance criteria" program element, which relates to revising procedures to (a) specify there are no indications of peeling or delamination; (b) require inspection of cementitious coatings/linings and that minor cracking and spalling is acceptable provided there is no evidence that the coating/lining is debonding from the base material (original SLRA Enhancement 7); and (c) require that wall thickness measurements, projected to the next inspection, meet design minimum wall requirements. The staff reviewed this enhancement and finds it acceptable because when the subject enhancement is implemented the "acceptance criteria" program element will be consistent with the corresponding program element in GALL-SLR Report AMP XI.M42.

Enhancement 11. (*originally Enhancement 8; renumbered to Enhancement 10 in SLRA Change Notice 2 and renumbered to Enhancement 11 by letter dated September 3, 2019).* SLRA Section B2.1.28 includes an enhancement to the "corrective actions" program element which relates to revising procedures to permit the removal of coatings/linings that do not meet acceptance criteria. The staff reviewed this enhancement and finds it acceptable because when the subject enhancement and Enhancements 12, 13, 14, and 15 are implemented, the "corrective actions" program element will be consistent with the corresponding program element in GALL-SLR Report AMP XI.M42.

Enhancement 12. *(originally Enhancement 9, renumbered to Enhancement 11 in SLRA Change Notice 2 and renumbered to Enhancement 12 by letter dated September 3, 2019)*. SLRA Section B2.1.28 includes an enhancement to the "corrective actions" program element, which relates to revising procedures by including an alternative to repair or removal of internal coatings exhibiting indications of peeling and delamination. The staff reviewed this enhancement and finds it acceptable because when the subject enhancement and Enhancements 11, 13, 14, and 15 are implemented, the "corrective actions" program element will be consistent with the corresponding program element in GALL-SLR Report AMP XI.M42.

Enhancement 13. *(originally Enhancement 10, renumbered to Enhancement 12 and expanded upon in SLRA Change Notice 2; renumbered as Enhancement 13 by letter dated September 3, 2019*). SLRA Section B2.1.28 includes an enhancement to the "corrective actions" program element, which relates to revising procedures to require physical testing when

determining if a blister that does not meet acceptance criteria can remain inservice. The staff reviewed this enhancement and finds it acceptable because when the subject enhancement and Enhancements 11, 12, 14, and 15 are implemented, the “corrective actions” program element will be consistent with the corresponding program element in GALL-SLR Report AMP XI.M42.

Enhancement 14. *(introduced as Enhancement 13 in Change Notice 2, renumbered to Enhancement 14 by letter dated September 3, 2019).* SLRA Section B2.1.28 includes an enhancement to the “corrective actions” program element which relates to revising procedures to require additional inspections if one of the inspections does not meet acceptance criteria due to current or projected degradation. The staff reviewed this enhancement and finds it acceptable because when the subject enhancement and Enhancements 11, 12, 13, and 15 are implemented, the “corrective actions” program element will be consistent with the corresponding program element in GALL-SLR Report AMP XI.M42.

Enhancement 15. *(introduced as Enhancement 14 by Change Notice 2, renumbered to Enhancement 15 by letter dated September 3, 2019).* SLRA Section B2.1.28 includes an enhancement to the “corrective actions” program element, which relates to revising procedures to require that physical testing is performed where physically possible or examination is conducted to ensure that the extent of repaired or replaced coatings encompasses sound coating material. The staff reviewed this enhancement and finds it acceptable because when the subject enhancement and Enhancements 11, 12, 13, and 14 are implemented, the “corrective actions” program element will be consistent with the corresponding program element in GALL-SLR Report AMP XI.M42.

Based on its audit and review of the SLRA, as amended by letter dated April 2, 2019, and Dominion’s responses to RAIs B2.1.28-1, B2.1.28-2, B2.1.28-3, B2.1.28-4, B2.1.28-5, RAI B2.1.28-5a, RAI B2.1.28-6, and B2.1.28-6a, 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 Dominion 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 exception between Dominion’s program and GALL-SLR Report AMP XI.M42 associated with the “detection of aging effects” program element, and its justification, and finds that the AMP, with the exception, is adequate to manage the applicable aging effects. In addition, the staff reviewed the enhancements associated with the “scope of program,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” “acceptance criteria,” and “corrective actions” program elements and finds that, when implemented, they will make the AMP adequate to manage the applicable aging effects.

Operating Experience. As amended by letter dated April 2, 2019, SLRA Section B2.1.28 summarizes operating experience related to the Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks program. The staff evaluated the operating experience information by reviewing the subsequent license renewal application and conducting an audit (ADAMS Accession No. ML19046A433). 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 needed additional information, and issued an RAI. RAI B2.1.28-7, RAI B2.1.28-7a, and Dominion’s responses are documented in ADAMS Accession Nos. ML19155A050, ML19183A440, ML19217A358, and ML19253B330.

In its responses, Dominion added a new Enhancement 7 to reflect the following: (a) the component cooling heat exchanger channel head coatings will continue to be inspected on a 1-year inspection interval; and (b) if two subsequent inspections demonstrate no change in coating condition, inspection frequencies at those locations may be conducted consistent with inspection Category B of NUREG-2191, Table XI.M42-1 (i.e., every 4 years).

During its evaluation of Dominion's response to RAI B2.1.28-7a, the staff noted that GALL-SLR Report Table XI.M41-2 recommends that if two sequential subsequent inspections demonstrate no change in coating/lining condition, subsequent inspections at those locations may be conducted to Inspection Category A (i.e., every 6 years). The staff finds Dominion's response and changes to SLRA Section B2.1.28 and Table A4.0-1 acceptable because: (a) the component cooling heat exchanger channel head coatings will continue to be inspected on a 1-year inspection interval, consistent with the frequency cited in operating experience example No. 10; and (b) Dominion's criteria to extend the inspection interval to every 4 years are bounded by GALL-SLR Report Table XI.M42-1 recommendations.

In addition, during its review of operating experience example No. 4, the staff noted that followup inspections of the recirculation spray cooler have not occurred since 2011. However, as amended by letter dated June 27, 2019, in response to RAI B2.1.28-4, the staff noted that baseline inspections will be performed for all accessible surfaces of heat exchangers prior to the subsequent period of extended operation. Based on its audit and review of the application, and review of Dominion's responses to RAIs B2.1.28-4, B2.1.28-7, and B2.1.28-7a, 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.

<u>UFSAR Supplement</u>. As amended by letter dated April 2, 2019, SLRA Section A1.28 provides the UFSAR supplement for the Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in GALL-SLR Report Table XI-01. The staff also noted that Dominion committed to ongoing implementation of the existing Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks 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.

<u>Conclusion</u>. On the basis of its review of Dominion's Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks program, the staff concludes that those program elements for which Dominion claimed consistency with the GALL-SLR Report are consistent. In addition, the staff reviewed the exception and its justification and concludes that the AMP, with the exception, is adequate to manage the applicable aging effects. 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 Dominion 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 ASME Section XI, Subsection IWE

SLRA Section B2.1.29, as amended by letter dated April 2, 2019, states that the ASME Section XI, Subsection IWE Aging Management Program (AMP) is an existing program with enhancements that will be consistent, with the program elements in the GALL-SLR Report AMP XI.S1, "ASME Section XI, Subsection IWE," except for the exception identified in the SLRA.

Staff Evaluation. During its audit (ADAMS Accession No. ML19128A079), the staff reviewed Dominion's claim of consistency with the GALL-SLR Report. The staff compared the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements of the SLRA to the corresponding program elements of GALL-SLR Report AMP XI.S1.

For the "parameters monitored or inspected," "detection of aging effects," and "acceptance criteria" program elements, the staff needed additional information, which resulted in Dominion voluntarily supplementing the SLRA AMP through Change Notice 2, dated April 2, 2019. The staff review of the supplemental information is included in its evaluation of the AMP exception and enhancements below.

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

Exception 1. SLRA Section B2.1.29, as amended by SLRA Change Notice 2, dated April 2, 2019, includes an exception to the "parameters monitored or inspected" and "detection of aging effects" program elements, which relates to not monitoring for cracking, utilizing supplemental surface examinations of carbon steel containment pressure-retaining boundary components except high temperature mechanical penetrations that are subject to cyclic loading but have no CLB fatigue analysis. This exception applies to the following Unit 1 and Unit 2 containment pressure-retaining boundary components of carbon steel material (listed in SLRA Table 3.5.2-1) that were determined to have no existing CLB fatigue analysis or TLAAs: penetrations (electrical penetrations, mechanical penetrations except high temperature penetrations), equipment hatch, personnel hatch, and equipment hatch airlock doors. As justification for the exception, SLRA Section B2.1.29 states that these containment components were designed in accordance with ASME Code Section III, Subsection N-415.1, 1968 edition. The staff noted that such evaluation may potentially fit the definition of a TLAA. However, contrary to the SLRA Change Notice 2 exception justification statements noted above, the staff noted that SLRA Sections 3.5.2.2.1.5 and 4.6.3 state that there are no TLAAs for containment penetrations. Further, SLRA Section 4.6.1 provides a TLAA disposition only for the containment liner plate and there were no supplemental amendments provided in SLRA Change Notice 2 that addressed components covered by the exception. The NRC issued RAI B2.1.29-1 to request additional information on the adequacy of the AMP. RAI B2.1.29-1 and Dominion's response dated June 27, 2019, is documented in ADAMS Accession No. ML19183A386.

In its RAI response, Dominion stated that the containment contains components subject to cyclic loading without fatigue analyses. The containment equipment hatch was designed in accordance with ASME Code, Section III, Subsection N415.1, "Vessels Not Requiring Analysis for Cyclic Operation," and constructed of ASME SA-442 Grade 60 and SA-516 Grade 60 FBX

steel material, which are the same as the containment liner. The steel mechanical penetrations (with maximum piping operating temperature less than 200 °F) and electrical penetration sleeves are constructed of ASME SA-333, Grade 3 material; the stainless steel penetrations are constructed of ASME SA-312, Type 304 and Type 316 material; and the electrical penetration flanges are constructed of SA-350 Grade LF2 steel. Dominion further stated that for subsequent license renewal, the six conditions specified in ASME Section III, Subsection N-415.1 to evaluate cyclic fatigue (fatigue waiver) were applied to each of these materials used in the construction of the containment penetration components listed above. The six conditions evaluated fatigue cycles 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. Dominion noted that Condition 5 was not applicable because dissimilar welds will receive supplemental surface examinations. Dominion summarized the results of these evaluations, which determined that a detailed fatigue analysis was not required since the six conditions were satisfied for stress fluctuations caused by pressure, temperature, and design earthquake load cycles for 80 years, indicated in SLRA Table 4.6.1-1 (as supplemented by this RAI response). Dominion concluded that the results of the above fatigue waiver analyses justified the program exception that surface examinations will not be required for these components. For the airlocks, Dominion stated that 10 CFR 50, Appendix J, Type B local leak rate tests capable of detecting cracking are performed as described in UFSAR Sections 5.5.4 and 5.5.6; therefore, surface examinations are not required for these components also.

During its evaluation of Dominion's response to RAI B2.1.29-1, the staff noted that Dominion provided the following technical basis to justify not performing supplemental surface examinations to detect cracking due to cyclic loading for containment pressure-retaining boundary components that do not have a CLB fatigue analysis. For the steel equipment hatch, containment steel mechanical penetrations (maximum operating temperature less than 200 °F), steel electrical penetrations, stainless steel penetrations that are subject to cyclic loading but do not have a CLB fatigue analysis, Dominion summarized the results of its supplemental evaluation that showed it met the fatigue waiver criteria in ASME Section III, Subsection N-415.1 for these components. The staff noted from SLRA Section 2.4.1.1 and UFSAR Section 15.5.1.8 that airlocks at Surry include an emergency access airlock and a personnel access hatch for each unit, both of which have double door closures. For the airlocks, Dominion credited the Appendix J Type B local leak rate tests capable of detecting cracking performed as described in UFSAR Sections 5.5.4 and 5.5.6. The staff's noted, while reviewing UFSAR Section 5.5.4, that only the complete full volume airlock test (second method where the space between the inner and outer airlock door is pressurized to test pressure), and not the seal test (first method), is capable of detecting cracking due to cyclic loading. The staff further noted that UFSAR Section 5.5.6 states, "The personnel air lock full volume test was performed prior to initial fuel load and is performed periodically thereafter, in accordance with 10 CFR Part 50 Appendix J, Option B. …… Seal tests are not substituted for the airlock full volume test." The staff finds Dominion's response acceptable because Dominion provided an adequate justification for not performing supplemental surface examinations for steel and stainless steel containment pressure-retaining components (except air locks) that do not have a CLB fatigue analysis based on a fatigue waiver evaluation satisfying the requirements of ASME Section III, Subsection N-415.1. For airlocks, Dominion credited the Appendix J Type B "full volume airlock test" as described in UFSAR Sections 5.5.4 and 5.5.6. The staff notes that the test is capable of detecting cracking and therefore is acceptable. The staff's concerns in RAI B2.1.29-1 are thus resolved.

The staff reviewed exception 1 (no supplemental monitoring for cracking of certain steel containment pressure-retaining boundary components subject to cyclic loading but have no CLB fatigue analysis) against the corresponding program elements in GALL-SLR Report AMP XI.S1 and finds it acceptable. Dominion has demonstrated analytically, by evaluation satisfying the six fatigue waiver conditions stipulated in Subarticle N-415.1 “Vessel Not Requiring Analysis for Cyclic Operation” of the ASME Code, Section III, 1968 edition, that the stated containment pressure-retaining boundary components (steel equipment hatch, steel mechanical penetrations (with a maximum piping operating temperature less than 200 °F), steel electrical penetrations, and stainless steel penetrations) 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. For the airlocks (emergency airlock and personnel hatch), Dominion credited 10 CFR 50, Appendix J, Type B “full volume” local leak tests, described in UFSAR Sections 5.5.4 and 5.5.6, which is capable of detecting cracking and is an acceptable method in lieu of surface examination in GALL-SLR Report AMP XI.S1. Therefore, no supplemental surface examinations, recommended in GALL-SLR Report AMP XI.S1 for components without CLB fatigue analysis, are required for managing the aging effect of cracking due to cyclic loading for these specific components. The components not covered by this exception and that require supplemental surface examinations to detect cracking are listed in the staff’s evaluation of Enhancement 3 below.

Enhancement 1. SLRA Section B2.1.29 includes an enhancement to the “preventive actions” program element which relates to revising procedures in accordance with specific industry standards by including preventive actions with regard to bolting material, lubricants and sealants selection, and installation torque. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.S1 and finds it acceptable because when it is implemented for replacement bolting, procedures will specify that bolting material, installation torque or tension, and use of lubricants and sealants are in accordance with industry guidelines (EPRI NP-5769, EPRI TR-104213, and NUREG-1339), which is consistent with the GALL-SLR Report recommendations regarding preventive actions for bolting integrity.

Enhancement 2. SLRA Section B2.1.29 includes an enhancement to the “preventive actions” program element which relates to revising procedures to specify preventive actions for storage, lubricants, and stress corrosion cracking (SCC) potential of ASTM A325, ASTM F1852 and ASTM A490 structural bolting. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.S1 and finds it acceptable because when it is implemented, plant procedures will specify preventive actions for storage, lubricants, and SCC potential of ASTM A325, ASTM F1852, and ASTM A490 structural bolting in accordance with Section 2 of the Research Council for Structural Connections’ publication, “Specification for Structural Joints Using ASTM A325 or A490 Bolts,” which is consistent with the recommendations in the GALL-SLR Report AMP.

Enhancement 3. SLRA Section B2.1.29, as amended by SLRA Change Notice 2, dated April 2, 2019, includes an enhancement to the “parameters monitored or inspected,” “detection of aging effects” and “acceptance criteria” program elements which relates to conducting periodic supplemental surface examinations of specific susceptible containment pressure-retaining boundary components to manage cracking. The specific components subject to surface examinations are containment pressure-retaining portions of the fuel transfer tube, fuel transfer tube enclosure, fuel transfer tube blind flange, dissimilar metal weld penetrations, and high temperature steel piping penetrations (for containment piping with maximum operating temperature equal to or exceeding 200 °F as identified in UFSAR

Section 14B2.2.1 and UFSAR Table 14B-2). The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.S1 and finds it acceptable because when it is implemented: (1) it will perform supplemental surface examinations, in addition to visual examinations, once in a 10-year interval, of specific containment pressure-retaining boundary components to detect and manage cracking pursuant to the acceptance criteria in IWE-3122; (2) it will be consistent with the recommendations of the GALL-SLR Report to detect cracking in components susceptible to SCC or subject to cyclic loading but have no CLB fatigue or fatigue waiver analyses; and (3) the frequency of examination of once in a 10-year interval is reasonable because there has been no plant-specific operating experience of cracking in these components.

Enhancement 4. SLRA Section B2.1.29, as amended by SLRA Change Notice 2, dated April 2, 2019, includes an enhancement to the "detection of aging effects" program element which relates to conducting a one-time supplemental volumetric examination of the containment liner surfaces if triggered by plant-specific operating experience of containment liner corrosion initiating on the inaccessible side.

From a review of plant-specific operating experience, the staff noted that the triggering operating experience has not occurred to date at Surry. 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 liner surfaces inaccessible from one side, if triggered by plant-specific operating experience of liner corrosion initiated on the inaccessible side.

Based on its audit and review of the SLRA, and its amendment dated April 2, 2019, and its response to RAI B2.1.29-1 dated June 27, 2019, the staff finds that the "scope of program," "preventive actions," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements for which Dominion 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 exception associated with the "parameters monitored or inspected" and "detection of aging effects" program elements and its justification, and finds that the AMP, with the exception, is adequate to manage the applicable aging effects. In addition, the staff reviewed the enhancements associated with the "preventive actions," "parameters monitored or inspected," "detection of aging effects," and "acceptance criteria" program elements and finds that, when implemented, they will make the AMP adequate to manage the applicable aging effects.

<u>Operating Experience</u>. SLRA Section B2.1.29 summarizes the operating experience related to the ASME Section XI, Subsection IWE AMP. The staff evaluated operating experience information by reviewing the SLRA and conducting an audit (ADAMS Accession No. ML19046A433). 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 Dominion should modify its proposed program beyond that incorporated during the development of and staff review of the SLRA.

Based on its audit and review of the application, and its amendment dated April 2, 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 AMP was evaluated.

UFSAR Supplement. SLRA Section A1.29 provides the UFSAR supplement for the ASME Section XI, Subsection IWE 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 Dominion committed to ongoing implementation of the existing ASME Section XI, Subsection IWE AMP for managing the effects of aging for applicable components during the subsequent period of extended operation. The staff also noted that Dominion committed to implement the four SLRA AMP enhancements 6 months prior to the subsequent period of extended operation.

The staff finds that the information in the UFSAR supplement, with commitments as amended by letter dated April 2, 2019, is an adequate summary description of the program.

Conclusion. On the basis of its review of Dominion's ASME Section XI, Subsection IWE AMP, as amended, and the response to RAI B2.1.29-1, the staff concludes that those program elements for which Dominion claimed consistency with the GALL-SLR Report are consistent. In addition, the staff reviewed the exception and its justification and concludes that the AMP, with the exception, is adequate to manage the applicable aging effects. 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 Dominion 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 ASME Section XI, Subsection IWL

SLRA Section B2.1.30 states that the ASME Section XI, Subsection IWL program is an existing program with enhancements that will be consistent with the program elements in the GALL-SLR Report AMP XI.S2, "ASME Section XI, Subsection IWL."

Staff Evaluation. During its in-office audit (ADAMS Accession No. ML19128A079), the staff reviewed Dominion's claim of consistency with the GALL-SLR Report. The staff compared the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements of the SLRA to the corresponding program elements of GALL-SLR Report AMP XI.S2.

The staff also reviewed the portions of the "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 B2.1.30 includes an enhancement to the "monitoring and trending" program element which relates to ensuring that quantitative measurements are used and that inspections consider prior results. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.S2 and finds it acceptable because when it is implemented it will be consistent with GALL-SLR Report recommendations for using quantitative measurements and using previous results to trend and manage degradation.

Enhancement 2. SLRA Section B2.1.30 includes an enhancement to the “acceptance criteria” program element which relates to determining whether cracks are active or passive. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.S2 and finds it acceptable because when it is implemented it will be consistent with GALL-SLR Report recommendations for using ACI 349-3R in implementing concrete inspections.

Based on its audit and review of the SLRA and the onsite audit performed the week of April 22, 2019 (ADAMS Accession No. ML19169A329), 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 Dominion claimed consistency with the GALL-SLR Report are consistent with the corresponding program elements of GALL-SLR Report AMP XI.S2. In addition, the staff reviewed the enhancements associated with the “monitoring and trending” and “acceptance criteria” program elements and finds that when implemented, they will make the AMP adequate to manage the applicable aging effects.

Operating Experience. SLRA Section B2.1.30 summarizes operating experience related to the ASME Section XI, Subsection IWL program. The staff evaluated operating experience information by reviewing the subsequent license renewal application and conducting an audit (ADAMS Accession No. ML19046A433). 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 Dominion should modify its proposed program beyond that incorporated during the development of the SLRA. Based on its audit and review of the application, the staff finds that the conditions and operating experience at the plant are bounded by those for which the ASME Section XI, Subsection IWL was evaluated.

UFSAR Supplement. SLRA Section A1.30 provides the UFSAR supplement for the ASME Section XI, Subsection IWL program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in GALL-SLR Report Table XI-01. The staff also noted that Dominion committed to ongoing implementation of the existing ASME Section XI, Subsection IWL program for managing the effects of aging for applicable components during the subsequent period of extended operation. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. On the basis of its review of Dominion’s ASME Section XI, Subsection IWL program, the staff concludes that those program elements for which Dominion 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 Dominion 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 ASME Section XI, Subsection IWF

SLRA Section B2.1.31 states that the ASME Section XI, Subsection IWF AMP is an existing program with enhancements that will be consistent with the program elements in the GALL-SLR

Report AMP XI.S3, “ASME Section XI, Subsection IWF.” Dominion amended this SLRA section by letter dated April 2, 2019 (ADAMS Accession No. ML19095A666).

Staff Evaluation. During its audits (ADAMS Accession Nos. ML19128A079 and ML19169A329, for the in-office and onsite audit reports, respectively), the staff reviewed Dominion’s claim of consistency with the GALL-SLR Report. The staff compared the “scope of program,” “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” “acceptance criteria,” and “corrective actions” program elements of the SLRA to the corresponding program elements of GALL-SLR Report AMP XI.S3.

The staff also reviewed the portions of the “scope of program,” “preventive actions,” “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 seven enhancements is as follows.

Enhancement 1. SLRA Section B2.1.31 includes an enhancement to the “scope of program” program element, which relates to revision of inservice inspection (ISI) procedures for acceptability of inaccessible areas (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 such inaccessible areas. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.S3 and finds it acceptable because when it is implemented it will provide for inspection of inaccessible areas consistent with the recommendations of GALL-SLR Report AMP XI.S3.

Enhancement 2. SLRA Section B2.1.31 includes an enhancement to the “preventive actions” program element, which relates to revision of ISI procedures for installation and replacement of bolting material and use of lubricants and sealants in accordance with industry practices (e.g., EPRI NP-5769, EPRI TR-104213) and NRC recommendations for resolution of Generic Safety Issue (GSI)-29, “Bolting Degradation or Failure in Nuclear Power Plants.” The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.S3 and finds it acceptable because when it is implemented it will provide an equivalent level of preventive measures as those recommended by GALL-SLR Report AMP XI.S3.

Enhancement 3. SLRA Section B2.1.31 includes an enhancement to the “preventive actions” program element, which relates to revision of storage and handling procedures for storage of high-strength bolts and lubricants, as discussed in Section 2 of RCSC (Research Council for Structural Connections) publication, “Specification for Structural Joints Using ASTM A325 or A490 Bolts.” The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.S3 and finds it acceptable because when it is implemented it will provide an equivalent level of preventive measures as those recommended by GALL-SLR Report AMP XI.S3.

Enhancement 4. SLRA Section B2.1.31 includes an enhancement to the “parameters monitored or inspected” program element, which relates to revision of procedures for monitoring for stress corrosion cracking (SCC) of nuclear steam supply system (NSSS) component supports, Class 1 high-strength bolting greater than 1-inch nominal diameter, including F1 ASTM A325 and/or ASTM A490 bolts (or their respective equivalent twist-off type ASTM 852 and/or ASTM F2280 bolts). The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.S3 and finds it acceptable because when it is

implemented it will exceed the corresponding GALL-SLR Report AMP XI.S3 program element guidance.

Enhancement 5. SLRA Section B2.1.31 includes an enhancement to the "detection of aging effects" program element, which relates to revision of ISI procedures by including a one-time inspection within 5 years prior to entering the subsequent period of extended operation, of an additional 5 percent of the sample populations for Class 1, 2, and 3 piping supports. In compliance with GALL-SLR Report guidance, the additional supports will be selected from the remaining population of IWF piping supports and will include components that are most susceptible to age-related degradation. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.S3 and finds it acceptable because when it is implemented it will include the corresponding GALL-SLR Report AMP XI.S3 program element guidance.

Enhancement 6. SLRA Section B2.1.31 includes an enhancement to the "detection of aging effects" program element, which relates to revision of ISI procedures to specify that, for NSSS component supports, high-strength bolting greater than 1-inch nominal diameter, volumetric examination comparable to that of ASME Code, Section XI, Table IWB-2500-1, Examination Category B-G-1 will be performed to detect cracking, in addition to the VT-3 examination. According to the proposed enhancement, in each 10-year period during the subsequent period of extended operation, a representative sample of bolts will be inspected, where the sample will be 20 percent of the population (for a material/environment combination) up to a maximum of 25 bolts. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.S3 and finds it acceptable because when it is implemented it will include the corresponding GALL-SLR Report AMP XI.S3 program element guidance.

Enhancement 7. SLRA Section B2.1.31, as amended by letter dated April 2, 2019, includes an enhancement to the "monitoring and trending" program element, which relates to sampling of component supports that do not exceed the acceptance standards of IWF-3400 but that are electively repaired to as-new condition. The enhancement calls for the sample to be increased or modified to include other representative supports from the remaining population of supports that were not repaired. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.S3 and finds it acceptable because when it is implemented it will align the "monitoring and trending" program element to that of the GALL-SLR Report AMP XI.S3.

Based on its audit and review of the SLRA, and its amendment dated April 2, 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 Dominion 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," "parameters monitored or inspected," "detection of aging effects," and "monitoring and trending" program elements and finds that when implemented, they will make the AMP adequate to manage the applicable aging effects.

Operating Experience. SLRA Section B2.1.31 summarizes the operating experience related to the ASME Section XI, Subsection IWF AMP. The staff evaluated operating experience information by reviewing the subsequent license renewal application and conducting an audit (ADAMS Accession No. ML19046A433). 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 Dominion should modify its proposed program beyond that incorporated.

Based on its audit and review of the application, the staff finds that the conditions and operating experience at the plant are bounded by those for which the ASME Section XI, Subsection IWF AMP was evaluated.

UFSAR Supplement. SLRA Section A1.31 provides the UFSAR supplement for the ASME Section XI, Subsection IWF AMP. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in GALL-SLR Report Table XI-01.

The staff also noted that Dominion committed (Commitment No. 31, as amended by letter dated April 2, 2019) to enhance its procedures dealing with inspection of inaccessible areas, installation of high strength bolts and selection and storage of sealants and lubricants, inspection of high strength bolts for SCC, and sampling as outlined in the above reviewed and evaluated enhancements 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 Dominion's ASME Section XI, Subsection IWF AMP, the staff concludes that those program elements for which Dominion 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 Dominion 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 Masonry Walls

SLRA Section B2.1.33 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." Dominion amended this SLRA section by Change Notice No. 3 dated June 10, 2019 (ADAMS Accession No. ML19168A028).

Staff Evaluation. During its audit (ADAMS Accession No. ML19128A079), the staff reviewed Dominion'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," and "acceptance criteria" program elements of the SLRA to the corresponding program elements of GALL-SLR Report AMP XI.S5.

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

Enhancement 1. SLRA Section B2.1.33 includes an enhancement to the “detection of aging effects” program element which relates to qualification requirements for inspection personnel. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.S5 and finds it acceptable because when it is implemented it will be consistent with the GALL-SLR Report recommendation to ensure that personnel performing the inspections and evaluations of masonry walls are qualified in accordance with industry guidelines and standards (i.e., ACI 349.3R).

Enhancement 2. SLRA Section B2.1.33, as amended by Change Notice No. 3 dated June 10, 2019, includes an enhancement to the “monitoring and trending” and “acceptance criteria” program elements which relates to assessing observed aging effects against evaluation basis and forward trending of the inspection results. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.S5 and finds it acceptable because when it is implemented it will be consistent with the GALL-SLR Report recommendations to identify the trending of inspection results and projection to the next inspection interval, and to ensure that the observed aging effects do not invalidate the evaluation basis of the wall or impact its intended function.

Based on its audit and review of the SLRA, and its amendment by Change Notice No. 3, 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 Dominion 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 enhancements associated with the “detection of aging effects,” “monitoring and trending,” and “acceptance criteria” program elements and finds that when implemented, they will make the AMP adequate to manage the applicable aging effects.

Operating Experience. SLRA Section B2.1.33 summarizes the operating experience related to the Masonry Walls AMP. The staff evaluated operating experience information by reviewing the subsequent license renewal application and conducting an audit (ADAMS Accession No. ML19046A433). 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 Dominion should modify its proposed program beyond that incorporated during the development of the SLRA. Based on its audit and review of the application, the staff finds that the conditions and operating experience at the plant are bounded by those for which the Masonry Walls AMP was evaluated.

UFSAR Supplement. SLRA Section A1.33 provides the UFSAR supplement for the Masonry Walls 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 Dominion committed to implement the program enhancements 6 months prior to the subsequent period of extended operation. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. On the basis of its review of Dominion’s Masonry Walls AMP, the staff concludes that those program elements for which Dominion 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 Dominion has demonstrated that the effects of aging will be adequately managed so that the intended

function(s) will be maintained consistent with the CLB for the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.27 Structures Monitoring

SLRA Section B2.1.34 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." Dominion amended this SLRA section by letter dated September 3, 2019 (ADAMS Accession No. ML19253B330), and October 14, 2019 (ADAMS Accession No. ML19294A044).

Staff Evaluation. During its audit (ADAMS Accession No. ML19128A079), the staff reviewed Dominion's claim of consistency with the GALL-SLR Report. The staff compared the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements of the SLRA to the corresponding program elements of GALL-SLR Report AMP XI.S6.

For the "detection of aging effects" program element, the staff needed additional information, which resulted in the issuance of RAIs. RAI B2.1.34-1 and RAI B2.1.34-1a and Dominion's response are documented in ADAMS Accession Nos. ML19204A357 and ML19253B330, respectively.

In its response, Dominion stated that a baseline inspection will be performed prior to January 1, 2031, to ensure that wooden poles are inspected before entering the subsequent period of extended operation and within the expected 50-year service life of the wooden pole's treatment. Dominion also stated that the results of the baseline inspection will be used to determine the frequency of subsequent inspections, not to exceed every 8 years, as recommended by the U.S. Department of Agriculture Rural Utilities Service Bulletin 1730B-121 for wooden poles inspections and maintenance.

During its evaluation of Dominion's response to RAI B2.1.34-1a, the staff noted that Dominion's proposed inspections, frequencies, and parameters monitored and inspected are commensurate to those guidelines used for wooden poles within the industry. The staff finds Dominion's response and changes to the SLRA Sections A1.34 and B2.1.34, and Table A4.0-1 item 34, acceptable because they will adequately detect and manage the aging effects of wooden poles prior to a loss of intended function.

The staff also reviewed the portions of the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements associated with 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 12 enhancements follows.

Enhancement 1. SLRA Section B2.1.34 includes an enhancement to the "scope of program" program element which relates to including the decontamination building, radwaste facility, health physics yard office building, laundry facility, and machine shop structures to the scope of the program, and to establishing a quantitative baseline inspection for these structures prior to the subsequent period of extended operations. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.S6 and finds it acceptable

because when it is implemented it will (1) be consistent with the GALL-SLR Report recommendation to include all structures and structural components and commodities in the scope of the Structures Monitoring program, and (2) establish quantitative baseline inspection data prior to the subsequent period of extended operations for trending purposes.

Enhancement 2. SLRA Section B2.1.34, as amended by letter dated June 10, 2019, includes an enhancement to the "scope of program" program element, which relates to including the oiled-sand cushion to the inspection for the fire protection/domestic water tank foundation. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.S6 and finds it acceptable because when it is implemented it will be consistent with the GALL-SLR Report recommendation to include all structural components and commodities in the scope of license renewal that will be managed by the Structures Monitoring program.

Enhancement 3. SLRA Section B2.1.34 includes an enhancement to the "preventive actions" program element, which relates to the proper selection of bolting material and lubricants and to the appropriate torque or tension in accordance with industry standards and specifications to ensure bolting integrity. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.S6 and finds it acceptable because when it is implemented it will be consistent with the GALL-SLR Report recommendation to include preventive actions that provide reasonable assurance that structural bolting integrity is maintained.

Enhancement 4. SLRA Section B2.1.34 includes an enhancement to the "parameters monitored or inspected" program element, which relates to detection and evaluation of loose, missing, or damaged bolts, rivets, and nuts during inspections. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.S6 and finds it acceptable because when it is implemented it will be consistent with the GALL-SLR Report recommendation to monitor loose bolts and nuts and evaluate for acceptability.

Enhancement 5. SLRA Section B2.1.34 includes an enhancement to the "detection of aging effects" program element, which relates to revising current procedures to require that inspector qualification be consistent with the requirements of the American Concrete Institute (ACI) 349.3R-02. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.S6 and finds it acceptable because when it is implemented it will be consistent with the GALL-SLR Report recommendation for personnel performing the inspections and evaluations to be qualified in accordance with industry guidelines and standards (i.e., ACI 349.3R).

Enhancement 6. SLRA Section B2.1.34, as amended by letter dated September 3, 2019, includes an enhancement to the "detection of aging effects" program element, which relates to the inspection of wooden poles, at a frequency not to exceed every 8 years, using sounding or other appropriate techniques (including boring and excavation), as an augmented examination to the visual inspection, to detect changes in material properties. Since this enhancement addresses a plant-specific component not previously addressed in the GALL-SLR Report AMP XI.S6, the staff reviewed this enhancement against the criteria in SRP-SLR Sections A.1.2.3.3 and A.1.2.3.4. The staff finds Dominion's plant-specific enhancement adequate because the proposed parameters monitored and inspected, and inspection frequencies are commensurate with industry guidelines for wooden pole inspections to detect the presence and manage the extent of the aging effects prior to a loss of intended function.

Enhancement 7. SLRA Section B2.1.34 includes an enhancement to the “detection of aging effects” program element, which relates to the evaluation of inaccessible areas of structural components when conditions exist in accessible areas that could indicate the presence of, or result in, degradation to such inaccessible areas. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.S6 and finds it acceptable because when it is implemented it will be consistent with the GALL-SLR Report recommendation to evaluate inaccessible areas of structural components for acceptability when conditions exist in accessible areas that may indicate potential degradation in the inaccessible areas.

Enhancement 8. SLRA Section B2.1.34 includes an enhancement to the “detection of aging effects” program element, which relates to performing VT-1 examination on stainless steel and aluminum components to identify cracking due to stress corrosion cracking (SCC). The staff noted that Dominion addressed the associated further evaluation from SRP-SLR Section 3.5.2.2.2.4 by incorporating the GALL-SLR Report AMP XI.M36 recommendations into the Structures Monitoring program to adequately manage the aging effects of stainless steel and aluminum components. Because this enhancement incorporates plant-specific actions into the AMP, the staff reviewed the applicant’s enhancement to the “detection of aging effects” program element against the criteria in SRP-SLR Section A.1.2.3.4. The staff finds the plant-specific enhancement to the “detection of aging effects” program element acceptable because the proposed inspection frequency, sample size, and methodology is consistent with the GALL-SLR Report AMP XI.M36 recommendations and the SRP-SLR criteria for detecting the aging effect prior to a loss of intended function.

Enhancement 9. SLRA Section B2.1.34 includes an enhancement to the “detection of aging effects” program element, which relates to the detection of loss of material due to corrosion and other superficial corrosion for the neutron shield tank (NST) to ensure that it continues to perform its intended functions, including structural support of the RPV. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.S6 and finds it acceptable because when it is implemented it will be consistent with the GALL-SLR Report recommendation to detect and quantify the aging effects associated with the NST before there is a loss of intended function.

Enhancement 10. SLRA Section B2.1.34 includes an enhancement to the “corrective actions” program element, which relates to performing additional sample-based inspections to detect cracking in stainless steel and aluminum components if an inspection result does not meet the acceptance criteria due to current or projected degradation, and to further evaluate the results by taking proper corrective action to address the issue. Because this enhancement incorporates plant-specific actions into the AMP, the staff reviewed the applicant’s enhancement to the “corrective actions” program element against the criteria in SRP-SLR Section A.1.2.3.7. The staff finds the plant-specific enhancement to the “corrective actions” program element acceptable because it is consistent with the SRP-SLR criteria for taking the necessary corrective actions prior to a loss of intended function.

Enhancement 11. SLRA Section B2.1.34 includes an enhancement to the “corrective actions” program element, which relates to considering the structural support function of the NST for the reactor pressure vessel when evaluating findings associated with the NST. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.S6 and finds it acceptable because when it is implemented it will be consistent with the GALL-SLR Report recommendation to evaluate the inspections results and address, within the

corrective action program, any results that do not meet the acceptance criteria before loss of intended function.

Enhancement 12. SLRA Section B2.1.34 includes an enhancement to the “corrective actions” program element, which relates to including the evaluation of loss-of-coolant accident (LOCA) events by a civil/mechanical design engineer to identify potential structural degradation. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.S6 and finds it acceptable because when it is implemented it will be consistent with the GALL-SLR Report recommendation to evaluate the inspections results and address, within the applicant’s corrective action program, any degraded structures that do not meet the acceptance criteria before loss of intended function.

Based on its audit and review of the SLRA, amendments, RAI B2.1.34-1 and RAI B2.1.34-1a, the staff finds that the “scope of program,” “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” “acceptance criteria,” and “corrective actions” program elements for which Dominion 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,” “acceptance criteria,” and “corrective actions” program elements and finds that when implemented, they will make the AMP adequate to manage the applicable aging effects.

Operating Experience. SLRA Section B2.1.34 summarizes the operating experience related to the Structures Monitoring program. The staff evaluated operating experience information by reviewing the subsequent license renewal application and conducting an audit (ADAMS Accession No. ML19046A433). 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 Dominion should modify its proposed program beyond that incorporated. Based on its audit and review of the application, 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 A1.34 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 Dominion committed to ongoing implementation of the existing Structures Monitoring program for managing the effects of aging for applicable components during the subsequent period of extended operation. The staff also noted that Dominion committed to implement the enhancements for the Structures Monitoring program 6 months prior to the subsequent period of extended operation, and to perform a baseline inspection for wooden poles prior to January 1, 2031. The staff finds that the information in the UFSAR supplement, as amended by letter dated June 10, 2019, and supplemented by letter dated September 3, 2019, is an adequate summary description of the program.

Conclusion. On the basis of its review of Dominion’s Structures Monitoring program, the staff concludes that those program elements for which Dominion 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 Dominion has demonstrated that the effects of aging will be adequately managed so that the intended

function(s) will be maintained consistent with the CLB for the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.28 Inspection of Water Control Structures Associated with Nuclear Power Plants

SLRA Section B2.1.35 states that the Inspection of Water-Control Structures Associated with Nuclear Power Plants AMP is an existing program with enhancements that will be consistent with the program elements in the GALL-SLR Report AMP XI.X7, "Inspection of Water-Control Structures Associated with Nuclear Power Plants."

Staff Evaluation. During its audit (ADAMS Accession No. ML19128A079 for the in-office audit report), the staff reviewed Dominion'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," and "acceptance criteria" program elements of the SLRA to the corresponding program elements of GALL-SLR Report AMP XI.X7.

The staff also reviewed the portions of the "preventive actions" and "detection of aging effects" program elements associated with enhancements to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of these 3 enhancements follows.

Enhancement 1. SLRA Section B2.1.35 includes an enhancement to the "preventive actions" program element, which relates to revising procedures to provide guidance for specification of bolting material, lubricants and sealants, and installation torque or tension to prevent degradation and assure structural bolting integrity. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.S7 and finds it acceptable because when it is implemented it will be consistent with the GALL-SLR Report recommendation to include preventive actions that provides reasonable assurance that structural bolting integrity is maintained.

Enhancement 2. SLRA Section B2.1.35 includes an enhancement to the "preventive actions" program element, which relates to revising procedures to specify the preventive actions for storage in Section 2 of the Research Council for Structural Connections publication, "Specification for Structural Joints Using ASTM A325 or A490 Bolts" for ASTM A325, ASTM F1852, ASTM F2280, and/or ASTM A490 structural bolts. The Inspection of Water-Control Structures Associated with Nuclear Power Plants program is implemented as part of the Structures Monitoring program, in which SLRA Section B2.1.34 also includes this enhancement. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.S7 and finds it acceptable because when it is implemented it will be consistent with the GALL-SLR Report recommendation to include preventive actions for storage, lubricant selection, and bolting and coating material selection.

Enhancement 3. SLRA Section B2.1.35 includes an enhancement to the "detection of aging effects" program element, which relates to revising procedures to ensure that inspector qualification requirements are consistent with the requirements in the American Concrete Institute (ACI) 349.3R-02. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.S7 and finds it acceptable because when it is implemented it will be consistent with the GALL-SLR Report recommendation to ensure that

personnel performing the inspections and evaluations are qualified in accordance with industry guidelines and standards (i.e., ACI 349.3R).

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,” and “acceptance criteria” program elements for which Dominion claimed consistency with the GALL-SLR Report are consistent with the corresponding program elements of GALL-SLR Report AMP XI.S7. In addition, the staff reviewed the enhancements associated with the “preventive actions” and “detection of aging effects” program elements and finds that when implemented, they will make the AMP adequate to manage the applicable aging effects.

Operating Experience. SLRA Section B2.1.35 summarizes the operating experience related to the Inspection of Water-Control Structures Associated with Nuclear Power Plants AMP. The staff evaluated operating experience information by reviewing the subsequent license renewal application and conducting an audit (ADAMS Accession No. ML19046A433). 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 Dominion should modify its proposed program beyond that incorporated. Based on its audit and review of the application, 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 AMP was evaluated.

UFSAR Supplement. SLRA Section A1.35 provides the UFSAR supplement for the Inspection of Water-Control Structures Associated with Nuclear Power Plants 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 Dominion committed to implement the program enhancements 6 months prior to the subsequent period of extended operation. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. On the basis of its review of Dominion’s Inspection of Water-Control Structures Associated with Nuclear Power Plants AMP, the staff concludes that those program elements for which Dominion 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 Dominion 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).

3.0.3.2.29 Protective Coating Monitoring and Maintenance

SLRA Section B2.1.36 states that the Protective Coating Monitoring and Maintenance program is an existing program with enhancements that will be consistent with the program elements in GALL-SLR Report AMP XI.S8, “Protective Coating Monitoring and Maintenance. Dominion amended this SLRA section by letters dated April 2, 2019 (ADAMS Accession No. ML19095A666), and June 27, 2019 (ADAMS Accession No. ML19183A440).

Staff Evaluation. During its audit (ADAMS Accession No. ML19128A079), the staff reviewed Dominion's claim of consistency with the GALL-SLR Report. The staff compared the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements of the SLRA to the corresponding program elements of GALL-SLR Report AMP XI.S8.

For the "monitoring and trending" program element, the staff needed additional information, and issued an RAI. RAI B2.1.36-1 and Dominion's response are documented in ADAMS Accession No. ML19183A440.

In its response, Dominion stated that the program basis document ETE-SLR-2018-1341 will be revised to remove the statement that coatings margin does not need to be preserved. Additionally, the applicant stated that an inventory of unqualified coatings is maintained by tracking debris volume. The GSI-191 Program Site Owner assures any changes, to add or remove unqualified coatings from containment, are made in accordance with site procedures.

During its evaluation of Dominion's response to RAI B2.1.36-1, the staff noted that the applicant stated that unqualified coatings are tracked, and that the quantity of degraded and unqualified coatings are assessed to ensure the quantity does not affect the intended function of the emergency core cooling system (ECCS) suction strainers. Additionally, the applicant removed the statement from ETE-SLR-2018-1341 that coatings margin does not need to be preserved. The staff finds Dominion's response acceptable because it is consistent with the GALL-SLR recommendation to periodically assess degraded coatings in containment and compare them with the total amount of permitted degraded coatings to provide reasonable assurance of post-accident operability of the ECCS.

The staff also reviewed the portions of the "monitoring and trending" 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 is as follows.

Enhancement 1. SLRA Section B2.1.36 includes an enhancement to the "monitoring and trending" program element to revise procedures to require a pre-inspection review of the previous two condition assessment reports for protective coatings prior to each refueling outage. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.S8 and finds it acceptable because when it is implemented it will be consistent with the recommendations in the GALL-SLR report to review the previous two condition assessment reports for protective coatings.

Based on its audit and review of the SLRA, amendments, and Dominion's response to RAI B2.1.36-1, 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 Dominion claimed consistency with the GALL-SLR Report are consistent with the corresponding program elements of GALL-SLR Report AMP XI.S8. In addition, the staff reviewed the enhancement associated with the "monitoring and trending" program element and finds that, when implemented, it will make the AMP adequate to manage the applicable aging effects.

Operating Experience. SLRA Section B2.1.36 summarizes the operating experience related to the Protective Coating Monitoring and Maintenance program. The staff evaluated operating experience information by reviewing the subsequent license renewal application and conducting

an audit (ADAMS Accession No. ML19046A433). 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 Dominion should modify its proposed program beyond that incorporated. Based on its audit and review of the application, 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 A1.36 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.

For the UFSAR supplement, the staff needed additional information, and issued an RAI. RAI B2.1.36-2 and Dominion's responses are documented in ADAMS Accession No. ML19183A440.

In its response, Dominion revised the proposed UFSAR supplement to state that the Protective Coating Monitoring and Maintenance program "consists of guidance for selection, application, inspection, and maintenance of protective coatings."

During its evaluation of Dominion's response to RAI B2.1.36-2, the staff noted that the Protective Coating Monitoring and Maintenance program covers selection, application, inspection, and maintenance of protective coatings. The staff finds Dominion's response and changes to the UFSAR acceptable because the changes make the proposed UFSAR supplement consistent with the recommended UFSAR supplement in the GALL-SLR.

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 Dominion committed to ongoing implementation of the existing Protective Coating Monitoring and Maintenance program for managing the effects of aging for applicable components during the subsequent period of extended operation. The staff also noted that Dominion committed to implement an enhancement to the Protective Coating Monitoring and Maintenance program to revise the procedures to require a pre-inspection review of the two previous condition assessment reports prior to each refueling outage within 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 June 27, 2019 (ADAMS Accession No. ML19183A440), is an adequate summary description of the program.

Conclusion. On the basis of its review of Dominion's Protective Coating Monitoring and Maintenance program, the staff concludes that those program elements for which Dominion 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 Dominion 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).

3.0.3.2.30 Electrical Insulation for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements

SLRA Section B2.1.37 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.”

<u>Staff Evaluation</u>. During its audit (ADAMS Accession No. ML19128A079), the staff reviewed Dominion’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.E1.

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

<u>Enhancement 1</u>. SLRA Section B2.1.37 includes an enhancement to the “parameters monitored or inspected” program element, which relates to the identification of adverse localized environments of temperature, moisture, radiation, contamination, and oxygen. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.E1 and finds it acceptable because evaluating adverse localized environments for temperature, moisture, radiation, contamination, and oxygen is consistent with GALL-SLR Report AMP XI.E1.

<u>Enhancement 2</u>. SLRA Section B2.1.37 includes an enhancement to the “detection of aging effects” program element, which relates to the description of testing methodology, and specifically, a sample size of 20 percent of each cable and connection insulation material type found within the adverse localized environment with a maximum sample size of 25. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.E1 and finds it acceptable because the testing methodology is consistent with GALL-SLR Report AMP XI.E1.

<u>Enhancement 3</u>. SLRA Section B2.1.37 includes an enhancement to the “detection of aging effects” program element, which relates to an inspection frequency of at least once every 10 years. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.E1 and finds it acceptable because the inspection frequency of at least once every 10 years is consistent with GALL-SLR Report AMP XI.E1.

<u>Enhancement 4</u>. SLRA Section B2.1.37 includes an enhancement to the “parameters monitored or inspected” and “detection of aging effects” program elements that relate to the addition of a jacket surface and connection covering material anomalies, including embrittlement, melting, swelling, and surface contamination. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.E1

and finds it acceptable because the addition of a jacket surface and connection covering material anomalies is consistent with GALL-SLR Report AMP XI.E1.

Enhancement 5. SLRA Section B2.1.37 includes an enhancement to the "parameters monitored or inspected" and "detection of aging effects" program elements that relate to the performance of a review of previously identified and mitigated adverse localized environments cumulative aging effects. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.E1 and finds it acceptable because the performance of a review of previously identified and mitigated adverse localized environments cumulative aging effects is consistent with GALL-SLR Report AMP XI.E1.

Enhancement 6. SLRA Section B2.1.37 includes an enhancement to the "acceptance criteria" program element, which relates to acceptance criteria for both tests and visual inspections of the electrical cable and connection insulation material. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.E1 and finds it acceptable because acceptance criteria for both tests and visual inspections of the electrical cable and connection insulation material are consistent with GALL-SLR Report AMP XI.E1.

Enhancement 7. SLRA Section B2.1.37 includes an enhancement to the "corrective actions" program element, which relates to performance of an engineering evaluation of unacceptable test results and visual indications of cable and connection electrical insulation abnormalities. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.E1 and finds it acceptable because performance of an engineering evaluation of unacceptable test results and visual indications of cable and connection electrical insulation abnormalities is consistent with GALL-SLR Report AMP XI.E1.

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 Dominion 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," "detection of aging effects," "acceptance criteria," and "corrective actions" program elements and finds that when implemented, they will make the AMP adequate to manage the applicable aging effects.

Operating Experience. SLRA Section B2.1.37 summarizes the 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 subsequent license renewal application and conducting an audit (ADAMS Accession No. ML19046A433). 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 Dominion should modify its proposed program. Based on its audit and review of the application, 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 program was evaluated.

UFSAR Supplement. SLRA Section A1.37 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 finds that the information in the UFSAR supplement is an adequate summary description of the program. The staff also noted that Dominion committed to implement enhancements to the Electrical Insulation for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program, 6 months prior to the subsequent period of extended operation for managing the effects of aging.

Conclusion. On the basis of its review of Dominion'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 Dominion 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 Dominion 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).

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

SLRA Section B2.1.38 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 audit (ADAMS Accession No. ML19128A079), the staff reviewed Dominion's claim of consistency with the GALL-SLR Report. The staff compared the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements of the SLRA to the corresponding program elements of GALL-SLR Report AMP XI.E2.

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

Enhancement 1. SLRA Section B2.1.38 includes an enhancement to the "parameters monitored or inspected" program element, which relates to testing the post-accident neutron monitoring system cables and connection external to containment. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.E2 and finds it acceptable because when it is implemented it will be consistent with GALL-SLR Report AMP XI.E2.

Enhancements 2 and 3. SLRA Section B2.1.38 includes enhancements to the "detection of aging effects" program element. A new procedure will be developed for testing the post-accident neutron monitoring system cables and connections external to containment that

include recommendation for types of electrical insulation tests, including insulation resistance test, time domain reflectometry test, or other tests judged to be effective in determining cable system insulation physical, mechanical, and chemical properties. The new procedure includes a test frequency of at least once every 10 years with the first test completed prior to the subsequent period of extended operation. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.E2 and finds it acceptable because when it is implemented it will be consistent with GALL-SLR Report AMP XI.E2.

Enhancement 4. SLRA Section B2.1.38 includes an enhancement to the "acceptance criteria" program element. A new procedure will be developed for testing the post-accident neutron monitoring system cables and connections external to containment that includes acceptance criteria for the recommended test methods. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.E2 and finds it acceptable because when it is implemented it will be consistent with GALL-SLR Report AMP XI.E2.

Enhancement 5. SLRA Section B2.1.38 includes an enhancement to the "corrective actions" program element. A new procedure will be developed for testing the post-accident neutron monitoring system cables and connections external to containment. The new procedure will include corrective actions and a requirement for an engineering evaluation to be performed when acceptance criteria are not met. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.E2 and finds it acceptable because when it is implemented it will be consistent with GALL-SLR Report AMP XI.E2.

Operating Experience. SLRA Section B2.1.38 summarizes the 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 program. The staff evaluated operating experience information by reviewing the subsequent license renewal application and conducting an audit (ADAMS Accession No. ML19046A433). 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 Dominion should modify its proposed program. Based on its audit and review of the application, 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 program was evaluated.

UFSAR Supplement. SLRA Section A1.38 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 finds that the information in the UFSAR supplement is an adequate summary description of the program. The staff also noted that Dominion committed to implement enhancements to the Electrical Insulation for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits program, 6 months prior to the subsequent period of extended operation for managing the effects of aging.

Conclusion. On the basis of its review of Dominion's Electrical Insulation for Electrical Cables and Connections Not Subject to 10 CFR 50 49 Environmental Qualification Requirements Used in Instrumentation Circuits, the staff concludes that those program elements for which Dominion

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 Dominion 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).

3.0.3.2.32 Electrical Insulation for Inaccessible Medium-Voltage Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements

SLRA Section B2.1.39 states that the Electrical Insulation for Inaccessible Medium-Voltage Power Cables 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.E3A, "Electrical Insulation for Inaccessible Medium-Voltage Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements." Dominion amended this SLRA section by letter dated April 2, 2019.

Staff Evaluation. During its audit (ADAMS Accession No. ML19128A079), the staff reviewed Dominion's claim of consistency with the GALL-SLR Report. The staff compared the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements of the SLRA to the corresponding program elements of GALL-SLR Report AMP XI.E3A.

The staff also reviewed the portions of the "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitored 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 11 enhancements is as follows.

Enhancement 1. SLRA Section B2.1.39 includes an enhancement to the "preventive actions" program element, which relates to inspection of in-scope manholes after event-driven occurrences, such as heavy rain, rapid thawing of ice and snow, or flooding. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.E3A and finds it acceptable because inspecting in-scope manholes after event-driven occurrences is consistent with GALL-SLR Report AMP XI.E3A.

Enhancement 2. SLRA Section B2.1.39 includes an enhancement to the "preventive actions" program element, which relates to verification that automatic and passive drainage features are operating properly. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.E3A and finds it acceptable because verification that automatic and passive drainage features are operating properly is consistent with GALL-SLR Report AMP XI.E3A.

Enhancement 3. SLRA Section B2.1.39 includes an enhancement to the "parameters monitored or inspected" program element, which relates to testing of medium-voltage cables that are exposed to significant moisture to determine the condition of the electrical insulation. The staff reviewed this enhancement against the corresponding program elements in

GALL-SLR Report AMP XI.E3A and finds it acceptable because testing medium-voltage cables that are exposed to significant moisture is consistent with GALL-SLR Report AMP XI.E3A.

Enhancement 4. SLRA Section B2.1.39 includes an enhancement to the "parameters monitored or inspected" program element, which relates to adjusting the inspection frequency of manholes based on plant-specific operating experience over time with water collection. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.E3A and finds it acceptable because adjusting the inspection frequency of manholes based on plant-specific operating experience is consistent with GALL-SLR Report AMP XI.E3A.

Enhancement 5. SLRA Section B2.1.39 includes an enhancement to the "detection of aging effects" program element, which relates to creating a new recurrent event and maintenance schedule for testing the "A" reserve station service transformer (RSST) cables at least once every 6 years. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.E3A and finds it acceptable because testing of in-scope inaccessible medium-voltage cables at least once every 6 years is consistent with GALL-SLR Report AMP XI.E3A.

Enhancement 6. SLRA Section B2.1.39 includes an enhancement to the "detection of aging effects" program element, which relates to creating a new recurrent event and maintenance schedule for testing the "B" RSST cables at least once every 6 years. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.E3A and finds it acceptable because testing of in-scope inaccessible medium-voltage cables at least once every 6 years is consistent with GALL-SLR Report AMP XI.E3A.

Enhancement 7. SLRA Section B2.1.39 includes an enhancement to the "detection of aging effects" program element, which relates to creating a new recurrent event and maintenance schedule for testing the "C" RSST cables at least once every 6 years. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.E3A and finds it acceptable because testing of in-scope inaccessible medium-voltage cables at least once every 6 years is consistent with GALL-SLR Report AMP XI.E3A.

Enhancement 8. SLRA Section B2.1.39 includes an enhancement to the "detection of aging effects" program element, which relates to testing medium-voltage cable that includes a requirement that a specific type of test performed will be a proven test, utilizing one or more tests such as dielectric loss (dissipation factor (Tan-Delta)/power factor), alternating current (AC) withstand, partial discharge, step voltage, time domain reflectometry, insulation resistance and polarization index, or line resonance analysis, for detecting deterioration of the insulation system due to submergence (e.g., selected test is applicable to the specific cable construction: shield and non-shield, and the insulation material under test). The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.E3A and finds it acceptable because proven tests, utilizing one or more tests, and applicable tests selected for the specific cable construction and insulation material is consistent with GALL-SLR Report AMP XI.E3A.

Enhancement 9. During the in-office audit, the staff reviewed the "detection of aging effects" program element in program basis document ETE-SLR-2018-1345 and noted that this program element does not include a test matrix that documents inspection method, test methods, and acceptance criteria. GALL-SLR Report AMP XI.E3A recommends a test matrix to be included. In a letter dated April 2, 2019 (ADAMS Accession No. ML19095A666), Dominion stated that the

Electrical Insulation for Inaccessible Medium-Voltage Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program description was revised by including a plant-specific inaccessible medium-voltage test matrix that documents inspection methods, test methods, and acceptance criteria for the in-scope inaccessible medium-voltage power cables. SLRA Section B2.1.39 is supplemented to revise the program description and add an enhancement that includes the above discussion regarding a plant-specific inaccessible medium-voltage test matrix. The staff reviewed this enhancement against the corresponding program element in GALL-SLR Report AMP XI.E3A and finds it acceptable because including a plant-specific inaccessible medium-voltage test matrix is consistent with GALL-SLR Report AMP XI.E3A.

Enhancement 10. SLRA Section B2.1.39 includes an enhancement to the "monitoring and trending" program element, which relates to testing medium-voltage cable that includes a requirement to review visual inspection and physical test results that are trendable and repeatable to provide additional information on the rate of cable or connection insulation degradation. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.E3A and finds it acceptable because trending of test results, utilizing the same visual inspection and test method to provide the rate of cable or connection insulation degradation, is consistent with GALL-SLR Report AMP XI.E3A.

Enhancement 11. SLRA Section B2.1.39 includes an enhancement to the "acceptance criteria" program element, which relates to creating a new procedure for testing medium-voltage cable that includes acceptance criteria for tests and inspections. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.E3A and finds it acceptable because the acceptance criteria for each test or inspection determined by the specific type of test performed and the specific cable tested, is consistent with GALL-SLR Report AMP XI.E3A.

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 Dominion claimed consistency with the GALL-SLR Report are consistent with the corresponding program elements of GALL-SLR Report AMP XI.E3A.

Operating Experience. SLRA Section B2.1.39 summarizes the operating experience related to the Electrical Insulation for Inaccessible Medium-Voltage Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program. The staff evaluated operating experience information by reviewing the subsequent license renewal application and conducting an audit (ADAMS Accession No. ML19046A433). 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 Dominion should modify its proposed program. Based on its audit and review of the application, 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 A1.39 provides the UFSAR supplement for the Electrical Insulation for Inaccessible Medium-Voltage Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended

description in GALL-SLR Report Table XI-01. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program. The staff also noted that Dominion committed to implement enhancements to the Electrical Insulation for Inaccessible Medium-Voltage Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program 6 months prior to the subsequent period of extended operation for managing the effects of aging.

Conclusion. On the basis of its review of Dominion'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 Dominion 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 Dominion 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).

3.0.3.2.33 Metal Enclosed Bus

SLRA Section B2.1.42 states that the Metal Enclosed Bus is an existing program with enhancements that will be consistent with the program elements in the GALL-SLR Report AMP XI.E4, "Metal Enclosed Bus," except for the exceptions identified in the SLRA.

Staff Evaluation. During its audit (ADAMS Accession No. ML19128A079), the staff reviewed Dominion's claim of consistency with the GALL-SLR Report. The staff compared the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements of the SLRA to the corresponding program elements of GALL-SLR Report AMP XI.E4.

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 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 12 exceptions and enhancements are as follows.

Exception 1. SLRA Section B2.1.42 includes an exception to the "detection of aging effects" program element related to the inspection of metal enclosed bus associated with transfer bus F, when aging degradation that impacts intended functions is confirmed during inspections of metal enclosed bus associated with transfer bus D or E, or during a dual unit outage of at least 10 days. The staff reviewed this exception against the corresponding program element in GALL-SLR Report AMP XI.E4 and finds it acceptable because periodic internal inspections and testing of metal enclosed bus associated with transfer buses D and E will demonstrate that metal enclosed bus associated with transfer bus F continues to remain consistent with the CLB. GALL-SLR Report AMP XI.E4 states that for inaccessible metal enclosed bus segments evaluation, along with accessible metal enclosed bus inspection and test program, will continue to maintain the metal enclosed bus consistent with the CLB, and as such, the applicant is utilizing this approach to assess the metal enclosed bus associated with transfer bus F.

Exception 2. SLRA Section B2.1.42 includes an exception to "detection of aging effects" program element related to a 12-year inspection interval for in-scope metal enclosed bus associated with emergency buses that are provided by the same manufacturer, in non-aggressive environments, with similar operating characteristics. The staff reviewed this exception against the corresponding program element in GALL-SLR Report AMP XI.E4 and finds it acceptable because although each emergency bus metal enclosed bus is inspected once every 12 years, at least one of the emergency buses provided by the same manufacturer, in non-aggressive environments, with similar operating characteristics, is inspected at a frequency of at least every 6 years, and if degradation is occurring, corrective actions can be performed on the remaining emergency bus metal enclosed bus inspection population, consistent with the degradation observed.

Enhancement 1. SLRA Section B2.1.42 includes an enhancement to the "scope of program" program element, which relates to developing a procedure to inspect metal enclosed bus associated with the 1A2 480 V bus. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.E4 and finds it acceptable because when it is implemented it will allow for inspection of the metal enclosed bus associated with the 1A2 480 V bus, which is within the scope of license renewal.

Enhancement 2. SLRA Section B2.1.42 includes an enhancement to the "parameters monitored or inspected" program element, which relates to revising procedures to require initiation of a condition report that will result in an engineering evaluation of the inaccessible metal enclosed bus segments and, together with the accessible metal enclosed inspection and test program, will continue to maintain the metal enclosed bus consistent with the CLB. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.E4 and finds it acceptable because when it is implemented it will demonstrate that the inaccessible metal enclosed bus segments, together with the accessible metal enclosed inspection and test program, will continue to maintain the metal enclosed bus consistent with the CLB.

Enhancement 3. SLRA Section B2.1.42 includes an enhancement to the "parameters monitored or inspected," and "detection of aging effects" program elements, which relate to inspection of accessible internal portions (bus enclosure assemblies), including insulation material and bus insulating supports, as well as gaskets, boots, and sealants. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.E4 and finds it acceptable because when it is implemented it will allow for inspection of accessible internal portions (bus enclosure assemblies), including insulation material and bus insulating supports, as well as gaskets, boots, and sealants.

Enhancement 4. SLRA Section B2.1.42 includes an enhancement to the "parameters monitored or inspected," "detection of aging effects," and "acceptance criteria" program elements, which relate to inspecting a sample of accessible bolted connections not covered with heat shrink tape or boots for loose or corroded bolted connections and damaged hardware. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.E4 and finds it acceptable because when it is implemented it will allow for inspection of a sample of accessible bolted connections not covered with heat shrink tape or boots for loose or corroded bolted connections and damaged hardware.

Enhancement 5. SLRA Section B2.1.42 includes an enhancement to the "detection of aging effects" program element, which relates to defining a representative sample of 20 percent of the accessible bolted connection population, with a maximum of 25. The staff reviewed this

enhancement against the corresponding program elements in GALL-SLR Report AMP XI.E4 and finds it acceptable because when it is implemented it will allow for inspection of a representative sample of accessible bolted connections.

Enhancement 6. SLRA Section B2.1.42 includes an enhancement to the “detection of aging effects” program element, which relates to inspecting metal enclosed bus associated with the 0-AAC-SW-0L bus on a maximum 10-year frequency. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.E4 and finds it acceptable because when it is implemented it will allow for inspection of metal enclosed bus associated with the 0-AAC-SW-0L bus on a maximum 10-year frequency.

Enhancement 7. SLRA Section B2.1.42 includes an enhancement to the “detection of aging effects” program element, which relates to inspecting metal enclosed bus associated with the 1-EP-LCC-1A2 bus on a maximum 10-year frequency. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.E4 and finds it acceptable because when it is implemented it will allow for inspection metal enclosed bus associated with the 1-EP-LCC-1A2 bus on a maximum 10-year frequency.

Enhancement 8. SLRA Section B2.1.42 includes an enhancement to the “monitoring and trending” program element, which relates to trending bus connection resistance values to provide information on the rate of connection degradation. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.E4 and finds it acceptable because when it is implemented it will allow for trending bus connection resistance values to provide information on the rate of connection degradation.

Enhancement 9. SLRA Section B2.1.42 includes an enhancement to the “acceptance criteria” program element, which relates to verifying accessible electrical insulation materials, accessible metal enclosed bus internal surfaces, and accessible elastomers that are free of unacceptable conditions. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.E4 and finds it acceptable because when it is implemented it will allow for verifying accessible electrical insulation materials, accessible metal enclosed bus internal surfaces, and accessible elastomers are free of unacceptable conditions.

Enhancement 10. SLRA Section B2.1.42 includes an enhancement to the “corrective actions” program element, which relates to specifying that when any acceptance criterion is not met, the unacceptable results are entered into the corrective action program. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP XI.E4 and finds it acceptable because when it is implemented it will allow for specifying that when any acceptance criterion is not met, the unacceptable results are entered into the corrective action program.

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 Dominion claimed consistency with the GALL-SLR Report are consistent with the corresponding program elements of GALL-SLR Report AMP XI.E4. The staff also reviewed the exceptions associated with the “detection of aging effects” program element, and their justifications, and finds that the AMP, with the exceptions, is adequate to manage the applicable aging effects. In addition, the staff reviewed the enhancements associated with the “scope of program,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and

trending," "acceptance criteria," and "corrective actions" program elements and finds that, when implemented, they will make the AMP adequate to manage the applicable aging effects.

Operating Experience. SLRA Section B2.1.42 summarizes the operating experience related to the Metal Enclosed Bus. The staff evaluated operating experience information by reviewing the subsequent license renewal application and conducting an audit (ADAMS Accession No. ML19046A433). 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 Dominion should modify its proposed program. Based on its audit and review of the application, 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 A1.42 provides the UFSAR supplement for the Metal Enclosed Bus program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in GALL-SLR Report Table XI-01. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program. The staff also noted that Dominion committed to implement enhancements to the Metal Enclosed Bus program, 6 months prior to the subsequent period of extended operation for managing the effects of aging.

Conclusion. On the basis of its review of Dominion's Metal Enclosed Bus program, the staff concludes that those program elements for which Dominion 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. 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 Dominion 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).

3.0.3.2.34 High-Voltage Insulators

SLRA Section B2.1.44 states that the High-Voltage Insulators program is a new program that will be consistent, with the program elements in the GALL-SLR Report AMP XI.E7, "High-Voltage Insulators," except for the exception identified in the SLRA.

Staff Evaluation. During its audit (ADAMS Accession No. ML19128A079), the staff reviewed Dominion'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.E7.

The staff also reviewed the portions of the "scope of program" program element associated with an 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. SLRA Section B2.1.44 includes an exception to the “scope of program” program element related to the inclusion of medium-voltage insulators in this AMP. The staff reviewed this exception against the corresponding program element in GALL-SLR Report AMP XI.E7 and finds it acceptable because Dominion has not reduced the scope of the program as compared to the GALL-SLR Report. Surry does not have any in-scope high-voltage insulators due to the design and configuration of the switchyard. The station blackout (SBO) recovery path only comprises medium-voltage insulators, and as such, Dominion has taken an exception to the “scope of program” program element by incorporating these components into this AMP. This exception constitutes a more conservative approach for maintaining the intended functions of equipment needed for SBO recovery. Therefore, the staff finds this exception acceptable.

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 Dominion claimed consistency with the GALL-SLR Report are consistent with the corresponding program elements of GALL-SLR Report AMP XI.E7. The staff also reviewed the exception associated with the “scope of program” program element, and its justification, and finds that the AMP, with the exception, is adequate to manage the applicable aging effects.

Operating Experience. SLRA Section B2.1.44 summarizes the operating experience related to the High-Voltage Insulators program. The staff evaluated operating experience information by reviewing the subsequent license renewal application and conducting an audit (ADAMS Accession No. ML19046A433). 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 Dominion should modify its proposed program.

Based on its audit and review of the application, the staff finds that the conditions and operating experience at the plant are bounded by those for which the High-Voltage Insulators program was evaluated.

UFSAR Supplement. SLRA Section A1.44 provides the UFSAR supplement for the High-Voltage Insulators 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 Dominion committed to implement the new High-Voltage Insulators 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.

Conclusion. On the basis of its review of Dominion’s High-Voltage Insulators program, the staff concludes that those program elements for which Dominion claimed consistency with the GALL-SLR Report are consistent. In addition, the staff reviewed the exception and its justification and concludes that the AMP, with the exception, is adequate to manage the applicable aging effects. The staff concludes that Dominion 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).

3.0.3.2.35 Fatigue Monitoring

SLRA Section B3.1 states that the Fatigue Monitoring program is an existing program with enhancements that will be consistent, with the program elements in the GALL-SLR Report AMP X.M1, "Fatigue Monitoring."

Staff Evaluation. During its audit (ADAMS Accession No. ML19128A079), the staff reviewed Dominion's claim of consistency with the GALL-SLR Report. The staff compared the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements of the SLRA to the corresponding program elements of GALL-SLR Report AMP X.M1.

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 enhancements to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of these three enhancements is as follows.

Enhancement 1. SLRA Section B3.1 includes an enhancement to the "parameters monitored or inspected" program element, which relates to revising the program cycle counting procedures to add the "Normal Charging and Letdown Shutdown and Return to Service" transient cycles associated with the ASME Code Section XI, Appendix L analysis. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP X.M1 and finds it acceptable because when it is implemented, it will ensure that the Fatigue Monitoring program will monitor all applicable plant transients that cause cyclic strains and contribute to fatigue consistent with the GALL-SLR Report.

Enhancement 2. SLRA Section B3.1 includes an enhancement to the "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements, which relates to revising procedures to require the monitoring and tracking of transient cycles associated with the ASME Code, Section XI, Appendix L analysis between the inspections for each ASME Code, Section XI, Appendix L location, as well establishing a surveillance limit to initiate corrective actions prior to exceeding transient cycle assumptions. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP X.M1 and finds it acceptable because when it is implemented, it will: (a) ensure that the Fatigue Monitoring program will monitor all applicable plant transients that cause cyclic strains and contribute to fatigue consistent with the GALL-SLR Report, and (b) initiate corrective actions to ensure that the inspection frequency of the ASME Code, Section XI, Appendix L locations remains valid for the subsequent period of extended operation.

Enhancement 3. SLRA Section B3.1 includes an enhancement to the "corrective actions" program element, which relates to revising procedures to expand existing corrective action guidance associated with exceeding a cycle counting surveillance limit to recommend consideration of component repair, component replacement, performance of a more rigorous analysis, performance of an ASME Code, Section XI, Appendix L flaw tolerance analysis, or scope expansion to consider other locations with the highest environmentally adjusted cumulative usage factor values. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP X.M1 and finds it acceptable because when it is implemented, it will ensure that the Fatigue Monitoring program will initiate

corrective actions consistent with the GALL-SLR Report, including evaluating if there may be additional plant-specific components susceptible to environmentally assisted fatigue.

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 Dominion claimed consistency with the GALL-SLR Report are consistent with the corresponding program elements of GALL-SLR Report AMP X.M1. In addition, the staff reviewed the enhancements associated with the “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” “acceptance criteria,” and “corrective actions” program elements and finds that, when implemented, they will make the AMP adequate to manage the applicable aging effects.

Operating Experience. SLRA Section B3.1 summarizes the operating experience related to the Fatigue Monitoring program. The staff evaluated operating experience information by reviewing the subsequent license renewal application and conducting an audit (ADAMS Accession No. ML19046A433). 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 Dominion should modify its proposed program.

Based on its audit and review of the application, the staff finds that the conditions and operating experience at the plant are bounded by those for which the Fatigue Monitoring program was evaluated.

UFSAR Supplement. SLRA Section A2.1 provides the UFSAR supplement for the Fatigue 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 SLRA Table A4.0-1, Dominion committed to ongoing implementation of the existing Fatigue Monitoring program for managing the effects of aging for applicable components during the subsequent period of extended operation. This includes Dominion’s commitment to implement the three enhancements of the AMP. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. Based on its review of Dominion’s Fatigue Monitoring program, the staff concludes that those program elements for which Dominion 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 Dominion 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).

3.0.3.2.36 Environmental Qualification of Electric Equipment

SLRA Section B3.3 states that the Environmental Qualification of Electric Equipment is an existing program with enhancements that will be consistent with the program elements in the GALL-SLR Report AMP X.E1, “Environmental Qualification of Electric Equipment.”

Staff Evaluation. During its audit (ADAMS Accession No. ML19128A079), the staff reviewed Dominion's claim of consistency with the GALL-SLR Report. The staff compared the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements of the SLRA to the corresponding program elements of GALL-SLR Report AMP X.E1.

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

Enhancement 1. SLRA Section B3. 3 includes an enhancement to the "parameters monitored or inspected" and "detection of aging effects" program elements, which relate to performing a walkdown once prior to the subsequent period of extended operation and every 10 years thereafter in order to visually inspect accessible electrical EQ equipment and evaluate the EQ environment. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP X.E1 and finds it acceptable because when it is implemented it will be consistent with GALL-SLR Report AMP X.E1.

Enhancement 2. SLRA Section B3.3 includes an enhancement to the "corrective actions" program element, which relates to evaluating and taking appropriate corrective actions when an unexpected adverse localized environment or condition is identified during operational or maintenance activities. The staff reviewed this enhancement against the corresponding program elements in GALL-SLR Report AMP X.E1 and finds it acceptable because when it is implemented it will be consistent with GALL-SLR Report AMP X.E1.

GALL-SLR Report AMP X.E1 states that supplemental EQ regulatory guidance for compliance with 10 CFR 50.49 includes NUREG-0588, "Interim Staff Position on Environmental Qualification of Safety-Related Electrical Equipment." NUREG-0588 states that equipment interfaces for electrical equipment should be included in qualification process. Thus, the equipment that should be qualified includes gaskets, seals, lubricants, terminations, and other mechanical equipment. The staff conducted an onsite audit (ADAMS Accession No. ML19169A329) regarding how Dominion addressed interfaces between mechanical and electrical equipment for the Surry EQ program and understand how the SLRA addresses the aging effects of the interfaces of electrical equipment to ensure safety function performance will be maintained throughout the period of subsequent license renewal. Specifically, the staff reviewed Dominion's qualification evaluations of electric equipment such as motor operated valves, transmitters, and solenoid valves to ensure that the environmental effects of mechanical components like gaskets, seals, lubricants and connections were addressed with respect to subsequent license renewal. The staff confirmed and verified that interfaces, including seals, lubricants, and gaskets are addressed in the Surry EQ program. Furthermore, staff verified that some lubricants are qualified separately while other lubricants are qualified with the equipment they serve. The plant qualification evaluations document replacement components and their respective replacement schedule as well as routine maintenance to maintain qualification (e.g., the replacement interval of an O-ring in a junction box seal is 10 years). The staff finds that the applicant has addressed interfaces between mechanical and electrical equipment for the Surry EQ program with respect to subsequent license renewal.

Based on its audits 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 Dominion 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 enhancements associated with the “parameters monitored or inspected,” “detection of aging effects,” and “corrective actions” program elements and finds that, when implemented, they will make the AMP adequate to manage the applicable aging effects.

Operating Experience. SLRA Section B3.03 summarizes operating experience related to the Environmental Qualification of Electric Equipment. The staff evaluated operating experience information by reviewing the subsequent license renewal application and conducting an audit (ADAMS Accession No. ML19046A433). 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 Dominion should modify its proposed program. Based on its audit and review of the application, 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 A3.03 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 Dominion committed to ongoing implementation of the existing Environmental Qualification of Electric Equipment program for managing the effects of aging for applicable components during the period of extended operation. The staff also noted that the applicant committed to implement the enhancement to the program 6 months prior to the subsequent period of extended operation. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. On the basis of its review of Dominion’s Environmental Qualification of Electric Equipment program, the staff concludes that those program elements for which Dominion 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 Dominion 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

The Surry SLRA Appendix B does not include any plant-specific AMPs.

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 aging management review (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 aging management program (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 current licensing basis] (CLB) 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 corrective actions [program element 7], confirmation process [program element 8], and administrative controls [program element 9] 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, "UFSAR Supplement," Section A1, "Summary Descriptions of Aging Management Programs," and SLRA Appendix B, "Aging Management Programs," Section B1.3, "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 A1, states:

> The Quality Assurance (QA) Program is described in Topical Report DOM-QA-1, "Dominion Energy Nuclear Facility Quality Assurance Program Description," which implements the requirements of 10 CFR 50, Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants." The QA Program is consistent with the summary in Appendix A.2, "Quality Assurance for Aging Management Programs (Branch Technical Position IQMB-1)" of NUREG-2192. The QA Program provides the basis for the corrective actions, confirmation process, and administrative controls elements of aging management programs (AMPs). The scope of the existing QA Program is expanded to also include safety-related and nonsafety-related structures and components (SCs) subject to AMPs.

SLRA Appendix B, Section B.1.3, states:

> The Quality Assurance (QA) Program is described in Topical Report DOM-QA-1, "Dominion Energy Nuclear Facility Quality Assurance Program Description," which implements the requirements of 10 CFR 50, Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants." The QA Program includes the three elements of Corrective Actions, Confirmation Process, and Administrative Controls, which are applicable to the safety-related and nonsafety-related systems, structures, and components (SSCs) that are subject to aging management review. The QA Program is consistent with NUREG-2191, Appendix A, "Quality Assurance for Aging Management Programs," and the summary in NUREG-2192, Appendix A.2, "Quality Assurance for Aging Management Programs (Branch Technical Position IQMB-1)."

3.0.4.2 Staff Evaluation

The staff reviewed SLRA Appendix A, Section A1, and Appendix B, Section B1.3, which describe how the applicant's existing quality assurance program includes the quality assurance-related elements (corrective actions, confirmation process, and administrative controls) for AMPs, consistent with the staff's guidance described in Branch Technical Position IQMB-1. During the staff's in-office audit (ADAMS Accession No. ML19128A079), 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 A1, and SLRA Appendix B, Section B1.3, 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, "UFSAR Supplement," Section A1, "Summary Descriptions of Aging Management Programs," and SLRA Appendix B, "Aging Management Programs," Section B1.4, "Operating Experience," describe the consideration of operating experience for aging management programs (AMPs). SLRA Sections A1 and B1.4 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 A1 and B1.4 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 A1 and B1.4 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 with 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 A1 and B1.4 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 A1 and B1.4 state that the ongoing evaluation of operating experience included a review of corrective actions, which may result 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 by including nonsafety-related SCs.

SLRA Appendix A, “UFSAR Supplement,” Section A1, “Summary Descriptions of Aging Management Programs,” and SLRA Appendix B, “Aging Management Programs,” Section B1.3, “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 A1 and B1.3 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 A1 and B1.4 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 A1 and B1.4 state that internal and external operating experience is captured and systematically reviewed on an ongoing basis. 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 A1 and B1.4 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 A1 and B1.4 state that the applicant's program requires that when evaluations indicate that the effects of aging are not being adequately managed, the affected AMPs are either enhanced or new AMPs are developed, as appropriate.

The staff determined that the applicant's evaluations of age-related 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.

<u>Evaluation of AMP Implementation Results</u>. 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 B1.4 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 B1.4 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 B1.4 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 B1.4 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.

<u>Training</u>. 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 Sections A1 and B1.4 state 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 A.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 A.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 A1 and B1.4 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 A1 and B1.4 state that the operating experience program will be implemented on an ongoing basis throughout the terms of the renewed licenses. SLRA Section A1 provides the UFSAR supplement summary description of the applicant's enhanced programmatic activities for ongoing review of the operating experience. Upon issuance of the renewed licenses in accordance with 10 CFR 54.31(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 the completion of the staff's review and the consistency of the applicant's operating experience review activities with the guidance in SRP-SLR, Section A.4.2, the staff finds the applicant's programmatic activities for the ongoing review of operating experience acceptable.

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 A1 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.

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 finds that it provides an adequate summary description, as required by 10 CFR 54.21(d).

3.1 Aging Management of Reactor Vessels, 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 Programs for Reactor Vessel, Internals, and Reactor Coolant System,” is a summary comparison of the applicant’s AMR results with those provided in the GALL-SLR Report for the reactor coolant system (RCS) components and component groups.

3.1.2 Staff Evaluation

Table 3.1-1, below, summarizes the NRC staff's evaluation of the component groups listed in SLRA Section 3.1 and addressed in the GALL-SLR Report.

Table 3.1-1 Staff Evaluation for Reactor Vessel, Internals, and Reactor Coolant System Components Evaluated in the GALL-SLR Report

Component Group (SRP-SLR Item No.)	Staff Evaluation
3.1.1-001	Consistent with the GALL-SLR Report (see SER Section 3.1.2.2.1)
3.1.1-002	Consistent with the GALL-SLR Report (see SER Section 3.1.2.2.1)
3.1.1-003	Consistent with the GALL-SLR Report (see SER Section 3.1.2.2.1)
3.1.1-004	Not applicable to Surry (see SER Section 3.1.2.2.1)
3.1.1-005	Consistent with the GALL-SLR Report (see SER Section 3.1.2.2.1)
3.1.1-006	Not applicable to PWRs (see SER Section 3.1.2.2.1)
3.1.1-007	Not applicable to PWRs (see SER Section 3.1.2.2.1)
3.1.1-008	Consistent with the GALL-SLR Report (see SER Section 3.1.2.2.1)
3.1.1-009	Consistent with the GALL-SLR Report (see SER Section 3.1.2.2.1)
3.1.1-010	Consistent with the GALL-SLR Report (see SER Section 3.1.2.2.1)
3.1.1-011	Consistent with the GALL-SLR Report (see SER Section 3.1.2.2.1)
3.1.1-012	Consistent with the GALL-SLR Report (see SER Section 3.1.2.2.2, items 1 and 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 Surry (see SER Section 3.1.2.2.3, item 3)
3.1.1-016	Not applicable to PWRs (see SER Section 3.1.2.2.4, item 1)
3.1.1-017	Not applicable to PWRs (see SER Section 3.1.2.2.4, item 2)
3.1.1-018	Consistent with the GALL-SLR Report (see SER Section 3.1.2.2.5)
3.1.1-019	Consistent with the GALL-SLR Report (see SER Section 3.1.2.2.6, item 1)
3.1.1-020	Consistent with the GALL-SLR Report (see SER Section 3.1.2.2.6, item 2)
3.1.1-021	Not applicable to PWRs (see SER Section 3.1.2.2.7)
3.1.1-022	Not applicable to Surry (see SER 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	Consistent with the GALL-SLR Report (see SER Section 3.1.2.2.11, items 1 and 2)
3.1.1-026	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.1.1-027	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.1.1-028	Consistent with the GALL-SLR Report (see SER Section 3.1.2.2.9)
3.1.1-029	Not applicable to PWRs (see SER Section 3.1.2.2.12)
3.1.1-030	Not applicable to PWRs
3.1.1-031	Not applicable to PWRs
3.1.1-032	Not Used (see SER Section 3.1.2.1.1)
3.1.1-033	Consistent with the GALL-SLR Report (see SER Section 3.1.2.1.2)
3.1.1-034	Not applicable to Surry (see SER Section 3.1.2.1.1)
3.1.1-035	Consistent with the GALL-SLR Report
3.1.1-036	Consistent with the GALL-SLR Report

Component Group (SRP-SLR Item No.)	Staff Evaluation
3.1.1-037	Consistent with the GALL-SLR Report
3.1.1-038	Consistent with the GALL-SLR Report
3.1.1-039	Consistent with the GALL-SLR Report
3.1.1-040	Consistent with the GALL-SLR Report
3.1.1-040a	Consistent with the GALL-SLR Report
3.1.1-041	Not applicable to PWRs (see SER Section 3.1.2.2.12)
3.1.1-042	Consistent with the GALL-SLR Report
3.1.1-043	Not applicable to PWRs
3.1.1-044	Consistent with the GALL-SLR Report
3.1.1-045	Consistent with the GALL-SLR Report
3.1.1-046	Consistent with the GALL-SLR Report
3.1.1-047	Consistent with the GALL-SLR Report
3.1.1-048	Consistent with the GALL-SLR Report
3.1.1-049	Consistent with the GALL-SLR Report
3.1.1-050	Consistent with the GALL-SLR Report
3.1.1-051a	Not applicable to Surry (see SER Section 3.1.2.2.9)
3.1.1-051b	Not applicable to Surry (see SER Section 3.1.2.2.9)
3.1.1-052a	Not applicable to Surry (see SER Section 3.1.2.2.9)
3.1.1-052b	Not applicable to Surry (see SER Section 3.1.2.2.9)
3.1.1-052c	Not applicable to Surry (see SER Section 3.1.2.2.9)
3.1.1-053a	Consistent with the GALL-SLR Report (see SER Section 3.1.2.2.9)
3.1.1-053b	Consistent with the GALL-SLR Report (see SER Section 3.1.2.2.9)
3.1.1-053c	Consistent with the GALL-SLR Report (see SER Section 3.1.2.2.9)
3.1.1-054	Not used. Addressed by 3.1.1-028. (see SER Section 3.1.2.2.9)
3.1.1-055a	Not applicable to Surry (see SER Section 3.1.2.2.9)
3.1.1-055b	Not applicable to Surry (see SER Section 3.1.2.2.9)
3.1.1-055c	Consistent with the GALL-SLR Report (see SER Section 3.1.2.2.9)
3.1.1-056a	Not applicable to Surry (see SER Section 3.1.2.2.9)
3.1.1-056b	Not applicable to Surry (see SER Section 3.1.2.2.9)
3.1.1-056c	Not applicable to Surry (see SER 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 Surry (see SER Section 3.1.2.2.9)
3.1.1-058b	Not applicable to Surry (see SER Section 3.1.2.2.9)
3.1.1-059a	Consistent with the GALL-SLR Report (see SER Section 3.1.2.2.9)
3.1.1-059b	Consistent with the GALL-SLR Report (see SER Section 3.1.2.2.9)
3.1.1-059c	Consistent with the GALL-SLR Report (see SER Section 3.1.2.2.9)
3.1.1-060	Not applicable to PWRs
3.1.1-061	Consistent with the GALL-SLR Report
3.1.1-062	Not applicable to Surry
3.1.1-063	Not applicable to PWRs
3.1.1-064	Consistent with the GALL-SLR Report
3.1.1-065	Not applicable to Surry
3.1.1-066	Not applicable to Surry
3.1.1-067	Consistent with the GALL-SLR Report
3.1.1-068	Not applicable to Surry

Component Group (SRP-SLR Item No.)	Staff Evaluation
3.1.1-069	Consistent with the GALL-SLR Report
3.1.1-070	Consistent with the GALL-SLR Report
3.1.1-071	Consistent with the GALL-SLR Report
3.1.1-072	Consistent with the GALL-SLR Report
3.1.1-073	Not applicable to Surry
3.1.1-074	Consistent with the GALL-SLR Report
3.1.1-075	Not applicable to Surry
3.1.1-076	Consistent with the GALL-SLR Report
3.1.1-077	Consistent with the GALL-SLR Report (see SER Section 3.1.2.1.3)
3.1.1-078	Not applicable to Surry
3.1.1-079	Not applicable to PWRs
3.1.1-080	Not applicable to Surry
3.1.1-081	Not applicable to Surry
3.1.1-082	Not applicable to Surry
3.1.1-083	Not used
3.1.1-084	Not applicable to PWRs
3.1.1-085	Not applicable to PWRs
3.1.1-086	Not applicable to Surry
3.1.1-087	Not used
3.1.1-088	Consistent with the GALL-SLR Report
3.1.1-089	Consistent with the GALL-SLR Report
3.1.1-090	Consistent with the GALL-SLR Report
3.1.1-091	Not applicable to PWRs
3.1.1-092	Consistent with the GALL-SLR Report
3.1.1-093	Consistent with the GALL-SLR Report
3.1.1-094	Not applicable to PWRs
3.1.1-095	Not applicable to PWRs
3.1.1-096	Not applicable to PWRs
3.1.1-097	Not applicable to PWRs
3.1.1-098	Not applicable to PWRs
3.1.1-099	Not applicable to PWRs (see SER Section 3.1.2.2.13)
3.1.1-100	Not applicable to PWRs
3.1.1-101	Not applicable to PWRs
3.1.1-102	Not applicable to PWRs
3.1.1-103	Not applicable to PWRs (see SER Section 3.1.2.2.12)
3.1.1-104	Not applicable to PWRs
3.1.1-105	Consistent with the GALL-SLR Report (see SER Section 3.1.2.2.15)
3.1.1-106	Not applicable to Surry
3.1.1-107	Consistent with the GALL-SLR Report
3.1.1-108	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.1.1-109	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.1.1-110	Not applicable to PWRs
3.1.1-111	Consistent with the GALL-SLR Report
3.1.1-112	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.1.1-113	Not applicable to PWRs

Component Group (SRP-SLR Item No.)	Staff Evaluation
3.1.1-114	Not Used (see SER Section 3.1.2.1.1)
3.1.1-115	Not applicable to Surry (see SER Section 3.1.2.2.15)
3.1.1-116	Consistent with the GALL-SLR Report (see SER Section 3.1.2.2.10, item 1)
3.1.1-117	Not used (see SER Section 3.1.2.2.10, item 2)
3.1.1-118	Not used (see SER Section 3.1.2.2.9)
3.1.1-119	Consistent with the GALL-SLR Report (see SER Section 3.1.2.2.9)
3.1.1-120	Not applicable to PWRs (see SER Section 3.1.2.2.14)
3.1.1-121	Not applicable to PWRs
3.1.1-122	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.1.1-123	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.1.1-124	Consistent with the GALL-SLR Report
3.1.1-125	Not applicable to Surry (see SER Section 3.1.2.1.1)
3.1.1-126	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.1.1-127	Consistent with the GALL-SLR Report (see SER Section 3.1.2.1.4)
3.1.1-128	Not applicable to PWRs
3.1.1-129	Not applicable to PWRs
3.1.1-130	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.1.1-131	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.1.1-132	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.1.1-133	Not applicable to PWRs
3.1.1-134	Consistent with the GALL-SLR Report
3.1.1-135	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.1.1-136	Consistent with the GALL-SLR Report (see SER Section 3.1.2.2.16)
3.1.1-137	Consistent with the GALL-SLR Report
3.1.1-138	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.1.1-139	Consistent with the GALL-SLR Report (see SER Section 3.1.2.2.6, item 3)

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 Surry 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. The staff verified that the material presented in the SLRA was applicable and that the applicant identified the appropriate GALL-SLR Report AMRs. For those AMR items the staff found to be consistent with the GALL-SLR Report, and for which no additional evaluation or request for additional information (RAI) applies, the GALL-SLR Report provides a basis for acceptability of the AMR item. The staff's conclusion of "Consistent with the GALL-SLR Report" is documented in SER Table 3.1-1 and no separate writeup is required or provided. 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.

Section 3.1.2.1.1 documents the staff's review of AMR items for which the GALL-SLR Report does not recommend further evaluation that the applicant determined to not be applicable or not used.

3.1.2.1.1 Aging Management Review Results Identified as Not Applicable or Not Used

For SLRA Table 3.1.1, items 3.1-1-004, 3.1-1-015, 3.1-1-022, 3.1-1-034, 3.1-1-051a, 3.1-1-051b, 3.1-1-052a, 3.1-1-052b, 3.1-1-052c, 3.1-1-055a, 3.1-1-055b, 3.1-1-056a, 3.1-1-056b, 3.1-1-056c, 3.1-1-058a, and 3.1-1-058b, 3.1-1-062, 3.1-1-065, 3.1-1-066, 3.1-1-068, 3.1-1-073, 3.1-1-075, 3.1-1-078, 3.1-1-080, 3.1-1-081, 3.1-1-082, 3.1-1-086, 3.1-1-106, 3.1-1-115, and 3.1-1-125, the applicant claims that the corresponding AMR items in the GALL-SLR Report are not applicable to Surry. The staff reviewed the SLRA and UFSAR and confirmed that the applicant's SLRA does not have any AMR results that are applicable for these items.

For SLRA Table 3.1.1, items 3.1-1-006, 3.1-1-007, 3.1-1-016, 3.1-1-017, 3.1-1-021, 3.1-1-029, 3.1-1-030, 3.1-1-031, 3.1-1-041, 3.1-1-043, 3.1.1-056a, 3.1.1-056b, 3.1.1-056c, 3.1-1-060, 3.1-1-063, 3.1-1-079, 3.1-1-084, 3.1-1-085, 3.1-1-091, 3.1-1-094, 3.1-1-095, 3.1-1-096, 3.1-1-097, 3.1-1-098, 3.1-1-099, 3.1-1-100, 3.1-1-101, 3.1-1-102, 3.1-1-103, 3.1-1-104, 3.1-1-110, 3.1-1-113, 3.1-1-120, 3.1-1-121, 3.1-1-128, 3.1-1-129, and 3.1-1-133, the applicant claims that the corresponding AMR items in the GALL-SLR Report are not applicable because the associated items are only applicable to boiling-water reactors (BWRs). The staff reviewed the SRP-SLR, confirmed that these items only apply to BWRs, and finds that these items are not applicable to Surry because it is a PWR.

For the following SLRA Table 3.1.1, items, the applicant claims that the corresponding items in the GALL-SLR Report are not used because they are addressed by other SLRA Table 1 items: 3.1-1-054 (addressed by 3.1.1-028), 3.1-1-083 (addressed by 3.1.1-012), 3.1-1-087 (addressed by 3.1.1-028, 3.1.1-059a, 3.1.1-059b, 3.1.1.-059c, and 3.1.1-119), 3.1-1-114 (addressed by 3.1.1-020, 3.1.1-033, 3.1.1-037, 3.1.1.-039, 3.1.1.-042, 3.1.1-088, and 3.1.1-116), 3.1-1-117 (addressed by 3.1.1-059a; see SER Section 3.1.2.2.9), and 3.1-1-118 (addressed by 3.1.1-053a, 3.1.1-053b, and 3.1.1.-053c). The staff reviewed the SLRA and confirmed that the aging effects will be addressed by other SLRA Table 1 items. Therefore, the staff finds Dominion's proposal to use alternate items acceptable.

SLRA Table 3.1.1, item 3.1.1-032 is related to stainless steel, nickel alloy, or cast austenitic stainless steel (CASS) reactor vessel internals, and core support structure (not already referenced as ASME Section XI Examination Category B-N-3 core support structure components in MRP-227-A), exposed to reactor coolant and neutron flux. The aging effects are cracking and loss of material due to wear. The SLRA states that this item is not applicable and the associated aging items in NUREG-2191 are not used. The staff noted that although not identified, the aging effects associated with reactor vessel internal core support structures will be managed by other SLRA Table 1 AMR items. Therefore, the staff finds Dominion's proposal to use alternate items in SLRA Table 1 in lieu of item 3.1.1-032 acceptable.

SLRA Table 3.1.1, item 3.1.1-125 addresses managing cracking due to flow-induced vibration and high-cycle fatigue for nickel alloy steam generator tubes at support plate locations exposed to secondary feedwater or steam. Dominion stated that this item is not applicable. The staff evaluated Dominion's claim and finds it acceptable because the applicant analyzed the flow-induced vibration and fluidelastic excitation, and vortex shedding to determine that the code allowable number of cycles is infinite and fatigue factor is zero for the tubes. Therefore, this AMR item is not applicable. This analysis is captured in TLAA 4.7.8, "Steam Generator Tube High Cycle Fatigue Evaluation," and the associated NRC staff SER section.

3.1.2.1.2 Cracking Due to Stress Corrosion Cracking

SLRA Table 3.1.1, item 3.1.1-033 addresses cracking due to SCC for stainless steel, and steel with stainless steel cladding Class 1 reactor coolant pressure boundary components exposed to reactor coolant. For the SLRA Table 2 AMR item (as amended in response to RAI B2.1.10-2) that cites generic note E, the SLRA credits the Steam Generators program and Water Chemistry program to manage the aging effect for steel with stainless steel cladding channel head (and cladding) exposed to reactor coolant. The AMR items cite plant-specific note 4, which states "[t]he Steam Generators (B2.1.10) program will manage cracking of channel head (and cladding) exposed to reactor coolant."

For SLRA AMR item 3.1.1-033, the staff needed additional information, and issued an RAI. RAI B2.1.10-2 and Dominion's response are documented in ADAMS Accession No. ML19204A357.In its response, Dominion stated that cracking in steel with stainless steel cladding channel heads (and cladding) will be managed by the Steam Generators program and the Water Chemistry program. The applicant also noted that cracking of the channel heads is addressed by the degradation assessments performed as part of the Steam Generators program. Additionally, the applicant revised Table 3.1.2-4 to reflect information provided in the RAI response. The Steam Generators program monitors the condition of the channel heads, and the Water Chemistry program manages cracking due to SCC.

During its evaluation of Dominion's response to RAI B2.1.10-2, the staff noted that the applicant proposes to the use the Steam Generators and Water Chemistry programs to manage the applicable aging effects. The staff finds Dominion's response and changes to the SLRA and Table 3.1.2-4 acceptable because use of the Water Chemistry and Steam Generators programs will be adequate to manage cracking for the steam generator channel heads (and cladding), and their use is consistent with the GALL-SLR report.

Based on its review of components associated with AMR item 3.1.1-033 for which Dominion cited generic note E, the staff finds Dominion's proposal to manage the effects of aging using the Water Chemistry and Steam Generators programs acceptable because the AMPs selected

by the licensee will be adequate to manage the applicable aging effects as described in the evaluation of the RAI by the NRC staff above.

3.1.2.1.3 Loss of Material Due to Wear and Fretting

SLRA Table 3.1.1, item 3.1.1-077 and time-limited aging analysis (TLAA) 4.7.9, “Steam Generator Tube Wear Evaluation,” address loss of material due to wear and fretting for nickel alloy steam generator u-tubes exposed to treated water greater than 60 ºC (140 ºF), as described in the letter dated October 31, 2019 (Supplement 5). In that supplement, the licensee also corrected a citation that pointed to an incorrect TLAA. For the SLRA Table 2 AMR item that cites generic note E, the plant-specific note 1 had incorrectly credited the TLAA in Section 4.7.8 of the SLRA, “Steam Generator Tube High Cycle Fatigue Evaluation,” to manage the aging effect for nickel alloy exposed to treated water. The plant-specific note 1 has now been corrected by Supplement 5 to refer to the evaluation of loss of material in steam generator tubes at tube support plates, which is a plant-specific TLAA, evaluated in Section 4.7.9, “Steam Generator Tube Wear Evaluation.”

Based on its review of components associated with AMR item 3.1.1-077 for which Dominion cited generic note E, the staff finds Dominion’s proposal to manage the loss of material using the Steam Generators program and the plant-specific TLAA Steam Generator Tube Wear Evaluation acceptable because the applicant has evaluated tube wear in the plant-specific TLAA, and also uses the GALL-SLR Report recommended AMP (“Steam Generators”) to manage the loss of material described above.

3.1.2.1.4 Loss of Material Due to Boric Acid Corrosion

SLRA Table 3.1.1, AMR item 3.1.1 127 addresses loss of material due to boric acid corrosion for steel (with stainless steel or nickel alloy cladding) steam generator heads and tubesheets exposed to reactor coolant. For the SLRA Table 2 AMR item that cites generic note E, the SLRA credits the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program (ASME Section XI ISI program), instead of the Steam Generators program as recommended by the GALL SLR Report, to manage the aging effect for steel with stainless steel cladding primary inlet nozzles and outlet nozzles exposed to reactor coolant. The AMR item cites plant specific note 2, which states, “[t]he ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD (B2.1.1) program is used to manage loss of material for the primary inlet and outlet nozzles exposed to reactor coolant.”

For SLRA AMR item 3.1.1-127, the staff needed additional information, and issued an RAI. RAI B2.1.10-2 and Dominion’s response are documented in ADAMS Accession No. ML19204A357.In its response, Dominion stated that loss of material in the steel with stainless steel cladding primary inlet and outlet nozzles (and cladding) is managed by the ASME Section XI ISI program as well as the Water Chemistry program. The applicant also revised SLRA Table 3.1.1 item 3.1.1-127 and Table 3.1.2-4 to reflect information provided in the RAI response. The staff finds Dominion’s response and changes to the SLRA and Table 3.1.2-4 acceptable because the use of the Water Chemistry program to manage the given aging effect is consistent with the GALL-SLR Report, and because the ASME Section XI ISI program will provide visual inspections that are capable of detecting boric acid corrosion.

3.1.2.2 Aging Management Review Results for which Further Evaluation is Recommended by the GALL-SLR Report

In SLRA Section 3.1.2.2, the applicant further evaluates aging management for certain reactor coolant system (RCS) components as recommended by the GALL-SLR Report, and provides information concerning how it will manage the applicable aging effects. The staff reviewed the applicant's evaluation of these component groups against the criteria contained in SRP-SLR Section 3.1.2.2. The following subsections document the staff's review.

3.1.2.2.1 Cumulative Fatigue Damage

SLRA Section 3.1.2.2.1, associated with SLRA Table 3.1.1 items 3.1.1-001, 3.1.1-002, 3.1.1-003, 3.1.1-005, 3.1.1-008, 3.1.1-009, 3.1.1-010, and 3.1.1-011, states that TLAAs are evaluated in accordance with 10 CFR 54.21(c)(1) and that the evaluation of these TLAAs for fatigue of reactor vessel, internals, and reactor coolant system components, are addressed in SLRA Sections 4.3 and 4.7. This is consistent with SRP-SLR Section 3.1.2.2.1 and is, therefore, acceptable. The staff's evaluations of the TLAAs for fatigue of reactor vessel, internals, and reactor coolant system components are documented in SER Section 4.3.2.

SLRA Table 3.1.1, item 3.1.1-004, addresses cumulative fatigue damage, cracking due to fatigue, and cyclic loading for steel pressure vessel support skirt and attachment welds. Dominion stated that this item is not applicable. The staff evaluated Dominion's claim against the criteria in SRP-SLR Section 3.1.2.2.1 and finds it acceptable because the staff independently reviewed the applicant's UFSAR and confirmed that there are no steel pressure vessel support skirt and attachment welds within the scope of license renewal.

For AMR items 3.1.1-006 and 3.1.1-007, Dominion claimed that they were not applicable because they are only applicable to BWRs. The staff confirmed that this item is associated only with BWRs and, therefore, finds the applicant's claim acceptable.

3.1.2.2.2 Loss of Material due to General, Pitting, and Crevice Corrosion

<u>Item 1</u>. SLRA Section 3.1.2.2.2, item 1, associated with SLRA Table 3.1.1, item 3.1.1-012, states that loss of material due to general, pitting, and crevice corrosion could occur in the PWR steam generator upper and lower shell and transition cone exposed to secondary feedwater and steam. Dominion referred to Information Notice (IN) 90-04, which states that volumetric examinations of the shell-to-transition-cone girth welds, required by Section XI of the ASME Code, may not be sufficient to differentiate isolated cracks from inherent geometric conditions. Dominion further stated that following this IN, in addition to inspections required by the ASME Code, Section XI, it inspected a steam generator transition cone girth weld 100 percent using magnetic particle testing (MT). Dominion did not observe any degradation during these inspections. Dominion stated that the continued implementation of the Water Chemistry program, AMP B2.1.2, and the steam generator periodic inspections required by the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program, AMP B2.1.1, will effectively manage loss of material for the steam generator upper and lower shell and transition cone exposed to secondary feedwater and steam prior to loss of intended function.

The staff evaluated Dominion's ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program and Water Chemistry program as documented in SER Sections 3.0.3.2.1 and 3.0.3.2.2, respectively. In its review of components associated with SLR Table 3.1.1, item 3.1.1-012, the staff finds that Dominion has met the further evaluation criteria and

Dominion's proposal to manage the effects of aging using these programs is acceptable because (1) the ISI program includes enhanced examination techniques to confirm that the integrity of the steam generator shell is adequately maintained by detecting and monitoring potential flaws, (2) the Water Chemistry program monitors and controls the secondary water chemistry conditions to minimize environmental effects on aging degradation in these components, and (3) the use of these programs is consistent with the guidance in the GALL-SLR Report.

Based on the AMPs identified, the staff determines that Dominion's AMPs meet the criteria in SRP-SLR Section 3.1.2.2.2, item 1. For the items associated with SLRA Section 3.1.2.2.2, item 1, the staff concludes that the SLRA is consistent with the GALL-SLR Report and that Dominion 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).

Item 2. SLRA Section 3.1.2.2.2, item 2, associated with SLRA Table 3.1.1, item 3.1.1-012, addresses loss of material due to general, pitting, and crevice corrosion affecting the PWR steam generator upper and lower shell and transition cone exposed to secondary feedwater and steam. Dominion replaced the steam generators at Surry in 1981, for Unit 1, and in 1980, for Unit 2. The SLRA states:

> Only the lower shell assembly of the steam generator (Westinghouse Model 51F) was replaced, generating a cut in the middle of the transition cone and consequently creating a new transition cone closure weld. For this new transition cone closure weld, a one-time inspection at susceptible locations is an acceptable method to determine whether an aging effect is not occurring, or an aging effect is progressing very slowly, such that the component's intended function will be maintained during the subsequent period of extended operation. The One-Time Inspection (B2.1.20) program will perform a magnetic particle test inspection of the continuous circumferential transition cone closure weld on each steam generator (minimum 25 percent examination coverage of each weld) prior to the subsequent period of extended operation. This one-time inspection along with the continued implementation of the Water Chemistry (B2.1.2) program and the steam generator periodic inspections required by the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD (B2.1.1) program, will effectively manage loss of material for the steel steam generator components prior to loss of intended function.

For SLRA 3.1.2.2.2, item 2, the staff had questions regarding the minimum 25 percent examination coverage of each weld and not 100 percent or essentially 100 percent (i.e., greater than 90 percent) examination coverage. The staff needed additional information and issued RAI B2.1.1-4 (ADAMS Accession No. ML19155A050). The staff asked the applicant to discuss (1) whether the magnetic particle test (MT) will achieve 100 percent or essentially 100 percent examination coverage of the circumferential transition cone closure weld on each steam generator; and (2) the technical basis for the proposed minimum 25 percent examination coverage of each weld. In its response dated June 27, 2019 (ADAMS Accession No. ML19183A440), Dominion stated that its response to IN 90-04 included inspections required by the ASME Code, Section XI, and an additional inspection of a representative steam generator transition cone girth weld using MT. Dominion stated that the MT of the upper girth weld on the single steam generator achieved 100 percent coverage.

Dominion stated that for the subsequent period of extended operation, the periodic examinations of the steam generator transition cone girth welds will continue to be performed as described in the ASME Section XI Inservice Inspection, Subsections IWB, IWC and IWD program (SLRA Section B2.1.1). Dominion indicated that consistent with NUREG-2192, Section 3.1.2.2.2, it will perform a one-time inspection for the transition cone closure weld on each steam generator using MT as described in the One-Time Inspection program (SLRA Section B2.1.20). This one-time inspection will confirm the effectiveness of the Water Chemistry program (SLRA Section B2.1.2). Dominion further stated that for the transition cone closure weld on each steam generator, the one-time MT inspection is intended to cover essentially 100 percent of the total weld length.

As part of its response to RAI B2.1.1-4, Dominion revised SLRA Section B2.1.20, One-Time Inspection program, Program Description; Table A4.0-1, item 20; and further evaluated item 3.1.2.2.2, as indicated in Enclosure 5 of the June 27, 2019, letter, to indicate that the one-time MT inspection on each steam generator transition cone closure weld is intended to cover essentially 100 percent of the total weld length. The staff finds acceptable that Dominion will perform a one-time inspection of each steam generator transition cone closure weld using MT and it will achieve essentially 100 percent examination coverage of the total weld length as shown in the revised SLRA AMP B2.1.20; Table A4.0-1, item 20; and further evaluation item 3.1.2.2.2.

The staff's evaluations of Dominion's One-Time Inspection program and Water Chemistry program are documented in SER Sections 3.0.3.1.5 and 3.0.3.2.2, respectively. In its review of components associated with SLRA Table 3.1.1, item 3.1.1-012, the staff finds that Dominion has met the further evaluation criteria and Dominion's proposal to manage the effects of aging using these programs is acceptable because (1) the One-Time Inspection program includes surface examinations to confirm the integrity of the steam generator transition cone weld and to verify the effectiveness of the Water Chemistry program, (2) The Water Chemistry program monitors and controls the secondary water chemistry conditions to minimize environmental effects on aging degradation in these components, and (3) the use of these programs is consistent with the guidance in the GALL-SLR Report.

Based on the AMPs identified, the staff determines that Dominion's AMPs meet the criteria in SRP-SLR Section 3.1.2.2.2, item 2. For the items associated with SLRA Section 3.1.2.2.2, item 2, the staff concludes that the SLRA is consistent with the GALL-SLR Report and that Dominion 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).

3.1.2.2.3 Loss of Fracture Toughness due to Neutron Irradiation Embrittlement

<u>Item 1</u>. SLRA Section 3.1.2.2.3, item 1, associated with SLRA Table 3.1.1, item 3.1.1-013, states that TLAAs are evaluated in accordance with 10 CFR 54.21(c)(1) and that the evaluation of this TLAA, reactor vessel neutron embrittlement, is addressed in SLRA Section 4.2, "Reactor Vessel Neutron Embrittlement Analysis." This is consistent with SRP-SLR Section 3.1.2.2.3.1 and is, therefore, acceptable. The staff's evaluation regarding the TLAA for the reactor pressure vessel beltline and extended beltline neutron fluence is documented in SER Section 4.2.

<u>Item 2</u>. SLRA Section 3.1.2.2.3, item 2, associated with SLRA Table 3.1.1, item 3.1.1-014, addresses loss of fracture toughness due to neutron irradiation of the reactor pressure vessel beltline and extended beltline exposed to reactor coolant and neutron flux, which will be

managed by the Reactor Vessel Material Surveillance and Neutron Fluence Monitoring AMPs. The staff reviewed Dominion's proposal against the criteria in SRP-SLR Section 3.1.2.2.3, item 2.

In its review of components associated with AMR item 3.1.1-014, the staff finds that Dominion has met the further evaluation criteria, and Dominion's proposal to manage the effects of aging using the Reactor Vessel Material Surveillance and Neutron Fluence Monitoring AMPs is acceptable because it is consistent with GALL-SLR Report AMR item IV.A2.RP-229.

Based on the AMP identified, the staff concludes that Dominion's AMP meets SRP-SLR Section 3.1.2.2.3, item 2 criteria. For SLRA Table 3.1.1, item 3.1.1-014, 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 Dominion has demonstrated that the effects of aging will be adequately managed so that the intended function 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, item 3, associated with SLRA Table 3.1.1, item 3.1.1-015, addresses loss of fracture toughness due to neutron irradiation embrittlement in PWR reactor vessel internal (RVI) components exposed to a reactor coolant with neutron flux environment. Dominion stated that this item is not applicable. The staff evaluated Dominion's claim against the criteria in SRP-SLR Section 3.1.2.2.3, item 3, and finds it acceptable because:
(a) SRP-SLR Section 3.1.2.2.3, item 3, identifies that the AMR item and associated AMR further evaluation guidance are only applicable to RVI components in PWRs designed by the Babcock and Wilcox (B&W) Company, where the management of the aging effect may be within the scope of the TLAA in B&W Report No. BAW-2248, and (b) the UFSAR for Surry Power Station confirms that the reactor unit were designed by the Westinghouse Electric Company, and not by B&W.

3.1.2.2.4 Cracking due to Stress Corrosion Cracking and Intergranular Stress Corrosion Cracking

Item 1. For item 1, SRP-SLR Section 3.1.2.2.4 states that cracking due to stress corrosion cracking (SCC) and intergranular stress corrosion cracking (IGSCC) could occur in stainless steel and nickel alloy reactor vessel flange leak detection lines of BWRs. Dominion stated that item 1, associated with SLRA Table 3.1.1, item 3.1.1-016, is not applicable to Units 1 and 2, which are PWR units, because item 1 in SRP-SLR Section 3.1.2.2.4 is applicable to BWRs only. The staff confirmed that this item is associated only with BWRs and, therefore, finds the applicant's claim acceptable.

Item 2. For item 2, SRP-SLR Section 3.1.2.2.4 states that cracking due to SCC and IGSCC could occur in stainless steel BWR isolation condenser components exposed to reactor coolant. Dominion stated that item 2, associated with SLRA Table 3.1.1, item 3.1.1-017, is not applicable to Units 1 and 2, which are PWR units, because item 2 in SRP-SLR Section 3.1.2.2.4 is applicable to BWRs only. The staff confirmed that this item is associated only with BWRs and, therefore, finds the applicant's claim acceptable.

3.1.2.2.5 Crack Growth Due to Cyclic Loading

SLRA Section 3.1.2.2.5, associated with SLRA Table 3.1.1, item 3.1.1-018, states that TLAAs are evaluated in accordance with 10 CFR 54.21(c)(1) and that the evaluation of the TLAA on "Cracking Associated with Weld Deposited Cracking," is addressed in SLRA Section 4.7.7. This

is consistent with SRP-SLR Section 3.1.2.2.5 and SRP-SLR Table 3.1-1, item 3.1-1-018, and is therefore acceptable. The staff's evaluation of the TLAA for reactor pressure vessel cladding to vessel welds is documented in SER Section 4.7.7.

3.1.2.2.6 Cracking Due to Stress Corrosion Cracking

Item 1. SLRA Section 3.1.2.2.6, item 1, associated with SLRA Table 3.1.1, item 3.1.1-019, addresses the management of SCC in PWR reactor vessel bottom-mounted instrument guide tubes exposed to a reactor coolant environment. SLRA Section 3.1.2.2.6 states that the Surry bottom-mounted instrument guide tubes are being managed by the Water Chemistry program and the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program.

In its review of SLRA Table 3.1-1, item 3.1.1-019, the staff noted that the bottom-mounted instrumentation guide tubes are made of stainless steel with a normal operating environment of reactor coolant. The staff further noted that SCC of the bottom-mounted instrumentation guide tubes will be managed by the Water Chemistry program and the inspection will be implemented by the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program. The stainless steel guide tubes are in contact with the borated water environment. The staff finds that if cracking occurs, visual examinations would identify any indication of borated water leakage. Therefore, the staff finds acceptable Dominion's proposal to use its water chemistry program and the ASME Section XI ISI, Subsections IWB, IWC, and IWD program to manage cracking due to stress corrosion cracking.

The staff's evaluations of Dominion's Water Chemistry program and ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program are documented in SER Sections 3.0.3.2.2 and 3.0.3.2.1, respectively. In its review of components associated with SLRA Table 3.1.1, item 3.1.1-019, the staff finds that Dominion has met the further evaluation criteria and Dominion's proposal to manage the effects of aging using these programs is acceptable because (1) the Water Chemistry program monitors and controls the primary water chemistry conditions to minimize environmental effects on aging degradation in these components, (2) the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program provides for periodic testing and inspections to detect cracking, and (3) the use of these programs is consistent with the guidance in the GALL-SLR Report.

Based on the AMPs identified, the staff determines that Dominion's AMPs meet the criteria in SRP-SLR Section 3.1.2.2.6, item 1. For the items associated with SLRA Section 3.1.2.2.6, item 1, the staff concludes that the SLRA is consistent with the GALL-SLR Report and that Dominion 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).

Item 2. SLRA Section 3.1.2.2.6, item 2, associated with SLRA Table 3.1.1, item 3.1.1-020, states that aging of CASS Class 1 piping, piping components, and piping elements exposed to reactor coolant will be managed for cracking due to SCC by the Water Chemistry program and ASME Section XI Inservice Inspection Subsections IWB, IWC, and IWD program. SRP-SLR Section 3.1.2.2.6.2 notes that, while water chemistry control will mitigate SCC, "SCC could occur in CASS components that do not meet the NUREG-0313, 'Technical Report on Material Selection and Process Guidelines for BWR Coolant Pressure Boundary Piping,' guidelines with regard to ferrite and carbon content," and recommends further evaluation of a plant-specific program for components that do not meet NUREG-0313 guidelines to ensure adequate management of cracking due to SCC. SLRA Section 3.1.2.2.6 states that the CASS

components associated with item 3.1.1-020 are the reactor coolant elbows, which are "consistent with the NUREG-0313 guidelines with regard to ferrite and carbon content as verified by certified material test reports."

The staff's evaluations of the applicant's Water Chemistry program and ASME Section XI Inservice Inspection Subsections IWB, IWC, and IWD program are documented in SER Sections 3.0.3.2.2 and 3.0.3.2.1, respectively.

In its review of components associated with item 3.1.1-020, the staff finds that the applicant has met the further evaluation criteria, and the applicant's proposal to manage the effects of aging of the CASS components is acceptable because: (a) the CASS components are consistent with NUREG-0313 guidelines with regard to ferrite and carbon content as verified by certified material test reports; (b) the Water Chemistry program demonstrated its ability to control the primary water chemistry to manage for SCC of the CASS components; and (b) the ASME Section XI Inservice Inspection Subsections IWB, IWC, and IWD program provides adequate inspection methods to ensure detection of cracking in the CASS components due to SCC before loss of intended function, should it occur.

For those items associated with SLRA Section 3.1.2.2.6, item 2, the staff concludes that the SLRA is consistent with the GALL-SLR Report and that the applicant has demonstrated that the effects of aging of the CASS components will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of subsequent extended operation, as required by 10 CFR 54.21(a)(3).

<u>Item 3</u>. SLRA Section 3.1.2.2.6, item 3, associated with SLRA Table 3.1.1, item 3.1.1-139, addresses stainless steel and nickel alloy reactor vessel top head enclosure flange leak detection piping exposed to uncontrolled indoor air and reactor coolant leakage, which will be managed for cracking due to SCC by the External Surfaces Monitoring of Mechanical Components program. The staff reviewed Dominion's proposal against the criteria in SRP-SLR Section 3.1.2.2.6, item 3. In its review of components associated with item 3.1.1-139, the staff finds the applicant has met the further evaluation criteria, and the applicant's proposal to manage the effects of aging using the External Surfaces Monitoring of Mechanical Components program is acceptable because the program's visual inspections can detect indications of cracking prior to a loss of intended function through the identification of borated water leakage.

Based on the program identified, the staff determines that the applicant's program meets the criteria in SRP-SLR Section 3.1.2.2.6, item 3. For those AMR items associated with SLRA Section 3.1.2.2.6, 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 period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.2.7 Cracking Due to Cyclic Loading

The staff reviewed SLRA Section 3.1.2.2.7, associated with SLRA Table 3.1.1, item 3.1.1-021, against the criteria in SRP-SLR Section 3.1.2.2.7. SRP-SLR Section 3.1.2.2.7 states that cracking due to cyclic loading could occur in steel and stainless steel BWR isolation condenser components exposed to reactor coolant. Dominion stated that this item is not applicable to Surry Units 1 and 2, which are PWR units, because the associated item in SRP-SLR Section 3.1.2.2.7 is applicable to BWRs only. The staff confirmed that this item is associated only with BWRs and, therefore, finds the applicant's claim acceptable.

3.1.2.2.8 Loss of Material Due to Erosion

SLRA Section 3.1.2.2.8, associated with SLRA Table 3.1.1, item 3.1.1-022, addresses loss of material due to erosion for steel steam generator feedwater impingement plates exposed to secondary feedwater. Dominion stated that this item is not applicable. The staff evaluated Dominion's claim against the criteria in SRP-SLR Section 3.1.2.2.8 and finds it acceptable because the staff reviewed the applicant's UFSAR and confirmed that the SGs do not have feedwater impingement plates and the associated supports.

3.1.2.2.9 Aging Management of Pressurized-Water Reactor Vessel Internals

SLRA Section 3.1.2.2.9, associated with the following items in SLRA Table 3.1.1, addresses the following aging effects and mechanisms in reactor vessel internal components, which will be managed by either SLRA AMP B2.1.7, "PWR Vessel Internals" program, or for wear in the RVI flux thimble tubes, by AMP B2.1.24, "Flux Thimble Tube Inspection" program:

- Item 3.1.1-028 – loss of material due to wear in RVI flux thimble tubes
- Item 3.1.1-053a – MRP-defined "Primary" category RVI components subject to cracking mechanisms
- Item 3.1.1-053b – MRP-defined "Expansion" category RVI components subject to cracking mechanisms
- Item 3.1.1-053c – MRP-defined "Existing Program" category RVI components subject to cracking mechanisms
- Item 3.1.1-055c – MRP-defined "No Additional Measures" category RVI components
- Item 3.1.1-059a – MRP-defined "Primary" category RVI components subject to non-cracking effects or mechanisms
- Item 3.1.1-059b – MRP-defined "Expansion" category RVI components subject to non-cracking effects or mechanisms
- Item 3.1.1-059c – MRP-defined "Existing Program" category RVI components subject to non-cracking effects or mechanisms
- Item 3.1.1-119 – for plant-specific aspects of the previous AMR items above that may have been modified by the applicant's gap analysis results, as given in SLRA Appendix C

The staff reviewed Dominion's proposal against the criteria in SRP-SLR Section 3.1.2.2.9, which state that a program relying on the methods in Topical Report (TR)-1022863, "Materials Reliability: Pressurized Water Reactor Internals Inspection and Evaluation Guidelines (MRP-227-A)" (ADAMS Accession Nos. ML12017A191 through ML12017A197 and ML12017A199) may be used to manage the aging effects or mechanisms attributed to these components, when subject to a gap analysis, for the components that are included in the SLRA.

The staff noted that for aging management of the RVI components associated with items 3.1.1-53a, 3.1.1-53b, 3.1.1-53c, 3.1.1-55c, 3.1.1-59a, 3.1.1-59b, 3.1.1-59c, and 3.1.1-119, the items provide the applicant's basis for managing cracking and non-cracking effects in RVI components defined as "Primary," "Expansion," "Existing Program," and "No Additional Measures" category components in EPRI Report MRP-227, Revision 1, as modified by the plant-specific results of the applicant's RVI gap analysis (refer to SLRA Appendix C). The staff

noted that this includes that applicant's use of items 3.1.1-53a, 3.1.1-53b, and 3.1.1-53c as alternative bases for managing cracking in the components in lieu of the AMR basis in item 3.1.1-118. For these components, the staff found that the applicant's basis for crediting the PWR Vessel Internals program for aging management (as subject to the results of the applicant's gap analysis) is acceptable because the basis is consistent with the acceptance criteria guidelines in SRP-SLR Section 3.1.2.2.9.

The staff noted that the applicant credits item 3.1.1-028 for managing loss of material due to wear in the stainless steel flux thimble tubes in lieu of SLRA item 3.1.1-054. Additionally, the staff noted that the applicant credits SLRA AMP B2.1.24, "Flux Thimble Tube Inspection," as the applicable program for managing loss of material in the flux thimble tubes in lieu of GALL-SLR Report AMP XI.M16A, "PWR Vessel Internals," as recommended in SRP-SLR Table 3.1-1, item 028. The staff finds this basis to be acceptable because GALL-SLR Report Table 3.1-1, item 054, recommends that a program corresponding to GALL-SLR Report AMP XI.M37, "Flux Thimble Tube Inspection," be used to manage loss of material due to wear in PWR flux thimble tubes.

The staff noted that the applicant's SLRA does not credit items 3.1.1-051a, 3.1.1-051b, 3.1.1-052a, 3.1.1-052b, 3.1.1-052c, 3.1.1-055a, 3.1.1-055b, 3.1.1-056a, 3.1.1-056b, 3.1.1-056c, 3.1.1-058a, or 3.1.1-058b to manage aging in the RVI components. The staff finds this to be acceptable because: (a) the items are only applicable to the RVI components in PWRs designed by Babcock and Wilcox Company or Combustion Engineering Company, and (b) the staff has verified that the PWRs in Surry Units 1 and 2 were designed by the Westinghouse Electric Company.

Based on the programs identified, the staff concludes that Dominion's AMR basis meets the guidance in SRP-SLR Section 3.1.2.2.9. Furthermore, for the objective of managing loss of material in the flux thimble tubes, Dominion's basis is consistent with the AMR basis for Westinghouse-designed flux thimble tubes given in SRP-SLR Table 3.1-1, item 054. For those AMR items associated with SLRA Section 3.1.2.2.9, the staff concludes that the SLRA is consistent with the GALL-SLR Report and that Dominion 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). The staff evaluates the PWR Vessel Internals program in SER Section 3.0.3.2.4 and the Flux Thimble Tube Inspection program in SER Section 3.0.3.2.18.

3.1.2.2.10 Loss of Material Due to Wear

Item 1. SLRA Section 3.1.2.2.10, item 1, associated with SLRA Table 3.1.1, item 3.1.1-116, addresses loss of material due to wear in PWR control rod drive (CRD) head penetration nozzles made of nickel alloy caused by the interactions between the nozzles and the thermal sleeve centering pads. Dominion stated that it will manage the associated wear by the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program. The staff reviewed Dominion's proposal against the criteria in SRP-SLR Section 3.1.2.2.10, item 1. In its review of the components associated with AMR item 3.1.1-116, the staff finds Dominion has met the further evaluation criteria. Additionally, Dominion's proposal to manage the effects of aging using the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program is acceptable, because the program is capable of detecting wear of the CRD head penetration nozzles prior to a loss of the intended reactor coolant pressure boundary function attributed to the CRD nozzles. The staff's evaluation regarding the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program is documented in SER Section 3.0.3.2.1.

Item 2. SLRA Section 3.2.2.2.10, item 2, associated with SLRA Table 3.1.1 AMR item 3.1.1-117, addresses loss of material due to wear for stainless steel thermal sleeves of PWR CRD head penetration nozzles caused by the interactions between the nozzles and the thermal sleeves. The staff noted that Dominion credits item 3.1.1-059a as an alternative AMR item for managing loss of material due to wear for the thermal sleeves. Dominion stated that it will manage the associated wear by the PWR Vessel Internals program. The staff reviewed Dominion's proposal against the criteria in SRP-SLR Section 3.1.2.2.10, item 2. In its review of the thermal sleeves, the staff finds that Dominion has met the further evaluation criteria. Additionally, the staff finds that Dominion's proposal to manage the effects of aging using the PWR Vessel Internals program is acceptable because the program is capable of detecting wear of the thermal sleeves prior to a loss of the thermal cycling mitigation function attributed to the CRD nozzle thermal sleeves. The staff's evaluation regarding the PWR Vessel Internals program is documented in SER Section 3.0.3.2.4.

Based on the programs identified, the staff concludes that Dominion's programs meet the guidance of SRP-SLR Section 3.1.2.2.10, item 1, and Section 3.1.2.2.10, item 2. For those AMR items associated with SLRA Section 3.1.2.2.10, the staff concludes that the SLRA is consistent with the GALL-SLR Report and Dominion 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).

3.1.2.2.11 Cracking Due to Primary Water Stress Corrosion Cracking

Item 1. SLRA Section 3.1.2.2.11, associated with SLRA Table 3.1.1, item 3.1.1-025, addresses cracking for Alloy 600 material exposed to reactor coolant, which will be managed by the Steam Generators and Water Chemistry programs. The staff reviewed Dominion's proposal against the criteria in SRP-SLR Section 3.1.2.2.11, item 1. The staff noted that the Surry steam generator divider plate assemblies and the associated welds are fabricated from Alloy 600 and the associated weld materials. The staff also noted that Surry has Westinghouse Model 51 steam generators. In addition, the staff noted that the applicant claimed that because EPRI Report 3002002850, "Steam Generator Management Program: Investigation of Crack Initiation and Propagation in the Steam Generator Channel Head Assembly," cited the Westinghouse Model 51 steam generators as the most limiting model, a plant-specific AMP was not necessary.

For SLRA Section 3.1.2.2.11, item 1, the staff needed additional information, and issued an RAI. RAI B2.1.10-1 and Dominion's response are documented in ADAMS Accession No. ML19204A357. In its response, Dominion provided a comparison of plant-specific parameters for the steam generators to the criteria described in EPRI Report 3002002850. This included a comparison of SG component dimensions, material specifications, and transient cycles to the corresponding parameters described in EPRI Report 3002002850.

During its evaluation of Dominion's response to RAI B2.1.10-1, the staff noted that the plant-specific parameters provided by the licensee were bounded by the parameters used by EPRI in its analysis. Additionally, the SRP-SLR states that for plants with divider plate assemblies made with Alloy 600 and the associated weld materials, a plant-specific AMP is not necessary if the analyses in EPRI 3002002850 are bounding. The staff also noted that the applicant stated the primary water stress corrosion cracking (PWSCC) parts of the EPRI analyses were not applicable. The staff finds Dominion's response acceptable because the applicant's steam generators are bounded by the EPRI report and, consistent with the SRP-SLR, a plant-specific AMP is not necessary. Additionally, due to the previously approved

H* alternate repair criteria for Surry (License Amendment dated April 17, 2012 (ADAMS Accession No. ML12109A270)), the staff finds it acceptable that the PWSCC portions of the EPRI analyses were not applicable to Surry.

The staff finds that Dominion has met the further evaluation criteria because, as described in the evaluation of the RAI response above, the applicant's steam generators are bounded by EPRI 3002002850 and therefore a plant-specific AMP is not necessary.

Based on the programs identified, the staff concludes that Dominion's programs meet SRP-SLR Section 3.1.2.2.11, item 1 criteria. For those AMR items associated with SLRA Section 3.1.2.2.1, the staff concludes that the SLRA is consistent with the GALL-SLR Report and that Dominion 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 3.1.2.2.11, associated with SLRA Table 3.1.1, item 3.1.1-025, addresses cracking for nickel alloy steam generator tube-to-tubesheet welds exposed to reactor coolant. SRP-SLR Section 3.1.2.2.11 states that "a plant-specific AMP should be evaluated to confirm the effectiveness of the primary water chemistry and steam generator programs in certain circumstances." The SRP-SLR section further states that if an alternate repair criterion (such as H*) has been permanently approved for a unit's Alloy 600 steam generator tubes, the weld is no longer part of the pressure boundary and a plant-specific AMP is not necessary. Dominion stated that H* alternate repair criteria has been permanently approved for Surry's steam generators; therefore, the welds are not considered part of the reactor coolant pressure boundary and a plant-specific AMP is not necessary. The staff evaluated Dominion's claim against the criteria in SRP-SLR Section 3.1.2.2.11, item 2, and finds it acceptable because, in accordance with the SRP-SLR, the welds are not part of the reactor coolant pressure boundary due to approval of alternate repair criteria and a plant-specific program is not necessary.

3.1.2.2.12 Cracking Due to Irradiation-Assisted Stress Corrosion Cracking

SLRA Section 3.1.2.2.12, associated with SLRA Table 3.1.1, items 3.1.1-029, 3.1.1-041, and 3.1.1-103, addresses cracking due to stress corrosion cracking, intergranular stress corrosion cracking, or irradiation-assisted stress corrosion cracking in mechanical core plate access hole cover, welded core plate access hole cover made from nickel alloy materials and that are exposed to a BWR reactor coolant with neutron flux environment, or other BWR reactor vessel internal components that are made from nickel alloy or stainless steels materials and are exposed to a BWR reactor coolant with neutron flux environment. Dominion stated that these items are not applicable. The staff evaluated Dominion's claim against the criteria in SRP-SLR Section 3.1.2.2.12 and finds it acceptable because: (a) the applicable AMR items and the corresponding AMR further evaluation criteria in SRP-SLR Section 3.1.2.2.12 are only applicable to BWR-designed reactor units, and (b) the UFSAR confirms that the reactor units at Surry are PWR-designed light-water reactors.

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, item 3.1.1-099, addresses loss of fracture toughness due to neutron irradiation or thermal aging embrittlement in BWR reactor vessel internal components that are made from either nickel alloy materials or stainless steel and are exposed to a BWR reactor coolant with neutron flux environment. The AMR item also

addresses loss of fracture toughness due to thermal aging embrittlement in BWR reactor vessel internal components that are made from cast austenitic stainless steel materials and are exposed to a BWR reactor coolant environment. Dominion stated that this item is not applicable. The staff evaluated Dominion's claim against the criteria in SRP-SLR Section 3.1.2.2.13 and finds it acceptable because: (a) the applicable AMR item and AMR further evaluation criteria in SRP-SLR Section 3.1.2.2.13 are only applicable to BWR design reactor units, and (b) the UFSAR confirms that the Surry units are PWR design light-water reactors.

3.1.2.2.14 Loss of Preload Due to Thermal or Irradiation-Enhanced Stress Relaxation

SLRA Section 3.1.2.2.14, associated with SLRA Table 3.1.1, item 3.1.1-120, addresses loss of preload due to thermally induced or irradiation-enhanced stress relaxation in BWR core plate rim hold-down bolts that are exposed to a BWR reactor coolant with neutron flux environment. Dominion stated that this item is not applicable. The staff evaluated Dominion's claim against the criteria in SRP-SLR Section 3.1.2.2.14 and finds it acceptable because: (a) the applicable AMR item and AMR further evaluation criteria in SRP-SLR Section 3.1.2.2.14 are only applicable to BWR design reactor units (and specifically for those BWRs whose core plate assemblies are secured through the use of bolted connections), and (b) the UFSAR confirms that the Surry units are PWR design light-water reactors.

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 loss of material due to general (steel only), crevice or pitting corrosion, and cracking due to stress corrosion cracking (stainless steel only) for steel and stainless steel piping and piping components exposed to concrete: (a) loss of material of steel with an external environment of concrete is not applicable to components in the reactor coolant system, and (b) there are no stainless steel piping or piping components exposed to concrete in the reactor coolant systems. The staff reviewed Dominion's proposal against the criteria in SRP-SLR Section 3.1.2.2.15.

For SLRA items 3.1.1-105 and 3.1.1-115, the staff needed additional information, and issued an RAI. RAI 3.2.2.1.1-2 and Dominion's response are documented in ADAMS Accession No. ML19183A386. In its response, Dominion stated that the neutron shield tank outer wall is the only reactor coolant system component exposed to concrete. Based on its review of the UFSAR and Dominion's response to RAI 3.2.2.1.1-2, the staff finds Dominion's response and claim acceptable for the following reasons: (a) a search of the UFSAR did not reveal any reactor coolant system structures or components exposed to concrete that could be susceptible to water or groundwater intrusion, and (b) the RAI response clarified two statements in the UFSAR that may have, but ultimately did not, conflict with SLRA Table 3.1.1, items 3.1.1-105 and 3.1.1-115.

In its review of components associated with item 3.1.1-105, the staff finds that Dominion has met the further evaluation criteria, and Dominion's proposal that there are no aging effects requiring management is acceptable because, consistent with the further evaluation criteria: (a) the steel neutron shield tanks are encased in concrete that conforms to ACI 318, "Building Code Requirements for Reinforced Concrete;" (b) plant-specific operating experience did not reveal any instances of degradation of concrete around embedded components that could lead to penetration of water; and (c) the tanks are not potentially exposed to groundwater. In its

review of components associated with item 3.1.1-115, the staff finds that based on its review of the UFSAR, as confirmed by the response to RAI 3.2.2.1.1-2, there are no stainless steel components exposed to concrete in the reactor coolant system.

For those AMR items associated with SLRA Section 3.1.2.2.15, the staff concludes that the SLRA is consistent with the GALL-SLR Report and that Dominion has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.2.16 Loss of Material Due to Pitting and Crevice Corrosion in Stainless Steel and Nickel Alloys

SLRA Section 3.1.2.2.16, associated with SLRA Table 3.1.1, item 3.1.1-136, addresses stainless steel and nickel alloy piping and components exposed to air and condensation, which will be managed for loss of material due to pitting and crevice corrosion by the External Surfaces Monitoring of Mechanical Components program. The staff reviewed the applicant's proposal against the criteria in SRP-SLR Section 3.1.2.2.16. In its review of components associated with item 3.1.1-136, the staff finds the applicant has met the further evaluation criteria, and the applicant's proposal to manage the effects of aging using the External Surfaces Monitoring of Mechanical Components program is acceptable because the program's visual inspections are capable of detecting loss of material prior to a loss of intended function.

Based on the program identified, the staff determines that the applicant's program meets SRP-SLR Section 3.1.2.2.16 criteria. For those 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 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 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 Vessel, Internals, and Reactor Coolant System – Reactor Vessel – Aging Management Evaluation

<u>Steel Reactor Pressure Vessel Nozzle Clad with Stainless Steel Exposed to a Reactor Coolant with Neutron Flux Environment</u>. SLRA Table 3.1.2-1 includes a plant-specific AMR item which states there is a TLAA for steel RPV nozzles whose internal stainless cladding surfaces are exposed to an internal reactor coolant with neutron flux environment. The AMR item cites generic note H with plant-specific Note 3. The staff confirmed that there is a TLAA, as documented in SLRA Section 4.7.7, for these components and materials. The TLAA applies to the assessment of intergranular separations (i.e., shallow underclad cracks) that may develop in these types of welds as a result of thermal fatigue or vibrational fatigue loads. The staff's evaluation of the TLAA for these types of components is documented in SER Section 4.7.7.

3.1.2.3.2 Reactor Vessel, Internals, and Reactor Coolant System – Reactor Vessel Internals – Aging Management Evaluation

<u>Stellite Wear Surfaces Exposed to Reactor Coolant and Neutron Flux</u>. SLRA Table 3.1.2-2 states that loss of material due to wear will be managed in the stellite surfaces of the clevis insert assemblies, upper core plate and lower core plate alignment pins, and radial support keys that are exposed to a reactor coolant with neutron flux environment. SLRA Table 3.1.2-2 states that cracking in the clevis insert (for the surfaces that are made from stellite material and are exposed to reactor coolant with neutron flux environment) will be managed using the applicant's PWR Vessel Internals program (SLRA AMP B2.1.7). The AMR item cites generic note F and plant-specific note 5, which states that the component surfaces are made of stellite and that the PWR Vessel Internals program will be used to manage aging in the stellite surfaces of the components.

The staff reviewed the associated items in the SLRA and considered whether the aging effects proposed by Dominion constitute all of the applicable aging effects for this component, material, and environment description. The staff noted that the applicant has addressed aging of RVI components made from other materials in other AMR items. For the RVI components that have stellite wear surfaces, the staff noted that the applicant has addressed and evaluated cracking of the stellite surfaces in the clevis insert assemblies and wear in the stellite surfaces of the clevis inserts, alignment pins, and radial support keys as part of the applicant's RVI gap analysis that was included and evaluated in SLRA Appendix C. The staff also noted that the applicant has designated the clevis insert assemblies and their components (bolts and dowels) as "Primary" category components for the applicant's EPRI MRP-based PWR Vessel Internals program, based on generic operating experience for these types of assemblies in the industry. The staff also confirmed that the applicant currently includes the alignment pins for the RVI upper core and lower core plates as "Existing Program" components for the PWR Vessel Internals AMP. The staff finds this AMR basis to be acceptable because: (a) the applicant has assessed aging management needs for these components as part of the gap analysis for the program, and (b) this is consistent with the basis for performance of gap analyses in SRP-SLR Section 3.1.2.2.9 and GALL-SLR Report AMP XI.M16A, "PWR Vessel Internals." The staff evaluates the applicant's PWR Vessel Internals program in SER Section 3.0.3.2.4.

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 Programs for Engineered Safety Features," is a summary comparison of the applicant's AMR results with those provided in the GALL-SLR Report for the engineered safety features (ESF) components.

3.2.2 Staff Evaluation

Table 3.2-1, below, summarizes the staff's evaluation of the component groups listed in SLRA Section 3.2 and addressed in the GALL-SLR Report.

Table 3.2-1 Staff Evaluation for Engineered Safety Features Components Evaluated in the GALL-SLR Report

Component Group (SRP-SLR Item No.)	Staff Evaluation
3.2.1-001	Consistent with the GALL-SLR Report (see 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
3.2.1-004	Consistent with the GALL-SLR Report (see SER Section 3.2.2.2.2)
3.2.1-005	Consistent with the GALL-SLR Report
3.2.1-006	Not applicable to PWRs (see 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	Consistent with the GALL-SLR Report
3.2.1-009	Consistent with the GALL-SLR Report
3.2.1-010	Not applicable to Surry (see SER Section 3.2.2.1.1)
3.2.1-011	Not applicable to Surry
3.2.1-012	Not applicable to Surry
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 Surry
3.2.1-018	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.2.1-019	Consistent with the GALL-SLR Report
3.2.1-020	Consistent with the GALL-SLR Report
3.2.1-021	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.2.1-022	Consistent with the GALL-SLR Report
3.2.1-023	Not applicable to Surry (see SER Section 3.2.2.1.1)
3.2.1-024	Not applicable to Surry (see SER Section 3.2.2.1.1))
3.2.1-025	Not applicable to Surry (see SER Section 3.2.2.1.1))
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 Surry (see SER Section 3.2.2.1.1)

Component Group (SRP-SLR Item No.)	Staff Evaluation
3.2.1-028	Not applicable to Surry
3.2.1-029	Not applicable to Surry
3.2.1-030	Consistent with the GALL-SLR Report
3.2.1-031	Consistent with the GALL-SLR Report
3.2.1-032	Not applicable to Surry
3.2.1-033	Consistent with the GALL-SLR Report
3.2.1-034	Not applicable to Surry
3.2.1-035	Not applicable to Surry
3.2.1-036	Not applicable to Surry
3.2.1-037	Not applicable to Surry
3.2.1-038	Not applicable to Surry
3.2.1-039	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.2.1-040	Consistent with the GALL-SLR Report
3.2.1-041	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.2.1-042	Not applicable to Surry (see SER Section 3.2.2.2.10)
3.2.1-043	Not applicable to Surry
3.2.1-044	Consistent with the GALL-SLR Report
3.2.1-045	Not applicable to Surry
3.2.1-046	Not applicable to Surry
3.2.1-047	Not applicable to Surry
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	Not applicable to Surry
3.2.1-052	Not applicable to Surry
3.2.1-053	Consistent with the GALL-SLR Report (See SER Section 3.2.2.2.9)
3.2.1-053a	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.2.1-054	Not applicable to PWRs
3.2.1-055	Not applicable to Surry (see SER Section 3.2.2.2.9)
3.2.1-056	Not applicable to Surry (see SER Section 3.2.2.2.10)
3.2.1-057	Consistent with the GALL-SLR Report (see SER Section 3.2.2.1.2)
3.2.1-058	Not applicable to Surry
3.2.1-059	Not applicable to Surry
3.2.1-060	Not applicable to Surry
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 Surry
3.2.1-063	Consistent with the GALL-SLR Report
3.2.1-064	Consistent with the GALL-SLR Report
3.2.1-065	Not applicable to Surry
3.2.1-066	Not applicable to Surry (see SER Section 3.2.2.2.7)
3.2.1-067	Consistent with the GALL-SLR Report
3.2.1-068	Not applicable to Surry
3.2.1-069	Not applicable to Surry
3.2.1-070	Consistent with the GALL-SLR Report
3.2.1-071	Not applicable to Surry (see SER Section 3.2.2.1.2)

Component Group (SRP-SLR Item No.)	Staff Evaluation
3.2.1-072	Not applicable to Surry
3.2.1-073	Not applicable to Surry
3.2.1-074	Not applicable to Surry
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	Consistent with the GALL-SLR Report (see SER Section 3.2.2.2.9)
3.2.1-079	Consistent with the GALL-SLR Report
3.2.1-080	Not applicable to Surry (see SER Section 3.2.2.2.4)
3.2.1-081	Consistent with the GALL-SLR Report
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 applicable to Surry
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	Consistent with the GALL-SLR Report (see SER Section 3.2.2.2.9)
3.2.1-092	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.2.1-093	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.2.1-094	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.2.1-095	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.2.1-096	Not applicable to Surry
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 Surry
3.2.1-099	Consistent with the GALL-SLR Report (see SER Section 3.2.2.2.2)
3.2.1-100	Not applicable to Surry (see SER Section 3.2.2.2.8)
3.2.1-101	Not applicable to Surry (see SER Section 3.2.2.2.8)
3.2.1-102	Not applicable to Surry (see SER Section 3.2.2.2.8)
3.2.1-103	Consistent with the GALL-SLR Report (see SER Section 3.2.2.2.4)
3.2.1-104	Not applicable to Surry
3.2.1-105	Not applicable to Surry (see SER Section 3.2.2.2.10)
3.2.1-106	Consistent with the GALL-SLR Report (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 Surry (see SER Section 3.2.2.2.8)
3.2.1-110	Not applicable to Surry (see SER Section 3.2.2.2.8)
3.2.1-111	Not applicable to Surry (see SER Section 3.2.2.2.10)
3.2.1-112	Not applicable to Surry (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	Not applicable to Surry
3.2.1-115	Not applicable to Surry
3.2.1-116	Not applicable to Surry

Component Group (SRP-SLR Item No.)	Staff Evaluation
3.2.1-117	Not applicable to Surry
3.2.1-118	Not applicable to Surry
3.2.1-119	Not applicable to Surry (see SER Section 3.2.2.2.10)
3.2.1-120	Not applicable to Surry
3.2.1-121	Not applicable to Surry (see SER Section 3.2.2.2.10)
3.2.1-122	Not applicable to Surry
3.2.1-123	Not applicable to Surry
3.2.1-124	Not applicable to Surry
3.2.1-125	Not applicable to Surry
3.2.1-126	Not applicable to Surry
3.2.1-127	Not applicable to Surry
3.2.1-128	Not applicable to Surry
3.2.1-129	Consistent with the GALL-SLR Report
3.2.1-130	Consistent with the GALL-SLR Report
3.2.1-131	Not applicable to Surry
3.2.1-132	Not applicable to Surry (see SER Section 3.2.2.1.1))
3.2.1-133	Not applicable to Surry (see SER Section 3.2.2.1.1))
3.2.1-134	Not applicable to Surry

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 Surry or are consistent with the GALL-SLR Report. Section 3.2.2.1.1 summarizes the staff's review of items that are not applicable or not used and documents any RAIs issued and the staff's conclusions. The remaining subsections in SER Section 3.2.2.1 document the review of components that required additional information or otherwise require explanation.

(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 3.2.2-4 that the applicant determined to be consistent with the GALL-SLR Report. The staff audited and reviewed the information in the SLRA. The staff did not repeat its review of the matters described in the GALL-SLR Report. The staff verified that the material presented in the SLRA was applicable and that the applicant identified the appropriate GALL-SLR Report AMRs. For those AMR items the staff found to be consistent with the GALL-SLR Report, and for which no additional evaluation or request for additional information applies, the staff's review and conclusions as documented in the GALL-SLR Report are considered to be the basis for acceptability of the AMR item. The staff's conclusion of

“Consistent with the GALL-SLR Report” is documented in SER Table 3.2-1 and no separate writeup is required or provided. For the AMR item that required additional evaluation (such as responses to requests for additional information), the staff’s evaluation is documented in Section 3.2.2.1.2 below.

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

For SLRA Table 3.2-1, Items 3.2-1-010, 3.2-1-011, 3.2-1-012, 3.2-1-017, 3.2-1-023, 3.2-1-024, 3.2-1-025, 3.2-1-027, 3.2-1-028, 3.2-1-029, 3.2-1-032, 3.2-1-034, 3.2-1-035, 3.2-1-036, 3.2-1-037, 3.2-1-038, 3.2-1-042, 3.2-1-043, 3.2-1-045, 3.2-1-046, 3.2-1-047, 3.2-1-051, 3.2-1-052, 3.2-1-055, 3.2-1-056, 3.2-1-058, 3.2-1-059, 3.2-1-060, 3.2-1-062, 3.2-1-065, 3.2-1-066, 3.2-1-068, 3.2-1-069, 3.2-1-071, 3.2-1-072, 3.2-1-073, 3.2-1-074, 3.2-1-080, 3.2-1-087, 3.2-1-096, 3.2-1-098, 3.2-1-100, 3.2-1-101, 3.2-1-102, 3.2-1-104, 3.2-1-105, 3.2-1-109, 3.2-1-110, 3.2-1-111, 3.2-1-112, 3.2-1-114, 3.2-1-115, 3.2-1-116, 3.2-1-117, 3.2-1-118, 3.2-1-119, 3.2-1-120, 3.2-1-121, 3.2-1-122, 3.2-1-123, 3.2-1-124, 3.2-1-125, 3.2-1-126, 3.2-1-127, 3.2-1-128, 3.2-1-131, 3.2-1-132, 3.2-1-133, and 3.2-1-134, the applicant claims that the corresponding AMR items in the GALL-SLR Report are not applicable to Surry. The staff reviewed the SLRA and UFSAR and confirmed that the applicant’s SLRA does not have any AMR results that are applicable for these items.

For SLRA Table 3.2-1, items 3.2-1-006 and 3.2-1-054, the applicant claims that the corresponding AMR items in the GALL-SLR Report are not applicable because the associated items are only applicable to boiling-water reactors (BWRs). The staff reviewed the SRP-SLR, confirmed that these items only apply to BWRs, and finds that these items are not applicable to Surry because it is a PWR.

SLRA Table 3.2.1, item 3.2.1-010, addresses thermal aging embrittlement for cast austenitic stainless steel piping, and piping components exposed to treated borated water greater than 250 °C (greater than 482 °F) or treated water greater than 250 °C (greater than 482 °F) in the engineered safety features systems. Dominion stated that this item is not applicable. The staff evaluated Dominion’s claim and finds it acceptable because the staff verified from its review of the Surry UFSAR that there are no cast austenitic stainless steel piping and piping components exposed to treated borated water greater than 250 °C (greater than 482 °F) or treated water greater than 250 °C (greater than 482 °F) in Surry’s engineered safety features systems.

SLRA Table 3.2.1, item 3.2.1-028, addresses managing cracking due to SCC for stainless steel piping components exposed to closed-cycle cooling water greater than 60 °C (140 °F). The SLRA states that this item was not applicable. As clarified by letter dated September 16, 2019 (ADAMS Accession No. ML19267A042), Dominion confirmed that there are no stainless steel piping components exposed to closed-cycle cooling water greater than 60 °C (140 °F) that are subject to an AMR in the engineered safety features systems.

SLRA Table 3.2.1, item 3.2.1-029, addresses managing loss of material due to general, pitting, crevice corrosion, and MIC for steel piping exposed to closed-cycle cooling water. The SLRA states that this item is not applicable. As clarified by letter dated September 16, 2019, Dominion confirmed that there are no in-scope steel piping components exposed to closed-cycle cooling water in the engineered safety features systems.

3.2.2.1.2 No Aging Effect Requiring Management

SLRA Table 3.2.1, item 3.2.1-057, SLRA Table 3.3.1, item 3.3.1-114, and SLRA Table 3.4.1, item 3.4.1-054 address copper-alloy piping and piping components exposed to air, condensation, and gas, and state that there are no aging effects for this material and environment combination and no required AMP. During its review of components constructed from copper alloy greater than 15 percent zinc associated with items 3.2.1-057, 3.3.1-114, and 3.4.1-054, for which Dominion cited generic notes A or C, the staff noted that the SLRA states that there are no aging effects when exposed to air-indoor uncontrolled.

The staff noted that GALL-SLR Report item S-454 cites cracking as an applicable aging effect for copper alloy greater than 15 percent zinc piping and piping components exposed to air or condensation. The staff also noted that NUREG-2221, “Technical Bases for Changes in the Subsequent License Renewal Guidance Documents NUREG–2191 and NUREG–2192,” states that cracking occurs in the presence of ammonia-based compounds. The staff further noted that SLRA Change Notice 1, (ADAMS Accession No. ML19042A137) states:

> copper alloy (>15% Zn) components in condensation environments (i.e., systems in which the temperature may be below ambient dewpoint), and in the air-outdoor environments, are identified as having the potential for cracking because the component surfaces in these environments may be wetted, and the potential for degradation of a wetted surface due to concentration of ammonia contaminants may exist.
>
> . . .
>
> [t]he air-indoor uncontrolled environment is assigned to components that are uninsulated, or not exposed to condensation.
>
> . . .
>
> internal surfaces of the service air system and instrument air system downstream of the air dryers is dry air with a dewpoint that is maintained and monitored to prevent a buildup of water in the system.
>
> . . .
>
> [a]ging of uninsulated copper alloy (>15% Zn) components exposed to air-indoor uncontrolled in the Engineered Safety Features is aligned to item 3.2.1-057. Cracking of copper alloy >15% Zn in air is not expected in the absence of wetting and ammonia contaminants, which are not present in the air-indoor uncontrolled environment.

SLRA Change Notice 1 revised SLRA Section B2.1.23 and A1.23, “External Surfaces Monitoring of Mechanical Components;” B2.1.25 and A1.25, “Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components;” Table 3.2.1, item 3.2.1-071; Table 3.3.1, item 3.3.1-132; Table 3.3.2-11; Table 3.3.2-13; Table 3.4.1, items 3.4.1-063 and 3.4.1-106; Table 3.4.2-11; and Table A4.0-1, Commitment No. 23, to reflect the above descriptions of environments and the potential for cracking of copper alloy greater than 15 percent zinc. SLRA Change Notice 2, (ADAMS Accession No. ML19095A666) revised SLRA Table 3.3.2-28 to cite the External Surfaces Monitoring of Mechanical Components program to manage cracking for

copper alloy greater than 15 percent zinc insulated valve bodies in the domestic water hot water flow paths exposed to indoor uncontrolled air.

The staff finds Dominion's proposal acceptable in part. Managing cracking for copper alloy greater than 15 percent zinc exposed to condensation or the outdoor air environment is consistent with GALL-SLR Report item S-455. Citing no aging effects requiring management for internal surfaces of instrument air systems downstream of air dryers is acceptable because there is reasonable assurance that the introduction of ammonia will not occur. The staff has concluded that for components exposed to air-indoor uncontrolled, there is the potential for exposure to wetted surfaces due to packing or gasket leaks in piping systems located above the copper alloy greater than 15 percent zinc components. If these piping systems or the insulation surrounding the system contain ammonia compounds, there is a potential for cracking due to the ammonia and wetted environment. For SLRA items 3.2.1-057, 3.3.1-114, and 3.4.1-054, the staff needed additional information, and issued an RAI. RAI 3.2.2.1.1-1 and Dominion's response are documented in ADAMS Accession No. ML19183A386.

In its response, Dominion stated that:

> With the exception of the containment spray ring/recirculation system spray ring nozzles, which are mounted near the top of the Containment structures and therefore not susceptible to leakage dripping from above, Dominion will manage cracking of the copper alloy (>15% Zn) components exposed to an external environment of air-indoor uncontrolled with the External Surfaces Monitoring of Mechanical Components program…

In addition, with the exception of the spray nozzles discussed above for SLRA Tables 3.2.2-1 and 3.2.2-2, Dominion will revise all Table 2 AMR items for copper alloy greater than 15 percent zinc exposed to air-indoor uncontrolled to cite the External Surfaces Monitoring of Mechanical Components program to manage cracking. These AMR items will now cite GALL-SLR Report item A-405a (SRP-SLR Table 3.3.1, item 3.3.1-132) for components in auxiliary systems or S-454 (SRP-SLR Table 3.4.1, item 3.4.1-106) for components in steam and power conversion systems.

The staff finds Dominion's response and changes described above acceptable as follows. Based on the location of the containment spray ring/recirculation system spray ring nozzles, there is reasonable assurance that they will not be exposed to ammonia or ammonia compounds. The periodic visual inspections conducted in accordance with the External Surfaces Monitoring of Mechanical Components program can be capable of detecting cracking of copper alloy greater than 15 percent zinc components.

Based on its review of copper alloy and copper alloy greater than 15 percent zinc piping and piping components exposed to air environments, associated with items 3.2.1-057, 3.3.1-114, and 3.4.1-054, the staff finds Dominion's proposal as described above acceptable because, consistent with the GALL-SLR Report, there are either no aging effects (copper alloy) or cracking can be managed by periodic visual inspections (copper alloy greater than 15 percent zinc).

3.2.2.2 Aging Management Review Results for which Further Evaluation is Recommended by the GALL-SLR Report

In SLRA Section 3.2.2.2, the applicant further evaluates aging management for certain engineered safety features components as recommended by the GALL-SLR Report, and provides information concerning how it will manage the applicable aging effects. The staff reviewed the applicant's evaluation of these component groups against the criteria contained in SRP-SLR Section 3.2.2.2. The following subsections document the staff's review.

3.2.2.2.1 Cumulative Fatigue Damage

SLRA Section 3.2.2.2.1 associated with SLRA Table 3.2.1, AMR item 3.2.1-001, states that TLAAs are evaluated in accordance with 10 CFR 54.21(c)(1) and that the evaluation of this TLAA, fatigue of engineered safety features components, is addressed in SLRA Section 4.3.3. This is consistent with SRP-SLR Section 3.2.2.2.1 and is, therefore, acceptable. The staff's evaluation regarding the TLAA for fatigue of engineered safety features components is documented in SER Section 4.3.3.

3.2.2.2.2 Loss of Material Due to Pitting and Crevice Corrosion in Stainless Steel and Nickel Alloys

SLRA Section 3.2.2.2.2, associated with SLRA Table 3.2.1, items 3.2.1-004, 3.2.1-048, 3.2.1-099, 3.2.1-106, and 3.2.1-107 address loss of material due to pitting and crevice corrosion for stainless steel and nickel alloy piping, piping components, tanks, tanks within the scope of GALL-SLR Report AMP XI.M29, and insulated piping, piping components, and tanks exposed to air or condensation, which will be managed by the External Surfaces Monitoring of Mechanical Components, Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components, or Outdoor and Large Atmospheric Metallic Storage Tanks programs. The staff reviewed Dominion's proposal against the criteria in SRP-SLR Section 3.2.2.2.2.

In its review of components associated with AMR items 3.2.1-004, 3.2.1-048, 3.2.1-099, 3.2.1-106, and 3.2.1-107, the staff finds that Dominion has met the further evaluation criteria, and Dominion's proposal to manage the effects of aging using the External Surfaces Monitoring of Mechanical Components, Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components, or Outdoor and Large Atmospheric Metallic Storage Tanks programs is acceptable because the periodic visual inspections conducted as part of each of the programs are capable of detecting loss of material.

Based on the programs identified, the staff concludes that Dominion's programs meet SRP-SLR Section 3.2.2.2.2 criteria. For those AMR items associated with SLRA Section 3.2.2.2.2, the staff concludes that the SLRA is consistent with the GALL-SLR Report and that Dominion 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).

Dominion stated that the applicability of SLRA AMR items 3.2.1-004, 3.2.1-048, 3.2.1-099, 3.2.1-106, and 3.2.1-107 is limited to stainless steel components. The staff evaluated Dominion's claim and finds it acceptable because based on a review of the UFSAR and SLRA, there are no in-scope nickel alloy components in the engineered safety features systems.

SLRA Section 3.2.2.2.2, associated with SLRA Table 3.2.1, AMR item 3.2.1-112, addresses loss of material due to pitting or crevice corrosion for stainless steel and nickel alloy underground piping, piping components, and tanks. Dominion stated that this item is not applicable. The staff evaluated Dominion's claim against the criteria in SRP-SLR Section 3.2.2.2.2 and finds it acceptable because based on a review of the UFSAR and SLRA, there are no in-scope underground stainless steel or nickel alloy 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

In SLRA Section 3.2.2.2.3, associated with SLRA Table 3.2.1, item 3.2-1-006 addresses loss of material and flow blockage in metallic flow orifice and spray nozzles exposed to uncontrolled air - indoor, and condensation. The applicant stated that this item is not applicable. The staff evaluated the applicant's claim against the criteria in SRP-SLR Section 3.2.2.2.3 and finds it acceptable because the SRP-SLR confirms that these components are only applicable to BWRs, and Surry is a PWR.

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, 3.2.1-103, and 3.2.1-108 address cracking due to stress corrosion cracking for stainless steel piping, piping components, tanks, tanks within the scope of GALL-SLR Report AMP XI.M29, and insulated piping, piping components, and tanks exposed to air or condensation, which will be managed by the External Surfaces Monitoring of Mechanical Components, Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components, or Outdoor and Large Atmospheric Metallic Storage Tanks programs. The staff reviewed Dominion's proposal against the criteria in SRP-SLR Section 3.2.2.2.4.

During its review of AMR item 3.2.1-007, the staff noted that cracking will be managed for the piping and piping components in the containment spray (SLRA Table 3.2.2-1) and recirculation spray (SLRA Table 3.2.2-2) systems by the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program. The staff reviewed Table 6.1-1, "Augmented Inspections," item 2.2.1, "Containment and Recirculation Spray Piping," from the Technical Requirements Manual and noted that the six 9-inch square patches will be examined by visual (VT-1) and surface examination. At least 25 percent of the inspection locations are inspected in each one-third portion of each inservice inspection 10-year interval. This information was confirmed by Dominion (ADAMS Accession No. ML19198A059). The staff finds Dominion's proposal to cite the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program to manage cracking of these components acceptable because the extent, frequency, and inspection method can provide reasonable assurance that potential cracking will be detected.

In its review of components associated with AMR items 3.2.1-007, 3.2.1-103, and 3.2.1-108, the staff finds that Dominion has met the further evaluation criteria, and Dominion's proposal to manage the effects of aging using the External Surfaces Monitoring of Mechanical Components, Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components, or Outdoor and Large Atmospheric Metallic Storage Tanks programs is acceptable because the periodic visual inspections (e.g., VT-1) or surface examinations conducted as part of each of the programs can be capable of detecting cracking.

Based on the programs identified, the staff concludes that Dominion's programs meet SRP-SLR Section 3.2.2.2.4 criteria. For those AMR items associated with SLRA Section 3.2.2.2.4, the staff concludes that the SLRA is consistent with the GALL-SLR Report and that Dominion 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 item 3.2.1-080, addresses cracking due to stress corrosion cracking for stainless steel underground piping, piping components, and tanks. Dominion stated that this item is not applicable. The staff evaluated Dominion's claim against the criteria in SRP-SLR Section 3.2.2.2.4 and finds it acceptable because based on a review of the UFSAR and SLRA, there are no in-scope underground stainless steel 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 piping components exposed to raw water and waste water. Dominion stated that its review of operating experience for engineered safety features systems at Surry confirmed that loss of material due to recurring internal corrosion was not an aging effect requiring management (AERM) and that item 3.2.1-066 was not applicable. The staff evaluated the applicant's claim against the criteria in SRP-SLR Section 3.2.2.2.7 and finds it is acceptable because the staff did not identify any examples of recurring internal corrosion in engineered safety features systems during its independent review of Surry's operating experience database.

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 items 3.2.1-100, 3.2.1-101, 3.2.1-102, 3.2.1-109, and 3.2.1-110, addresses cracking due to stress corrosion cracking for aluminum components. Dominion stated that these items are not applicable. The staff evaluated Dominion's claim against the criteria in SRP-SLR Section 3.2.2.2.8 and finds it acceptable because based on a review of the UFSAR and SLRA, there are no in-scope aluminum components in the 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, item 3.2.1-091, addresses loss of material due to crevice or pitting corrosion and cracking due to stress corrosion cracking for stainless steel piping and piping components exposed to concrete, which will be managed by

the Buried and Underground Piping and Tanks program. The staff reviewed Dominion's proposal against the criteria in SRP-SLR Section 3.2.2.2.9.

SLRA Section 3.2.2.2.9 states that: (a) the stainless steel piping embedded within concrete at the containment sump is not potentially exposed to groundwater, whereas embedded piping that exits into soil is potentially exposed to groundwater; (b) for stainless steel components potentially exposed to groundwater, SLRA item 3.2.1-053 is cited for managing loss of material; (c) as amended by Change Notice 2 (ADAMS Accession No. ML19095A666), SLRA item 3.2.1-078 is cited for managing cracking; and (d) items 3.2.1-053 and 3.2.1-078 cite the Buried and Underground Piping and Tanks program to manage loss of material and cracking for these components. The staff noted that in the SLRA, plant-specific note 8 associated with SLRA Table 3.2.2-4, and as amended by Change Notice 2, plant-specific note 5 associated with SLRA Table 3.2.2-2 states, "[s]uction piping embedded in concrete from the containment sump is not exposed to groundwater, and has no aging effects requiring management."

During its review, the staff needed additional information, and issued a RAI. RAI 3.2.2.1.1-2 and Dominion's response are documented in ADAMS Accession No. ML19183A386.

In its response, Dominion stated that:

> The recirculation spray pump casings are not exposed to concrete. The recirculation spray pumps are described as the vertical deep-well type in UFSAR Section 6.3.1.3.2. The outside recirculation spray pumps are located within stainless steel wells connected to the sump by embedded piping and the inside recirculation spray pumps are located within wells within the sump. The wells are encased within the containment concrete (not potentially exposed to groundwater), and are considered part of the structure. The well lining is evaluated as an extension of the containment sump liner. The pump casing itself is located inside the well. The metallic components of the wells do not exit the concrete into soil.

The staff finds Dominion's response acceptable because it clarified that the recirculation spray pump casings are not exposed to concrete and as a result are not subject to SRP-SLR Section 3.2.2.2.9.

In its review of components associated with item 3.2.1-091, the staff finds that Dominion has met the further evaluation criteria, and Dominion's proposal to manage the effects of aging using the Buried and Underground Piping and Tanks program is acceptable because periodic visual inspections can be capable of detecting loss of material and cracking in stainless steel piping. For items not potentially exposed to groundwater, Dominion's proposal is acceptable for the following reasons because, consistent with the further evaluation criteria: (a) the stainless steel components are encased in concrete that conforms to ACI-318; and (b) plant-specific operating experience did not reveal any instances of degradation of concrete around embedded components that could lead to penetration of water.

Based on the program identified, the staff concludes that Dominion'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 Dominion 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, item 3.2.1-055, addresses loss of material due to general, crevice or pitting corrosion for steel piping and piping components exposed to concrete. Dominion stated that this item is not applicable. The staff evaluated Dominion's claim against the criteria in SRP-SLR Section 3.2.2.2.9 and finds it acceptable because based on a review of the UFSAR, there are no steel components exposed to concrete in the engineered safety features systems.

3.2.2.2.10 Loss of Material Due to Pitting and Crevice Corrosion in Aluminum Alloys

SLRA Section 3.2.2.2.10, associated with SLRA Table 3.2.1, AMR items 3.2.1-042, 3.2.1-056, 3.2.1-105, 3.2.1-111, 3.2.1-119, and 3.2.1-121 addresses loss of material for aluminum components. Dominion stated that these items are not applicable. The staff evaluated Dominion's claim against the criteria in SRP-SLR Section 3.2.2.2.10 and finds it acceptable because based on a review of the UFSAR and SLRA, there are no in-scope aluminum components in the 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 3.2.2-4 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.

3.2.2.3.1 Engineering Safety Features – Containment Spray – Aging Management Evaluation

<u>Cracking in Stainless Steel Piping, Piping Components Exposed to Treated Borated Water (none/none)</u>

SLRA Table 3.2.2-1, page 3-171, states that cracking for stainless steel piping and piping components exposed to treated borated water will be managed by the SLRA AMP B2.1.1, ASME Section XI Inservice Inspection Subsections IWB, IWC, and IWD program. The AMR item cites generic note H, for which Dominion has identified cracking as an aging effect, but there is no associated item in NUREG-2191 or in SLRA Table 3.2.1. The AMR item cites plant-specific note 3, which states that the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD (B2.1.1) program is used instead of Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B2.1.25) program to manage cracking in sensitized stainless steel components. The staff determines that the inspection requirements of the ASME Code, Section XI, as specified in AMP B2.1.1, provides necessary monitoring of the aging effect in the stainless steel piping. The staff finds Dominion's proposal to manage the aging effect acceptable because AMP B2.1.1 provides an appropriate technical

basis to demonstrate that it will be effective at managing the aging effect of stainless steel piping of the containment spray system in the treated borated water.

3.2.2.3.2 Engineering Safety Features – Safety Injection – Aging Management Evaluation

Cracking in Stainless Steel Piping, Piping Components Exposed to Treated Borated Water (none/none)

SLRA Table 3.2.2-4, page 3-187, states that cracking for stainless steel piping and piping components in the safety injection system exposed to treated borated water will be managed by the SLRA AMP B2.1.1, ASME Section XI Inservice Inspection Subsections IWB, IWC, and IWD program. The AMR item cites generic note H for which Dominion has identified no associated item in NUREG-2191 or in Table 3.2.1. The AMR item cites plant-specific note 7 which states that augmented inspections within the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD (B2.1.1) program will manage cracking of sensitized stainless steel. The staff determines that the augmented inspection specifications in AMP B2.1.1 will monitor adequately the aging effect in the stainless steel piping in the safety injection system. Therefore, the staff finds Dominion's proposal to manage the aging effect acceptable because AMP B2.1.1 specifically provided guidance on the augmented inspections to monitor the aging effect of the stainless steel piping of the safety injections system in the treated borated water.

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 Programs for Auxiliary Systems," is a summary comparison of the applicant's AMR results with those provided in the GALL-SLR Report for the auxiliary systems components.

3.3.2 Staff Evaluation

Table 3.3-1, below, summarizes the staff's evaluation of the component groups listed in SLRA Section 3.3 and addressed in the GALL-SLR Report.

Table 3.3-1 Staff Evaluation for Auxiliary Systems Components Evaluated in the GALL-SLR Report

Component Group (SRP-SLR Item No.)	Staff Evaluation
3.3.1-001	Consistent with the GALL-SLR Report (see 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	Consistent with the GALL-SLR Report (see SER Section 3.3.2.2.2)
3.3.1-003a	Not applicable to Surry (see SER Section 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	Consistent with the GALL-SLR Report

Component Group (SRP-SLR Item No.)	Staff Evaluation
3.3.1-008	Consistent with the GALL-SLR Report
3.3.1-009	Consistent with the GALL-SLR Report
3.3.1-010	Not applicable to Surry
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	Not applicable to PWRs
3.3.1-017	Consistent with the GALL-SLR Report
3.3.1-018	Not applicable to Surry
3.3.1-019	Not applicable to PWRs
3.3.1-020	Consistent with the GALL-SLR Report
3.3.1-021	Not applicable to PWRs
3.3.1-022	Not applicable to PWRs
3.3.1-023	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-024	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-025	Consistent with the GALL-SLR Report
3.3.1-026	Not applicable to PWRs
3.3.1-027	Not applicable to PWRs
3.3.1-028	Consistent with the GALL-SLR Report
3.3.1-029	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-030	Consistent with the GALL-SLR Report
3.3.1-030a	Consistent with the GALL-SLR Report (see SER Section 3.3.2.1.2)
3.3.1-031	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-032	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-032a	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-033	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-034	Consistent with the GALL-SLR Report
3.3.1-035	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-036	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-037	Consistent with the GALL-SLR Report
3.3.1-038	Consistent with the GALL-SLR Report
3.3.1-039	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-040	Consistent with the GALL-SLR Report
3.3.1-041	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-042	Consistent with the GALL-SLR Report
3.3.1-043	Consistent with the GALL-SLR Report (See SER Section 3.3.2.1.12)
3.3.1-044	Not applicable to Surry
3.3.1-045	Consistent with the GALL-SLR Report
3.3.1-046	Consistent with the GALL-SLR Report
3.3.1-047	Not applicable to Surry
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

Component Group (SRP-SLR Item No.)	Staff Evaluation
3.3.1-051	Not applicable to Surry
3.3.1-052	Consistent with the GALL-SLR Report
3.3.1-053	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-054	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-055	Consistent with the GALL-SLR Report
3.3.1-056	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-057	Consistent with the GALL-SLR Report
3.3.1-058	Consistent with the GALL-SLR Report
3.3.1-059	Consistent with the GALL-SLR Report
3.3.1-060	Consistent with the GALL-SLR Report (See SER Section 3.3.2.1.13)
3.3.1-061	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-062	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-063	Consistent with the GALL-SLR Report
3.3.1-064	Consistent with the GALL-SLR Report
3.3.1-065	Not applicable to Surry
3.3.1-066	Consistent with the GALL-SLR Report (see SER Section 3.3.2.1.5)
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	Not applicable to Surry
3.3.1-074	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-075	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-076	Consistent with the GALL-SLR Report
3.3.1-077	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-078	Consistent with the GALL-SLR Report
3.3.1-079	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-080	Not Used. Addressed by 3.3.1-078
3.3.1-081	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-082	Consistent with the GALL-SLR Report
3.3.1-083	Consistent with the GALL-SLR Report
3.3.1-084	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-085	Consistent with the GALL-SLR Report
3.3.1-086	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-087	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-088	Consistent with the GALL-SLR Report
3.3.1-089	Not used. Addressed by 3.3.1-55, 3.3.1-90, and 3.3.1-136
3.3.1-090	Consistent with the GALL-SLR Report
3.3.1-091	Consistent with the GALL-SLR Report
3.3.1-092	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-093	Consistent with the GALL-SLR Report
3.3.1-094	Consistent with the GALL-SLR Report (see SER Section 3.3.2.2.4)
3.3.1-094a	Consistent with the GALL-SLR Report (see SER Section 3.3.2.2.3)

Component Group (SRP-SLR Item No.)	Staff Evaluation
3.3.1-095	Consistent with the GALL-SLR Report
3.3.1-096	Consistent with the GALL-SLR Report
3.3.1-096a	Consistent with the GALL-SLR Report (see SER Section 3.3.2.1.3)
3.3.1-096b	Consistent with the GALL-SLR Report
3.3.1-097	Consistent with the GALL-SLR Report
3.3.1-098	Consistent with the GALL-SLR Report
3.3.1-099	Consistent with the GALL-SLR Report
3.3.1-100	Consistent with the GALL-SLR Report
3.3.1-101	Not applicable to Surry
3.3.1-102	Not applicable to Surry
3.3.1-103	Consistent with the GALL-SLR Report
3.3.1-104	Consistent with the GALL-SLR Report
3.3.1-105	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-106	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-107	Consistent with the GALL-SLR Report
3.3.1-108	Consistent with the GALL-SLR Report
3.3.1-109	Consistent with the GALL-SLR Report
3.3.1-109a	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-110	Not applicable to PWRs
3.3.1-111	Not Used (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	Not applicable to Surry
3.3.1-114	Consistent with the GALL-SLR Report (see SER Section 3.2.2.1.2)
3.3.1-115	Not applicable to Surry
3.3.1-116	Not applicable to Surry
3.3.1-117	Consistent with the GALL-SLR Report
3.3.1-118	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-119	Consistent with the GALL-SLR Report
3.3.1-120	Consistent with the GALL-SLR Report
3.3.1-121	Consistent with the GALL-SLR Report
3.3.1-122	Consistent with the GALL-SLR Report
3.3.1-123	Consistent with the GALL-SLR Report
3.3.1-124	Consistent with the GALL-SLR Report
3.3.1-125	Consistent with the GALL-SLR Report
3.3.1-126	Consistent with the GALL-SLR Report
3.3.1-127	Consistent with the GALL-SLR Report (see SER Section 3.3.2.2.7)
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 3.3.2.1.4)
3.3.1-131	Consistent with the GALL-SLR Report
3.3.1-132	Consistent with the GALL-SLR Report (see SER Section 3.3.2.1.6)
3.3.1-133	Not applicable to Surry
3.3.1-134	Consistent with the GALL-SLR Report
3.3.1-135	Consistent with the GALL-SLR Report
3.3.1-136	Consistent with the GALL-SLR Report

Component Group (SRP-SLR Item No.)	Staff Evaluation
3.3.1-137	Not applicable to Surry
3.3.1-138	Consistent with the GALL-SLR Report (see SER Section 3.3.2.1.7)
3.3.1-139	Consistent with the GALL-SLR Report (see SER Section 3.3.2.1.7)
3.3.1-140	Consistent with the GALL-SLR Report
3.3.1-141	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-142	Consistent with the GALL-SLR Report
3.3.1-143	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-144	Consistent with the GALL-SLR Report (see SER Section 3.3.2.2.10)
3.3.1-145	Consistent with the GALL-SLR Report
3.3.1-146	Not applicable to Surry (see SER Section 3.3.2.2.3)
3.3.1-147	Not applicable to Surry
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 Surry
3.3.1-150	Consistent with the GALL-SLR Report
3.3.1-151	Consistent with the GALL-SLR Report (see SER Section 3.3.2.1.3)
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 Surry
3.3.1-156	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-157	Not Used. Addressed by 3.3.1-058 and 3.3.1-078.
3.3.1-158	Not applicable to Surry
3.3.1-159	Not Used. Addressed by 3.3.1-082.
3.3.1-160	Consistent with the GALL-SLR Report
3.3.1-161	Consistent with the GALL-SLR Report
3.3.1-162	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-163	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-164	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-165	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-166	Not applicable to Surry
3.3.1-167	Not applicable to Surry
3.3.1-168	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-169	Consistent with the GALL-SLR Report
3.3.1-170	Consistent with the GALL-SLR Report
3.3.1-171	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-172	Not applicable to Surry
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	Consistent with the GALL-SLR Report
3.3.1-176	Not Used. Addressed by 3.3.1-175.
3.3.1-177	Consistent with the GALL-SLR Report
3.3.1-178	Not applicable to Surry (see SER Section 3.3.2.1.8)
3.3.1-179	Consistent with the GALL-SLR Report
3.3.1-180	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-181	Not applicable to Surry

Component Group (SRP-SLR Item No.)	Staff Evaluation
3.3.1-182	Consistent with the GALL-SLR Report (see SER Section 3.3.2.1.1)
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 Surry (see SER Section 3.3.2.1.8)
3.3.1-185	Not applicable to Surry
3.3.1-186	Not applicable to Surry (see SER Section 3.3.2.2.8)
3.3.1-187	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-188	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-189	Consistent with the GALL-SLR Report (see 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 Surry (see SER Section 3.3.2.2.8)
3.3.1-193	Consistent with the GALL-SLR Report
3.3.1-194	Not applicable to Surry
3.3.1-195	Not Used. Addressed by 3.3.1-030.
3.3.1-196	Not applicable to Surry
3.3.1-197	Not applicable to Surry
3.3.1-198	Not applicable to Surry
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	Consistent with the GALL-SLR Report (see SER Section 3.3.2.2.10)
3.3.1-203	Not applicable to PWRs
3.3.1-204	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-205	Consistent with the GALL-SLR Report (see 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
3.3.1-208	Not applicable to Surry
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 Surry
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 Surry
3.3.1-215	Not applicable to Surry
3.3.1-216	Not applicable to Surry
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 Surry
3.3.1-219	Consistent with the GALL-SLR Report
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 Surry (see SER Section 3.3.2.2.10)
3.3.1-224	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-225	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-226	Not applicable to Surry

Component Group (SRP-SLR Item No.)	Staff Evaluation
3.3.1-227	Not applicable to Surry (see SER Section 3.3.2.2.10)
3.3.1-228	Not applicable to Surry (see SER Section 3.3.2.2.4)
3.3.1-229	Not applicable to Surry
3.3.1-230	Not applicable to Surry
3.3.1-231	Not applicable to Surry (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 Surry (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	Consistent with the GALL-SLR Report
3.3.1-237	Not applicable to Surry
3.3.1-238	Consistent with the GALL-SLR Report
3.3.1-239	Not applicable to Surry
3.3.1-240	Consistent with the GALL-SLR Report (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	Not applicable to PWRs
3.3.1-245	Not applicable to Surry (see SER Section 3.3.2.2.10)
3.3.1-246	Not applicable to Surry (see SER Section 3.3.2.2.4)
3.3.1-247	Not used. Addressed by 3.3.1-240. (see SER Section 3.3.2.2.10)
3.3.1-248	Not applicable to Surry
3.3.1-249	Consistent with the GALL-SLR Report
3.3.1-250	Not applicable to Surry
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 Surry
3.3.1-253	Consistent with the GALL-SLR Report (see SER Section 3.3.2.2.10)
3.3.1-254	Consistent with the GALL-SLR Report (see SER Section 3.3.2.2.8)
3.3.1-255	Consistent with the GALL-SLR Report
3.3.1-256	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.3.1-257	Consistent with the GALL-SLR Report
3.3.1-258	Consistent with the GALL-SLR Report
3.3.1-259	Not applicable to Surry (see SER Section 3.3.2.1.1)
3.3.1-260	Consistent with the GALL-SLR Report
3.3.1-261	Not used. Addressed by 3.3.1-042, 3.3.1-207, 3.3.1-238.
3.3.1-262	Not Used. Addressed by 3.3.1-236, 3.3.1-238
3.3.1-263	Consistent with the GALL-SLR Report

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 Surry 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. The remaining

subsections in SER Section 3.3.2.1 document the review of components that required additional information or otherwise require explanation.

(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 3.3.2-43 that the applicant determined to be consistent with the GALL-SLR Report. The staff audited and reviewed the information in the SLRA. The staff did not repeat its review of the matters described in the GALL-SLR Report. The staff verified that the material presented in the SLRA was applicable and that the applicant identified the appropriate GALL-SLR Report AMRs. For those AMR items the staff found to be consistent with the GALL-SLR Report, and for which no additional evaluation or request for additional information applies, the staff's review and conclusions as documented in the GALL-SLR Report are considered to be the basis for acceptability of the AMR item. The staff's conclusion of "Consistent with the GALL-SLR Report" is documented in SER Table 3.3-1 and no separate writeup is required or provided. 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 3.3.2.1.13 below.

The staff notes that the applicant changed the designation for item 3.3.1-182 from "Not applicable" in the original submittal to "Consistent" as part of Change Notice 1, which was dated January 29, 2019. The NRC staff finds this change acceptable.

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

For SLRA Table 3.3-1, Items 3.3-1-003a, 3.3-1-010, 3.3-1-018, 3.3-1-044, 3.3-1-047, 3.3-1-051, 3.3-1-065, 3.3-1-073, 3.3-1-101, 3.3-1-102, 3.3-1-113, 3.3-1-115, 3.3-1-116, 3.3-1-133, 3.3-1-137, 3.3-1-146, 3.3-1-147, 3.3-1-149, 3.3-1-155, 3.3-1-158, 3.3-1-166, 3.3-1-167, 3.3-1-172, 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, 3.3-1-196, 3.3-1-197, 3.3-1-198, 3.3-1-208, 3.3-1-210, 3.3-1-214, 3.3-1-215, 3.3-1-216, 3.3-1-218, 3.3-1-223, 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, 3.3-1-237, 3.3-1-239, 3.3-1-245, 3.3-1-246, 3.3-1-248, 3.3-1-250, 3.3-1-252, and 3.3-1-259, the applicant claims that the corresponding AMR items in the GALL-SLR Report are not applicable to Surry. The staff reviewed the SLRA and UFSAR and confirmed that the applicant's SLRA does not have any AMR results that are applicable for these items.

For SLRA Table 3.3-1, items 3.3-1-016, 3.3-1-019, 3.3-1-021, 3.3-1-022, 3.3-1-026, 3.3-1-027, 3.3-1-110, 3.3-1-203, and 3.3-1-244, the applicant claims that the corresponding AMR items in the GALL-SLR Report are not applicable because the associated items are only applicable to

boiling-water reactors (BWRs). The staff reviewed the SRP-SLR, confirmed that these items only apply to BWRs, and finds that these items are not applicable to Surry because it is a PWR.

For the following SLRA Table 3.3-1, Items, Dominion claimed that the corresponding item in the GALL-SLR Report is not used because it is addressed by another SLRA Table 1 AMR item: 3.3-1-080 (addressed by 3.3.1-078), 3.3-1-089 (addressed by 3.3.1-55, 3.3.1-90, and 3.3.1-136), 3.3-1-111 (see below), 3.3-1-157 (addressed by 3.3.1-058 and 3.3.1-078), 3.3-1-159 (addressed by 3.3.1-082), 3.3-1-176 (addressed by 3.3.1-175), 3.3-1-195 (addressed by 3.3.1-030), 3.3-1-247 (addressed by 3.3-1-240), 3.3-1-261 (addressed by 3.3.1-042, 3.3.1-207, and 3.3.1-238), and 3.3-1-262 (addressed by 3.3.1-236 and 3.3.1-238). Note that item 3.3.1-247 was originally considered to be not applicable in the initial SLRA but was changed in a letter dated April 2, 2019 (ADAMS Accession No. ML19095A666), to reflect that the AERM is being addressed by item 3.3.1-240. The staff reviewed the SLRA and confirmed that the aging effects will be addressed by another SLRA Table 1 AMR item. Therefore, the staff finds Dominion's proposal to use alternate items acceptable.

SLRA Table 3.3.1, item 3.3.1-044 addresses managing cracking due to SCC for stainless steel or steel with stainless steel cladding heat exchanger components exposed to closed-cycle cooling water greater than 60 °C (140 °F). The SLRA states that these items are not applicable. As clarified by letter dated September 16, 2019, Dominion confirmed that there are no stainless steel heat exchanger components exposed to closed-cycle cooling water greater than 60 °C (140 °F) that are subject to an AMR in the auxiliary systems.

For SLRA Table 3.3.1, item 3.3.1-111, Dominion claimed that the corresponding item in the GALL-SLR report is not used because it is addressed by another SLRA Table 1 AMR item. The staff reviewed the SLRA and confirmed that the aging effects will be addressed by another SLRA Table 1 item. The staff noted that SLRA Table 3.5.2-5 addresses loss of material for steel elements in the Fuel Building structure that are exposed to an air – indoor uncontrolled environment. Therefore, the staff finds Dominion's proposal to use an alternate item acceptable.

3.3.2.1.2 Cracking, Blistering, and Loss of Material Due to Exposure to Ultraviolet Light, Ozone, Radiation, Temperature, or Moisture; Flow Blockage Due to Fouling

SLRA Table 3.3.1, item 3.3.1-030a, addresses cracking, blistering, loss of material, and flow blockage due to fouling for fiberglass and high density polyethylene piping exposed to raw water. For associated 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 cracking, blistering, and loss of material for the trash racks in the low level intake structure. Plant-specific note 4 associated with this item states that flow blockage is not an applicable AERM for the trash racks. The staff notes that flow blockage is typically associated with piping components, and the staff agrees that flow blockage does not need to be managed for the trash racks because the flow aspects are a fundamental feature of the trash rack operation. Based on its review of the components associated with item 3.3.1-030a for which Dominion cited generic note E, the staff finds Dominion'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's periodic visual inspections are able to identify cracking, blistering, and loss of material of the trash racks prior to a loss of function.

3.3.2.1.3 Reduction of Heat Transfer Due to Fouling

SLRA Table 3.3.1, item 3.3.1-050 addresses reduction of heat transfer due to fouling for stainless steel, copper alloy, and steel heat exchanger tubes exposed to closed-cycle cooling water. SLRA Table 3.3.1, item 3.3.1-096a addresses reduction of heat transfer due to fouling for steel, aluminum, copper alloy, stainless steel, and titanium heat exchanger tubes internal to components exposed to air or condensation (external). SLRA Table 3.3.1, item 3.3.1-151 addresses reduction of heat transfer due to fouling for stainless steel, steel, aluminum, copper alloy, and titanium heat exchanger tubes exposed to air or condensation. As amended by SLRA Change Notice 2, (ADAMS Accession No. ML19095A666), Dominion incorporated new AMR items to address reduction of heat transfer for heat exchangers with a heat transfer function into SLRA Tables 3.1.2-3, 3.3.2-8, and 3.3.2-9.

During its review of components associated with items 3.3.1-050, 3.3.1-096a, and 3.3.1-151 for which Dominion cited generic note A, the staff noted that the SLRA credits the Closed Treated Water Systems, Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components, and External Surfaces Monitoring of Mechanical Components programs, respectively, to manage reduction of heat transfer for copper alloy coolers, stainless steel heat exchanger penetration jackets, and stainless steel heat exchangers.

Based on its review of components associated with items 3.3.1-050, 3.3.1-096a, and 3.3.1-151 for which Dominion cited generic note A, the staff finds Dominion’s proposal to manage the effects of aging using the Closed Treated Water Systems, Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components, and External Surfaces Monitoring of Mechanical Components programs acceptable because the periodic visual inspections can be capable of detecting indications related to a buildup of material (e.g., airborne debris, corrosion products) that could reduce heat transfer.

3.3.2.1.4 Loss of Material Due to General, Pitting, Crevice Corrosion, MIC; Flow Blockage due to Fouling

SLRA Table 3.3.1, AMR item 3.3.1-064 addresses loss of material and flow blockage for steel and copper-alloy piping and piping components exposed to raw water, treated water, and raw water (potable). During its review of components associated with AMR item 3.3.1-064 for which Dominion cited generic note B, the staff noted that the SLRA credits the Fire Water System program to manage the aging effect for steel and copper-alloy piping and piping components exposed to raw water. SLRA Table 3.3.2-34 also cites AMR item 3.3.1-064 for copper alloy greater than 15 percent zinc hose racks and valve bodies exposed to raw water. Cracking normally would be considered as an aging effect under this material and environment, as recommended by GALL-SLR Report items A-473a, A-473b, and A-473c, associated with Table 1 item 3.3.1-160. However, NUREG-2221, “Technical Bases for Changes in the Subsequent License Renewal Guidance Documents NUREG–2191 and NUREG–2192,” states that the basis for citing cracking is due to the presence of ammonia or ammonia compounds. SLRA Table 3.3.1, item 3.3.1-160 states that ammonia or ammonia compounds are not present in the raw water associated with the fire water system. Therefore, cracking is not an applicable aging effect.

Based on its review of components associated with AMR item 3.3.1-064 for which Dominion cited generic note B, the staff finds Dominion’s proposal to manage the effects of aging using the Fire Water System program acceptable because the visual inspections and flow-related tests required by the program can be capable of detecting loss of material and flow blockage.

In addition, due to the absence of ammonia or ammonia compounds, cracking is not an applicable aging effect.

SLRA Table 3.3.1, AMR item 3.3.1-130 addresses loss of material due to general (where applicable), pitting, crevice corrosion, and MIC (except for aluminum, and in raw water, raw water (potable), treated water only); and flow blockage due to fouling for metallic sprinklers exposed to air, condensation, raw water, raw water (potable), or treated water. During its review of components associated with AMR item 3.3.1-130 for which Dominion cited generic note B, the staff noted that the SLRA credits the Fire Water System program to manage the aging effects for the copper alloy greater than 15 percent zinc sprinkler heads exposed to air-indoor uncontrolled, air-outdoor, and raw water.

The staff noted that these items do not cite cracking due to stress corrosion cracking as an aging effect for the sprinkler heads exposed to air-indoor uncontrolled, air-outdoor, and raw water. As amended by SLRA Change Notice No. 1 (ADAMS Accession No. ML19042A137), Dominion stated that, "[s]ince these components [exposed to the air-indoor uncontrolled environment] are not expected to be wetted through condensation or potential leakage that is retained under insulation, no concentration of low-level contaminants (ammonia or ammonia compounds) is expected. Therefore, copper alloy (>15 percent Zn) components exposed to air-indoor uncontrolled environment are not wetted or exposed to ammonia contaminants and are not susceptible to cracking." Dominion also stated, "[copper alloy (greater than 15 percent zinc) components] in the air-outdoor environments, are identified as having the potential for cracking because the component surfaces in these environments may be wetted, and the potential for degradation of a wetted surface due to concentration of ammonia contaminants may exist." SLRA Change Notice No. 2, (ADAMS Accession No. ML19095A666) revised SLRA Table 3.3.2-34 to cite (AMR item 3.3.1-132) the Fire Water System program to manage cracking for copper alloy greater than 15 percent zinc sprinkler heads in the fire protection system exposed to outdoor air. The staff needed additional information and issued an RAI. RAI 3.2.2.1.1-1 and Dominion's response are documented in ADAMS Accession No. ML19183A386.

In its response, Dominion stated that cracking will be managed by the External Surfaces Monitoring of Mechanical Components program for the sprinkler heads exposed to air-indoor uncontrolled. The staff finds Dominion's proposal and RAI response acceptable because the periodic visual inspections of sprinkler heads conducted can be capable of detecting cracking by either direct visual means or indirectly by water dripping from the sprinkler head.

3.3.2.1.5 Loss of Material Due to Pitting, Crevice Corrosion, and MIC and Flow Blockage due to Fouling

SLRA Table 3.3.1, item 3.3.1-066, addresses loss of material due to pitting, crevice corrosion, and MIC and flow blockage due to fouling (raw water only) for stainless steel piping and piping components exposed to raw water, treated water, and raw water (potable). 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 a tank (pump pulsation dampener) internally exposed to treated water.

The staff noted that the component's intended function is leakage boundary (i.e., nonsafety-related component that maintains mechanical and structural integrity to prevent spatial interactions that could cause failure of safety-related SSCs) and not a pressure boundary function for the fire water system (e.g., delivery of flow). Based on its review of AMR items

associated with SLRA Table 3.3.1, item 3.3.1-066, for which Dominion cited generic note E, the staff finds Dominion's proposal to manage the effects of aging using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program acceptable because: (a) the component does not have an in-scope fire water function, and (b) periodic visual inspections are capable of detecting loss of material.

3.3.2.1.6 Cracking Due to Stress Corrosion Cracking of Copper Alloy

SLRA Table 3.3.1, AMR item 3.3.1-132, as modified by letter dated January 29, 2019 (ADAMS Accession No. ML19042A137), addresses cracking due to stress corrosion cracking of copper alloy (with greater than 15 percent zinc) exposed to air and condensation environments. For the associated AMR items that cite generic note E, the SLRA credits the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program to manage this aging effect. The staff notes that SRP-SLR Table 3.3.1, item 3.3.1-160 recommends the comparable AMP for managing cracking of copper alloy (greater than 15 percent zinc) in different components. Based on its review of the components associated with AMR item 3.3.1-132 for which Dominion cited generic note E, the staff finds Dominion's proposal to manage the effects of aging using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program acceptable, because this program has similar inspection methods and acceptance criteria as the External Surfaces Monitoring of Mechanical Components program and is capable of identifying cracking due to stress corrosion cracking prior to a loss of intended function.

3.3.2.1.7 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 3.3.1-138 and 3.3.1-139 address (a) loss of coating or lining integrity due to blistering, cracking, flaking, peeling, delamination, rusting, or physical damage (AMR item 3.3.1-138); (b) loss of material or cracking for cementitious coatings/linings (AMR item 3.3.1-138); and (c) loss of material due to general, pitting, crevice corrosion, or MIC (AMR item 3.3.1-139) for any material piping, piping components, heat exchangers, and tanks with internal coatings/linings exposed to closed-cycle cooling water, raw water, raw water (potable), treated water, treated borated water, fuel oil, lubricating oil, and waste water. For the SLRA Table 2 AMR items that cite generic note E in SLRA Table 3.3.2-34, "Fire Protection," the SLRA credits the Fire Water System program to manage the aging effects for internally coated carbon steel fire protection and domestic water storage tanks.

SLRA Table 3.3.2-34, plant-specific note 4 was amended by letter dated April 2, 2019, to state:

> The Fire Water System (B2.1.16) program is used to manage loss of material and loss of coating integrity for internally coated carbon steel fire water storage tanks. Consistent with NUREG-2191, Table XI.M27-1, note 4, when degraded coatings are detected by internal coatings inspections, acceptance criteria and corrective action recommendations are followed consistent with the Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers and Tanks (B2.1.28) program."

Based on its review of components associated with AMR items 3.3.1-138 and 3.3.1-139 for which Dominion cited generic note E in SLRA Table 3.3.2-34, the staff finds Dominion's proposal to manage the effects of aging using the Fire Water System program acceptable because consistent with GALL-SLR Report AMP XI.M27, "Fire Water System," and AMP

XI.M42, “Internal Coatings/Linings For In-Scope Piping, Piping Components, Heat Exchangers, and Tanks,” managing loss of coating integrity and loss of material (for internally coated fire water tanks) by conducting inspections in accordance with AMP XI.M27 and using acceptance criteria and corrective actions in accordance with AMP XI.M42 is consistent with the GALL-SLR Report.

SLRA Table 3.3.1 items 3.3.1-138 and 3.3.1-139, as modified by letter dated July 17, 2019, address loss of coating/lining integrity due to blistering, cracking, flaking, peeling, delamination, rusting, or physical damage; and loss of material or cracking for cementitious coatings/linings (item 3.3.1-138) and loss of material due to general, pitting, crevice, or microbiologically-induced corrosion (item 3.3.1-139) for any material piping, piping components, heat exchangers, and tanks with internal coatings/linings exposed to closed-cycle cooling water, raw water, raw water (potable), treated water, treated borated water, fuel oil, lubricating oil, and waste water. In SLRA Tables 3.3.2-4, “Service Water,” and 3.3.2-5, “Circulating Water,” where Dominion cites generic note E for these items, the SLRA credits the Open-Cycle Cooling Water System program and notes that this program will manage the aging effects for the internal surfaces of the carbon fiber wrap (CFRP)-lined steel piping.

The staff noted that Dominion had initially credited the Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks program to manage aging for the CFRP lined piping. However, by letter dated July 17, 2019, in response to RAI B2.1.28-2, Dominion revised its approach to credit the Open-Cycle Cooling Water System program. Based on its review of components associated with items 3.3.1-138 and 3.3.1-139, which cite generic note E in SLRA Tables 3.3.2-4 and 3.3.2-5, the staff finds Dominion’s proposal to manage the effects of aging using the Open-Cycle Cooling Water System program acceptable because the AMP includes enhancements to provide additional guidance for personnel qualification requirements, extent and frequency of inspections, acceptance criteria, and corrective actions associated with CFRP-lined steel piping.

3.3.2.1.8 No Aging Effects Requiring Management

SLRA Table 3.3.1, AMR item 3.3.1-178 states that there are no aging effects requiring management for fiberglass piping and piping components exposed to concrete. Dominion stated that this item is not applicable. The staff evaluated Dominion’s claim and needed additional information and issued an RAI. RAI 3.2.2.1.1-2 and Dominion’s response are documented in ADAMS Accession No. ML19183A386. In its response, Dominion stated, “[a] walkdown of the MER-4 area confirmed that fiberglass piping in this area is not embedded in concrete. Review of fiberglass piping in other locations has not identified any fiberglass embedded in concrete in the auxiliary systems.”

Based on its review of the UFSAR and Dominion’s response to RAI 3.2.2.1.1-2, the staff finds Dominion’s response and claim acceptable for the following reasons: (a) a search of the UFSAR did not reveal any fiberglass auxiliary system structures or components embedded in concrete; and (b) the RAI response clarified a statement in the UFSAR that that was potentially associated with SLRA Table 3.3-1, item 3.3.1-178.

SLRA Table 3.3.1, AMR item 3.3.1-184 states that there are no aging effects requiring management for PVC piping, piping components, and tanks exposed to concrete. Dominion stated that this item is not applicable. The staff evaluated Dominion’s claim, needed additional information, and issued an RAI. RAI 3.2.2.1.1-2 and Dominion’s response are documented in ADAMS Accession No. ML19183A386.

In its response, Dominion stated:

> No portion of the "RF Liquid Waste Reverse Osmosis Unit" described in UFSAR Table 11.2-1 is within scope. That equipment is part of the Radwaste Facility Liquid Waste system, which is not the same as the Liquid and Solid Waste system described in SLRA Section 2.3.3.23), and is located in the Radwaste Facility, which does not contain any safety-related equipment. Review of PVC components in other locations has not identified any PVC embedded in concrete in the auxiliary systems.

Based on its review of the UFSAR and Dominion's response to RAI 3.2.2.1.1-2, the staff finds Dominion's response and claim acceptable for the following reasons: (a) a search of the UFSAR did not reveal any auxiliary system PVC structures or components embedded in concrete, and (b) the RAI response clarified a statement in the UFSAR that that was potentially associated with SLRA Table 3.3-1, item 3.3.1-184.

3.3.2.1.9 Cracking Due to Chemical Reaction, Weathering, Settlement, or Corrosion of Reinforcement; Loss of Material Due to Delamination, Exfoliation, Spalling, Popout, Scaling, or Cavitation; Flow Blockage Due to Fouling

SLRA Table 3.3.1, AMR item 3.3.1-195 addresses managing cracking due to chemical reaction, weathering, settlement, or corrosion of reinforcement (reinforced concrete only); loss of material due to delamination, exfoliation, spalling, popout, scaling, or cavitation; and flow blockage due to fouling (raw water only for concrete, concrete cylinder piping, reinforced concrete, asbestos cement, cementitious piping, and piping components exposed to raw water, treated water, raw water (potable). Dominion stated that this item is not used (addressed in item 3.3.1-030). The staff evaluated Dominion's claim and finds it acceptable because based on a review of the UFSAR and SLRA Table 3.3.2-34, "Auxiliary Systems – Fire Protection – Aging Management Evaluation, there are no concrete or cementitious piping or piping components in the fire protection system.

3.3.2.1.10 Loss of Material Due to Wear; Flow Blockage Due to Fouling

SLRA Table 3.3.1, AMR item 3.3.1-253 addresses loss of material due to wear and flow blockage due to fouling for 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 External Surfaces Monitoring of Mechanical Components program to manage loss of material due to wear for PVC piping and piping components exposed externally to waste water. The AMR item cites plant-specific note 3, which states "[f]low blockage is addressed by the cited NUREG-2191 item but is not an applicable AERM for external surfaces."

Based on its review of components associated with AMR item 3.3.1-253 for which Dominion cited generic note E, the staff finds Dominion's proposal to manage the effects of aging using the External Surfaces Monitoring of Mechanical Components program acceptable because: (a) periodic visual inspections of component surfaces at least once per refueling outage as required by the External Surfaces Monitoring program are sufficient to identify the potential for loss of material due to wear; and (b) flow blockage is not an applicable aging effect for the external surfaces of piping and piping components.

3.3.2.1.11 Time Limiting Aging Analysis

SLRA Table 3.3.2-34 originally included an AMR item that credited a TLAA (SLRA Section 4.5.1, "Piping Subsurface Indication Allowable and Estimated Cycles") for managing cracking in fire protection system steel piping and piping components exposed to raw water. As amended by SLRA Change Notice No. 2 (ADAMS Accession No. ML19095A666), this AMR item was deleted. (The original Footnote 6 stated that this cracking was due to fatigue. Footnote 6 was reused for a different AMR item in Change Notice No. 2.) Dominion stated that the TLAA is associated with piping in the fuel pool cooling system and not the fire protection system. The staff finds the change acceptable because Dominion revised SLRA Table 3.3.2-2 to cite the TLAA for the fuel pool cooling piping, and the cited aging effects and programs to manage steel piping exposed to raw water in the fire protection system are consistent with the GALL-SLR Report as cited in AMR items 3.3.1-064, 3.3.1-127, and 3.3.1-193.

3.3.2.1.12 Cracking Due to Stress Corrosion Cracking

SLRA Table 3.3.1, item 3.3.1-043 addresses managing cracking due to SCC for stainless steel piping components exposed to closed-cycle cooling water greater than 60 °C (140 °F). Although the SLRA initially stated that this item was not applicable, as clarified by letter dated September 16, 2019, Dominion stated that portions of the alternate AC diesel generator jacket water cooling subsystem are exposed to closed-cycle cooling water greater than 60 °C (140 °F). Consequently, Dominion revised SLRA item 3.3.1-043 to state that the item is consistent with the GALL-SLR Report. In addition, Dominion added a corresponding AMR item to SLRA Table 3.3.2-37 for managing cracking of stainless steel orifices in the alternate AC system using the Closed Treated Water Systems program. The staff reviewed the changes to the SLRA and finds Dominion's proposal acceptable because inspections performed through the Closed Treated Water Systems program are capable of identifying cracking of the stainless steel orifices prior to a loss of intended function.

3.3.2.1.13 Cracking Due to Chemical Reaction, Weathering, Settlement, or Corrosion of Reinforcement and Loss of Material Due to Delamination, Exfoliation, Spalling, Popout, or Scaling

SLRA Table 3.3.1, AMR item 3.3.1-060 addresses cracking and loss of material for reinforced concrete structural fire barrier walls, ceilings, and floors exposed to air. For the SLRA Table 2 AMR item that cites generic note E, the SLRA credits the ASME Section XI, Subsection IWL program to manage the aging effect for reinforced concrete exposed to air. The AMR item cites plant-specific note 1, which states concrete elements include beams, columns, walls, slabs, curbs, foundations, and pads.

Based on its review of components associated with AMR item 3.3.1-060 for which Dominion cited generic note E, the staff finds Dominion's proposal to manage the effects of aging using the ASME Section XI, Subsection IWL program acceptable because periodic visual examinations in accordance with ASME Section XI, Subsection IWL can identify cracking and loss of material before a loss of intended function.

3.3.2.2 Aging Management Review Results for which Further Evaluation is Recommended by the GALL-SLR Report

In SLRA Section 3.3.2.2, the applicant further evaluates aging management for certain auxiliary systems components as recommended by the GALL-SLR Report, and provides information

concerning how it will manage the applicable aging effects. The staff reviewed the applicant's evaluation of these component groups against the criteria contained in SRP-SLR Section 3.3.2.2. The following subsections document the staff's review.

3.3.2.2.1 Cumulative Fatigue Damage

SLRA Section 3.3.2.2.1 associated with SLRA Table 3.3.1, AMR item 3.3.1-001, states that TLAAs are evaluated in accordance with 10 CFR 54.21(c)(1) and that the evaluation of this TLAA, load cycles of NUREG-0612 plant 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 regarding the TLAA for load cycles of the plant cranes is documented in SER Section 4.7.1.

SLRA Section 3.3.2.2.1 associated with SLRA Table 3.3.1, AMR item 3.3.1-002, states that TLAAs are evaluated in accordance with 10 CFR 54.21(c)(1) and that the evaluation of this TLAA, fatigue of auxiliary systems and steam and power conversion systems components, is addressed in SLRA Section 4.3.3. This is consistent with SRP-SLR Section 3.3.2.2.1 and is, therefore, acceptable. The staff's evaluation regarding the TLAA for fatigue of auxiliary systems and steam and power conversion systems components is documented in SER Section 4.3.3.

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, item 3.3.1-003, addresses stainless steel heat exchanger tubing exposed to treated borated water greater than 60 ºC (140 ºF) in the chemical and volume control system (CVCS), which will be managed for stress corrosion cracking (SCC) by the GALL-SLR Report AMP XI.M2, "Water Chemistry." The staff reviewed the applicant's proposal against the criteria in SRP-SLR Section 3.3.2.2.2.

The staff noted that an independent search of Dominion's corrective action database did not find any evidence of SCC in the stainless steel non-regenerative heat exchanger in the CVCS. In its review of components associated with item 3.3.1-003, the staff finds that Dominion has met the further evaluation criteria, and the applicant's proposal to manage the effects of aging using the Water Chemistry program is acceptable because no evidence was found to indicate SCC in the stainless steel heat exchanger tubing in the CVCS, which satisfies the requirements of the "Further Evaluation" item 3.3.2.2.2 in the SRP-SLR.

The staff also noted that SLRA Section 3.3.2.2.2, associated with SLRA Table 3.3.1, AMR Item 3.3.1-003a, addresses cracking due to SCC and cyclic loading for stainless steel heat exchanger tubing exposed to treated borated water greater than 60 ºC (140 ºF) in the CVCS. Dominion stated in the SLRA that this item is not applicable and is being addressed in 3.3.1-003. The staff finds this acceptable because in its review of components associated with item 3.3.1-003 an independent search of Dominion's corrective action database did not find any evidence of cracking due to SCC or cyclic loading in the stainless steel non-regenerative heat exchanger in the CVCS.

Based on the program identified, the staff concludes that Dominion's program meets SRP-SLR Section 3.3.2.2.2. For those AMR items associated with SLRA Section 3.3.2.2.2, the staff concludes that the SLRA is consistent with the GALL-SLR Report and that Dominion 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).

3.3.2.2.3 Cracking Due to Stress Corrosion Cracking in Stainless Steel Alloys

SLRA Section 3.3.2.2.3, associated with SLRA Table 3.3.1, AMR items 3.3.1-004, 3.3.1-094a, and 3.3.1-205 address cracking due to stress corrosion cracking for stainless steel piping, piping components, and tanks, ducting and ducting components, and insulated piping, piping components, and tanks exposed to air or condensation, which will be managed by the External Surfaces Monitoring of Mechanical Components or the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components programs. The staff reviewed Dominion's proposal against the criteria in SRP-SLR Section 3.3.2.2.3.

In its review of components associated with AMR items 3.3.1-004, 3.3.1-094a, and 3.3.1-205, the staff finds that Dominion has met the further evaluation criteria, and Dominion's proposal to manage the effects of aging using the External Surfaces Monitoring of Mechanical Components or the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components programs is acceptable because the periodic visual inspections (e.g., VT-1) or surface examinations, conducted as part of each of the programs, are capable of detecting cracking.

Based on the programs identified, the staff concludes that Dominion's programs meet SRP-SLR Section 3.3.2.2.3 criteria. For those AMR items associated with SLRA Section 3.3.2.2.3, the staff concludes that the SLRA is consistent with the GALL-SLR Report and that Dominion has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3).

SLRA Section 3.3.2.2.3, associated with SLRA Table 3.2.1, AMR items 3.3.1-146 and 3.3.1-231, address cracking due to stress corrosion cracking for stainless steel underground piping, piping components, and tanks, and tanks within the scope of GALL-SLR Report AMP XI.M29. Dominion stated that these items are not applicable. The staff evaluated Dominion's claim and needed additional information and issued an RAI. RAI 3.2.2.1.1-2 and Dominion's response are documented in ADAMS Accession No. ML19183A440.

In its response, Dominion stated that:

> The Technical Support Center charcoal filter housing is non-safety-related, contains no fluids, and is not credited with support of safety-related functions or regulated events. The filter housing is not within scope and is accessible. The penetration vaults addressed in UFSAR Sections 9.10.4.3 and 9.10.4.7 are normally accessible areas. Review of other systems confirms that there are no stainless steel underground piping, piping components, and tanks in the auxiliary systems.

The staff evaluated Dominion's claim against the criteria in SRP-SLR Section 3.3.2.2.3 and finds it acceptable because based on a review of the UFSAR and SLRA, as well as the applicant's RAI response, there are no in-scope underground stainless steel piping, piping components, or 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, 3.3.1-094, 3.3.1-222, 3.3.1.232, and 3.3.1-241, address loss of material due to pitting and crevice

corrosion for stainless steel and nickel alloy piping and piping components, ducting and ducting components, tanks, insulated piping, piping components, and tanks, and heat exchanger components exposed to air or condensation, which will be managed by the External Surfaces Monitoring of Mechanical Components or the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components programs. The staff reviewed Dominion's proposal against the criteria in SRP-SLR Section 3.3.2.2.4.

In its review of components associated with AMR items 3.3.1-006, 3.3.1-094, 3.3.1-222, 3.3.1.232, and 3.3.1-241, the staff finds that Dominion has met the further evaluation criteria, and Dominion's proposal to manage the effects of aging using the External Surfaces Monitoring of Mechanical Components or the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components programs is acceptable because the periodic visual inspections conducted as part of each of the programs are capable of detecting loss of material.

Based on the programs identified, the staff concludes that Dominion's programs meet SRP-SLR Section 3.3.2.2.4 criteria. For those AMR items associated with SLRA Section 3.3.2.2.4, the staff concludes that the SLRA is consistent with the GALL-SLR Report and that Dominion has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3).

SLRA Section 3.3.2.2.4, associated with SLRA Table 3.3.1, AMR items 3.3.1-228 and 3.3.1-246 address loss of material due to pitting or crevice corrosion for stainless steel and nickel alloy tanks within the scope of GALL-SLR Report AMP XI.M29 and underground piping, piping components, and tanks. Dominion stated that these items are not applicable. The staff evaluated Dominion's claim against the criteria in SRP-SLR Section 3.3.2.2.4 and finds it acceptable because based on a review of the UFSAR and SLRA, there are no in-scope stainless steel or nickel alloy tanks within the scope of AMP XI.M29 and no in-scope stainless steel or nickel alloy underground piping, piping, components, or 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, as modified by letter dated July 17, 2019, is associated with SLRA Table 3.3.1, item 3.3.1-127 and addresses loss of material due to recurring internal corrosion in metallic piping components exposed to several water environments. Dominion stated that its review of operating experience identified this aging effect/mechanism in steel components exposed to raw water in the service water, circulating water, component cooling water, fire protection, plumbing, and ventilation systems. The SLRA provided the information for each of the five aspects identified in SRP-SLR Section 3.3.2.2.7 for the four programs being credited for managing this aging effect/mechanism. Dominion will use the following programs to manage this aging effect/mechanism: (1) Open-Cycle Cooling Water System program, for components in the service water and circulating water systems; (2) Fire Water System program, for

components in the fire protection system; (3) the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program, for components in the plumbing system and uncoated portions of the service water system that are not within the scope of GL 89-13; and (4) Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks program, for internally coated components in the circulating and service water systems. The SLRA states that the operating experience sections in Appendix B for these programs identify corrective actions taken or scheduled to address this aging effect/mechanism and that future occurrences of recurring internal corrosion will be documented in accordance with the corrective action program.

The staff reviewed Dominion's approach against the criteria in SRP-SLR Section 3.3.2.2.7 for the components associated with item 3.3.1-127. The staff finds that Dominion has met the further evaluation criteria and its approach to manage the associated aging effect/mechanism using the cited programs acceptable because the four 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 beyond those identified by Dominion, 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

SLRA Section 3.3.2.2.8, associated with SLRA Table 3.3.1, AMR items 3.3.1-189 and 3.3.1-254, address cracking due to stress corrosion cracking for aluminum piping, piping components, and tanks exposed to air, condensation, soil, concrete, raw water, or waste water, and heat exchanger components exposed to air or condensation, which will be managed by the External Surfaces Monitoring of Mechanical Components or the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components programs. The staff reviewed Dominion's proposal against the criteria in SRP-SLR Section 3.3.2.2.8.

SLRA Change Notice No. 2 (ADAMS Accession No. ML19095A666), revised SLRA Table 3.3.2-20 to change the type of material from stainless steel to aluminum for the reactor containment sump pump casing exposed to waste water or uncontrolled indoor air. AMR item 3.3.1-189 is cited to manage cracking with the External Surfaces Monitoring program. Plant-specific note 2 states, "[i]nternal and external environments are such that the external surface condition is representative of the internal surface condition."

In its review of components associated with AMR items 3.3.1-189 and 3.3.1-254, the staff finds that Dominion has met the further evaluation criteria, and Dominion's proposal to manage the effects of aging using the External Surfaces Monitoring of Mechanical Components or the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components programs is acceptable because the periodic visual inspections (e.g., VT-1), surface examinations, conducted as part of each of the programs, are capable of detecting cracking.

Based on the programs identified, the staff concludes that Dominion's programs meet 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 Dominion 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 tanks within the scope of GALL-SLR Report AMP XI.M29, underground piping, piping components, and tanks, and insulated piping, piping components, and tanks. Dominion stated that these items are not applicable. The staff evaluated Dominion's claim against the criteria in SRP-SLR Section 3.3.2.2.8 and finds it acceptable because based on a review of the UFSAR and SLRA, there are no in-scope aluminum alloy tanks within the scope of GALL-SLR Report AMP XI.M29, underground piping, piping components, and tanks, and insulated piping, piping components, and tanks 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, items 3.3.1-112 and 3.3.1-202, address loss of material due to general (steel only), crevice or pitting corrosion and cracking due to stress corrosion cracking (stainless steel only) for steel and stainless steel piping and piping components exposed to concrete, which will be managed by the Buried and Underground Piping and Tanks program. The staff reviewed Dominion's proposal against the criteria in SRP-SLR Section 3.3.2.2.9.

SLRA Section 3.3.2.2.9 states: (a) loss of material and cracking are not aging effects requiring management for steel and stainless steel components exposed to concrete where the component does not exit the concrete into a soil environment; (b) SLRA items 3.3.1-107 and 3.3.1-144 are cited for managing loss of material and cracking; and (c) item 3.3.1-107 and 3.3.1-144 cite the Buried and Underground Piping and Tanks program to manage loss of material and cracking (stainless steel only) for these components.

In its review of components associated with items 3.3.1-112 and 3.3.1-202, the staff finds that Dominion has met the further evaluation criteria, and Dominion's proposal to manage the effects of aging using the Buried and Underground Piping and Tanks program is acceptable because periodic visual inspections can be capable of detecting loss of material and cracking in stainless steel piping. For items not potentially exposed to groundwater, Dominion's proposal is acceptable for the following reasons because, consistent with the further evaluation criteria: (a) the steel components are encased in concrete that conforms to ACI-318, (b) plant-specific operating experience did not reveal any instances of degradation of concrete around embedded components that could lead to penetration of water, and (c) for stainless steel items, loss of material and cracking are not applicable aging effects as long as the piping is not potentially exposed to groundwater.

Based on the program identified, the staff concludes that Dominion'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 Dominion has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.2.10 Loss of Material Due to Pitting and Crevice Corrosion in Aluminum Alloys

SLRA Section 3.3.2.2.10, associated with SLRA Table 3.3.1, AMR items 3.3.1-234, 3.3.1-240 (as amended by letter dated April 2, 2019), and 3.3.1-242 address loss of material due to pitting and crevice corrosion for aluminum alloy piping, piping components, and tanks, and heat

exchanger components exposed to air or condensation, which will be managed by the External Surfaces Monitoring of Mechanical Components or the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components programs. The staff reviewed Dominion's proposal against the criteria in SRP-SLR Section 3.3.2.2.10.

SLRA Change Notice No. 2 (ADAMS Accession No. ML19095A666) revised SLRA Table 3.3.2-20 to change the type of material from stainless steel to aluminum for the reactor containment sump pump casings exposed to waste water or uncontrolled indoor air. SLRA Table 3.3.1, items 3.3.1-234 and 3.3.1-240, are cited to manage loss of material with the External Surfaces Monitoring program. Plant-specific note 2 states, "[i]nternal and external environments are such that the external surface condition is representative of the internal surface condition."

In its review of AMR items associated with SLRA Table 3.3.1, items 3.3.1-234, 3.3.1-240, and 3.3.1-242, the staff finds that Dominion has met the further evaluation criteria, and Dominion's proposal to manage the effects of aging using the External Surfaces Monitoring of Mechanical Components or the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components programs is acceptable because the periodic visual inspections conducted as part of each of the programs are capable of detecting loss of material.

Based on the programs identified, the staff concludes that Dominion's programs meet SRP-SLR Section 3.3.2.2.10 criteria. For those AMR items associated with SLRA Section 3.3.2.2.10, the staff concludes that the SLRA is consistent with the GALL-SLR Report and that Dominion has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3).

SLRA Section 3.3.2.2.10, associated with SLRA Table 3.3.1, items 3.3.1-223, 3.3.1-227, and 3.3.1-245 addresses loss of material due to pitting or crevice corrosion for aluminum alloy underground piping, piping components, and tanks, tanks within the scope of GALL-SLR Report AMP XI.M29, and insulated piping, piping components, and tanks exposed to air or condensation, and piping, piping components exposed to raw water or waste water. Dominion stated that these items are not applicable. The staff evaluated Dominion's claim against the criteria in SRP-SLR Section 3.3.2.2.10 and finds it acceptable because based on a review of the UFSAR and SLRA, there are no in-scope aluminum alloy components meeting the above component and environment combinations in the auxiliary systems.

3.3.2.3 Aging Management Review Results Not Consistent with or Not Addressed in the GALL-SLR Report (F-J)

The following subsections document the staff's review of AMR results listed in SLRA Tables 3.3.2-1 through 3.3.2-43 that are either not consistent with or not addressed in the GALL-SLR Report and are usually denoted with generic notes F through J. To efficiently capture and identify multiple applicable AMR items in each subsection, and because these AMR items often are not associated with a Table 1 item, the subsections are organized by applicable AMR section and then by material and environment combinations.

For component type, material, and environment combinations not evaluated in the GALL-SLR Report, the staff reviewed the applicant's evaluation to determine whether the applicant has demonstrated that it will adequately manage the effects of aging in a way that maintains the

intended function(s) consistent with the CLB for the subsequent period of extended operation. The following sections document the staff's evaluation.

3.3.2.3.1 Auxiliary Systems – Service Water – Aging Management Evaluation

Fiberglass Piping, Piping Components Exposed to Raw Water

The original SLRA submittal included an AMR item with a generic note H in Table 3.3.2-04 that related to fiberglass piping in the service water system. In Change Notice 2 (dated April 2, 2019, ADAMS Accession No. ML19095A666), the applicant changed the applicable AMP to "Inspection of Internal Surfaces and Miscellaneous Piping and Ducting Components" because the previously-cited AMP did not address fiberglass. This changed the note H into a note A, which denotes consistency with the GALL-SLR Report. The NRC staff found this change acceptable.

3.3.2.3.2 Auxiliary Systems – Chemical and Volume Control – Aging Management Evaluation

Stainless Steel Piping, Piping Components Exposed to Treated Borated Water

SLRA Table 3.3.2-15, page 3-421, states that cracking for stainless steel piping and piping components in the chemical and volume control system exposed to treated borated water will be managed by the SLRA AMP B2.1.1, ASME Section XI Inservice Inspection Subsections IWB, IWC, and IWD program. The AMR item cites generic note H for which Dominion has identified no associated item in NUREG-2191 or in Table 3.3.1. The AMR item cites plant-specific note 6 which states that augmented inspections within the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD (B2.1.1) program will manage cracking of sensitized stainless steel. The staff determines that the augmented inspection specifications in AMP B2.1.1 will monitor adequately the aging effect in the stainless steel piping in the chemical and volume control system. Therefore, the staff finds Dominion's proposal to manage aging effects acceptable because AMP B2.1.1 specifically provided guidance on the augmented inspections to monitor the aging effect of the stainless steel piping of the chemical and volume control system in the treated borated water.

3.3.2.3.3 Auxiliary Systems – Fire Protection – Aging Management Evaluation

Steel Piping, Piping Components Exposed to Raw Water

As discussed in SER Section 3.3.2.1.11, SLRA Table 3.3.2-34 originally included an AMR item that credited a TLAA. However, the applicant removed that AMR item in SLRA Change Notice No. 2 (ADAMS Accession No. ML19095A666). The NRC staff found this change acceptable.

3.3.2.3.4 Auxiliary Systems – Emergency Diesel Generator System – Aging Management Evaluation

Nickel Alloy Strainer Element Exposed Externally to Fuel Oil

SLRA Table 3.3.2-36, states that loss of material for nickel alloy strainer elements exposed to fuel oil will be managed by the Fuel Oil Chemistry program. The AMR item cites generic note G. The AMR item cites plant-specific note 2, which states, "The Fuel Oil Chemistry (B2.1.18) program will manage loss of material by precluding the presence of water, and the

One-Time Inspection (B2.1.20) program will confirm the effectiveness of the Fuel Oil Chemistry (B2.1.18) program."

The staff reviewed the associated items in the SLRA and considered whether the aging effects proposed by Dominion constitute all of the applicable aging effects for this component, material, and environment description. The staff noted that the applicant addressed loss of material for this component, material, and environment combination in other AMR items. Based on its review of the GALL-SLR Report, which states that loss of material in mechanical components may be due to general corrosion, pitting corrosion, galvanic corrosion, crevice corrosion, and microbiologically influenced corrosion, the staff finds that Dominion has identified all applicable aging effects for this component, material, and environment combination.

The staff finds Dominion's proposal to manage the effects of aging acceptable because the Fuel Oil Chemistry programs will manage contaminants in the fuel oil that could contribute to loss of material. Additionally, the One-Time Inspection program will verify the effectiveness of the Fuel Oil Chemistry program.

3.3.2.3.5 Auxiliary Systems – Alternate AC – Aging Management Evaluation

Steel Fuel Oil Radiator Tubes Exposed to Fuel Oil

As amended by SLRA Change Notice 2 (ADAMS Accession No. ML19095A666), SLRA Table 3.3.2-37 states that reduction of heat transfer for steel fuel oil radiator tubes exposed to fuel oil will be managed by the Fuel Oil Chemistry program. The AMR item cites generic note H, for which Dominion has identified reduction of heat transfer as an additional aging effect.

The staff finds Dominion's proposal to manage reduction of heat transfer acceptable because: (a) the Fuel Oil Chemistry program maintains contaminants at acceptable levels in the fuel oil, thus minimizing the potential for buildup of a film on the tubes that would reduce heat transfer; and (b) the effectiveness of the program is verified by the One-Time Inspection program visual inspections that are capable of detecting indications related to a buildup of material (e.g., sediment film, corrosion products) that could reduce heat transfer.

Internally Coated Carbon Steel Tanks Exposed to Air-Dry

SLRA Table 3.3.2-37 states that loss of material and loss of coating integrity for internally coated carbon steel tanks exposed to air-dry 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 Dominion constitute all of the applicable aging effects for this component, material, and environment description. Based on its review of the GALL-SLR Report, which states that internally coated carbon steel tanks exposed to more aggressive environments (e.g., raw water) are susceptible to loss of material and loss of coating integrity, the staff finds that Dominion 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 tanks 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 Dominion's proposal to manage the effects of aging using the Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks program acceptable because raw water is more aggressive than an air-dry environment; therefore, Dominion's proposal is bounded by GALL-SLR Report recommendations.

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 Programs for Steam and Power Conversion System," is a summary comparison of the applicant's AMR results with those provided in the GALL-SLR Report for the steam and power conversion systems components.

3.4.2 Staff Evaluation

Table 3.4-1, below, summarizes the staff's evaluation of the component groups listed in SLRA Section 3.4 and addressed in the GALL-SLR Report.

Table 3.4-1 Staff Evaluation for Steam and Power Conversion System Components in the GALL-SLR Report

Component Group (SRP-SLR Item No.)	Staff Evaluation
3.4.1-001	Consistent with the GALL-SLR Report (see 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	Consistent with the GALL-SLR Report
3.4.1-005	Consistent with the GALL-SLR Report
3.4.1-006	Consistent with the GALL-SLR Report
3.4.1-007	Not applicable to Surry
3.4.1-008	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.4.1-009	Consistent with the GALL-SLR Report
3.4.1-010	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.4.1-011	Consistent with the GALL-SLR Report
3.4.1-012	Consistent with the GALL-SLR Report
3.4.1-013	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.4.1-014	Consistent with the GALL-SLR Report
3.4.1-015	Consistent with the GALL-SLR Report
3.4.1-016	Consistent with the GALL-SLR Report
3.4.1-017	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.4.1-018	Consistent with the GALL-SLR Report
3.4.1-019	Not applicable to Surry (see SER Section 3.4.2.1.1)
3.4.1-020	Not applicable to Surry (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 Surry (see SER Section 3.4.2.1.1)

Component Group (SRP-SLR Item No.)	Staff Evaluation
3.4.1-023	Not applicable to Surry
3.4.1-024	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.4.1-025	Consistent with the GALL-SLR Report
3.4.1-026	Not applicable to Surry
3.4.1-027	Consistent with the GALL-SLR Report
3.4.1-028	Not applicable to Surry
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 Surry
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 (see SER Section 3.4.2.2.9)
3.4.1-036	Not used. Addressed by 3.4.1-034
3.4.1-037	Consistent with the GALL-SLR Report
3.4.1-038	Not used. Addressed by 3.4.1-089 and 3.4.1-091.
3.4.1-039	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.4.1-040	Consistent with the GALL-SLR Report
3.4.1-041	Consistent with the GALL-SLR Report
3.4.1-042	Not applicable to Surry
3.4.1-043	Consistent with the GALL-SLR Report
3.4.1-044	Consistent with the GALL-SLR Report
3.4.1-045	Not applicable to Surry
3.4.1-046	Not applicable to Surry
3.4.1-047	Not applicable to Surry
3.4.1-048	Not applicable to Surry
3.4.1-049	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.4.1-050	Consistent with the GALL-SLR Report
3.4.1-050a	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.4.1-051	Not used. Addressed by 3.4.1-050 (see SER Section 3.4.2.2.8)
3.4.1-052	Not applicable to Surry
3.4.1-053	Not applicable to Surry
3.4.1-054	Consistent with the GALL-SLR Report (see SER Section 3.2.2.1.2)
3.4.1-055	Consistent with the GALL-SLR Report
3.4.1-056	Not applicable to Surry
3.4.1-057	Not applicable to Surry
3.4.1-058	Not applicable to Surry
3.4.1-059	Consistent with the GALL-SLR Report
3.4.1-060	Consistent with the GALL-SLR Report
3.4.1-061	Not applicable to Surry (see SER Section 3.4.2.2.6)
3.4.1-062	Not used (addressed partially by 3.4.1-066 and 3.4.1-067)
3.4.1-063	Consistent with the GALL-SLR Report (see SER Section 3.2.2.1.2)
3.4.1-064	Consistent with the GALL-SLR Report
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

Component Group (SRP-SLR Item No.)	Staff Evaluation
3.4.1-067	Consistent with the GALL-SLR Report
3.4.1-068	Not applicable to Surry
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 Surry
3.4.1-071	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.4.1-072	Not applicable to Surry
3.4.1-073	Consistent with the GALL-SLR Report
3.4.1-074	Not applicable to Surry (see SER Section 3.4.2.2.2)
3.4.1-075	Not applicable to Surry
3.4.1-076	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.4.1-077	Consistent with the GALL-SLR Report
3.4.1-078	Not used. Addressed by 3.4.1-077
3.4.1-079	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.4.1-080	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.4.1-081	Consistent with the GALL-SLR Report
3.4.1-082	Not applicable to Surry (see SER Section 3.4.2.2.8)
3.4.1-083	Consistent with the GALL-SLR Report
3.4.1-084	Consistent with the GALL-SLR Report
3.4.1-085	Consistent with the GALL-SLR Report
3.4.1-086	Not applicable to Surry
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	Consistent with the GALL-SLR Report
3.4.1-090	Not applicable to Surry
3.4.1-091	Consistent with the GALL-SLR Report
3.4.1-092	Not applicable to Surry
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 Surry (see SER Section 3.4.2.2.9)
3.4.1-095	Not applicable to Surry (see SER Section 3.4.2.2.3)
3.4.1-096	Not applicable to Surry
3.4.1-097	Not applicable to Surry (see SER Section 3.4.2.2.9)
3.4.1-098	Not applicable to Surry (see SER Section 3.4.2.2.3)
3.4.1-099	Not applicable to Surry
3.4.1-100	Not applicable to Surry (see SER Section 3.4.2.2.2)
3.4.1-101	Not applicable to Surry
3.4.1-102	Not applicable to Surry (see SER Section 3.4.2.2.7)
3.4.1-103	Not applicable to Surry (see SER Section 3.4.2.2.3)
3.4.1-104	Not applicable to Surry (see SER Section 3.4.2.2.2)
3.4.1-105	Not applicable to Surry (see SER Section 3.4.2.2.7)
3.4.1-106	Consistent with the GALL-SLR Report (see SER Section 3.2.2.1.2)
3.4.1-107	Not applicable to Surry
3.4.1-108	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.4.1-109	Consistent with the GALL-SLR Report (see SER Section 3.4.2.2.7)
3.4.1-110	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.4.1-111	This item number is not used in the SRP-SLR or the GALL-SLR Report

Component Group (SRP-SLR Item No.)	Staff Evaluation
3.4.1-112	Not applicable to Surry (see SER Section 3.4.2.2.7)
3.4.1-113	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.4.1-114	Not applicable to Surry
3.4.1-115	Not applicable to Surry
3.4.1-116	Not applicable to Surry
3.4.1-117	Not applicable to Surry
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 Surry (see SER Section 3.4.2.2.9)
3.4.1-120	Not applicable to Surry (see SER Section 3.4.2.2.9)
3.4.1-121	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.4.1-122	Consistent with the GALL-SLR Report
3.4.1-123	Not used. Addressed by 3.4.1-122.
3.4.1-124	Not applicable to Surry
3.4.1-125	Not applicable to Surry
3.4.1-126	Not applicable to Surry
3.4.1-127	Not applicable to Surry
3.4.1-128	Not applicable to Surry
3.4.1-129	Not applicable to Surry
3.4.1-130	Not applicable to Surry (see SER Section 3.4.2.1.1)
3.4.1-131	Not applicable to Surry
3.4.1-132	Not applicable to Surry
3.4.1-133	Not applicable to Surry
3.4.1-134	Not applicable to Surry
3.4.1-135	Consistent with the GALL-SLR Report

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 Surry 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. The remaining subsections in SER Section 3.4.2.1 document the review of components that required additional information or otherwise require explanation.

(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 3.4.2-13 that the applicant determined to be consistent with the GALL-SLR Report. The staff audited and reviewed the information in the SLRA. The staff did

not repeat its review of the matters described in the GALL-SLR Report; however, the staff did verify that the material presented in the SLRA was applicable and that the applicant identified the appropriate GALL-SLR Report AMRs. For those AMR items the staff found to be consistent with the GALL-SLR Report, and for which no additional evaluation or request for additional information applies, the staff's review and conclusions as documented in the GALL-SLR Report are considered to be the basis for acceptability of the AMR item. The staff's conclusion of "Consistent with the GALL-SLR Report" is documented in SER Table 3.4-1 and no separate writeup is required or provided.

The staff notes that the applicant changed the designation for item 3.4.1-064 from "Not applicable" in the original submittal to "Consistent" as part of Change Notice 1, which was dated January 29, 2019. The NRC staff finds this change acceptable.

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

For SLRA Table 3.4-1, Items 3.4-1-007, 3.4-1-019, 3.4-1-020, 3.4-1-022, 3.4-1-023, 3.4-1-026, 3.4-1-028, 3.4-1-032, 3.4-1-042, 3.4-1-045, 3.4-1-046, 3.4-1-047, 3.4-1-048, 3.4-1-052, 3.4-1-053, 3.4-1-056, 3.4-1-057, 3.4-1-058, 3.4-1-061, 3.4-1-068, 3.4-1-070, 3.4-1-072, 3.4-1-074, 3.4-1-075, 3.4-1-082, 3.4-1-086, 3.4-1-090, 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, 3.4-1-103, 3.4-1-104, 3.4-1-105, 3.4-1-107, 3.4-1-112, 3.4-1-114, 3.4-1-115, 3.4-1-116, 3.4-1-117, 3.4-1-119, 3.4-1-120, 3.4-1-124, 3.4-1-125, 3.4-1-126, 3.4-1-127, 3.4-1-128, 3.4-1-129, 3.4-1-130, 3.4-1-131, 3.4-1-132, 3.4-1-133, and 3.4-1-134, the applicant claims that the corresponding AMR items in the GALL-SLR Report are not applicable to Surry. The staff reviewed the SLRA and UFSAR and confirmed that the applicant's SLRA does not have any AMR results that are applicable for these items.

For the following SLRA Table 3.4-1 items, Dominion claimed that the corresponding item in the GALL-SLR Report is not used because it is addressed by another SLRA Table 1 AMR item: 3.4.1-036 (addressed by 3.4.1-034), 3.4.1-038 (addressed by 3.4.1-089 and 3.4.1-091), 3.4.1-051 (addressed by 3.4.1-050), 3.4.1-062 (addressed by 3.4.1-066 and 3.4.1-067), 3.4.1-078 (addressed by 3.4.1-077), and 3.4-1-123 (addressed by 3.4.1-122). The staff reviewed the SLRA and confirmed that the aging effects will be addressed by another SLRA Table 1 AMR item. Therefore, the staff finds Dominion's proposal to use alternate items acceptable.

SLRA Table 3.4.1, item 3.4.1-023 addresses managing cracking due to SCC for stainless steel piping components exposed to closed-cycle cooling water greater than 60 °C (140 °F). The SLRA states that this item was not applicable. As clarified by letter dated September 16, 2019, Dominion confirmed that there are no stainless steel piping components exposed to closed-cycle cooling water greater than 60 °C (140 °F) that are subject to an AMR in the steam and power conversion systems.

3.4.2.1.2 Wall Thinning Due to Flow-Accelerated Corrosion

SLRA Table 3.4.1, item 3.4.1-005, addresses wall thinning due to flow-accelerated corrosion for steel piping and piping components exposed to steam or treated water. As amended by SLRA Change Notice No. 2 (ADAMS Accession No. ML19095A666), Dominion incorporated a new

AMR item to address wall thinning due to flow-accelerated corrosion for steel heat exchanger in SLRA Table 3.4.2-8, "Steam and Power Conversion System – Feedwater – Aging Management Evaluation."

During its review of components associated with AMR item 3.4.1-005, for which Dominion cited generic note A, the staff noted that Dominion credits the Flow-Accelerated Corrosion program to manage wall thinning due to flow-accelerated corrosion in steel heat exchangers.

Based on its review of components associated with AMR item 3.4.1-005, the staff finds Dominion's proposal to manage the effects of aging using the Flow-Accelerated Corrosion program acceptable because it is consistent with the GALL-SLR Report and the program can detect wall thinning due to flow-accelerated corrosion that could lead to leaks or ruptures of the given components.

3.4.2.2 Aging Management Review Results for which Further Evaluation is Recommended by the GALL-SLR Report

In SLRA Section 3.4.2.2, the applicant further evaluates aging management for certain steam and power conversion systems components as recommended by the GALL-SLR Report, and provides information concerning how it will manage the applicable aging effects. The staff reviewed the applicant's evaluation of these component groups against the criteria contained in SRP-SLR Section 3.4.2.2. The following subsections document the staff's review.

3.4.2.2.1 Cumulative Fatigue Damage Due to Fatigue

SLRA Section 3.4.2.2.1 associated with SLRA Table 3.4.1, AMR item 3.4.1-001, states that TLAAs are evaluated in accordance with 10 CFR 54.21(c)(1) and that the evaluation of this TLAA, fatigue of steam and power conversion systems components, is addressed in SLRA Section 4.3.3. This is consistent with SRP-SLR Section 3.4.2.2.1 and is, therefore, acceptable. The staff's evaluation regarding the TLAA for fatigue of steam and power conversion systems components is documented in SER Section 4.3.3.

3.4.2.2.2 Cracking Due to Stress Corrosion Cracking in Stainless Steel Alloys

SLRA Section 3.4.2.2.2, associated with SLRA Table 3.4.1, AMR item 3.4.1-002, addresses cracking due to stress corrosion cracking for stainless steel piping, piping components, and tanks exposed to air or condensation, which will be managed by the External Surfaces Monitoring of Mechanical Components or the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components programs. The staff reviewed Dominion's proposal against the criteria in SRP-SLR Section 3.4.2.2.2.

In its review of components associated with AMR item 3.4.1-002, the staff finds that Dominion has met the further evaluation criteria, and Dominion's proposal to manage the effects of aging using the External Surfaces Monitoring of Mechanical Components or the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components programs is acceptable because the periodic visual inspections (e.g., VT-1) or surface examinations, conducted as part of each of the programs, are capable of detecting cracking.

Based on the programs identified, the staff concludes that Dominion's programs meet SRP-SLR Section 3.4.2.2.2 criteria. For those AMR items associated with SLRA Section 3.4.2.2.2, the staff concludes that the SLRA is consistent with the GALL-SLR Report and that Dominion has

demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3).

SLRA Section 3.4.2.2.2, associated with SLRA Table 3.4.1, AMR items 3.4.1-074, 3.4.1-100, and 3.4.1-104 address cracking due to stress corrosion cracking for stainless steel underground piping, piping components, and tanks, tanks within the scope of GALL-SLR Report AMP XI.M29, and insulated piping, piping components, and tanks. Dominion stated that these items are not applicable. The staff evaluated Dominion's claim against the criteria in SRP-SLR Section 3.4.2.2.2 and finds it acceptable because based on a review of the UFSAR and SLRA, there are no in-scope stainless steel underground piping, piping components, and tanks, tanks within the scope of GALL-SLR Report AMP XI.M29, and insulated piping, piping components, and tanks 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, AMR item 3.4.1-003, addresses loss of material due to pitting and crevice corrosion for stainless steel and nickel alloy piping, piping components and tanks, exposed to air or condensation, which will be managed by the External Surfaces Monitoring of Mechanical Components or the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components programs. The staff reviewed Dominion's proposal against the criteria in SRP-SLR Section 3.4.2.2.3.

In its review of components associated with AMR item 3.4.1-003, the staff finds that Dominion has met the further evaluation criteria, and Dominion's proposal to manage the effects of aging using the External Surfaces Monitoring of Mechanical Components or the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components programs is acceptable because the periodic visual inspections conducted as part of each of the programs are capable of detecting loss of material.

Based on the programs identified, the staff concludes that Dominion's programs meet SRP-SLR Section 3.4.2.2.3 criteria. For those AMR items associated with SLRA Section 3.4.2.2.3, the staff concludes that the SLRA is consistent with the GALL-SLR Report and that Dominion has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3).

SLRA Section 3.4.2.2.3, associated with SLRA Table 3.3.1, AMR items 3.4.1-095, 3.4.1-098, and 3.4.1-103 address loss of material due to pitting or crevice corrosion for stainless steel and nickel alloy underground piping, piping components, and tanks, tanks within the scope of GALL-SLR Report AMP XI.M29, and insulated piping, piping components, and tanks. Dominion stated that these items are not applicable. The staff evaluated Dominion's claim against the criteria in SRP-SLR Section 3.4.2.2.3 and finds it acceptable because based on a review of the UFSAR and SLRA, (1) there are no in scope underground stainless steel or nickel alloy components and (2) no tanks within the scope of GALL-SLR Report AMP and insulated piping , piping components, tanks, tanks within the scope of AMP XI.M29 exposed to air and condensation 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, 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. Dominion stated that its review of operating experience for steam and power conversion systems at Surry confirmed that loss of material due to recurring internal corrosion was not an AERM and that item 3.4.1-061 was not applicable. The staff evaluated the applicant's claim against the criteria in SRP-SLR Section 3.4.2.2.6 and finds it is acceptable because the staff did not identify any examples of recurring internal corrosion in steam and power conversion systems during its independent review of Surry's 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 piping, piping components, and tanks exposed to air, condensation raw water, or waste water, which will be managed by the External Surfaces Monitoring of Mechanical Components program. The staff reviewed Dominion's proposal against the criteria in SRP-SLR Section 3.4.2.2.7.

In its review of components associated with AMR item 3.4.1-109, the staff finds that Dominion has met the further evaluation criteria, and Dominion's proposal to manage the effects of aging using the External Surfaces Monitoring of Mechanical Components program is acceptable because the periodic visual inspections (e.g., VT-1), surface examinations, conducted as part of the program, are capable of detecting cracking.

Based on the programs identified, the staff concludes that Dominion's programs meet 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 Dominion has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3).

SLRA Section 3.4.2.2.9, associated with SLRA Table 3.3.1, AMR items 3.4.1-102, 3.4.1-105, and 3.4.1-112 address cracking due to stress corrosion cracking for aluminum alloy tanks within the scope of GALL-SLR Report AMP XI.M29, insulated piping, piping components, and tanks, and underground piping, piping components, and tanks. Dominion stated that these items are not applicable. The staff evaluated Dominion's claim against the criteria in SRP-SLR Section 3.4.2.2.9 and finds it acceptable because based on a review of the UFSAR and SLRA, there are no in-scope aluminum alloy tanks within the scope of GALL-SLR Report AMP XI.M29, insulated piping, piping components, and tanks, and underground piping, piping components, and tanks within the steam and power conversion systems.

3.4.2.2.8 Loss of Material Due to General, Crevice, or Pitting Corrosion and Cracking Due to Stress Corrosion Cracking

SLRA Section 3.4.2.2.8, associated with SLRA Table 3.4.1, item 3.4.1-051, addresses loss of material due to general, crevice or pitting corrosion for steel piping and piping components exposed to concrete, which will be managed by the Buried and Underground Piping and Tanks program. The staff reviewed Dominion's proposal against the criteria in SRP-SLR Section 3.4.2.2.8.

In its review of SLRA Section 3.4.2.2.8, the staff noted that the GALL-SLR Report AMR item associated with Table 1 item 3.4.1-051 lists "none" for aging effect and "none" for recommended AMP. SLRA Table 1, item 3.4.1-051 states that item 3.4.1-050, which lists loss of material as an aging effect and recommends the Buried and Underground Piping and Tanks program, will be used instead of item 3.4.1-051.

In its review of components associated with item 3.4.1-050, the staff finds that Dominion has met the further evaluation criteria, and Dominion's proposal to manage the effects of aging using the Buried and Underground Piping and Tanks program is acceptable because periodic visual inspections can be capable of detecting loss of material in steel piping.

Based on the program identified, the staff concludes that Dominion's program meets SRP-SLR Section 3.4.2.2.8 criteria. For those AMR items associated with SLRA Section 3.4.2.2.8, the staff concludes that the SLRA is consistent with the GALL-SLR Report and that Dominion 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 3.4.2.2.8, associated with SLRA Table 3.4.1, item 3.4.1-082, addresses loss of material due to crevice or pitting corrosion and cracking due to stress corrosion cracking for stainless steel piping and piping components exposed to concrete. Dominion stated that this item is not applicable. The staff evaluated Dominion's claim against the criteria in SRP-SLR Section 3.4.2.2.8 and finds it acceptable because based on a review of the UFSAR, there are no stainless steel components exposed to concrete in the steam and power conversion systems.

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 3.3.1, AMR item 3.4.1-035, addresses loss of material due to pitting and crevice corrosion for aluminum alloy piping, piping components, and tanks exposed to air or condensation, which will be managed by the External Surfaces Monitoring of Mechanical Components program. The staff reviewed Dominion's proposal against the criteria in SRP-SLR Section 3.4.2.2.9.

In its review of components associated with AMR item 3.4.1-035, the staff finds that Dominion has met the further evaluation criteria, and Dominion's proposal to manage the effects of aging using the External Surfaces Monitoring of Mechanical Components program is acceptable because the periodic visual inspections conducted as part of each of the programs are capable of detecting loss of material.

Based on the programs identified, the staff concludes that Dominion's programs meet 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 Dominion has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3).

SLRA Section 3.4.2.2.9, 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 address loss of material due to pitting or crevice corrosion for aluminum alloy underground piping, piping components, and tanks, tanks within the scope of GALL-SLR Report AMP XI.M29, piping, piping components, and tanks exposed to air or condensation, and piping, piping components and tanks exposed to raw water or waste water. Dominion stated that these items are not applicable. The staff evaluated Dominion’s claim against the criteria in SRP-SLR Section 3.4.2.2.9 and finds it acceptable because based on a review of the UFSAR and SLRA, there are no in-scope aluminum alloy components meeting the above component and environment combinations 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 3.4.2-13 that are not consistent with, or not addressed in, the GALL-SLR Report.

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 Programs for Containments, Structures and Component Supports,” is a summary comparison of the applicant’s AMR results with those provided in the GALL-SLR Report for the containments, structures, and component supports components.

3.5.2 Staff Evaluation

Table 3.5-1, below, summarizes the staff’s evaluation of the component groups listed in SLRA Section 3.5 and addressed in the GALL-SLR Report.

Table 3.5-1 Staff Evaluation for Containments, Structures, and Component Supports Components in the GALL-SLR Report

Component Group (SRP-SLR Item No.)	Staff Evaluation
3.5.1-001	Consistent with the GALL-SLR Report (see SER Section 3.5.2.2.1.1)
3.5.1-002	Consistent with the GALL-SLR Report (see SER Section 3.5.2.2.1.1)
3.5.1-003	Not applicable to Surry (see SER Section 3.5.2.2.1.2)
3.5.1-004	Not applicable to PWRs (see SER Section 3.5.2.2.1.3, item 1)
3.5.1-005	Consistent with the GALL-SLR Report (see SER Section 3.5.2.2.1.3, item 1)
3.5.1-006	Not applicable to PWRs (see SER Section 3.5.2.2.1.3, item 2)
3.5.1-007	Not applicable to PWRs (see SER Section 3.5.2.2.1.3, item 3)

Component Group (SRP-SLR Item No.)	Staff Evaluation
3.5.1-008	Not applicable to Surry (see SER Section 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 Section 3.5.2.2.1.6)
3.5.1-011	Not applicable to Surry (see SER Section 3.5.2.2.1.7)
3.5.1-012	Consistent with the GALL-SLR Report (see SER Section 3.5.2.2.1.8)
3.5.1-013	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.5.1-014	Not applicable to Surry (see SER Section 3.5.2.2.1.9)
3.5.1-015	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.5.1-016	Consistent with the GALL-SLR Report
3.5.1-017	This item number is not used in the SRP-SLR nor the GALL-SLR Report
3.5.1-018	Consistent with the GALL-SLR Report
3.5.1-019	Consistent with the GALL-SLR Report
3.5.1-020	Consistent with the GALL-SLR Report (see SER Section 3.5.2.2.1.9)
3.5.1-021	Consistent with the GALL-SLR Report
3.5.1-022	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.5.1-023	Consistent with the GALL-SLR Report
3.5.1-024	Consistent with the GALL-SLR Report
3.5.1-025	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.5.1-026	Not applicable to Surry (see SER Section 3.5.2.1.1)
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 Surry
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	Not applicable to PWRs
3.5.1-037	Not applicable to PWRs
3.5.1-038	Not applicable to PWRs (see SER Section 3.5.2.2.1.6)
3.5.1-039	Not applicable to PWRs (see SER Section 3.5.2.2.1.6)
3.5.1-040	Not applicable to PWRs
3.5.1-041	Not applicable to PWRs (see SER Section 3.5.2.1.1)
3.5.1-042	Not applicable to Surry (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	Consistent with the GALL-SLR Report (see SER Section 3.5.2.2.2.1, item 3)
3.5.1-047	Not applicable to Surry (see SER Section 3.5.2.2.2.1, item 4)
3.5.1-048	Not applicable to Surry (see SER Section 3.5.2.2.2.2)
3.5.1-049	Not applicable to Surry (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	Not applicable to Surry (see SER Section 3.5.2.2.2.3, item 3)
3.5.1-052	Not applicable to Surry (see SER Section 3.5.2.2.2.4)

Component Group (SRP-SLR Item No.)	Staff Evaluation
3.5.1-053	Not applicable to Surry (see SER Section 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
3.5.1-058	Consistent with the GALL-SLR Report (see SER Section 3.5.2.1.2)
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
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 PWRs
3.5.1-077	Consistent with the GALL-SLR Report
3.5.1-078	Consistent with the GALL-SLR Report
3.5.1-079	Consistent with the GALL-SLR Report
3.5.1-080	Consistent with the GALL-SLR Report
3.5.1-081	Consistent with the GALL-SLR Report
3.5.1-082	Consistent with the GALL-SLR Report
3.5.1-083	Consistent with the GALL-SLR Report
3.5.1-084	This item number is not used in the SRP-SLR or the GALL-SLR Report
3.5.1-085	Not applicable to Surry
3.5.1-086	Not applicable to Surry
3.5.1-087	Consistent with the GALL-SLR Report
3.5.1-088	Consistent with the GALL-SLR Report (see SER Section 3.5.2.1.4)
3.5.1-089	Consistent with the GALL-SLR Report
3.5.1-090	Not applicable to Surry
3.5.1-091	Consistent with the GALL-SLR Report
3.5.1-092	Consistent with the GALL-SLR Report
3.5.1-093	Not used (see SER Section 3.5.2.1.1) (addressed by 3.5.1-092)
3.5.1-094	Consistent with the GALL-SLR Report
3.5.1-095	Not used (see SER Section 3.5.2.1.1) (addressed by 3.5.1-092)
3.5.1-096	Consistent with the GALL-SLR Report
3.5.1-097	Not applicable to Surry (see SER Section 3.5.2.2.2.6)

Component Group (SRP-SLR Item No.)	Staff Evaluation
3.5.1-098	Consistent with the GALL-SLR Report
3.5.1-099	Consistent with the GALL-SLR Report (see SER Section 3.2.2.2.4)
3.5.1-100	Consistent with the GALL-SLR Report (see SER Section 3.2.2.2.4)

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 Surry 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. The remaining subsections in SER Section 3.5.2.1 document the review of components that required additional information or otherwise require explanation.

(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 3.5.2-38 that the applicant determined to be consistent with the GALL-SLR Report. The staff audited and reviewed the information in the SLRA. The staff did not repeat its review of the matters described in the GALL-SLR Report; however, the staff did verify that the material presented in the SLRA was applicable and that the applicant identified the appropriate GALL-SLR Report AMRs. For those AMR items the staff found to be consistent with the GALL-SLR Report, and for which no additional evaluation or request for additional information applies, the staff's review and conclusions as documented in the GALL-SLR Report are considered to be the basis for acceptability of the AMR item. The staff's conclusion of "Consistent with the GALL-SLR Report" is documented in SER Table 3.5-1 and no separate writeup is required or provided. 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.

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

For SLRA Table 3.5-1, items 3.5-1-003, 3.5-1-008, 3.5-1-011, 3.5-1-014, 3.5-1-026, 3.5-1-032, 3.5-1-042, 3.5-1-047, 3.5-1-048, 3.5-1-049, 3.5-1-051, 3.5-1-052, 3.5-1-085, 3.5-1-086, 3.5-1-090, and 3.5-1-097, the applicant claims that the corresponding AMR items in the GALL-SLR Report are not applicable to Surry. The staff reviewed the SLRA and UFSAR and confirmed that the applicant's SLRA does not have any AMR results that are applicable for these items.

For SLRA Table 3.5-1, items 3.5-1-004, 3.5-1-006, 3.5-1-007, 3.5-1-036, 3.5-1-037, 3.5-1-038, 3.5-1-039, 3.5-1-040, 3.5-1-041, and 3.5-1-076, the applicant claims that the corresponding AMR items in the GALL-SLR Report are not applicable because the associated items are only applicable to boiling-water reactors (BWRs). The staff reviewed the SRP-SLR, confirmed that these items only apply to BWRs, and finds that these items are not applicable to Surry because it is a PWR.

SLRA Table 3.5.1, item 3.5.1-026, as amended by letter dated April 2, 2019, addresses managing loss of sealing for moisture barriers (caulking, flashing, and other sealants) of elastomers, rubber, and other similar materials exposed to air-indoor uncontrolled environment. Dominion stated that this item is not applicable. The staff evaluated Dominion's claim and finds it acceptable because, as explained in SLRA Section B2.1.29, the liner-to-concrete floor interface of the Surry containments does not include a typical moisture barrier in the original design and the current configuration; i.e., the component and material combination does not exist at the plant.

For SLRA Table 3.5.1, items 3.5.1-093 and 3.5.1-095, Dominion claimed that the corresponding items in the GALL-SLR Report are not applicable. The staff reviewed the SLRA and confirmed that the aging effects will be addressed by another SLRA Table 1 AMR item (3.5.1-092). The staff noted that Table IX.C in the GALL-SLR Report classifies "galvanize steel" material under the category of "steel." Therefore, the staff finds Dominion's proposal to use an alternate item acceptable.

3.5.2.1.2 Loss of Material or Loss of Form Due to Erosion, Settlement, Sedimentation, Frost Action, Waves, Currents, Surface Runoff and Seepage

SLRA Table 3.5.1, AMR item 3.5.1-058 addresses loss of material and loss of form due to erosion, settlement, sedimentation, frost action, waves, currents, surface runoff and seepage for earthen water-control structures: dams; embankments; reservoirs; channels; canals, and ponds exposed to air-outdoor, water-flowing or standing environment. For the SLRA Table 2 AMR items that cite generic note E, as amended by Change Notice No. 3, dated June 10, 2019 (ADAMS Accession No. ML19168A028), the SLRA credits the Structures Monitoring program to manage loss of material and loss of form of the oiled-sand cushion supporting the fire protection and domestic water storage tanks foundation. The AMR items cites plant-specific note 3, which states that the Structures Monitoring program will be used instead of the Inspection of Water-Control Structures Associated with Nuclear Power Plants program to manage the applicable aging effects for this component.

During the onsite audit (ADAMS Accession No. ML19169A329), the staff noted that tank ring foundations have a recessed area between the tank and the inner diameter of the foundation. In some locations, this ring was filled with dirt and in others it was filled with vegetation. The staff noted that as amended by Change Notice No. 3, dated June 10, 2019, the Structures Monitoring program and its associated UFSAR supplement were revised by including loss of material and loss of form as applicable aging effects.

Based on its review of components associated with AMR item 3.5.1-058 for which Dominion cited generic note E, the staff finds Dominion's proposal to manage the effects of aging using the Structures Monitoring program acceptable because there are no sources of flowing water that would undermine the oil sand cushion under the tank based on the staff's walkdown during the onsite audit. It is reasonable to conclude that the erosion either occurred due to removing vegetation or run off down the side of the tank during rain storms. The visual inspections

conducted for the Structures Monitoring program are capable of detecting erosion of the oil sand cushion at the periphery of the tanks.

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 due to weathering, chemical degradation, insect infestation, repeated wetting and drying, and fungal decay for wooden piles and/or sheeting exposed to air – outdoor, water flowing or standing, or groundwater/soil. 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 wooden poles. The AMR items cites plant-specific note 4, which states that the Structures Monitoring program will be used instead of the Inspection of Water-Control Structures Associated with Nuclear Power Plants program to manage the applicable aging effects for this component.

During the review of the Structures Monitoring program, as amended by Dominion by letter dated June 10, 2019, the staff needed additional information, and issued RAIs. RAI B2.1.34-1 and RAI B2.1.34-1a and Dominion's responses are documented in ADAMS Accession Nos. ML19204A357 and ML19204A357. The staff's evaluation of Dominion's responses and changes to SLRA Section B2.1.34 is documented in SER Section 3.0.3.2.27, "Structures Monitoring Program," which evaluates the program acceptability to adequately manage the aging effects for wooden poles.

Based on its review of components associated with AMR item 3.5.1-062 for which Dominion cited generic note E, the staff finds Dominion's proposal to manage the effects of aging using the Structures Monitoring Program acceptable because it is consistent with the GALL-SLR Report recommendations to ensure that parameters monitored or inspected, and inspection frequencies are commensurate with industry codes, standards, and guidelines for wooden poles and also consider industry and plant-specific operating experience.

3.5.2.1.4 Loss of Preload Due to Self-Loosening

SLRA Table 3.5.1, AMR item 3.5.1-088 addresses loss of preload due to self-loosening for steel 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 for stainless steel bolting in the cranes and hoists system. The AMR items cite plant-specific note 1, which states that the proposed program will manage loss of preload of stainless steel structural bolting in cranes.

Based on its review of components associated with AMR item 3.5.1-088 for which Dominion cited generic note E, the staff finds Dominion'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 use of visual inspections at a frequency that is consistent with applicable industry standards (i.e., ANSI B30 series) will ensure that loss of preload is detected prior to a loss of intended function.

During its review of components associated with AMR item 3.5.1-088 for which Dominion cited generic note A, the staff noted that the SLRA credits the Structures Monitoring program to manage the aging effect for steel structural bolting.

Based on its review of components associated with AMR item 3.5.1-088 for which Dominion cited generic note A, the staff finds Dominion's proposal to manage the effects of aging using the Structures Monitoring program acceptable because it is consistent with the GALL-SLR Report recommendation to ensure that visual inspection is used for steel structural bolting to detect loss of preload prior to a loss of intended function.

3.5.2.1.5 Loss of Material, Change in Material Properties, Cracking/Delamination, Separation

SLRA Table 3.5.2-37 addresses loss of material, change in material properties, cracking, delamination, and separation for Cerafiber®, Pyrocrete, Micarta®, Duxseal®, KBS® Sealbags, mineral wool, and gypsum fire barrier seals exposed to uncontrolled indoor air. For the SLRA Table 2 AMR item that cites generic note E, the SLRA credits the Fire Protection program to manage the aging effect for these fire barrier seals exposed to uncontrolled indoor air. The AMR item cites plant-specific note 2, which states that the Fire Protection program is used instead of the Structures Monitoring program to manage the applicable aging effects.

The staff reviewed material descriptions of each of the materials listed above and noted the following:

- Cerafiber® is a fiberization melt of alumina and silica.
- Pyrocrete® is a cement-based, cementitious fireproofing.
- Micarta is a phenolic composite material.
- Duxseal® is a heavy, putty-like material compounded with a non-asbestos inert fiber and non-drying synthetic oil base. It is easily removed and reapplied when necessary and has excellent shape retention.
- KBS® Sealbags consist of tightly woven, durable fiber-glass cloth, filled with a combination of mineral fibers, incombustible components, water-insoluble expansion agents, and fire retardant additives.
- Mineral wool is insulation made of inorganic fibers and thermosetting resin.
- Gypsum is composed of calcium sulfate and chemically combined water.

The staff notes that, for the above materials, changes in material properties would manifest in the form of the other aging effects, which can all be identified using the Fire Protection program. Based on its review of components associated with the above components for which Dominion cited generic note E, the staff finds Dominion's proposal to manage the effects of aging using the Fire Protection program acceptable because periodic visual inspections can be capable of identifying loss of material, cracking, delamination, and separation in these materials.

3.5.2.2 Aging Management Review Results for which Further Evaluation is Recommended by the GALL-SLR Report

In SLRA Section 3.5.2.2, the applicant further evaluates aging management for certain containment, structures, and component supports components as recommended by the GALL-SLR Report, and provides information concerning how it will manage the applicable aging effects. The staff reviewed the applicant's evaluation of these component groups against the criteria contained in SRP-SLR Section 3.5.2.2. The following subsections document the staff's review.

3.5.2.2.1 Pressurized-Water Reactor and Boiling Water Reactor Containments

3.5.2.2.1.1 Cracking and Distortion Due to Increased Stress Levels from Settlement; Reduction of Foundation Strength, and Cracking Due to Differential Settlement and Erosion of Porous Concrete Subfoundations

SLRA Section 3.5.2.2.1.1, associated with SLRA Table 3.5-1, items 3.5.1-001 and 3.5.1-002, addresses 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 in the concrete dome, wall, basemat, ring girders, and buttresses exposed to soil and water-flowing, which will be managed by the ASME Section XI, Subsection IWL program or the Structural Monitoring program. The staff reviewed Dominion's proposal against the criteria in SRP-SLR Section 3.5.2.2.1.1.

In its review of components associated with AMR items 3.5.1-001 and 3.5.1-002, the staff finds that Dominion has met the further evaluation criteria, and Dominion's proposal to manage the effects of aging using the ASME Section XI, Subsection IWL program or the Structures Monitoring program is acceptable for the following reasons: (1) a site survey conducted in May 1975, and the followup survey program indicated that the differential movement between safety-related structures was below the allowable tolerance of 0.5 inch. Inspection of structural interfaces showed no visible evidence of differential displacements; (2) accessible concrete components are monitored by the Structures Monitoring program or the ASME Section XI, Subsection IWL program for the components respectively within their scope to confirm the absence of any visible effects due to settlement; (3) porous concrete was placed immediately below the containment mat to serve as an internal drainage system, and a drain system keeps the water level below the top surface of the foundation mat; and (4) the Surry CLB credits a dewatering system for the containment, which is subject to aging management as part of the plumbing system to ensure the continued functionality of the system during the subsequent period of extended operation.

Based on the programs identified, the staff concludes that Dominion's programs meet SRP-SLR Section 3.5.2.2.1.1 criteria. For those AMR items associated with SLRA Section 3.5.2.2.1.1, the staff concludes that the SLRA is consistent with the GALL-SLR Report and that Dominion 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).

3.5.2.2.1.2 Reduction of Strength and Modulus Due to Elevated Temperature

SLRA Section 3.5.2.2.1.2, associated with SLRA Table 3.5-1, item 3.5.1-003, addresses reduction of strength and modulus of elasticity due to elevated temperature in concrete components (e.g., dome, wall, basemat, ring girders, buttresses, containment, fill-in annulus) of containment structures exposed to an air-indoor uncontrolled or air-outdoor environment. Dominion stated that this item is not applicable. The staff evaluated Dominion's claim against the criteria in SRP-SLR Section 3.5.2.2.1.2 and finds it acceptable. Based on the staff's review of the SLRA and UFSAR Sections 15.5.1.8 and 5.3.1.2, containment structure piping penetrations for all thermally hot (over 150 °F) piping systems are sleeved penetrations, and the penetration cooling coils managed for aging in the component cooling system ensure that temperatures of the concrete containment components are kept below the GALL-SLR Report recommended threshold limits of 150 °F for general areas and 200 °F for local areas.

Therefore, concrete containment components are not exposed to the temperatures required for this aging effect to occur.

3.5.2.2.1.3 Loss of Material Due to General, Pitting, and Crevice Corrosion

Item 1. SLRA Section 3.5.2.2.1.3, item 1, as amended by letter dated April 2, 2019, associated with SLRA Table 3.5.1, AMR items 3.5.1-004, 3.5.1-005, and 3.5.1-035, addresses loss of material due to general, pitting and crevice corrosion for inaccessible and accessible areas of drywell shell, drywell head, and containment liner (including liner anchors and integral attachments) of steel material exposed to air-indoor uncontrolled environment. Dominion stated that item 3.5.1-004 is not applicable. For components associated with items 3.5.1-005 and 3.5.1-035, Dominion stated that the aging effects will be managed by the ASME Section XI, Subsection IWE, and 10 CFR Part 50, Appendix J AMPs. The staff reviewed Dominion’s proposal against the criteria in SRP-SLR Section 3.5.2.2.1.3, item 1.

The staff evaluated Dominion’s non-applicability claim against the criteria in SRP-SLR Section 3.5.2.2.1.3, item 1, and finds it acceptable because item 3.5.1-004 only applies to BWR containment drywell shells and the Surry containments are PWR designs that do not incorporate drywell shells.

For items 3.5.1-005 and 3.5.1-035, the staff noted that Dominion concluded a plant-specific program to manage this aging effect in accessible and inaccessible areas of the Surry containment liner and integral attachments are not required based on the following: (1) review of plant-specific operating experience associated with inaccessible areas has not identified any indications of corrosion, and that operating experience associated with accessible areas has identified only minor indications of corrosion, which have been repaired by corrective action; (2) the concrete containments were designed, constructed, and inspected in accordance with ACI and ASTM standards (e.g., ACI 301, ASTM C260), which provided for controlled good quality, dense, well cured, air entrained, and low permeability concrete; (3) the design satisfied crack control criteria of ACI 318-63; and (4) the ASME Section XI, Subsection IWL program monitors and manages any cracks in the containment concrete that could potentially provide a pathway for water to reach inaccessible areas of the steel liner.

In its review of components associated with AMR items 3.5.1-005 and 3.5.1-035, the staff finds that Dominion has met the further evaluation criteria, and Dominion’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 for the following reasons: (1) plant-specific operating experience with regard to corrosion associated with the containment liner has been minor and has been corrected by repair, (2) the design and construction of containment concrete has been in accordance with applicable ACI and ASTM standards to produce durable concrete, (3) containment concrete is monitored for cracks by the ASME Section XI, Subsection IWL AMP, and (4) the continued monitoring using the proposed AMPs provides reasonable assurance that any occurrence of corrosion of the containment liner and its integral attachments will be identified and corrected prior to loss of intended function.

Based on the programs identified, the staff concludes that Dominion’s programs meet the 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 Dominion 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, associated with SLRA Table 3.5.1, AMR item 3.5.1-006, addresses loss of material for steel torus shell exposed to air - indoor uncontrolled or treated water. Dominion stated that this item is not applicable. The staff evaluated Dominion’s claim against the criteria in SRP-SLR Section 3.5.2.2.1.3, item 2, and finds it acceptable because Surry containments are PWR designs that do not incorporate torus shells.

Item 3. SLRA Section 3.5.2.2.1.3, associated with SLRA Table 3.5.1, AMR item 3.5.1-007, addresses loss of material for steel suppression chamber shell, steel torus ring girders and steel downcomers exposed to air - indoor uncontrolled or treated water. Dominion stated that this item is not applicable. The staff evaluated Dominion’s claim against the criteria in SRP-SLR Section 3.5.2.2.1.3, item 3, and finds it acceptable because Surry containments are PWR designs that do not incorporate torus, downcomers, or suppression chambers.

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, AMR item 3.5.1-008, addresses loss of prestress forces due to relaxation, shrinkage, creep, and elevated temperature for prestressed concrete containments exposed to air-indoor uncontrolled and air-outdoor environment. Dominion stated that this item is not applicable. The staff evaluated Dominion’s claim against the criteria in SRP-SLR Section 3.5.2.2.1.4 and finds it acceptable because the Surry containments do not use prestressed tendons. Therefore, a TLAA for prestressed tendons is not necessary.

3.5.2.2.1.5 Cumulative Fatigue Damage

SLRA Section 3.5.2.2.1.5, associated with SLRA Table 3.5.1, AMR item 3.5.1-009, states that TLAAs are evaluated in accordance with 10 CFR 54.21(c)(1) and that the evaluation of this TLAA, fatigue of the steel containment liner plate, is addressed in SLRA Section 4.6. 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 containment liner plate is documented in SER Section 4.6.

3.5.2.2.1.6 Cracking Due to Stress Corrosion Cracking

SLRA Section 3.5.2.2.1.6, as amended by letter dated April 2, 2019, associated with SLRA Table 3.5.1, AMR item 3.5.1-010, addresses cracking due to stress corrosion cracking (SCC) for penetration sleeves made of stainless steel, or carbon steel with dissimilar metal welds 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 Dominion’s proposal against the criteria in SRP-SLR Section 3.5.2.2.1.6.

The staff noted that Surry containment pressure-retaining boundary does not have stainless steel bellows. The staff also noted from SLRA Tables 3.5.2-1 and 3.3.2-1, that AMR item 3.5.1-010 is applicable for Surry to dissimilar metal welds of carbon steel penetration sleeves connected to stainless steel high energy pipes, and stainless steel containment pressure-retaining boundary portions of the fuel transfer tube, fuel transfer tube enclosure, and blind flange (fuel transfer tube), exposed to air – indoor uncontrolled environment. The staff noted that plant operating experience has not identified SCC associated with these stainless steel and dissimilar metal weld components. The staff further noted that visual examinations are augmented with periodic surface examinations performed once during each 10-year inspection interval to manage cracking due to SCC for the specific components listed above.

In its review of components associated with AMR item 3.5.1-010, the staff finds that Dominion has met the further evaluation criteria, and Dominion'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 for the following reasons: (a) the ASME Section XI, Subsection IWE program will be enhanced by including periodic surface examination, in addition to visual examination, for specific containment penetration components susceptible to SCC; (b) the proposed surface examination frequency of once in 10 years is adequate considering no plant-specific operating experience of SCC; and (c) the proposed programs and examination method enhancement are in accordance with the GALL-SLR Report recommendations to adequately manage this aging effect during the subsequent period of extended operations.

The staff also noted that SLRA Table 3.5.1 claimed that items 3.5.1-038 and 3.5.1-039, also associated with the further evaluation recommended in SRP-SLR Section 3.5.2.2.1.6, are not applicable because these items apply to BWRs only. The staff evaluated Dominion's non-applicability claim, and finds it acceptable because SLRA Table 3.5.1, items 3.5.1-038 and 3.5.1-039, only apply to BWR containment suppression chamber shell and vent line bellows, respectively, and the Surry containments are PWR designs that do not incorporate these components.

Based on the programs identified, the staff concludes that Dominion's programs meet SRP-SLR Section 3.5.2.2.1.6 criteria. For those AMR items associated with SLRA Section 3.5.2.2.1.6, as amended, the staff concludes that the SLRA is consistent with the GALL-SLR Report and that Dominion 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, 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 girders, buttresses) of containment structures exposed to an air-outdoor or groundwater/soil environment. Dominion stated that aging effects due to freeze-thaw are not applicable in inaccessible areas and a plant-specific program is not required. The staff evaluated Dominion's claim against the criteria in SRP-SLR Section 3.5.2.2.1.7 and finds it acceptable because: (1) the concrete mix designs contain an air-entraining admixture capable of entraining 3 to 5 percent air in accordance with ASTM-C260, "Standard Specification for Air-Entraining Admixtures for Concrete, and plant operating experience has not identified any aging effects related to freeze-thaw in accessible areas; therefore, a plant-specific program is not needed; and (2) the Structures Monitoring program and the ASME Section XI, Subsection IWL program will opportunistically confirm the absence of aging effects by examining normally inaccessible structural components when scheduled maintenance work and planned plant modifications permit access, and will evaluate observed aging effects in accessible areas that could be indicative of degradation in inaccessible areas.

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, 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, which will be managed by the ASME Section XI, Subsection IWL

program. The staff reviewed Dominion's proposal against the criteria in SRP-SLR Section 3.5.2.2.1.8.

The staff noted that augmented inspections for alkali-silica reaction (ASR) incorporated into the ASME Section XI, Subsection IWL program include visual examination for pattern cracking with darkened crack edges, water ingress, and misalignment to identify conditions that could be indicative of ASR; such conditions would be addressed in the corrective action program. The staff also noted that plant operating experience has not identified any indications of ASR; this was based on testing of concrete cores from samples of the Surry concrete structures including Unit 2 containment, in a research study performed in 1988. The staff further noted that, in the ASME Section XI, Subsection IWL program, evaluations of accessible areas provide the basis for extrapolation to the expected conditions of inaccessible areas, and assessment of potential degradation in such areas.

In its review of components associated with item 3.5.1-012, the staff finds that Dominion has met the further evaluation criteria, and Dominion's proposal to manage the effects of aging using the ASME Section XI, Subsection IWL program is acceptable because: (1) plant operating experience has not identified any indications of ASR; (2) the augmented inspections for ASR performed every 5 years under the ASME Section XI, Subsection IWL program will be capable to identify conditions that could be indicative of ASR in accessible areas; (3) the ASME Section XI, Subsection IWL program provides evaluation of conditions in inaccessible areas if ASR is indicated in accessible areas; and (4) a plant-specific AMP is not needed.

Based on the program identified, the staff concludes that Dominion's program meets SRP-SLR Section 3.5.2.2.1.8 criteria. For those AMR items associated with SLRA Section 3.5.2.2.1.8, the staff concludes that the SLRA is consistent with the GALL-SLR Report and that Dominion has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.2.1.9 Increase in Porosity and Permeability Due to Leaching of Calcium Hydroxide and Carbonation

SLRA Section 3.5.2.2.1.9, as amended by Dominion's SLRA Change Notice 3, dated June 10, 2019 (ADAMS Accession No. ML19168A028), associated with SLRA Table 3.5-1, item 3.5.1-014, addresses increase in porosity and permeability; 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 a water-flowing environment. Dominion stated that a plant-specific program is not required to manage this aging effect in inaccessible areas. The staff reviewed Dominion's proposal against the criteria in SRP-SLR Section 3.5.2.2.1.9.

The staff noted from the SLRA, as amended by Change Notice 3, dated June 10, 2019 (ADAMS Accession No. ML19168A028), that the Structures Monitoring program and the ASME Section XI, Subsection IWL program inspect for evidence of leaching of calcium hydroxide and carbonation in accessible, and normally inaccessible structural components when scheduled maintenance work and planned plant modifications permit access. The staff also noted that these AMPs require evaluation of inspection results for the acceptability of inaccessible areas when conditions exist in accessible areas that could indicate the presence of or result in degradation of inaccessible areas. The staff further noted that although plant operating experience has identified some evidence of leaching in accessible areas, Dominion's evaluation

determined that the observed leaching did not adversely impact structural integrity or result in a loss of intended functions of the containment structures.

The staff reviewed Dominion's proposal against the criteria in SRP-SLR Section 3.5.2.2.1.9 and finds it acceptable because: (1) Dominion's evaluation determined that the observed leaching of calcium hydroxide and carbonation in accessible areas did not adversely impact the structural integrity or result in a loss of intended function of the containment structures; therefore, a plant-specific AMP is not needed for inaccessible areas; (2) the Structures Monitoring program and the ASME Section XI, Subsection IWL program inspect for evidence of the aging effect in accessible areas (SLRA AMR item 3.5.1-020, as amended by SLRA Change Notice No. 2 (ADAMS Accession No. ML19095A666)) and require that evaluation of inspection results includes consideration of the acceptability of inaccessible areas when conditions exist in accessible areas that could indicate the presence of, or result in, degradation to inaccessible areas; and (3) the Structures Monitoring program and the ASME Section XI, Subsection IWL program will perform opportunistic inspections of normally inaccessible areas when scheduled maintenance or planned plant modifications permit access.

3.5.2.2.2 Safety-Related and Other Structures and Component Supports

In SLRA Section 3.5.2.2, the applicant further evaluates aging management, as recommended in the GALL-SLR Report, for the containment, structures, and component supports components and provides information concerning how it will manage the applicable aging effects. The staff reviewed the applicant's evaluation of component groups for which the GALL-SLR Report recommends further evaluation against the criteria contained in SRP-SLR Section 3.5.2.2. The following subsections document the staff's review.

3.5.2.2.2.1 Aging Management of Inaccessible Areas

<u>Item 1</u>. SLRA Section 3.5.2.2.2.1, item 1, 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 concrete areas of Groups 1-3, 5, and 7-9 structures; foundation exposed to an air-outdoor or groundwater/soil environment. Dominion stated that aging effects due to freeze-thaw are not applicable in inaccessible areas and a plant-specific AMP is not required. The staff evaluated Dominion's claim against the criteria in SRP-SLR Section 3.5.2.2.2.1, item 1, and finds it acceptable because: (1) the concrete mix designs contain an air-entraining admixture capable of entraining 3 to 5 percent air in accordance with ASTM-C260, "Standard Specification for Air-Entraining Admixtures for Concrete," and plant operating experience has not identified any aging effects related to freeze-thaw in accessible areas; therefore, a plant-specific AMP is not needed; and (2) the Structures Monitoring program will opportunistically confirm the absence of aging effects by examining normally inaccessible structural components when scheduled maintenance work and planned plant modifications permit access, and will evaluate observed aging effects in accessible areas that could be indicative of degradation in inaccessible areas.

<u>Item 2</u>. SLRA Section 3.5.2.2.2.1, item 2, associated with SLRA Table 3.5.1, item 3.5.1-043, addresses cracking due to expansion from reaction with aggregates in inaccessible concrete areas for Groups 1-5 and 7-9 structures and foundation exposed to any environment, which will be managed by the Structures Monitoring program. The staff reviewed Dominion's proposal against the criteria in SRP-SLR Section 3.5.2.2.2.1, item 2.

The staff noted that augmented inspections for alkali-silica reaction (ASR) incorporated into the Structures Monitoring program include visual examination for pattern cracking with darkened

crack edges, water ingress, and misalignment to identify conditions that could be indicative of ASR; such conditions would be addressed in the corrective action program. The staff also noted that plant operating experience has not identified any indications of ASR; this was based on testing of concrete cores from samples of the Surry concrete structures including Unit 1 Condensate Storage Tank Missile Shield and Unit 2 Safeguards Building in a research study performed in 1988. The staff further noted that, in the Structures Monitoring program, evaluations of accessible areas provide the basis for extrapolation to the expected conditions of inaccessible areas and for assessment of potential degradation in such areas.

In its review of components associated with item 3.5.1-043, the staff finds that Dominion has met the further evaluation criteria, and Dominion’s proposal to manage the effects of aging using the Structures Monitoring program is acceptable because: (1) plant operating experience has not identified any indications of ASR; (2) the augmented inspections for ASR performed every 5 years under the Structures Monitoring program will be capable of identifying conditions that could be indicative of ASR in accessible areas; (3) the Structures Monitoring program provides for evaluation of conditions in inaccessible areas based on indications in accessible areas; and (4) a plant-specific AMP is not required.

Based on the program identified, the staff concludes that Dominion’s program meets SRP-SLR Section 3.5.2.2.2.1, item 2 criteria. For those AMR items associated with SLRA Section 3.5.2.2.2.1, item 2 criteria, the staff concludes that the SLRA is consistent with the GALL-SLR Report and that Dominion 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 3.5.2.2.2.1, item 3, associated with SLRA Table 3.5.1, item 3.5.1-044, addresses cracking and distortion due to increased stress levels from settlement for inaccessible concrete areas of structures for all Groups exposed to soil environment, which will be managed by the Structures Monitoring program. SLRA Section 3.2.2.2.1, 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 a water-flowing environment, which will be managed by the Structures Monitoring program. The staff evaluated Dominion’s proposal against the criteria in SRP-SLR Section 3.5.2.2.2.1, item 3.

The staff reviewed UFSAR Section 2.4.3.5 and noted that settlement was not a concern at the Surry site based on the site survey conducted in May 1975. The staff also noted that a followup survey program was continued over the next 2 years to further monitor site elevations. The followup survey program indicated that a small amount of heave had occurred in the vicinity of both containment structures; however, the differential movement between safety-related structures was below the allowable tolerance of 0.5 inch.

In its review of components associated with items 3.5.1-044 and 3.5.1-046, the staff finds that Dominion has met the further evaluation criteria, and Dominion’s proposal to manage the effects of aging using the Structures Monitoring program is acceptable because: (1) Dominion does not credit a dewatering system at Surry except for the containment; (2) accessible concrete components for in-scope structures are monitored by the Structures Monitoring program to confirm the absence of any visible effects due to settlement; (3) a site survey conducted in May 1975, and the followup survey program, indicated that site settlement was not a problem, and the differential movement between safety-related structures was below the allowable tolerance of 0.5 inch; and (4) inspection of structural interfaces showed no visible evidence of

differential displacements, and the Structures Monitoring program will continue to monitor structures for indications of settlement.

Based on the program identified, the staff concludes that Dominion's program meets SRP-SLR Section 3.5.2.2.2.1, item 3 criteria. For those AMR items associated with SLRA Section 3.5.2.2.2.1, item 3, the staff concludes that the SLRA is consistent with the GALL-SLR Report and that Dominion 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 4</u>. SLRA Section 3.5.2.2.2.1, item 4, as amended by Dominion's SLRA Change Notice 3, dated June 10, 2019 (ADAMS Accession No. ML19168A028), associated with SLRA Table 3.5.1, item 3.5.1-047, addresses increase in porosity and permeability and loss of strength due to leaching of calcium hydroxide and carbonation in inaccessible concrete areas of Groups 1-5 and 7-9 structures, exterior above-grade and below-grade, and foundation exposed to a water-flowing environment, which will be managed by the Structures Monitoring program. Dominion stated that a plant-specific AMP is not required to manage this aging effect in inaccessible areas. The staff evaluated Dominion's proposal against the criteria in SRP-SLR Section 3.5.2.2.2.1, item 4.

The staff noted from the SLRA, as amended by Change Notice 3, dated June 10, 2019, that the Structures Monitoring program inspects for evidence of leaching of calcium hydroxide and carbonation in accessible and normally inaccessible structural components when scheduled maintenance work and planned plant modifications permit access. The staff also noted that the Structures Monitoring program requires evaluation of inspection results for the acceptability of inaccessible areas when conditions exist in accessible areas that could indicate the presence of or result in degradation of inaccessible areas. The staff further noted that although plant operating experience has identified some evidence of leaching in accessible areas, Dominion's evaluation determined that the observed leaching did not adversely impact structural integrity or intended functions of the containment structures.

In its review of components associated with item 3.5.1-047, the staff finds that Dominion has met the further evaluation criteria, and Dominion's proposal to manage the effects of aging using the Structures Monitoring program is acceptable because: (1) Dominion's evaluation determined that the observed leaching of calcium hydroxide and carbonation in accessible areas has no impact on the intended function; therefore, a plant-specific AMP is not needed for inaccessible areas; (2) the Structures Monitoring program inspects for evidence of the aging effect in accessible areas and requires that evaluation of inspection results includes consideration of the acceptability of inaccessible areas when conditions exist in accessible areas that could indicate the presence of, or result in degradation to, inaccessible areas; and (3) the Structures Monitoring program will perform opportunistic inspections of normally inaccessible areas when scheduled maintenance or planned plant modifications permit access.

Based on the program identified, the staff concludes that Dominion'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 Dominion 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, item 3.5.1-048, addresses reduction of strength and modulus of elasticity due to elevated temperature in concrete of Groups 1-5 structures exposed to an air-indoor uncontrolled environment. Dominion stated that this item is not applicable. The staff evaluated Dominion'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 and UFSAR Section 9.5.1 (1) Surry's concrete temperatures are kept below the GALL-SLR Report recommended threshold limits of 150 °F for general areas and 200 °F for local areas, and (2) review of operating experience has identified no issues related to elevated temperatures affecting concrete structures; therefore, the 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 concrete areas of Group 6 structures exposed to any environment. Dominion stated that aging effects due to freeze-thaw are not applicable in inaccessible areas and a plant-specific AMP is not required. The staff evaluated Dominion's claim against the criteria in SRP-SLR Section 3.5.2.2.2.3, item 1, and finds it acceptable because: (1) the concrete mix designs contain an air-entraining admixture capable of entraining 3 to 5 percent air in accordance with ASTM-C260, "Standard Specification for Air-Entraining Admixtures for Concrete," and plant operating experience has not identified any aging effects related to freeze-thaw in accessible areas; therefore, a plant-specific AMP is not needed; and (2) the Structures Monitoring program (which includes Group 6 structures, which are addressed in the Inspection of Water-Control Structures Associated with Nuclear Power Plants program) will opportunistically confirm the absence of aging effects by examining normally inaccessible structural components when scheduled maintenance work and planned plant modifications permit access and will evaluate observed aging effects in accessible areas that could be indicative of degradation in inaccessible areas, and (3) underwater inspections of water-control structures are periodically conducted using divers.

Item 2. SLRA Section 3.5.2.2.2.3, item 2, associated with SLRA Table 3.5.1, item 3.5.1-050, addresses cracking due to expansion from reaction with aggregates in inaccessible concrete areas of Group 6 structures and in foundation exposed to any environment, which will be managed by the Structures Monitoring program. The staff reviewed Dominion's proposal against the criteria in SRP-SLR Section 3.5.2.2.2.3, item 2.

The staff noted that augmented inspections of alkali-silica reaction (ASR) incorporated into the Structures Monitoring program (which includes Group 6 structures, which are addressed in the Inspection of Water-Control Structures Associated with Nuclear Power Plants program) include visual examination for pattern cracking with darkened crack edges, water ingress, and misalignment to identify conditions that could be indicative of ASR; such conditions would be addressed in the corrective action program. The staff also noted that plant operating experience has not identified any indications of ASR; this was based on testing of concrete cores from samples of the Surry concrete structures, including the intake canal in a research study performed in 1988. The staff further noted that the Structures Monitoring program evaluations of accessible areas provide the basis for extrapolation to the expected condition of inaccessible areas and the assessment of potential degradation in such areas.

In its review of components associated with item 3.5.1-050, the staff finds that Dominion has met the further evaluation criteria, and Dominion’s proposal to manage the effects of aging using the Structures Monitoring program is acceptable because: (1) plant operating experience has not identified any indications of ASR; (2) the augmented inspections for ASR performed every 5 years under the Structures Monitoring program will be capable of identifying conditions that could be indicative of ASR in accessible areas; (3) the Structures Monitoring program provides evaluation of conditions in inaccessible areas based on conditions in accessible areas; and (4) a plant-specific AMP is not required.

Based on the program identified, the staff concludes that Dominion’s program meets SRP-SLR Section 3.5.2.2.2.3, item 2, criteria. For those AMR items associated with SLRA Section 3.5.2.2.2.3, item 2, the staff concludes that the SLRA is consistent with the GALL-SLR Report and that Dominion 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, as amended by Dominion’s SLRA Change Notice 3, dated June 10, 2019 (ADAMS Accession No. ML19168A028), associated with SLRA Table 3.5.1, item 3.5.1-051, addresses increase in porosity and permeability and loss of strength due to leaching of calcium hydroxide and carbonation in inaccessible concrete areas of Group 6 structures, exterior above-grade and below-grade, foundation, and interior slab exposed to a water-flowing environment, which will be managed by the Structures Monitoring program. Dominion stated that a plant-specific program is not required to manage this aging effect in inaccessible areas. The staff reviewed Dominion’s proposal against the criteria in SRP-SLR Section 3.5.2.2.2.3, item 3.

The staff noted from the SLRA, as amended by Change Notice 3, dated June 10, 2019, the Structures Monitoring program inspects for evidence of leaching of calcium hydroxide and carbonation in accessible and normally inaccessible structural components when scheduled maintenance work and planned plant modifications permit access. The staff also noted that the Structures Monitoring program requires evaluation of inspection results for the acceptability of inaccessible areas when conditions exist in accessible areas that could indicate the presence of or result in degradation of inaccessible areas. The staff further noted that although plant operating experience has identified some evidence of leaching in accessible areas, Dominion’s evaluation determined that the observed leaching did not adversely impact structural integrity or intended functions of the containment structures.

In its review of components associated with item 3.5.1-051, the staff finds that Dominion has met the further evaluation criteria and Dominion’s proposal to manage the effects of aging using the Structures Monitoring program is acceptable because: (1) Dominion’s evaluation determined that the observed leaching of calcium hydroxide and carbonation in accessible areas has no impact on the intended function; therefore, a plant-specific AMP is not needed for inaccessible areas; (2) the Structures Monitoring program inspects for evidence of the aging effect in accessible areas and requires that evaluation of inspection results includes consideration of the acceptability of inaccessible areas when conditions exist in accessible areas that could indicate the presence of, or result in degradation to, inaccessible areas; and (3) the Structures Monitoring program will perform opportunistic inspections of normally inaccessible areas when scheduled maintenance or planned plant modifications permit access.

Based on the program identified, the staff determines that Dominion’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 Dominion 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, AMR 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, which Dominion claimed is not applicable; and aluminum and SS support members, welds, bolted connections, and support anchorage to building structure exposed to air or condensation, which will be managed by the ASME Section XI, Subsection IWF program and the Structures Monitoring program. Dominion amended this SLRA section by letter dated April 2, 2019. The staff reviewed Dominion's proposal against the criteria in SRP-SLR Section 3.5.2.2.2.4.

For SLRA AMR item 3.5.1-052, Dominion claimed that the corresponding item in the GALL-SLR Report is not applicable because there are no SS tank liners within the scope of subsequent license renewal. The staff reviewed the SLRA and noted that the aging effects for SS containment sump liner will be managed using SLRA AMR item 3.5.1-100. The staff also noted that other SS and steel tanks that are within the scope of subsequent license renewal are addressed as components of the applicable mechanical system, not as Groups 7 or 8 structures. Therefore, the staff finds Dominion's claim acceptable.

Dominion stated that for AMR item 3.5.1-099, the applicability is limited to SS support components exposed to air because there are no aluminum support components that are within the scope of the ASME Section XI, Subsection IWF program. The staff noted that a search of Dominion's UFSAR and SLRA confirmed that no in-scope aluminum support components exposed to air or condensation are present in the ASME Section XI Class 1, 2, 3, or Class MC piping support systems, except for those SS components listed in SLRA 3.5.2-36 and 3.5.2-38 and AMR item 3.5.1-099.

The staff also noted that Dominion identified pitting, crevice corrosion or cracking for SS piping components exposed to air or condensation during the plant-specific operating experience review and proposed to manage the aging effects for applicable SS components by enhancing the applicable AMP. Consistent with the SRP-SLR Section 3.5.2.2.2.4 recommendations, Dominion enhanced the Structures Monitoring program, in part, by integrating the recommended inspection frequency methodology and sample inspection criteria defined in GALL-SLR Report AMP XI.M36 for SS and aluminum components.

In its review of components associated with AMR items 3.5.1-099 and 3.5.1-100, the staff finds that Dominion has met the further evaluation criteria, and Dominion's proposal to manage the effects of aging using the ASME Section XI, Subsection IWF program and the Structures Monitoring program is acceptable because it uses periodic visual examinations and/or surface examination methods that are capable of detecting loss of material and cracking due to SCC prior to a loss of intended function of the associated SS components.

Based on the programs identified, the staff concludes that Dominion's programs meet SRP-SLR Section 3.5.2.2.2.4 criteria. For those AMR items associated with SLRA Section 3.5.2.2.2.4, the

staff concludes that the SLRA is consistent with the GALL-SLR Report and that Dominion 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, as amended by Change Notice 3, is associated with SLRA Table 3.5.1 AMR item 3.5.1-053 and addresses cumulative fatigue damage or cracking due to fatigue in component support members, anchor bolts, and welds for Groups B1.1, B1.2, and B1.3 component supports. SRP-SLR Section 3.5.2.2.2.5 states that evaluations involving time-dependent fatigue, cyclical loading, or cyclical displacement for these components are TLAAs as defined in 10 CFR 54.3, only if a CLB fatigue analysis exists. Dominion stated that there are no TLAAs associated with component support members, anchors bolts, and welds for Groups B1.1 and B1.2. Dominion further stated that Group B1.3 component supports are associated with BWRs, and therefore, are not applicable to Surry. The staff noted that Surry is a PWR, also search of the Dominion's UFSAR and SLRA confirmed that there are no TLAAs as defined by 10 CFR 54.3 for these components for Surry. Therefore, the staff finds Dominion's claim that AMR item 3.51-053 is not applicable to Surry acceptable.

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, as amended by SLRA Change Notice 1, dated January 29, 2019 (ADAMS Accession No. ML19042A137), addresses Dominion's further evaluation of aging effects of irradiation on concrete and steel structures near the reactor vessel in two subparts:

- Irradiation Damage of the Concrete Biological Shield (CBS) Wall
- Irradiation of the Reactor Vessel (RV) Steel Support Assemblies

<u>Irradiation Damage of the Concrete Biological Shield (CBS) Wall</u>

SLRA Section 3.5.2.2.2.6, as amended by Change Notice 1, associated with SLRA Table 3.5.1, AMR item 3.5.1-97, addresses Dominion's further evaluation related to reduction of strength and mechanical properties of the CBS Wall (or primary shield wall) exposed to irradiation (neutron and gamma radiation, and radiation-induced heating) in air – indoor uncontrolled environment. Based on its evaluation, which stated that the neutron fluence/gamma dose and temperature levels on the CBS Wall are less than the respective SRP-SLR threshold limits, Dominion concluded that a plant-specific AMP to manage the effect of irradiation on the reinforced-concrete CBS wall is not required. The staff reviewed Dominion's conclusion against the criteria in SRP-SLR Section 3.5.2.2.2.6, which states in part:

> [B]ased on literature review of existing research, radiation fluence limits of 1×10^{19} neutrons/cm^2 neutron radiation and 1×10^8 Gy (1×10^{10} rad) gamma dose are considered conservative radiation exposure levels beyond which concrete material properties may begin to degrade markedly….
>
> Further evaluation is recommended of a plant-specific program to manage aging effects of irradiation if the estimated (calculated) fluence levels or irradiation dose received by any portion of the concrete from neutron (fluence cutoff energy E > 0.1 MeV) or gamma radiation exceeds the respective threshold level during the subsequent period of extended operation or if plant-specific OE [operating

experience] of concrete irradiation degradation exists that may impact intended functions.

The staff noted that SLRA Section 3.5.2.2.2.6, as amended by Change Notice 1, states that the effective full-power years (EFPY) value for Surry Units 1 and 2 for 80 years of operation is 68 EFPY (as explained in SLRA Section 4.2.1, which the staff reviewed and evaluated in SER Section 4.2.1); however, 72 EFPY was used conservatively to estimate the fluence/dose values on the CBS Wall. The SLRA states that, based on the plant-specific study in EPRI Report 3002013051 (specific example plant utilized is Surry Power Station (Surry)), the estimated (calculated) neutron fluence and gamma dose incident on the CBS Wall surface (attenuated from the reactor vessel (RV) internal diameter (ID) to outer diameter and through the Neutron Shield Tank (NST) at the RV beltline region) are 1.18×10^{13} neutrons/cm^2 (E > 1.0 MeV) and 2.75×10^8 rads, respectively, at the end of the subsequent period of extended operation. The SLRA states that the maximum water temperature in the NST is 125 ºF. It also states that the expected maximum concrete temperature due to gamma dose radiation heating to be 125.1 °F, which is approximately the same as the maximum ambient temperature of 125 °F at the CBS Wall concrete surface. The SLRA also states that no plant-specific operating experience of concrete irradiation degradation has been identified.

During its in-office and onsite audits (ADAMS Accession Nos. ML19128A079 and ML19169A329, respectively) for the irradiation effects technical issue, the staff reviewed Dominion's technical reports, calculations, drawings, and other documentation related to SLRA Section 3.5.2.2.2.6 with regard to evaluation of the CBS Wall. Subsequent to theses audits and review of Change Notice 1 for SLRA Section 3.5.2.2.2.6, the staff needed additional information regarding evaluation of irradiation effects for the CBS Wall, as discussed below.

In its review, the staff noted that SLRA Section 3.5.2.2.2.6, as amended by Change Notice 1, states: "no plant-specific OE [operating experience] of concrete irradiation degradation has been identified." The amended SLRA also states: "[t]here is no plant-specific or industry operating experience of reactor vessel steel support assembly irradiation degradation that would impact a license renewal intended function." However, it was not clear what monitoring or inspection actions may have formed the bases for the above plant-specific operating experience statements, which resulted in issuance of an RAI. RAI 3.5.2.2.2.6-2 and Dominion's response are documented in ADAMS Accession No. ML19204A357.

During its evaluation of Dominion's response to RAI 3.5.2.2.2.6-2, the staff noted that the accessible portions of the CBS Wall, the RV sliding foot supports, and the neutron shield tank are periodically inspected by one or more of the following programs.

- Structures Monitoring (SLRA B2.1.34) on a 5-year frequency
- ASME Section XI, Subsection IWF (SLRA B2.1.31) on a 10-year frequency
- External Surfaces Monitoring (SLRA B2.1.23) each refueling outage

The staff also noted that inspection results that fail to meet acceptance criteria are entered into the corrective action program. The staff further noted that Dominion's "review of condition reports generated over the past ten years for these programs identified no degradation due to irradiation" that would impact a license renewal intended function for the above components. Additionally, the staff reviewed the operating experience for the above SLRA AMPs for irradiation-induced aging mechanisms and resulting aging effects and found none for concrete in the CBS Wall compartment (reactor cavity area) or steel/ Lubrite® lubricant in the NST and RV support assemblies. The staff finds Dominion's response to RAI 3.5.2.2.2.6-2 acceptable

because Dominion clarified the inspection actions which provided the basis that to-date that there is no known plant-specific operating experience of irradiation-induced aging effects for the CBS Wall compartment and steel/Lubrite®™ lubricant in the NST/RV support assemblies.

During its review of SLRA Section 3.5.2.2.2.6, as amended by Change Notice 1, the staff noted two apparent discrepancies of fluence values cited in the SLRA and issued an RAI. RAI 3.5.2.2.2.6-4 and Dominion's response are documented in ADAMS Accession No. ML19204A357. In its response, Dominion clarified and corrected administrative errors in the plant-specific fluence values cited in the SLRA as follows: (a) The maximum neutron fluence at the CBS wall surface at the beltline region for 72 EFPY inadvertently provided as 1.18 x 10^{13} n/cm^2 (E > 1.0 MeV) was corrected to read 1.18 x 10^{13} n/cm^2 (E > 0.1 MeV); and (b) The fast neutron fluence at the outside surface of the RV inadvertently provided as 5.0 x 10^{19} n/cm^2 (E > 1.0 MeV) was corrected to read 5.0 x $10^{\mathbf{18}}$ n/cm^2 (E > 1.0 MeV). Dominion also clarified that the maximum fast neutron fluence on the NST at the RV-side surface of 3.42 x 10^{18} n/cm^2 (E > 1 MeV) at 68 EFPY reported in the SLRA is for Unit 1 and that the corresponding value for Unit 2 at 68 EFPY is 3.82 x 10^{18} n/cm^2 (E > 1 MeV).

The staff finds Dominion's response to RAI 3.5.2.2.2.6-4 and corresponding changes to SLRA Section 3.5.2.2.2.6 acceptable for the following reasons: (a) Dominion confirmed and corrected the typographical errors in two neutron fluence values cited in SLRA Section 3.5.2.2.2.6, as amended by Change Notice 1; and (b) Dominion clarified the fast neutron value for the Unit 2 NST on the RV-side at 68 EFPY is bounding compared to that of Unit 1 for fracture toughness calculation.

The staff noted that conclusions made in SLRA Section 3.5.2.2.2.6 with respect to the need for aging management of the concrete CBS Wall depends, in part, on the projected fluence and gamma dose at the end of the subsequent period of extended operation. The staff reviewed the estimates for neutron fluence and gamma dose provided by Dominion in SLRA Section 3.5.2.2.2.6, as amended by Change Notice 1, for the inner surface of the CBS Wall at the axial height of the limiting fluence from the RV (i.e., at the traditional belt-line region). The initial estimates of concrete neutron fluence, gamma dose, and temperature (including radiation-induced heating) provided by Dominion in SLRA Section 3.5.2.2.2.6 for this location were based on EPRI Report 3002013051, "Irradiation Damage of the Concrete Biological Shield that Utilizes a Neutron Shield Tank."

During the audits, the staff noted regions of the CBS Wall above and below the NST that may also be regions of interest, in addition to the belt-line region because they are not shielded by the NST. During its SLRA review, the staff determined that the information provided in the SLRA was insufficient to determine adequacy of the model(s) used for fluence/dose estimates and whether reasonable assurance exists that the limiting gamma dose and neutron fluence values for concrete were identified, with sufficient margin and conservatism to accommodate uncertainties in validation of fluence analysis methodologies directly applicable to CBS Wall regions of interest. This resulted in issuance of an RAI. RAI 3.5.2.2.2.6-1 and Dominion's response are documented in ADAMS Accession No. ML19204A357.

During its evaluation of the response to RAI 3.5.2.2.2.6-1, Request 1, the staff noted that Dominion specifically provided additional information regarding the methodology used to obtain the fluence/dose estimates in EPRI Report 3002013051, as well as additional Surry plant-specific analyses, documented in the audited Westinghouse Letter Report LTR-REA-18-88, Revision 2. The EPRI Report 3002013051, as noted in the RAI response, is generic for a 3-loop PWR study (specific example plant utilized being Surry)

baselined on H.B. Robinson transport analyses performed by Oak Ridge National Laboratories and TransWare for 72 EFPY, but not reviewed by NRC. The plant-specific Westinghouse analyses, performed to determine the fluence on the NST and CBS Wall, used an amended version (in radial direction) of the RG 1.190-compliant Westinghouse model used to predict the RV fluence for RV integrity evaluations. This model, which is documented in WCAP-18028-NP, Revision 0, “Extended Beltline Pressure Vessel Fluence Evaluations Applicable to Surry Units 1 & 2” (ADAMS Accession No. ML18085A160), is based on NRC-approved Westinghouse RV fluence analysis methods (as documented in WCAP-14040-A, Revision 4, “Methodology Used to Develop Cold Overpressure Mitigating System Setpoints and RCS Heatup and Cooldown Limit Curves” (ADAMS Accession No. ML050120209). Furthermore, in its response to RAI 3.5.2.2.2.6-1, Request 2, Dominion reported the Westinghouse projected neutron fluence and gamma dose values for 72 EFPY for the areas of the CBS Wall at the beltline region (Area 1); and, above the NST (Area 2) and below the NST (Area 3), which the staff identified as potentially limiting due to unshielded streaming radiation effects. Dominion also stated that key limiting fluence results for the NST on the RV-side for 68 EFPY are summarized in the response to RAI 3.5.2.2.2.6-4 (Request 3), as previously noted above.

The staff finds that the methodology described in Dominion’s response to RAI 3.5.2.2.2.6-1, Request 1, used for fluence/dose estimates for the CBS Wall and NST acceptable as follows:

- Information from the Surry plant-specific analyses was used to support a fluence estimate at the CBS Wall surface just above the NST. This location corresponds to the location of the maximum calculated neutron fluence and gamma dose from the audited Westinghouse model, because this location is the closest non-shielded area of the CBS Wall to the centerline of the core. While RG 1.190 is only valid for the traditional beltline region of the RV, an appropriate level of detail was provided for the geometry and composition of the relevant structures, although Dominion performed some homogenization of regions that are not expected to have a significant effect on the fluence for the regions laterally adjacent to the RPV. Consistent with the WCAP-14040-A methodology, the axial flux in the core was characterized with a burnup weighted average of the respective power distributions from individual operating cycles, with the most recent operating cycle considered to be representative of future operating cycles. The staff finds Dominion’s approach to be reasonable given that any significant impacts due to changes in operations would need to be addressed by the licensee prior to making such changes.
- The uncertainty in the fluence near the top of the NST may be significantly higher than that for the traditional beltline region due to the lack of validation and the modeling simplifications near the top of the core. However, the underlying transport methodology has been shown to be capable of achieving uncertainties of no more than about 13 percent for fast neutron fluence (as stated in WCAP-14040-A) and there is a reasonable level of detail in the extended model. Furthermore, the uncertainty or error in the neutron fluence predictions provided for the CBS Wall would need to exceed 200 percent to approach the lower limit of 1×10^{19} n/cm^2 indicated in SRP-SLR Section 3.5.2.2.2.6 as a conservative upper bound of neutron fluence for concrete without degradation. Therefore, the NRC staff finds that there is reasonable assurance that the uncertainties in the neutron fluence prediction will be accommodated by the available margin to the SRP-SLR damage threshold for neutron fluence. A similar line of reasoning applies to the gamma radiation predictions, but the predicted gamma dose would have to increase by approximately 30-fold to approach the corresponding SRP-SLR damage threshold for gamma dose (1×10^8 Gy). The significantly larger

margin to the SRP-SLR gamma damage threshold helps offset the fact that the gamma dose prediction capabilities of the WCAP-14040-A methodology has not been as well validated as the neutron fluence prediction capabilities.

- The staff did not find it necessary to perform a detailed enough review to draw any conclusions about EPRI Report 3002013051. The agreement in gamma dose predictions between EPRI Report 3002013051 and the Westinghouse results in Dominion's response to RAI 3.5.2.2.2.6-1, Request 2, however, provides additional confidence in the ability of the Westinghouse methodology to calculate the gamma dose with reasonable accuracy, despite its relative lack of validation for this purpose. (The methodology validation as described and reviewed by the NRC in WCAP-14040-A focused on validation of the fast neutron fluence predictions.) However, as previously noted, EPRI Report 3002013051 has not been submitted to the NRC for review or endorsement, and the staff did not find it necessary to do a full review of the EPRI report calculations. As a result, this SER does not represent a generic endorsement of the findings in this report.

During its evaluation of Dominion's response to RAI 3.5.2.2.2.6-1, Request 2, the staff noted that, based on the Westinghouse analyses, limiting values of neutron fluence and gamma dose for the CBS Wall were in Area 2 (region immediately above the NST located below the RV nozzles) of Unit 2. The staff also noted that the limiting values of fluence/dose projected to the end of the subsequent period of extended operation (based on 72 EFPY) for the CBS Wall is 3.17×10^{18} n/cm^2 (E > 0.1 MeV) for neutron fluence, and 2.97×10^6 Gy for gamma dose. The staff further noted that the limiting value of neutron fluence on the RV-side of the NST for 68 EFPY was for Unit 2 at 3.82×10^{18} n/cm^2 (E > 1.0 MeV).

The staff finds Dominion's response to RAI 3.5.2.2.2.6-1, Request 2, acceptable because it provided the key limiting results for neutron fluence and gamma dose for the regions of interest of the CBS Wall and RV-side of the NST needed for staff evaluation of irradiation aging effects for the subsequent period of extended operation.

Based on review of SLRA Section 3.5.2.2.2.6, as amended by letters dated January 29, 2019, and July 17, 2019, and responses to RAIs 3.5.2.2.2.6-1, 3.5.2.2.2.6-2, and 3.5.2.2.2.6-4, the staff finds that Dominion has met the further evaluation criteria in SRP-SLR 3.5.2.2.2.6 for the CBS Wall concrete and Dominion's determination that a plant-specific AMP is not required, to manage aging effects of irradiation on the CBS Wall during the subsequent period of extended operation, is acceptable for the following reasons: (a) the calculated limiting neutron fluence on the CBS Wall of 3.17×10^{18} n/cm^2 (E > 0.1 MeV, 72 EFPY) is less than the SRP-SLR threshold limit of 1×10^{19} n/cm^2 (E > 0.1 MeV); (b) the calculated limiting gamma dose on the CBS Wall of 2.97×10^8 rad (2.97×10^6 Gy) for 72 EFPY is less than the SRP-SLR threshold limit of 1×10^{10} rad; (c) the use of 72 EFPY for fluence/dose estimates of the CBS Wall is conservative since SLRA Section 4.2.1 (evaluated by the staff in SER Section 4.2.1) conservatively estimated it to be 68 EFPY for 80 years of operation; (d) the maximum temperature in the CBS Wall concrete including radiation-induced heating of 125.1 ^oF is less than the SRP-SLR Section 3.5.2.2.2.2 limit of 200 ^oF for local areas and 150 ^oF for general areas with sufficient margin; (e) there is no plant-specific operating experience to date of irradiation degradation; and (f) the accessible areas of the CBS Wall will continue to be monitored by visual inspection on a 5-year interval using the Structures Monitoring program (SLRA Section B2.1.34).

<u>Conclusion</u>. For the CBS Wall associated with SLRA Section 3.5.2.2.2.6, the staff concludes that a plant-specific AMP is not required to manage aging effects due to irradiation, and, as

such, Dominion's evaluation for CBS Wall meets the SRP-SLR Section 3.5.2.2.2.6 criteria and its SLRA is consistent with the GALL-SLR Report. Further, Dominion has demonstrated that the effects of aging due to radiation for Units 1 and 2 CBS Wall 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).

Irradiation of the Reactor Vessel (RV) Support Steel Assembly

SLRA Section 3.5.2.2.2.6, as amended by Change Notice 1, includes a new subsection entitled, "Irradiation of the Reactor Vessel Support Steel Assembly," which describes Dominion's further evaluation to address the aging effect of loss of fracture toughness due to neutron irradiation embrittlement of the RV steel support structures and components, which includes the RV sliding feet assembly and the NST, exposed to an air-indoor uncontrolled environment. Based on a fracture mechanics evaluation and noting that there is no plant-specific operating experience to date of the aforementioned aging effect, Dominion concluded such an aging effect does not require aging management at Surry for the subsequent period of extended operation. The staff evaluated Dominion's conclusion based on the GALL-SLR Report and SRP-SLR principles.

Dominion's evaluation references a 1986 Project Topical Report (PTR), "Reactor Vessel Support for Unit No 1 Surry Power Station, Life Extension Evaluation of the Reactor Vessel Support," including Appendix 3, "Resistance to Brittle Fracture of the Neutron Shield Tank Materials," for estimates of fast neutron fluence of E > 1.0 MeV at the outside surface of the RV to be 5.0×10^{18} n/cm^2 (as corrected by response to RAI 3.5.2.2.2.6-3) for 76.8 EFPY. Based on that estimate, the amended SLRA Section 3.5.2.2.2.6 states that the inner surface (RV-side) of the NST has E > 1.0 MeV fluence of 4.5×10^{18} n/cm^2 and 3.42×10^{18} n/cm^2 for 76.8 EFPY and 68 EFPY, respectively. The amended SLRA Section 3.5.2.2.2.6 further states that the PTR fracture mechanics evaluation predates resolution of Generic Safety Issue 15 (GSI-15), "Radiation Effects on Reactor Pressure Vessel Supports," as reported in NUREG-0933.

Based on the PTR calculations, analyses, references, and subsequent reevaluations, Dominion determined that peak stresses for design basis loads associated with the Units 1 and 2 RV support assemblies (NST, sliding shoes) are below the critical (allowable) stress limits for calculated through-wall and/or surface flaws based on projected fracture toughness to the end of the subsequent period of extended operation. Dominion, therefore, concluded that a plant-specific program is not required to manage the aging effect. SLRA Section 3.5.2.2.2.6, as amended by Change Notice 1, also concluded that the RV support components subject to irradiated environment would perform their intended functions through the subsequent period of extended operation without being managed for these aging effects.

The staff, however, noted that the information presented in the SLRA, as amended by Change Notice 1, was not sufficient to allow the NRC staff to determine the adequacy of the fracture mechanics evaluation and whether reasonable assurance exists that the relevant aging effects have been identified for the RV support steel assembly (sliding feet and NST). To evaluate Dominion's claims of structural adequacy at the RV structural support and sliding shoe assemblies, and management of applicable aging effects associated with irradiated materials and components, the staff performed in-office and onsite audits (at Surry and Dominion Headquarters) (ADAMS Accession Nos. ML19169A329 and ML19128A079, respectively).

During the audits, the staff examined reports and calculations relevant to RV structural support assemblies and interviewed Dominion's representatives to obtain additional information related

to the disposition of irradiation effects on these structures. The staff needed additional information regarding the following:

- Management of aging effects for the RV structural support assemblies. Furthermore, the SLRA did not address the effects of aging due to potential stress corrosion cracking due to irradiation and/or condensation on the six RPV sliding support blocks made of maraged steel and loss of their sliding mechanical function due to thermal and irradiation breakdowns of the lubricant used in the sliding support assembly blocks.
- Whether SPS had a plant-specific structural consequence analysis in the current licensing basis (CLB), like those cited in NUREG- 0933, which postulates failure of one or more Surry RV support assemblies as it appeared to be implied in Surry SLRA Section 3.5.2.2.2.6, as amended by Change Notice 1.
- Whether the NST RPV structural support system exposed to the entire energy spectrum of the reactor cavity (i.e., E > 0.1 MeV) would remain capable of carrying critical loads even if cracking and loss of material aging effects were to occur.
- Whether the RPV sliding steel shoe assemblies constructed in part by Vascomax® maraged steel and fitted with Lubrite® lubricant exposed to plant-specific radiation fluence/gamma dose levels would continue to maintain their intended function, so that that there would be no additional applied stresses imposed on the NSTs and RVs during the subsequent period of extended operation.

Subsequent to the audits, for SLRA Section 3.5.2.2.2.6, as amended by SLRA Change Notice 1, with respect to the fluence/dose values presented in the SLRA and to resolve the above concerns, the NRC staff needed additional information, and issued multiple RAIs reviewed, evaluated, and resolved below. RAIs 3.5.2.2.2.6-3, 3.5.2.2.2.6-5, and 3.5.2.2.2.6-7 through 3.5.2.2.2.6-10 and Dominion's responses are documented in ADAMS Accession No. ML19204A357.

In its SLRA Change Notice 1, Dominion appeared to imply that plant safety could be maintained even when the RPV structural steel supports sustained damage. Dominion based its statement on conclusion made in GSI-15, "Radiation Effects on Reactor Pressure Vessel Supports" resolution, as reported in NUREG- 0933. The staff, concerned with the inclusion of such statement in the revised SLRA, requested through RAI 3.5.2.2.2.6-3 a clarification of whether there is a plant-specific consequence analysis that postulates damage or failure for one or more of the RPV structural steel support assemblies in the current licensing basis (CLB), like those cited in NUREG- 0933.

The staff found Dominion's response to RAI 3.5.2.2.6-3 acceptable because it confirmed that no structural consequence analysis postulating RV support failure exists in the Surry CLB.

As noted above, SLRA Section 3.5.2.2.2.6, as amended by Change Notice 1, provides a supplemental discussion for the applied tensile stresses for the area of the NST subject to high neutron fluence. It states that the PTR calculated applied (tensile) stresses were compared to the critical stresses derived from a fracture toughness evaluation. The PTR evaluation was performed to determine the structural integrity of the Unit 1 NST for 100 calendar years (76.8 EFPY) of operation. The evaluation concluded: (a) the applied tensile stresses calculated from the peak tensile stresses for the associated loads of the NST were demonstrated to be below the critical stress for a through-wall flaw and a surface flaw; and (b) loss of fracture toughness due to irradiation embrittlement is not an AERM for the NST. The supplemental

discussion in SLRA Change Notice 1 further states that the PTR evaluation was updated for subsequent license renewal, which validated that the original PTR evaluation is bounding for: (a) the Unit 2 NST; (b) the applied tensile stresses for both units through the subsequent period of extended operation; and (c) the 80-year (68 EFPY) projected fluence values at the inner surface of the NSTs.

To ensure the adequacy of fracture toughness calculations, the staff requested Dominion in RAI 3.5.2.2.2.6-5, Request 1, to identify and justify the specific loads, loading conditions, and loading combinations used or omitted as not applicable in the PTR and PTR updated fracture mechanics evaluation(s) of the NST for all calculated applied stresses.

In its response, Dominion noted that design loads were based on the load combination of gravity (dead) and square root sum of the squares seismic and LOCA loads. Based on the described load combination, Dominion calculated the resulting tensile stresses.

During its evaluation of Dominion's response to RAI 3.5.2.2.2.6-5, Request 1, the staff noted that for the above-described loading combination, Dominion followed the updated LOCA (longer duration of branch line breaks) and dead weight loads (heavier RV Heads Replacements) described in the audited documents ETE-SLR-2018-1270 and CEM-0142, similarly combining these as noted in the audited PTR design basis methodology. The staff notes the realism in the said loading combination, which implicitly considers through the square root sum of the squares combination, a normal distribution for the uncertainty of dynamic loads, with vertical and horizontal accelerations acting simultaneously, as noted in UFSAR 1.2.2, "Structures." The staff also notes the added conservatism of using a "bump" factor of 1.5 to provide an additional safety factor in the estimation of seismic forces discussed in CEM-0142 and confirmed in UFSAR Section 1.4.2, "Performance Standards."

The staff finds Dominion's response to RAI 3.5.2.2.2.6-5, Request 1, acceptable because it realistically and conservatively estimated applied loads in calculating the critical stress of 6.28 ksi (tensile) used in the fracture toughness calculations.

The staff was concerned that loss of material (corrosion) of the NST could affect estimation of applied tensile stresses. Therefore, in RAI 3.5.2.2.2.6-5, Request 2, the staff requested Dominion to confirm whether all applied stresses considered for the fracture mechanics calculations of the NST were augmented by including the 10 percent reduction in steel section for potential loss of material due to corrosion as promulgated in the audited Technical Report CE-0087.

In its response, Dominion stated that the 10 percent reduction in steel section for loss of material due to corrosion was not considered when calculating the applied stresses for fracture toughness evaluation. To this end, Dominion stated that SLRA Section B2.1.34, "Structures Monitoring," reviewed and evaluated in SER Section 3.0.3.2.27, will be enhanced (Enhancement 9 in SLRA Section B2.1.34 and License Renewal Commitment No. 34-9 in SLRA Table A4.0-1) to specify that loss of material due to corrosion on the external surfaces of NST will be evaluated to ensure that it will continue to perform its intended functions, including structural support of the RV, during the subsequent period of extended operation.

The staff finds Dominion's response to RAI 3.5.2.2.2.6-5, Request 2, acceptable because it provided a new enhancement and a corresponding commitment listed in SLRA Table A4.0-1, "Subsequent License Renewal Commitments," to SLRA Section B2.1.34," Structures Monitoring," as reported in Enclosure 5 of Dominion's letter dated July 17, 2019.

The staff noted that SLRA Section 3.5.2.2.2.6, as amended by Change Notice 1, did not include sufficient information addressing the methodology used in the updated evaluation of the PTR, including derivation of the critical (allowable) and applied (controlling) tensile stresses to assess the NST structural integrity exposed to the entire energy spectrum (more than E > 0.1 MeV) of streaming radiation from the RV during the subsequent period of extended operation. Therefore, the staff issued RAI 3.5.2.2.2.6-5, Request 3.

In its response to RAI 3.5.2.2.2.6-5, Request 3, Dominion stated that its updated PTR evaluation uses its fracture mechanics methodology consistent with the ASME Code, Section XI, Appendix A, and the fracture mechanics approach in Figure 4-3 of NUREG-1509. The methodology evaluates the stress intensity factors formulas to calculate the critical stress corresponding to when brittle fracture would occur for both a postulated surface flaw and postulated through-wall flaw. Dominion detailed its methodology as follows:

(1) Dominion started with ASME Code, Section XI, Figure A-4200-1, which plots the fracture toughness, K_{Ic} and K_{Ia} (or its synonymous K_{IR}), versus the temperature curve for the RV and RV support steel material. Dominion chose the K_{Ia} curve, which is the more conservative curve from the ASME Code, representing the lowest bound value on all test data used. This value was 26.7 ksi√in. By using the lowest value in the K_{Ia} curve, Dominion is assuming a very high embrittlement and a large shift in RT_{NDT}.

(2) Dominion then applied a safety margin of √2 based on ASME Code, Section XI, IWB-3600, resulting in a new K_{Ia} value of 18.9 ksi√in.

(3) Dominion then used this resulting new K_{Ia} value and calculated the corresponding critical stress for a 1/4T postulated surface flaw and postulated through-wall flaw using ASME Code, Section XI formulas. The resulting critical stress value for the 1/4T postulated surface flaw was approximately 16 ksi. The resulting critical stress value for the postulated through-wall flaw was approximately 8 ksi.

(4) These critical stress values were compared to the calculated limiting maximum applied tensile stress of 6.28 ksi.

Dominion concluded its evaluation by stating that because the design basis tensile stresses are below the critical stresses, the critical regions of the NST are protected against brittle fracture; therefore, the NST will maintain structural integrity for the subsequent period of extended operation.

The staff finds the first step in the methodology acceptable because Dominion used the K_{Ia} curve, which is the more conservative curve, of ASME Code, Section XI, Figure A-4200-1. The staff noted that using the lowest value in the K_{Ia} curve would account for the embrittlement shift of the NST caused by multiple factors (e.g., neutron fluence, copper content). The staff finds the second step in the methodology acceptable because Dominion conservatively applied a safety margin for a pressure-retaining component, although the NST is not a pressure-retaining component. The staff finds the third step in the methodology acceptable because in its review of the methodology, the staff performed independent calculations using ASME Code, Section XI formulas and verified the calculated critical stress values for the 1/4T postulated surface flaw and postulated through-wall flaw. The staff finds the fourth step in the methodology acceptable because there is sufficient margin between the calculated maximum applied tensile stress and the allowable stress. Therefore, the staff finds Dominion's response to RAI 3.5.2.2.6-5, Request 3, acceptable because Dominion performed its fracture mechanics evaluation related to loss of fracture toughness due to irradiation for 80 years of operation using a conservative

and appropriate methodology that was in accordance with NUREG-1509 and ASME Code Section XI.

In its response to RAI 3.5.2.2.2.6-5, Request 4, Dominion confirmed that its fracture mechanics evaluation accounts for the effects of irradiation embrittlement of the weld metals used and developed heat affected zones in the NST. The response stated that its PTR evaluation imposed special quality requirements on the materials that included:

- drop weight tests of the deposited weld metal to be employed in welding the A-516 Grade 60 plate with a nil-ductility temperature of -40 °F
- Charpy values of -40 °F in the heat affected zone of welded test pieces

The staff finds the response to RAI 3.5.2.2.2.6-5, Request 4, acceptable because the initial fracture toughness (initial RT_{NDT}) of the NST is based on weld and heat affected zone considerations. Additionally, as discussed above, Dominion is using the lower bound K_{Ia} curve, which accounts for these in the initial fracture toughness of the NST with a large embrittlement shift.

Based on the discussion and evaluation of the response to RAI 3.5.2.2.2.6-5 above, the staff finds that there is reasonable assurance that loss of fracture toughness due to irradiation embrittlement is not an AERM for the NST for Units 1 and 2.

Regarding chromated fluid leakage from the NST, the staff, following reviews of operating experience during its audits (ADAMS Accession Nos. ML19046A433, ML19128A079, and ML19169A329) and its concern about NST's ability to fulfill its intended shielding function as described in UFSAR 11.3.2.1, "Primary Shielding," issued RAI 3.5.2.2.2.6-7. In RAI 3.5.2.2.2.6-7, Request 1, the staff requested Dominion to discuss, considering the Unit 2 NST fluid leakage, how a leaking NST could ensure the CBS Wall structural integrity, prevent its overheating and dehydration, and limit the activation of plant components within the reactor containment.

In its response, Dominion stated that each unit's NST "is maintained full" of chromated fluid during plant operations. Dominion also stated that for each unit "[a] surge tank connected to the shield tank via surge line piping [...] functions to provide an expansion/contraction volume for the neutron shield tank" chromated fluid. Dominion further stated that, "if addition of water to the neutron shield system is required, operators remotely open a valve to add water from the component cooling [water] system in accordance with plant procedures." To compensate for the Unit 2 NST leakage, Dominion stated that, "[h]istorically, a maximum of two additions to the Unit 2 surge tank have been required annually to maintain the level within the normal operating range."

The staff reviewed UFSAR Section 9.4.3.4, "Neutron Shield Tank Cooling Water System Description," Table 9.4-6, 'Neutron Shield Tank Cooling Water System Component Design Data," and Figure 9.4-4, "Neutron Shield Tank Cooling Water System," and verified the existence of two NST surge tanks (one for each unit). The staff also verified that each "surge tank accommodates thermal expansion of the neutron shield water." The staff further verified that each NST system has a supply line from the component cooling water system connected to the surge line piping. The staff confirmed that "cool water from the component cooling water system or the chilled water system is circulated through the neutron shield tank cooler, cooling the heated neutron shield tank chromated" fluid to 125 °F or less. The staff also confirmed in UFSAR Dominion's provisions of NST system fluid replenishment when "[a] level

sensor on the surge tank sends a signal to the control room to indicate low system level. A solenoid-operated valve is actuated from the control room to replenish the system from the component cooling water system."

The staff noted 1.5 to 2.0 gallons of daily leakage of chromated fluid from the NST of Unit 2 in the above-reviewed operating experience and requested, in RAI 3.5.2.2.2.6-7, Request 2, that Dominion clarify which AMPs and AMRs would be used to manage the impact of chromated fluid leakage from NST on external surfaces of affected components. In its response, Dominion stated that chromated fluid leakage on NST external steel surfaces, including its skirt, does not pose a loss of material risk as chromates are effective corrosion inhibitors and the wetted steel surfaces are systematically inspected through implementation of SLRA AMP B2.1.34, "Structures Monitoring," at a 5-year frequency.

The staff reviewed the SLRA as amended by Change Notice 3, dated June 10, 2019 (ADAMS Accession No. ML19168A028), and confirmed that SLRA Table 3.1.2-3 includes AMR Table 1, item 3.5.1-077, to manage the effects of aging for loss of material of NST external surfaces, including the NST support skirt, with SLRA AMP B2.1.34, "Structures Monitoring," at a 5-year frequency. The staff also confirmed that Dominion modified AMR Table 1, item 3.5.1-077, by including aging effects for loss of material for the NST structure.

The staff finds Dominion's response to 3.5.2.2.2.6-7, Requests 1 and 2, acceptable for the following reasons. Dominion has in place a process with governing procedures to continuously monitor the level of NST while maintaining its internal fluid temperature 125 °F or less, which is the highest temperature that the attached CBS Wall would be exposed to. Moreover, the 125 °F CBS Wall temperature is less than the 150 °F general area temperature specified in SRP-SLR Section 3.5.2.2.2.2 to be the limiting normal operation or any other long-term period temperature before loss of concrete strength occurs. Dominion also designated in Change Notice 3, SLRA AMP B2.1.34, "Structures Monitoring," to manage loss of material for the external surfaces of the NST and its appurtenances during the subsequent period of external operation.

In addition to the above concerns for external loss of material to the NST, the staff was also concerned about potential loss of material internal to the NST. The staff noted that Dominion selected the continued use of sampling AMP, "Closed Treated Water System," described in SLRA Section B2.1.12, to inspect for loss of material internal to the NST. The staff expressed its concerns in RAI 3.5.2.2.2.6-8 that Dominion selected GALL-SLR Report AMP XI.M21A, "Closed Treated Water System," guidance to manage the NST internal environment for loss of material due to heated chromated water subject to radiation at the recommended 10-year frequency of inspection. In its three-part request in RAI 3.5.2.2.2.6-8, the staff requested Dominion to (a) verify the inspection frequency of the NST fluid, (b) discuss results of chemical analyses and trends of the chromated fluid chemistry over the life of the plant, and (c) discuss potential issues of heat and streaming radiation on the chromated fluid.

In its response to Request 1, Dominion stated that every refueling outage (RFO) includes a chemical analysis of a "representative sample" to assess the water chemistry of the NST. In its response to Request 2, Dominion stated that chromated water samples are examined for concentrations of iron as a byproduct of NST internal steel corrosion, for chloride and fluoride ions that assist corrosion, and for chromates that inhibit corrosion. Dominion also stated that since 2001, chloride and fluoride concentrations remained far below the procedural limits, whereas chromate concentration for passivation of steel at both NSTs over time remained above minimum station requirements. Iron concentrations tracking, as a diagnostic parameter of active NST internal corrosion, began in 2005, and remained at the instrumentation detection

level except for two samples (one each for Unit 1 and Unit 2 NSTs) that were marginally above that detection level, thus requiring no further action. In its response to Request 3, Dominion reaffirmed that each NST's chromated fluid remains at less than 125 °F during operations due to cooling and natural circulation of the fluid within each NST, and that the constancy of fluid chemical analysis coupled with the lack of any corrective actions is an indication that radiation has not affected the chromated fluid chemistry.

During its evaluation of Dominion's response to RAI 3.5.2.2.2.6-8, Requests 1 and 2, the staff confirmed that the reported chemical concentrations of chloride, fluoride, iron, chromates, and monitoring frequencies were within the limits of the audited procedure CH-93.400, "Closed Cooling Water [CCW] Chemistry," for the NSTs, with additional provisions taken when these control parameters specifying the desired chemistry are outside the prescribed limits. The staff noted that UFSAR 9.4.3.1, "Component Cooling Water System Description," include details on the addition of potassium chromate for corrosion inhibition and potassium hydroxide and potassium dichromate for pH control, for an effective chromated water chemistry.

During its evaluation of Dominion's response to RAI 3.5.2.2.2.6-8, Request 3, regarding the effects of heat on the NST fluid chemistry, the staff notes the previous resolution of Request 1 to RAI 3.5.2.2.2.6-8, stating that NST chromated fluid temperature control is achieved through constant circulation of the fluid through the NST confined coolers.

The staff also evaluated Dominion's response to RAI 3.5.2.2.2.6-8, Request 3, regarding radiation effects on the NST fluid and the effects of dissolved oxygen on corrosion rates and on the thin adherent iron oxide formed at the NST inner steel (anodic) surface. To this end, the staff notes little changes if any to the NST fluid chemistry, that:

- Contains a naturally circulating corrosion inhibiting chromated fluid at a relatively constant temperature of 125 °F or less.
- The contained chromated fluid consistently exhibits minimal (barely susceptible at the instrumentation detection level) corrosion products (iron) observed during each chromated water chemical analysis.
- Has formed a protecting oxide film on its inner surface that appears to mitigate potential aging effects due to corrosion.
- A potential degradation of the NST ASTM-516 Grade 60 steel plate is highly unlikely, in the event of its direct contact with dissolved hydrogen, as noted in NUREG/CR-7153, "Expanded Materials Degradation Analysis (EMDA) Volume 3: Aging of Reactor." The yield and tensile strengths of the NST steel plate are below 80,000 and 90,000 psi, respectively, rendering such steels relatively resistant to cracking when exposed to dissolved hydrogen as discussed in "Production Engineering" by Economides.

The staff finds Dominion's response to 3.5.2.2.2.6-8 acceptable for the following reasons: (a) it has maintained the chromated fluid at concentrations inhibiting corrosion, (b) the chromated fluid demonstrated its effectiveness in maintaining both the control and diagnostic parameters within prescribed limits, and (c) there is no operating experience of adverse effects of streaming radiation during each sampling of the chromated fluid chemistry.

The staff reviewed SLRA Section 3.5.2.2.2.6, as amended by Change Notice 1, to determine whether radiation can degrade the Lubrite® lubricant used at the RV steel support feet assemblies and adversely impact the intended function of the sliding feet. Since SLRA

Section 3.5.2.2.2.6 did not appear to address whether the lubricant used at Surry RV steel support feet assemblies was designed to withstand potential effects of expected radiation neutron fluence/gamma dose over 80 years of operation, the staff needed additional information, and issued RAI 3.5.2.2.2.6-9.

In its response to RAI 3.5.2.2.2.6-9 (ADAMS Accession No. ML19204A357), Dominion stated that Lubrite®™ Type II (Lubrite®) lubricant is used in the RV sliding foot assemblies. This lubricant comprises graphite and an organic binder that is recommended by the manufacturer to be adequate for service temperature of 500 ºF and fast neutron exposure up to 1.5×10^{18} n/cm^2. Dominion also stated that after installation of the lubricant, the organic binder was baked off leaving "…essentially pure graphite…." In its discussion, Dominion also included information based on discussions with the manufacturer of Lubrite® that stated the expected neutron exposure through 80 years of plant operation are not expected to result in dimensional changes of the graphite lubricant. Dominion further stated that the fluence levels at the RV sliding foot assemblies are projected to receive orders of magnitude less fluence through 80 years of operation. As per the fluence analysis performed for the Surry SLRA, the projected neutron fluence (E > 1.0 MeV) for the location of the RV sliding foot assemblies is estimated at less than 5×10^{17} n/cm^2. Additionally, Dominion indicated that there is no plant-specific operating experience that has detected the loss of mechanical function for the RV sliding foot assemblies due to Lubrite® degradation, noting that this aging effect is being managed by the ASME Section XI, Subsection IWF program (SLRA Section B2.1.31).

During its evaluation of Dominion's response to RAI 3.5.2.2.2.6-9, the staff noted that the lubricant initially consists of both graphite and an organic binder; the organic binder is baked off during the installation process for the lubricant and therefore is no longer a component of the lubricant. Additionally, the staff noted that Dominion's predicted neutron fluence (E > 1.0 MeV) at the locations of the RV sliding foot assemblies (less than 5×10^{17} n/cm^2) is lower than the manufacturer recommended fluence for the Lubrite® lubricant (1.5×10^{18} n/cm^2). Dominion also stated that it has not observed signs of Lubrite® degradation leading to loss of mechanical function at the RV sliding foot assemblies. The staff's independent review of literature noted that National Aeronautics and Space Administration (NASA) Report SP-8053, "Nuclear and Space Radiation Effects on Materials," dated June 1970, provided tests results that show graphite properties do not experience significant aging effects until neutron fluence greater than 1×10^{19} n/cm^2 based on E > 1.0 keV, which includes effects of both fast and slow neutrons. The staff further notes that the response to RAI 3.5.2.2.2.6-1 states the limiting fluence (E > 0.1 MeV, which is an energy level practically considered to include slow and fast neutrons) for the CBS Wall above the NST is 3.17×10^{18} n/cm^2. This is approximately in the area of the RV support feet where the Lubrite® is used, although the fluence is expected to be closer to 5×10^{18} n/cm^2 (E > 0.1 MeV) because the RV support feet are closer to the reactor core than the CBS Wall, which is lower than the threshold in the NASA Report for the neutron energy spectrum including fast and slow neutrons. Therefore, the staff notes that the expected fluence on the Lubrite® for 80 years of operation is less than what may degrade it.

The staff finds Dominion's response to RAI 3.5.2.2.2.6-9 acceptable as follows. The organic binder in the lubricant was baked off as part of the installation process, therefore leaving no organic material to degrade. Further, the expected fast neutron fluence (E > 1 MeV) at the Lubrite® for the subsequent period of extended operation of 5×10^{17} n/cm^2 is less than the corresponding manufacturer recommended fluence threshold limit of 1.5×10^{18} n/cm^2, with sufficient margin. Additionally, the expected neutron fluence at energy levels including fast and slow neutrons of 5×10^{18} n/cm^2 (E > 0.1 MeV) is less than the related degradation threshold of 1×10^{19} n/cm^2 cited in NASA Report SP-8053, with sufficient margin. These above data indicate

that Lubrite® will receive a lower fluence than what may degrade it with sufficient margin. Finally, Dominion has not detected loss of mechanical function of the Lubrite® during inspections conducted under Dominion's ASME Section XI, Subsection IWF program. Based on the response to the RAI and ongoing implementation of inspections to detect loss of mechanical function of Lubrite®, the staff has reasonable assurance that the Lubrite® will not lose its lubricating function due to neutron fluence effects on the lubricant during the subsequent period of extended operation under the conditions described by Dominion.

Section 15.6.2.2.1, "Reactor Vessel Support," of the UFSAR states that the RV is supported on NST by six sliding block assemblies made in part of maraged steel. The audited PTR identified the maraged steel to be Vascomax®. The aforementioned UFSAR section also states that the maraged steel components were ultrasonically tested for flaws to MIL-1-8950 standard and verified by X-rays not to exceed 1/32 inch. During its review, the staff identified the need for additional information regarding the potential for stress corrosion cracking (SCC) of maraged steel components of the RV support during the subsequent period of extended operation, which resulted in issuance of RAI 3.5.2.2.2.6-10.

The staff notes that the GALL-SLR Report, in its "Environments" sections, and Tables IX.D and IX.F, state that SCC is highly dependent on the simultaneous presence of three conditions: susceptible material, environment (aqueous, high temperature), and applied tensile loads/stresses. Accordingly, the staff issued RAI 3.5.2.2.2.6-10 to confirm that SCC is not an aging effect that Dominion needs to manage for Vascomax® during the subsequent period of extended operation, and whether the Heresite coating applied to Vascomax® is subjected to aging effects or credited for aging management. During the onsite audit (ADAMS Accession No. ML19169A329), the staff-audited document CE-1653 appeared to suggest that such steel assemblies maybe subject to SCC. In its response, Dominion confirmed that CE-1653 discusses the potential for SCC in Vascomax® steels. However, in this plant-specific application of Vascomax® maraged steel, Dominion stated that stresses in the sliding foot assemblies are below the threshold for SCC "... since the conditions required for crack growth - aqueous environment, high temperatures during operation, etc. are not present."

As noted above, the key elements contributing to SCC as also identified by Dominion in its response to RAI 3.5.2.2.2.6-10, Request 3, are tensile stresses, high temperatures, and aqueous environments. The staff reviewed UFSAR Section 15.6.2.2.1, "Reactor Vessel Support," and noted that the RV sliding foot supports are no longer required to restrain uplift forces because of recently updated LOCA loads. UFSAR Section 14.5.3.4.1, "Reactor Equipment System Model - LOCA Analysis," describes that the reduction in LOCA loads is due to re-evaluation and subsequent increase of opening times in RCS branch line breaks based on an NRC-approved methodology. UFSAR Section 15.6.2.2.1 concludes that "[t]he combined seismic and LOCA loads when added to dead weight are not sufficient to create uplift in the supports." Dominion also stated that Heresite coating is not credited for corrosion control and does not have a license renewal intended function; therefore, aging management of Heresite is not required.

The staff finds Dominion's response to RAI 3.5.2.2.2.6-10 acceptable as follows. Based on the alternatively developed LOCA forces combined with other existing design basis loads as outlined in the UFSAR, SCC could not occur because two out of three conditions necessary for SCC, namely tensile service-stresses and a wet (aqueous) environment, do not exist. Further, the Heresite coating does not require aging management because it is not within the scope of license renewal.

Based on review of the SLRA Section 3.5.2.2.2.6, as amended by letters dated January 29, 2019, and July 17, 2019, related amendment to SLRA Section B2.1.34 and SLRA Table 3.1.2-3 by letters dated June 10, 2019, and July 17, 2019, and responses to RAIs 3.5.2.2.2.6-3, 3.5.2.2.2.6-5, and 3.5.2.2.2.6-7 through 3.5.2.2.2.6-10, the staff determines that Dominion has met the intent of SRP-SLR further evaluation criteria consistent with GALL-SLR Report principles. The staff also determines that Dominion's conclusion that a plant-specific program is not required to manage aging effects of irradiation for the RV support steel assembly (NST and sliding feet assembly) for the period of extended operation is acceptable for the following reasons:

(a) Dominion's fracture mechanics evaluation and fluence evaluations provided reasonable assurance that loss of fracture toughness due to irradiation or other irradiation aging effects will not occur during the subsequent period of extended operation.

(b) Dominion's proposal to continue to manage aging effects for loss of material and loss of mechanical function using the ASME Section XI Subsection IWF, Structures Monitoring, and Closed Treated Water Systems AMPs (as applicable) provide reasonable assurance that applicable aging effects will be adequately managed.

(c) Dominion has not identified to date plant-specific operating experience of degradation due to irradiation aging effects.

(d) Dominion has adequately addressed the staff's concerns related to all potential aging effects consistent with SRP-SLR and GALL-SLR Report principles.

<u>Conclusion</u>. Based on the programs identified to manage loss of material and loss of mechanical function of the RV support structural steel assemblies (NST and the sliding foot assemblies), the staff determines that Dominion's program(s) and AMRs in the SLRA, as amended by SLRA Change Notices 1 and 3, are acceptable. Further, the staff determines Dominion has adequately assessed through evaluations that a plant-specific program is not needed to manage the effects of aging due to radiation (loss of fracture toughness due to irradiation embrittlement) for Units 1 and 2 NST structural steel support assemblies and RV support sliding feet assemblies. Therefore, Dominion's evaluation of the NST and RV support sliding feet meets the intent of SRP-SLR further evaluation criteria, consistent with the GALL-SLR Report principles. As such, the staff concludes that the SLRA is consistent with the GALL-SLR Report to manage the effects of aging for the NST structural steel and RV support sliding feet assemblies. The staff also concludes that Dominion 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 period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.2.3 Quality Assurance for Aging Management of Nonsafety-Related Components

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 3.5.2-38 that are either not consistent with or not addressed in the GALL-SLR Report and that are usually denoted with generic notes F through J. To efficiently capture and identify multiple applicable AMR items in each subsection, and because these AMR items often are not associated with a Table 1 item, the subsections are organized by applicable AMR section and then by material and environment combinations.

For component type, material, and environment combinations not evaluated in the GALL-SLR Report, the staff reviewed the applicant's evaluation to determine whether the applicant has demonstrated that it will adequately manage the effects of aging in a way that maintains the intended function(s) consistent with the CLB for the subsequent period of extended operation. The following sections document the staff's evaluation.

3.5.2.3.1 Containment Structure – Summary of Aging Management Evaluation – SLRA Table 3.5.2-5

<u>Stainless Steel Spent Fuel Pool Liner Plates Exposed to Treated Borated Water</u>.

SLRA Table 3.5.2-5, as supplemented by a letter dated April 2, 2019 (ADAMS Accession No. ML19095A666), states there is a TLAA for cumulative fatigue damage of stainless steel spent fuel pool liner plate exposed to treated borated water, which cites generic note H. The staff confirmed that there is a TLAA, as documented in SLRA Section 4.7.4, for this component and material. The staff's evaluation of the TLAA for stainless steel spent fuel pool liner fatigue is documented in SER Section 4.7.4.

<u>Cerafiber®, Cera Blanket, Marinite Board Fire Stops Exposed to Uncontrolled Indoor Air</u>.

SLRA Table 3.5.2-37 states that loss of material, change in material properties, cracking, and separation for Cerafiber®, Cera blanket, and Marinite® board fire stops exposed to uncontrolled indoor air will be managed by the Fire Protection program. The AMR item cites generic note J.

The staff reviewed the associated items in the SLRA and considered whether the aging effects proposed by Dominion constitute all of the applicable aging effects for this component, material, and environment description. The staff reviewed material descriptions available on manufacturer websites, which state:

- Cerafiber® is a fiberization melt of alumina and silica.
- Cera® blanket is a ceramic fiber refractory blanket made from long refractory fibers.
- Marinite® boards are thermal structural boards formed from calcium silicate with inert fillers and reinforcing agents.

Based on its review of material descriptions available on manufacturer websites, the staff finds that Dominion has identified all applicable aging effects for this component, material, and environment combination.

The staff noted that Cerafiber®, Cera® blanket, and Marinite® are similar to polymeric materials as described in the GALL-SLR Report. The staff also noted that GALL-SLR Report item A-797,

an AMR item for generic polymeric materials, cites loss of material and cracking as applicable aging effects. The staff also noted that, for the above materials, changes in material properties would likely manifest in the form of the remaining aging effects. The staff finds Dominion's proposal to manage the effects of aging acceptable because periodic visual inspections can be capable of identifying loss of material, change in material properties, cracking, and separation.

<u>3M Interam, Pyrocrete, Bio-Fire Fire Wraps and Coatings Exposed to Uncontrolled Indoor Air</u>.

SLRA Table 3.5.2-37 states that loss of material, change in material properties, cracking, delamination, and separation for 3M Interam, Pyrocrete, and BIO™ K-10 Mortar fire wraps and coatings exposed to uncontrolled indoor air will be managed by the Fire Protection program. The AMR item cites generic note J.

The staff reviewed the associated items in the SLRA and considered whether the aging effects proposed by Dominion constitute all of the applicable aging effects for this component, material, and environment description. The staff reviewed material descriptions available on manufacturer websites, which state:

- 3M™ Interam™ is an endothermic mat with either aluminum or stainless steel backing. Upon exposure to high temperatures, the material releases chemically-bound water. 3M™ Interam™ is composed of alumina trihydrate, refractory ceramic fibers, polymeric materials, water, and aluminum.
- Pyrocrete is a cement-based, cementitious fireproofing.
- BIO™ K-10 Mortar is a rapid hardening gypsum/cement compound.

The staff reviewed the aging effects for aluminum and stainless steel components exposed to uncontrolled indoor air identified in the GALL-SLR Report and noted that the applicable aging effects are limited to cracking and loss of material. The staff also reviewed the aging effects for polymeric components identified in the GALL-SLR Report (A-797) and noted that the applicable aging effects are hardening or loss of strength, loss of material, and cracking; however, since 3M™ Interam™ is backed by aluminum or stainless steel, hardening or loss of strength is not a concern. The staff also reviewed the aging effects for cementitious components exposed to air identified in the GALL-SLR Report (AP-253) and noted that the applicable aging effects are limited to cracking and loss of material. Based on its review of material descriptions available on manufacturer websites, the staff finds that Dominion has identified all applicable aging effects for this component, material, and environment combination.

The staff noted that, for the above materials, changes in material properties would likely manifest in the form of the remaining aging effects identified by Dominion. The staff finds Dominion's proposal to manage the effects of aging acceptable because periodic visual inspections can be capable of identifying loss of material, cracking, delamination, and separation.

<u>Thermo-Lag and Marinite Radiant Energy Shields Exposed to Uncontrolled Indoor Air</u>.

SLRA Table 3.5.2-37 states that loss of material, change in material properties, cracking, delamination, and separation for Thermo-lag® and Marinite® radiant energy shields exposed to uncontrolled indoor air will be managed by the Fire Protection program. The AMR item cites generic note J.

The staff reviewed the associated items in the SLRA and considered whether the aging effects proposed by Dominion constitute all of the applicable aging effects for this component, material, and environment description. The staff reviewed material descriptions available on manufacturer websites, which state:

- Thermo-lag® is a thermally-activated, intumescent epoxy material.
- Marinite® board is a high-density insulation formed from calcium silicate, inert fillers, and reinforcing agents. Marinite® is non-corroding and water resistant.

The staff noted that Thermo-lag® is similar to a polymeric material and GALL-SLR Report item A-797, an AMR item for generic polymeric materials, which cites hardening or loss of strength, loss of material, and cracking as applicable aging effects. Since epoxies are not pliable, hardening or loss of strength are not applicable as aging effects for Thermo-lag®. The staff also noted that Marinite® board is used as structural steel fireproofing and that EPRI TR-1006756 states that important parameters to maintain for structural fireproofing include thickness of material and continuity of material. Based on its review of material descriptions available on manufacturer websites, the GALL-SLR Report, and EPRI TR-1006756, the staff finds that Dominion has identified all applicable aging effects for this component, material, and environment combination.

The staff noted that, for the above materials, changes in material properties would likely manifest in the form of the remaining aging effects. The staff finds Dominion's proposal to manage the effects of aging acceptable because periodic visual inspections can be capable of identifying loss of material, cracking, delamination, and separation.

3.6 <u>Aging Management of Electrical and Instrumentation and Controls</u>

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, "Electrical and Instrumentation and Control Systems," as being subject to an AMR. SLRA Table 3.6.1, "Summary of Aging Management Programs for the Electrical Components," is a summary comparison of the applicant's AMR results with those provided in the GALL-SLR Report for electrical components.

3.6.2 Staff Evaluation

Table 3.6-1, below, summarizes the staff's evaluation of the component groups listed in SLRA Section 3.6 and addressed in the GALL-SLR Report.

Table 3.6-1 Staff Evaluation for Electrical Components Evaluated in the GALL-SLR Report

Component Group (SRP-SLR Item No.)	Staff Evaluation
3.6.1-001	Consistent with the GALL-SLR Report (see SER Section 3.6.2.2.1)
3.6.1-002	Consistent with the GALL-SLR Report
3.6.1-003	Consistent with the GALL-SLR Report
3.6.1-004	Not applicable to Surry (see SER Section 3.6.2.2.3)

Component Group (SRP-SLR Item No.)	Staff Evaluation
3.6.1-005	Not applicable to Surry (see SER Section 3.6.2.2.3 and 3.6.2.3.2)
3.6.1-006	Not applicable to Surry (see SER Section 3.6.2.2.3 and 3.6.2.3.2)
3.6.1-007	Not applicable to Surry (see SER Section 3.6.2.2.3 and 3.6.2.3.2)
3.6.1-008	Consistent with the GALL-SLR Report
3.6.1-009	Consistent with the GALL-SLR Report
3.6.1-010	Consistent with the GALL-SLR Report
3.6.1-011	Consistent with the GALL-SLR Report
3.6.1-012	Consistent with the GALL-SLR Report
3.6.1-013	Consistent with the GALL-SLR Report
3.6.1-014	Consistent with the GALL-SLR Report
3.6.1-015	Not applicable to Surry
3.6.1-016	Not applicable to Surry
3.6.1-017	Not applicable to Surry (see SER Section 3.6.2.3.1)
3.6.1-018	Not applicable to Surry (see SER Section 3.6.2.3.1)
3.6.1-019	Consistent with the GALL-SLR Report
3.6.1-020	Consistent with the GALL-SLR Report
3.6.1-021	Consistent with the GALL-SLR Report (see SER Sections 3.6.2.2.3 and 3.6.2.3.2)
3.6.1-022	Not applicable to Surry (see SER Section 3.6.2.3.1)
3.6.1-023	Consistent with the GALL-SLR Report
3.6.1-024	Consistent with the GALL-SLR Report
3.6.1-025	This item number is not used in the SRP-SLR nor in the GALL-SLR Report
3.6.1-026	This item number is not used in the SRP-SLR nor in the GALL-SLR Report
3.6.1-027	Not applicable to Surry
3.6.1-028	This item number is not used in the SRP-SLR nor in the GALL-SLR Report
3.6.1-029	Not applicable to Surry (see SER Section 3.6.2.2.2)
3.6.1-030	Not applicable to Surry (see SER Section 3.6.2.2.2)
3.6.1-031	Not applicable to Surry (see SER Section 3.6.2.2.2)
3.6.1-032	Not applicable to Surry

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 Surry 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 documents any RAIs issued and the staff's conclusions. The remaining subsections in SER Section 3.6.2.1 document the review of components that required additional information or otherwise require explanation.

(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 Tables 3.6.2-1 through 3.6.2-3 that the applicant determined to be consistent with the GALL-SLR Report. The staff audited and reviewed the information in the SLRA. The staff did not repeat its review of the matters described in the GALL-SLR Report. The staff verified that the material presented in the SLRA was applicable and that the applicant identified the appropriate GALL-SLR Report AMRs. For those AMR items the staff found to be consistent with the GALL-SLR Report, and for which no additional evaluation or request for additional information applies, the staff's review and conclusions as documented in the GALL-SLR Report are considered to be the basis for acceptability of the AMR item. The staff's conclusion of "Consistent with the GALL-SLR Report" is documented in SER Table 3.6-1 and no separate writeup is required or provided. The staff did not identify any AMR items that required additional review with an associated writeup.

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

For SLRA Table 3.6-1, items 3.6-1-004, 3.6-1-005, 3.6-1-006, 3.6-1-007, 3.6-1-015, 3.6-1-016, 3.6-1-017, 3.6-1-018, 3.6-1-022, 3.6-1-027, 3.6-1-029, 3.6-1-030, 3.6-1-031, and 3.6-1-032, the applicant claims that the corresponding AMR items in the GALL-SLR Report are not applicable to Surry. The staff reviewed the SLRA and UFSAR and confirmed that the applicant's SLRA does not have any AMR results that are applicable for these items.

3.6.2.2 Aging Management Review Results for which Further Evaluation is Recommended by the GALL-SLR Report

In SLRA Section 3.6.2.2, the applicant further evaluates aging management for certain electrical and instrumentation and controls system components as recommended by the GALL-SLR Report, and provides information concerning how it will manage the applicable aging effects. The staff reviewed the applicant's evaluation of these component groups against the criteria contained in SRP-SLR Section 3.6.2.2. The following subsections document the staff's review.

3.6.2.2.1 Electrical Equipment Subject to Environmental Qualification

SLRA Section 3.6.2.2.1, associated with SLRA Table 3.6.1, item 3.6.1-001, states that TLAAs are evaluated in accordance with 10 CFR 54.3 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, which states that TLAAs as defined in 10 CFR 54.3 are evaluated in accordance with 10 CFR 10 54.21(c)(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 3.6.1, items 3.6.1-029, 3.6.1-030, and 3.6.1-031, addresses 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 outdoor air. Dominion stated that these items are not applicable because there are no in-scope cable bus arrangements at Surry. The staff reviewed Surry electrical arrangement drawings and performed an independent search of the operating experience database and finds Dominion’s statement acceptable because cable bus arrangements are not utilized at Surry.

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 3.6.1, 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, transmission connections, as well as switchyard buses and connections. The criteria in SRP-SLR Section 3.6.2.2.3 state that the GALL-SLR Report recommends further evaluation of a plant-specific AMP to ensure that the aging effects are adequately managed. A discussion of each of these AMR items is provided as follows.

<u>Transmission Conductors Composed of Aluminum, Steel Exposed to Air Outdoor</u>. SLRA item 3.6.1-004 addresses 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 this item is not applicable because Surry does not utilize these components. The staff finds the applicant’s proposal acceptable because the in-scope transmission conductors at Surry are all aluminum conductors (AAC) as verified during the staff’s operating experience (ADAMS Accession No. ML19046A433) and in-office audit Accession No. ML19128A079). According to GALL-SLR Report item 3.6.1-021, AAC transmission conductors do not require an AMP to manage the aging effect of loss of conductor strength due to corrosion.

<u>Transmission Connectors Composed of Aluminum and Steel Exposed to an Air Outdoor Environment</u>. SLRA 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 stated that oxidation and loss of preload are not applicable aging effects for Surry transmission connectors based on Surry design and operating experience.

Dominion stated that at Surry, 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 Surry indicate that increased resistance due to general corrosion and oxidation are not AERMs. The SLRA also stated that Surry transmission connectors are designed and installed using aluminum bolts, nuts, and lock washers that provide vibration absorption and prevent loss of preload because the lock washers are torqued to flatten when installed. Therefore, based on Surry design and as confirmed by operating experience, Dominion concluded that oxidation and loss of preload are not applicable aging mechanisms for Surry transmission connectors.

The staff reviewed the associated items in the SLRA, conducted an audit (ADAMS Accession No. ML19169A329), 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 Surry 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 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 stated that loss of material and increased resistance of connection are not applicable aging effects for Surry switchyard bus and connections.

Dominion stated that Surry uses aluminum tubular switchyard bus supported by post insulators. Connections between switchyard bus and active components, such as circuit breakers, are short lengths of flexible aluminum conductors that are not typically subject to vibration under wind loading. Switchyard bus is not subject to abrasion induced by wind loading due to its rigid mounting.

Dominion further stated that Surry is located in a largely agricultural area on the James River, a fresh to brackish water supply. Salt spray and salt coating have not been experienced on switchyard components at Surry. There are no nearby industrial facilities that produce airborne industrial effluents affecting Surry. Aluminum cable and bus material does not experience any appreciable aging effects in this environment. Aluminum switchyard bus and cable connections are treated with corrosion inhibitors to avoid connection oxidation. Connection hardware includes aluminum and stainless steel. Connections that are assembled using aluminum bolts and nuts do not use lock washers but are torqued to prevent loss of preload. Connections that are assembled using stainless steel bolts and nuts include lock washers and are torqued to prevent loss of preload. Dominion concluded that based on design and confirmed by operating experience, wind-induced abrasion and increased resistance of connection due to oxidation and loss of preload are not applicable aging mechanisms for switchyard bus and connections at Surry.

The staff reviewed the associated items in the SLRA, conducted an audit (ADAMS Accession No. ML19169A329), and confirmed that these aging effects are not applicable for this component, material, and environment combination. The staff 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. 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 AERM at Surry.

Transmission Conductors Composed of Aluminum, Steel Exposed to Air Outdoor. SLRA 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 Surry transmission conductors.

Dominion stated that in-scope transmission conductors operate at distribution voltages (34.5 kV) instead of transmission voltages. They are installed with shorter spans, at lower elevations, and

with less sag than transmission conductors. Thus, they tend to be less affected by wind loading than transmission conductors. Based on design and confirmed by operating experience, wind-induced abrasion is not an applicable aging mechanism for transmission conductors at Surry.

The staff reviewed the associated items in the SLRA and conducted an audit (ADAMS Accession No. ML19169A329). 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 Surry. Therefore, the staff finds that loss of material (wear) of transmission conductors and connections due to wind-induced abrasion is not an AERM at Surry.

Conclusion. Based on its audit and application review, the staff concludes that Dominion has met the SRP-SLR Section 3.6.2.2.3 criteria. For those items that apply to SLRA Section 3.6.2.2.3, the staff finds that the SLRA is consistent with the GALL-SLR Report and that Dominion has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.6.2.2.4 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 Tables 3.6.2-1 through 3.6.2-3 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 3.6.2-1, items 3.6.1-017 and 3.6.1-018, state that increased electrical resistance of connection due to chemical contamination, corrosion, oxidation, fatigue from ohmic heating, thermal cycling, electrical transients, and fatigue caused by frequent fuse removal/manipulation or vibration, of fuse holders (i.e., metallic clamps) exposed to air-indoor controlled or uncontrolled environment is not applicable, and no AMP is proposed. Furthermore, SLRA

Table 3.6.2-1, item 3.6.1-022, states that reduced insulation resistance due to thermal/thermo-oxidative degradation of organics, radiolysis, and photolysis (UV sensitive materials only) of organics, radiation-induced oxidation, and moisture intrusion of fuse holders (i.e., electrical insulation material, Bakelite, phenolic melamine or ceramic, and molded polycarbonate) in air-indoor controlled or uncontrolled environment is not applicable, and no AMP is proposed. The AMR items cite generic note I as well as site-specific notes 5 and 6, stating that Surry in-scope fuse holders are not subject to moisture, contamination, corrosion, vibration, and frequent manipulation.

In SLRA Section 3.6.2.3, Dominion stated that a review of individual fuse holders not part of active equipment was performed, and five fuse holders were identified that require an AMR. Dominion further stated that these five fuse holders are located in air-indoor controlled environment in the control room, emergency switchgear room, or the instrument rack room. Based on walkdowns performed by Dominion, the fuse holders were found to be clean and dry, with no evidence of moisture intrusion, chemical contamination, oxidation, or corrosion. In addition, the fuses operate at low power where no appreciable thermal cycling or ohmic heating occurs. The SLRA stated that the fuses were not subject to frequent manipulation, and due to the location of the fuse holders, vibration is not an applicable aging mechanism. Dominion concluded that based on the installed location, design configuration, operating service conditions, and operating experience, the in-scope fuse holders are not susceptible to the aging effects and mechanisms mentioned in the 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 Dominion’s proposal acceptable based on its review of SLRA 3.6.2.3, as well as an independent search of the operating experience (ADAMS Accession No. ML19046A433). The 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, vibration. Therefore, Surry in-scope fuse holders do not experience aging effects requiring aging management, and the provisions of GALL-SLR Report AMP XI.E5 are not applicable.

3.6.2.3.2 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 3.6.2, Dominion stated that the aging effects related to the following are not applicable: transmission conductors composed of aluminum exposed to air-outdoor environment (Table 1, item 3.6.1-021); 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, copper, bronze, stainless steel, 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).

As a result, Dominion proposed no AMPs for the above component, material, and environment combinations. These AMR 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, the SLRA further provides plant-specific notes 1 through 4 for these AMR items respectively, as follows:

- Plant-specific note 1. Loss of material and increased resistance of connection are not applicable aging effects for switchyard bus and connections at SPS [Surry]. The in-scope switchyard bus and connections are subject to neither wind-induced abrasion nor oxidation or loss of pre-load.
- Plant-specific note 2. Loss of material is not an applicable aging effect for transmission conductors at SPS. The in-scope transmission conductors are not subject to wind-induced abrasion.
- Plant-specific note 3. Increased resistance of connection is not an applicable aging effect for transmission connections at SPS. The in-scope transmission connections are not subject to oxidation or loss of pre-load.
- Plant-specific note 4. Loss of conductor strength is not an applicable aging effect for transmission conductors at SPS. The in-scope transmission conductors are all-aluminum conductor construction and have the same characteristics as aluminum conductor aluminum alloy reinforced transmission conductors.

The staff's evaluation of Dominion's claim regarding SLRA Table 3.6.1, items 3.6.1-005, 3.6.1-006, and 3.6.1-007, is documented in SER Section 3.6.2.2.3.

3.7 <u>Conclusion for Aging Management Review Results</u>

The NRC staff reviewed SLRA Section 3, "Aging Management Review Results," and SLRA Appendix B, "Aging Management Programs," as supplemented. Based on its audits and its review of the applicant's aging management review results and aging management programs, 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 current licensing basis 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 aging management programs and activities credited for managing aging at Surry.

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 Surry Power Station, Units 1 and 2, 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 Part 54 are in accordance with the Atomic Energy Act of 1954, as amended, and the NRC's regulations.

4 TIME-LIMITED AGING ANALYSES

4.1 Identification of Time-Limited Aging Analyses and Exemptions

This section of the safety evaluation report (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 in the subsequent license renewal application (SLRA).

The regulation in Title 10 of the *Code of Federal Regulations* (10 CFR) 54.21(c)(1) requires an applicant for license renewal to identify each evaluation, analysis, or calculation (henceforth referred to as "analysis") 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) 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 regulatory exemptions that were granted in accordance with the exemption approval criteria in 10 CFR 50.12, are based on a TLAA, and remain in effect for the CLB. For any such exemptions, the rule requires the applicant to evaluate and justify the continuation of the exemptions during the 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 U.S. Nuclear Regulatory Commission's (NRC's) acceptance criteria and procedures for reviewing TLAA identification methodologies and results in a subsequent license renewal application (SLRA) are given in Chapter 4.1 of NUREG-2192, "Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants" (SRP-SLR). The acceptance criteria are given in SRP-SLR Section 4.1.2 and the review procedures are given in SRP-SLR Section 4.1.3.

The SRP-SLR Report may be accessed in the NRC's Agencywide Documents Access and Management System (ADAMS) at Accession No. ML16274A402.

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 used to identify those analyses that may potentially conform to the definition of a TLAA in 10 CFR 54.3(a). The applicant provides its list of TLAAs in SLRA Table 4.1.5-2. 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 to determine whether the CLB contained any exemptions that would need to be identified and evaluated in accordance with requirements stated in 10 CFR 54.21(c)(2). The applicant stated that its review of the CLB did not identify any exemptions for the CLB that were granted in accordance with 10 CFR 50.12, are based on a TLAA, and remain in effect in the CLB.

4.1.2 Staff Evaluation

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 Sections 4.1 2 and 4.1.3, respectively.

4.1.2.1.1 Analyses in the CLB Conforming to the 10 CFR 54.3 TLAA Definition Criteria

SLRA Table 4.1.5-2, "Time-Limited Aging Analyses and Dispositions," identifies those generic analyses or plant-specific analyses in the CLB that have been identified and evaluated as TLAAs in the SLRA. The staff verified that the analyses identified in SLRA Table 4.1.5-2 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 is in compliance with 10 CFR 54.21(c)(1). The staff provides its evaluations of these TLAAs in SER Sections 4.2 through 4.7.

4.1.2.1.2 Absence of TLAA Bases – TLAAs for BWR-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 analyses are applicable only to the CLBs for boiling-water reactor (BWR)-designed light-water reactors: (a) time-dependent probability of failure analyses (i.e., BWRVIP-05 analyses) for BWR reactor pressure vessel (RPV) axial and circumferential welds, (b) plant-specific reflood thermal shock analyses for BWR RPVs, (c) plant-specific reflood thermal shock analyses for BWR core shroud or other BWR reactor internals, (d) plant-specific loss of preload analyses for BWR core plate rim hold-down bolts, (e) plant-specific BWR main steam line flow restrictor erosion analyses, and (f) time-dependent irradiation-assisted stress corrosion cracking analyses for BWR reactor internals.

The staff verified that these analyses are not applicable to the CLB for Surry Power Station, Units 1 and 2 (Surry) because the updated final safety analysis report (UFSAR) confirms that the reactor units are pressurized-water reactors (PWRs) designed by the Westinghouse Electric Company. Therefore, the staff finds that the applicant does not need to identify or evaluate these types of TLAAs in the SLRA because (a) the analyses are not contained or incorporated by reference in the CLB, and (b) 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 SLRA Table 4.1.5-1, the applicant identifies that the following analyses or types of analyses do not qualify as TLAAs for the SLRA:

- ductility reduction evaluation for reactor internals
- high-energy line break analyses or time-dependent analyses performed in accordance with NRC Bulletin 88-08, "Thermal Stresses in Piping Connected to Reactor Coolant Systems"
- corrosion allowance calculations
- flaw growth analyses for stress corrosion cracking
- predicted lower limit analyses

Ductility Reduction Evaluation for Reactor Internals

The staff noted that SRP-SLR Section 3.1.2.2.3, item 3, identifies that this type of analysis is only applicable to PWRs designed by the Babcock and Wilcox Company. The staff also noted that the UFSAR identifies that the PWRs at Surry were designed by the Westinghouse Electric Company and that the CLB does not include this type of fracture toughness analysis for the reactor internals in Units 1 and 2. Therefore, the staff finds that the applicant does not need to evaluate this type of analysis as a TLAA in the SLRA because the analysis is not contained or incorporated by reference in the CLB and does not conform to criterion 6 for defining TLAAs in 10 CFR 54.3(a).

High-Energy Line Break Analyses or Time-Dependent Analyses Performed in Accordance with NRC Bulletin 88-08, "Thermal Stresses in Piping Connected to Reactor Coolant Systems"

SLRA Table 4.1.5-1 identifies that the CLB does not include any cumulative fatigue analyses for the Class 1 piping as a part of a high-energy line break assessment or in response to NRC Bulletin 88-08, rather ultrasonic inspections were performed in response to the bulletin. The staff reviewed the design basis for the facility and verified that the CLB did not perform any American Society of Mechanical Engineers (ASME) Section III cumulative usage factor (CUF) analyses for the Class 1 piping as a part of original plant design, such that the CUF analyses would be an integral part of a high-energy line break basis or Class 1 piping thermal stratification basis for the facility. Therefore, the staff finds that the applicant does not need to evaluate these types of analyses as TLAAs in the SLRA because they are not contained or incorporated by reference in the CLB and do not conform to criterion 6 for defining TLAAs in 10 CFR 54.3(a).

Corrosion Allowance Assessments

SLRA Table 4.1.5-1 identifies that corrosion allowance assessments are not applicable to Surry. The staff reviewed the UFSAR for the facility and verified that the CLB does not include any time-dependent corrosion allowance analyses. Therefore, the staff finds that the applicant does not need to evaluate any corrosion allowance analyses as TLAAs in the SLRA because they are not contained or incorporated by reference in the CLB and do not conform to criterion 6 for defining TLAAs in 10 CFR 54.3(a).

Flaw Growth Analyses for Stress Corrosion Cracking

SLRA Table 4.1.5-1 identifies that flaw growth analyses are not applicable to Surry . The staff reviewed the UFSAR for the facility and verified that the CLB does not include these types of crack growth analyses. Therefore, the staff finds that the applicant does not need to evaluate these types of analyses as TLAAs in the SLRA because they are not contained or incorporated by reference in the CLB and do not conform to criterion 6 for defining TLAAs in 10 CFR 54.3(a).

Predicted Lower Limit Analyses

SLRA Table 4.1.5-1 identifies that predicted lower limit analyses are not applicable to Surry. These analyses are related to containment pre-stressed tendons. The staff reviewed the UFSAR for the facility and verified that the CLB does not include any predicted lower limit analyses, and the containments are reinforced concrete structures without the use of prestressed tendons. Therefore, the staff finds that the applicant does not need to evaluate these types of analyses as TLAAs in the SLRA because they are not contained or incorporated by reference in the CLB and do not conform to criterion 6 for defining TLAAs in 10 CFR 54.3(a).

4.1.2.1.4 Staff Determination – TLAA Identification Results

Based on 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 these TLAAs in Chapter 4 of the SLRA. The staff did not find any additional analyses contained or incorporated by reference in the CLB that would conform to the definition of a TLAA in 10 CFR 54.3(a) or would need to be identified and evaluated in the SLRA in accordance with 10 CFR 54.21(c)(1).

4.1.2.2 Identification of Exemptions

The staff reviewed the applicant’s regulatory exemption methodology and results in accordance with the review procedures in SRP-SLR Section 4.1. The staff performed a search of the CLB and the NRC’s Agencywide Documents Access and Management System (ADAMS) database to identify any exemptions for the CLB that were granted in accordance with 10 CFR 50.12.

Following the staff’s audit of SLRA Section 4.1 in February 2019, the staff determined that the applicant was granted a regulatory exemption under 10 CFR 50.12 that permitted use of ASME Code Case N-514 as the basis for establishing the low-temperature overpressure protection (LTOP) system pressure lift and system enable temperature setpoints for the units, as documented in a safety evaluation (SE) dated October 31, 1995 (refer to ADAMS Legacy Library Accession No. 9512140231, Microfiche Address 86532, Microfiche Pages 294-301). The staff determined that the exemption may be based on a TLAA because (a) the exemption was granted in accordance with the provisions in 10 CFR 50.12, (b) the exemption to use ASME

Code Case N-514 may be based on the results of the applicant's adjusted reference temperature or pressure-temperature (P-T) limits TLAAs, and (c) the exemption may remain in effect for the CLB. Therefore, for this exemption, the staff determined the need for issuance of a request for additional information (RAI). RAI 4.1-1 and the applicant's response are provided in ADAMS Accession No. ML19155A050.

In the applicant's response to RAI 4.1-1 (ADAMS Accession No. ML19183A386), the applicant clarified that the exemption approving implementation of ASME Code N-514 is no longer in effect for the CLB. Specifically, the applicant clarified that the provisions of Code Case N-514 have been incorporated into the 1996 and more recent versions of ASME Section XI, Appendix G. The applicant also explained that the applicant's methodology for generating the P-T limits for 68 effective full-power years (EFPY) were developed using the K_{Ic} methodology in the 1998 Edition of ASME Section XI, Appendix G, and using the NRC's limitation that the pressure lift setpoint for the power-operated relief valves (PORVs) would be established using 100 percent of the pressure that corresponds to the LTOP system enable temperature point in the P-T limit cooldown curve (i.e., at a pressure of 399.6 psig). The staff reviewed further aspects of the CLB and verified that the applicant is required by Technical Specification (TS) Section 3.1.G to set the pressure lift setpoint for the PORVs in the LTOP system at a pressure less than or equal to 390 psig, which is less than the required LTOP pressure lift in ASME Section XI, Appendix G. Similarly, the staff determined that TS Section 3.1.G requires the applicant to enable the LTOP system if the reactor coolant system operating temperature falls below a temperature of 350 ºF, which is higher than the required enable temperature in ASME Section XI, Appendix G. Therefore, based on its review, the staff has confirmed that the CLB does not rely on ASME Code Case N-514 as the basis for establishing the pressure lift setpoint or system enable temperature setpoints for the LTOP system, and that the exemption approving use of Code Case N-514 is no longer in effect. The review matter raised in RAI 4.1-1 is resolved.

Therefore, based on this review, the staff concludes that the applicant does not need to identify the exemption on the use of ASME Code Case N-514 in accordance with 10 CFR 54.21(c)(2) because the staff has confirmed that the exemption no longer remains in effect for the CLB. The staff also finds that the applicant does not need to report and evaluate any exemptions in accordance with 10 CFR 54.21(c)(2) because the staff has confirmed that the CLB does not include any exemptions that were granted in accordance with 10 CFR 50.12, are based on a TLAA, and remain in effect for the CLB.

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 CLB does not include any exemptions that were granted in accordance with 10 CFR 50.12, are based on a TLAA, and remain in effect for the CLB. Therefore, the staff concludes that the applicant does not need to identify or evaluate any regulatory exemptions in accordance with the requirements specified in 10 CFR 54.21(c)(2).

4.2 <u>Reactor Vessel Neutron Embrittlement Analysis</u>

4.2.1 Neutron Fluence Projections

4.2.1.1 Summary of Technical Information in the Application

SLRA Section 4.2.1 describes Virginia Electric and Power Company's (Dominion or the applicant) TLAA for neutron fluence projections of the reactor vessel that have been used as inputs to the neutron embrittlement analyses that evaluate the reduction of the fracture toughness aging effect resulting from neutron irradiation.

Updated neutron fluence evaluations were performed and documented in WCAP-18028-NP, Revision 0, "Extended Beltline Pressure Vessel Fluence Evaluations Applicable to Surry Power Station Units 1 & 2". RPV beltline and extended beltline fast neutron fluences (E > 1.0 MeV) at the end of 80 years of operation were calculated for Units 1 and 2. The analysis methodologies used to calculate the Units 1 and 2 RPV fluences satisfy the guidance set forth in Regulatory Guide (RG) 1.190, "Calculational and Dosimetry Methods for Determining Pressure Vessel Neutron Fluence." These methodologies have been approved by the NRC and are described in detail in WCAP-14040-A, Revision 4, "Methodology Used to Develop Cold Overpressure Mitigating System Setpoints and RCS [Reactor Coolant System] Heatup and Cooldown Limit Curves", and are documented in UFSAR Section 4.1.7.3, "Calculation of Integrated Fast Neutron (E Greater than 1.0 MeV [sic]) Flux at the Irradiation Samples."

Dominion dispositioned the TLAA on neutron fluence analyses in accordance with 10 CFR 54.21(c)(1)(ii) by demonstrating that the neutron fluence has been projected to the end of the subsequent period of extended operation.

4.2.1.2 Staff Evaluation

The staff reviewed Dominion's TLAA for neutron fluence projections and the corresponding disposition of the TLAA in accordance with 10 CFR 54.21(c)(1)(ii), consistent with the review procedures in SRP-SLR Section 4.2.3.1.1. Specifically, the staff reviewed whether the applicant (a) identified the neutron fluence for each beltline material at the end of the subsequent period of extended operation, (b) used the NRC staff-approved methodology to calculate the neutron fluence, and (c) applied a methodology that is consistent with the guidance in NRC Regulatory Guide (RG) 1.190.

The applicant stated that the calculations for neutron fluence projections were performed based on the NRC-approved methodology as described in WCAP-14040-A, Revision 4, "Methodology Used to Develop Cold Overpressure Mitigating System Setpoints and RCS Heatup and Cooldown Limit Curves." The plant-specific calculation results were documented in WCAP-18028-NP. The two Westinghouse calculation notes supporting WCAP-18028-NP, Westinghouse Calculation Note CN-REA-08-74, "Pressure Vessel Neutron Fluence Evaluation to Support the MUR for Surry Unit I," July 2009, and Westinghouse Calculation Note CN-REA-08-75, "Pressure Vessel Neutron Fluence Evaluation to Support the MUR for Surry Unit 2," July 2009, were audited by the staff. The staff's review and audit results are summarized below.

In performing the fast neutron exposure evaluations for the Surry reactor vessels, the applicant conducted a series of fuel-cycle-specific forward transport calculations using the three-dimensional flux synthesis technique described in WCAP-18028-NP. The staff

determined that the WCAP-18028-NP's use of the DORT discrete ordinates code, cross section library, and the cross section angular representation P_5 and S_{16} order of angular quadrature are in conformance with NUREG/CR-6115, "PWR and BWR Pressure Vessel Fluence Calculation Benchmark Problems and Solutions," dated September 2001, and Regulatory Guide 1.190 and are, therefore, acceptable.

For the Surry transport calculations (which includes the use of spatial mesh, angular quadrature and pointwise inner iteration flux convergence criterion, etc.), the [r, θ], [r, z], and [r] reactor models were constructed to include the core, the reactor internals, the thermal shield—including explicit representations of the surveillance capsules at 15°, 25°, 35° and 45°—the pressure vessel cladding and vessel wall, the insulation external to the pressure vessel, and the water-filled shield tank as described in WCAP-18028-NP. The staff determined that the spatial mesh and angular quadrature and the pointwise inner iteration flux convergence criterion as utilized with these reactor models for WCAP-18028-NP are in conformance with RG 1.190 and are, therefore, acceptable.

The energy distribution of the source is determined on a fuel assembly specific basis by selecting a fuel assembly burnup representative of conditions averaged over each fuel cycle and an initial enrichment characteristic for each assembly as outlined by WCAP-18028-NP. It is noted that the water densities used in the core, bypass, and downcomer regions, as well as in the upper and lower core plenum regions, are determined based on the average temperature rise in the 36 fuel assemblies located on the periphery of the reactor core during each fuel cycle calculation. The staff finds that the use of the peripheral water density in the analytical models is justifiable because the neutron fluence at the pressure vessel is dominated by leakage from the peripheral fuel assemblies. The staff found from WCAP-18028-NP that the preparation of the core neutron source for the transport calculation is in conformance with NUREG/CR-6115 and RG 1.190 and is, therefore, acceptable.

The calculations included the measurement uncertainty recapture (MUR) power uprates that were implemented at the onset of Unit 1 Cycle 24 and Unit 2 Cycle 24. For the future projections, the applicant assumed that the core power distribution and associated plant operating characteristics from the latest implemented cycles were representative of the future plant operation. Therefore, for Unit 1, projections for Cycles 27 and beyond were based on Cycle 26, whereas for Unit 2, projections for Cycles 26 and beyond were based on Cycle 25. The staff finds the assumption reasonable and acceptable because the core power, cycle length, operating strategy, and fuel assembly design are anticipated not to be significantly changed for the future cycles. In addition, a conservative fluence projection of 100 percent capacity factor for 20 years of operation is made.

Therefore, the results from the neutron transport calculations provided data in terms of fuel cycle-averaged neutron flux, which is multiplied by the appropriate fuel cycle length to generate the incremental fast neutron exposure for each fuel cycle.

Based on the review of WCAP-14040-A and the audit, the staff found that the neutron fluence methodology was essentially unbiased with an uncertainty well within the 20 percent criterion established in Regulatory Guide 1.190. The Westinghouse calculation notes include an evaluation of the dosimetry sensor sets from three of the first four surveillance capsules withdrawn from Unit 1 provided in Westinghouse Calculation Note, CN-REA-08-74, "Pressure Vessel Neutron Fluence Evaluation to Support the MUR for Surry Unit 1," whereas the evaluation for the first five surveillance capsules withdrawn from Unit 2 was provided in Westinghouse Calculation Note, CN-REA-08-75, "Pressure Vessel Neutron Fluence Evaluation

to Support the MUR for Surry Unit 2." The dosimetry analyses documented in the Westinghouse calculation notes showed and confirmed via audit by the staff that the ±20 percent (1σ) acceptance criterion specified in Regulatory Guide 1.190 is met.

Consistent with Sections 3.1 and 4.2 of the SRP-SLR, the applicant identified the beltline materials and their locations (the nozzle shell to intermediate shell circumferential weld located close to the active fuel region and the lower extent of the nozzle shell forging, connected to the nozzle shell to intermediate shell circumferential weld) and the extended beltline materials (inlet and outlet nozzles that are located above the active fuel region) in the fracture toughness evaluation because they are projected to experience neutron fluence in excess of 1.0×10^{17} n/cm^2 at the end of the subsequent period of extended operation. Based on the neutron transport calculation results and the beltline materials information, the staff confirmed that the applicant had acceptably tabulated the fast neutron fluence projections to 68 EFPY, equivalent to 80 years of operation, for the beltline and extended beltline materials in SLRA Tables 4.2.1-1 and 4.2.1-2 for Units 1 and 2, respectively.

The staff determined Dominion has demonstrated the analysis for the neutron fluence for the reactor vessel has been projected to the end of the subsequent period of extended operation pursuant to 10 CFR 54.21(c)(1)(ii). The analysis meets the acceptance criteria in SRP-SLR Section 4.2.2.1.1 because the methods used to calculate the neutron fluence are consistent with the NRC-approved methodology (WCAP-14040-A), where the methodology adheres to the guidance of NRC Regulatory Guide (RG) 1.190 as summarized above, and the SLRA provided the neutron fluence projections for each beltline and extended beltline material at the end of the subsequent period of extended operation.

4.2.1.3 UFSAR Supplement

SLRA Section A3.2.1 provides the UFSAR supplement summarizing the TLAA for neutron fluence projections. The staff reviewed SLRA Section A3.2.1 consistent with the review procedures in SRP-SLR Section 4.2.3.1.1.2.

Based on its review of the UFSAR supplement, the staff finds it acceptable because it meets the acceptance criteria in SRP-SLR Section 4.2.2.1.1.2. Additionally, the staff finds that Dominion provided an adequate summary description of its actions to address the TLAA for neutron fluence projections to the end of the subsequent period of extended operation, as required by 10 CFR 54.21(d).

4.2.1.4 Conclusion

On the basis of its review, the staff concludes that Dominion has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(ii), that the neutron fluence for the RPV beltline and extended beltline materials 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).

4.2.2 Upper-Shelf Energy

The NRC's regulation in 10 CFR Part 50, Appendix G, "Fracture Toughness Requirements," establishes the regulatory requirements for evaluation of Charpy-impact upper-shelf energy (USE) fracture toughness properties for those ferritic base metal and weld metals that comprise RPVs.

4.2.2.1 Summary of Technical Information in the Application

SLRA Section 4.2.2 describes Dominion's TLAA for USE of the ferritic base metal and weld metals in the Surry RPVs. The applicant states that the TLAA on upper-shelf energy is an analysis that meets the definition of a TLAA in 10 CFR 54.3(a). The applicant identifies 68 EFPY to represent plant operation through the end of the subsequent period of extended operation. The applicant states that the USE values for all ferritic RPV beltline and extended beltline material at Surry have been projected to 68 EFPY. The applicant also states that equivalent margins analyses (EMAs) have been performed and projected to 68 EFPY for those RPV materials whose projected values of USE could not meet the 50 ft-lb requirement specified in 10 CFR Part 50, Appendix G. Dominion dispositioned the TLAA on USE in accordance with 10 CFR 54.21(c)(1)(ii) by demonstrating that the TLAA calculations have been projected to the end of the subsequent period of extended operation.

4.2.2.2 Staff Evaluation

The staff reviewed Dominion's TLAA on USE and the corresponding disposition of the TLAA in accordance with 10 CFR 54.21(c)(1)(ii), consistent with the acceptance criteria defined in SRP-SLR Section 4.2.2.1.2.2 and the review procedures defined in SRP-SLR Section 4.2.3.1.2.2.

The staff performed its review to confirm that either RPV USE values for 68 EFPY would meet the 50 ft-lb requirement in 10 CFR Part 50, Appendix G, or that the applicant performed appropriate EMAs to demonstrate that the weld and base materials would have adequate safety margins against fracture equivalent to those required by ASME Section XI. For those welds and base materials requiring an EMA, the staff verified that the applicant used the methods in Appendix K of the 2007 Edition of ASME Section XI as the basis for performing the J-integral flaw tolerance analyses under both normal operating and upset loading conditions (i.e., ASME Service Level A and B loading conditions) and under emergency and faulted loading conditions (i.e., ASME Service Level C and D loading conditions).

During the period from February 4–28, 2019, the staff performed an in-office audit of the TLAA on USE. As a part of its audit activities, the staff performed independent calculations of the USE values for the RPV materials to verify the validity of the USE values provided for Unit 1 in SLRA Table 4.2.2-5 and for Unit 2 in SLRA Table 4.2.2-6. For those weld and base materials that required an EMA, the staff performed independent EMA calculations to verify that the applicant performed acceptable analyses consistent with ASME Section XI, Appendix K. The details of the methods of analysis in ASME Section XI, Appendix K (including flaw tolerance analysis acceptance criteria set in the ASME Appendix) and the staff observations regarding the applicant's USE calculations and EMAs are summarized in the staff's Audit Report section entitled "SLRA TLAA Section 4.2.2, Upper Shelf Energy" (ADAMS Accession No. ML19128A079).

The staff verified the information provided in SLRA Tables 4.2.2-5 and 4.2.2-6, specifically that the USE values for the RPV materials in Units 1 and 2 at 68 EFPY identified to exceed the 50 ft-lb requirement in Appendix G remain above 50 ft-lb at the end of the subsequent period of extended operation.

For the materials that do not meet the 50-ft-lb criterion of Appendix G, the staff verified that the applicant submitted EMAs to demonstrate compliance with 10 CFR Part 50, Appendix G, Paragraph IV.A.1.a, that the material toughness will "provide margins of safety against fracture

equivalent to those required by Appendix G of Section XI of the ASME Code." For these materials, the staff verified that the applicant performed EMAs using the elastic-plastic fracture mechanics (EPFM) methods in ASME Section XI, Appendix K. The staff also performed independent EMA calculations to confirm the applicant's analyses to verify the proprietary EPFM values provided by the applicant, and verify that the EMA results satisfy the safety margin requirements in ASME Section XI, Appendix K, for Service Level A, B, C, and D.

The staff observed that the EMAs in all cases satisfy the acceptance criteria defined in ASME Section XI, Appendix K.

Therefore, the staff finds Dominion has demonstrated, pursuant to 10 CFR 54.21(c)(1)(ii), that the USE analyses or EMAs have been projected to the end of the subsequent period of extended operation (i.e., to 68 EPFY). Additionally, the staff finds that the TLAA on USE meets the acceptance criteria in SRP-SLR Section 4.2.2.1.2.2 because, for each material, (a) the applicant has projected the USE analyses to the end of the subsequent period of extended operation and demonstrated that it meets the 50-ft-lb criterion, and, (b) for each material whose USE values for 68 EFPY have been projected to be less than 50 ft-lb, the applicant has performed an EMA projected to the end of the subsequent period of extended operation that meets the requirements of 10 CFR Part 50, Appendix G.

4.2.2.3 UFSAR Supplement

SLRA Section A3.2.2, "Upper Shelf Energy," provides the UFSAR supplement summarizing the applicant's TLAA on USE. The staff reviewed the UFSAR supplement consistent with the acceptance criteria in SRP-SLR Section 4.2.2.2 and the review procedures in SRP-SLR Section 4.2.3.2.

The staff noted that the UFSAR supplement provides an acceptable summary of how the RPV values of USE have been projected to the end of the subsequent period of extended operation, as performed to comply with the 50 ft-lb minimum USE value requirements specified in 10 CFR Part 50, Appendix G. The staff noted that, for those RPV materials whose USE values could not be demonstrated to be equivalent or greater than 50 ft-lb at 68 EFPY, the UFSAR supplement also provides an acceptable summary of the EMAs that were performed for each material.

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 Dominion 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 Dominion has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(ii), that the USE analyses for the ferritic RPV beltline and extended beltline materials have been projected to the end of the subsequent period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.2.3 Pressurized Thermal Shock

The thermal shock rule (10 CFR 50.61) establishes the fracture toughness requirements for protection against pressurized thermal shock events, including methods for performing adjusted reference temperature calculations (i.e., calculations of RT_{PTS} values) for those ferritic base and weld materials that are used to fabricate the RPV in U.S. PWR designs. The calculations of RT_{PTS} are based on the cumulative neutron fluence exposures to the materials, as projected for the inside surface for the materials at the end of the licensed period for the plant.

4.2.3.1 Summary of Technical Information in the Application

SLRA Section 4.2.3 describes Dominion's TLAA for projecting the RT_{PTS} values for the Units 1 and 2 RPVs to the end of the subsequent period of extended operation. Dominion dispositioned the TLAA on pressurized thermal shock (PTS) in accordance with 10 CFR 54.21(c)(1)(ii) by demonstrating that the TLAA has been projected to the end of the subsequent period of extended operation.

4.2.3.2 Staff Evaluation

The staff reviewed Dominion's TLAA on PTS and the corresponding disposition of the TLAA in accordance with 10 CFR 54.21(c)(1)(ii) consistent with the acceptance criteria defined in SRP-SLR Section 4.2.2.1.3.2 and the review procedures defined in SRP-SLR Section 4.2.3.1.3.2.

During the period from February 4–28, 2019, the staff performed an in-house audit of the TLAA on PTS to verify that the TLAA had appropriately projected the RT_{PTS} values for the RPV beltline and extended beltline materials to the end of the subsequent period of extended operation (i.e., to 68 EFPY) in accordance with 10 CFR 54.21(c)(1)(ii). The staff performed its review to confirm that RPV RT_{PTS} values for 68 EFPY would meet, as appropriate, the 270 ºF screening criterion specified in 10 CFR 50.61 for RPV axial weld and base metals or the 300 ºF screening for RPV circumferential weld materials. As a part of its audit activities, the staff also performed independent calculations of the RT_{PTS} values for the RPV materials to verify the validity of the values that were provided in SLRA Table 4.2.3-1 for the Unit 1 RPV materials and in SLRA Table 4.2.3-2 for the Unit 2 RPV materials. The details of the staff observations regarding the applicant's RT_{PTS} calculations are summarized in the staff's Audit Report section entitled "SLRA TLAA Section 4.2.3, Pressurized Thermal Shock" (ADAMS Accession No. ML19128A079). The staff's Audit Report input for the TLAA, in part, cites the bases for the copper (Cu) and nickel (Ni) alloying contents, initial reference temperature nil ductility transition (RT_{NDT}) values (i.e., $RT_{NDT(U)}$ values), and σ_I variance values that were used as input parameters for the RT_{PTS} calculations, and the sources of any RPV surveillance data that may be applicable to the calculations of RT_{PTS}.

Based on the results of the staff's audit and independent calculations, the staff verified that the RT_{PTS} calculations for the Unit 1 RPV at 68 EFPY are limited by the RT_{PTS} calculation for the RPV lower shell axial weld L2 fabricated from Linde 80 Weld Heat 299L44. For this material, both the applicant and staff calculated an RT_{PTS} value of 253.2 ºF at 68 EFPY, based on a projected RPV inside surface fluence of 1.26×10^{19} n/cm^2 (E > 1.0 MeV) at 68 EFPY, a staff-approved $RT_{NDT(U)}$ value of -74.3 ºF and a staff-approved σ_I variance value of 12.8 ºF (as given in Framatome Report BAW-2308, Revision 2 and approved in the staff's SE for the report (ADAMS Accession No. ML080770349)), a full σ_Δ variance value of 28.0 ºF for the

material, and the applicable RPV surveillance data for Weld Heat 299L44. The staff verified that this value meets the PTS screening criterion of 270.0 ºF for RPV axial weld metals.

Similarly, the staff verified that the RT_{PTS} calculations for the Unit 2 RPV at 68 EFPY are limited by the RT_{PTS} calculations for RPV intermediate-to-lower shell circumferential weld fabricated from Rotterdam Weld Heat 0227. For this material, both the applicant and staff calculated an RT_{PTS} value of 272.5 ºF at 68 EFPY, using the chemistry factor table for weld metals given in 10 CFR 50.61. The staff noted that if the credible, site-specific surveillance data for Rotterdam Weld Heat 0227 are used as the basis for the RT_{PTS} calculation, the RT_{PTS} value for the weld is 222.5 ºF. The staff verified that the applicant's RT_{PTS} values projected for this weld metals at 68 EFPY, one using the table chemistry factor in 10 CFR 50.61 and one calculated in accordance with the applicable surveillance data, meet the PTS screening criterion of 300.0 ºF for RPV circumferential weld metals.

Based on its review of the TLAA and independent calculations, the staff verified that the RT_{PTS} calculations for all RPV beltline and extended beltline materials at 68 EPFY were performed in accordance with 10 CFR 50.61. The staff also verified that the RT_{PTS} values for the materials meet the PTS screening criteria in 10 CFR 50.61.

Therefore, the staff finds Dominion has demonstrated pursuant to 10 CFR 54.21(c)(1)(ii), that the TLAA on PTS has been projected to the end of the subsequent period of extended operation. Additionally, it meets the acceptance criteria in SRP-SLR Section 4.2.2.1.3.2 because (a) the applicant has appropriately projected the RT_{PTS} values for the RPV beltline and extended beltline materials to the end of the subsequent period of extended operation with 10 CFR 50.61, and (b) the applicant has demonstrated that the RT_{PTS} values meet the PTS screening criteria in the 10 CFR 50.61.

4.2.3.3 UFSAR Supplement

SLRA Section A3.2.3, "Pressurized Thermal Shock," provides the UFSAR supplement summarizing the TLAA on PTS. The staff reviewed SLRA Section A3.2.3 consistent with the acceptance criteria in SRP-SLR Section 4.2.2.2 and the review procedures in SRP-SLR Section 4.2.3.2.

The staff noted the UFSAR supplement summary description for the TLAA on PTS was consistent with that provided for these types of TLAAs in SRP-SLR Table 4.2-1. The staff also noted the UFSAR supplement summary description for the TLAA provided an adequate summary of the basis for dispositioning the TLAA on PTS in accordance with the requirement in 10 CFR 54.21(c)(1)(ii).

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 Dominion provided an adequate summary description of the TLAA, as required by 10 CFR 54.21(d).

4.2.3.4 Conclusion

On the basis of its review, the staff concludes that Dominion has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(ii), that the RT_{PTS} calculations for the RPV beltline and extended beltline materials have been projected to the end of the subsequent period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.2.4 Adjusted Reference Temperature

4.2.4.1 Summary of Technical Information in the Application

SLRA Section 4.2.4, "Adjusted Reference Temperature," describes Dominion's evaluation of the adjusted reference temperature (ART) of the Surry RPV beltline and extended beltline materials that accounts for neutron embrittlement through the end of the subsequent period of extended operation. ART is the sum of the initial nil-ductility reference temperature ($RT_{NDT(U)}$) and the adjustment in RT_{NDT} (ΔRT_{NDT}) that is caused by neutron irradiation exposure, and a margin term to account for uncertainties in the $RT_{NDT(U)}$ and ΔRT_{NDT} values. SLRA Tables 4.2.4-5 and 4.2.4-7 show the 68 EFPY ART calculations for the RPV beltline and extended beltline materials at the RPV surface, and SLRA Tables 4.2.4-6 and 4.2.4-8 for the quarter-thickness (1/4T) location. SLRA Table 4.2.4-9 summarizes the limiting materials for each Surry unit. Dominion applied the methodology in Regulatory Guide (RG) 1.99, Revision 2, to determine ART.

Dominion dispositioned the TLAA in accordance with 10 CFR 54.21(c)(1)(ii) by demonstrating that the ART analyses for the materials have been projected to the end of the subsequent period of extended operation (68 EFPY).

4.2.4.2 Staff Evaluation

The staff reviewed Dominion's TLAA on ART and the corresponding disposition of the TLAA in accordance with 10 CFR 54.21(c)(1)(ii) by confirming Dominion's 68 EFPY ART calculations at the RPV surface in SLRA Tables 4.2.4-5 and 4.2.5-7, and the 1/4T location presented in SLRA Tables 4.2.4-6 and 4.2.4-8. The staff verified that Dominion applied the methodology of RG 1.99, Revision 2, in determining the 68 EFPY ART values at the RPV surface and 1/4T locations. The staff noted that the SLRA tables do not show the ART values at the three-quarters thickness (3/4T) location and that these ART values are determined by changing the input for radial distance from the inside surface to 3/4T in the fluence attenuation formula in RG 1.99, Revision 2.

The staff's confirmatory evaluations included verifying the $RT_{NDT(U)}$ and ΔRT_{NDT} values, the margins due to uncertainties in both $RT_{NDT(U)}$ and ΔRT_{NDT}, and attenuation of the 68 EFPY fluence values in SLRA Tables 4.2.1-1 and 4.2.1-2 to the 1/4T location. The staff confirmed the copper and nickel content with those specified in the 48 EFPY pressure-temperature limits license amendment request (ADAMS Accession No. ML101310604), which the staff approved by letter dated May 31, 2011 (ADAMS Accession No. ML11110A111). The staff noted that if attenuated fluence values are less than 1×10^{17} n/cm^2 (E > 1 MeV), Dominion set the ΔRT_{NDT} and the corresponding term to account for uncertainties due to ΔRT_{NDT}, σ_Δ, to zero, consistent with the fluence threshold established in Appendix H to 10 CFR Part 50 for monitoring changes in the fracture toughness properties of ferritic materials.

The staff confirmed that the $RT_{NDT(U)}$ values (and corresponding margin term for $RT_{NDT(U)}$) of Linde 80 RPV beltline shell welds (Heat Nos. 299L44, 72445, 8T1762, and 8T1554) are consistent with the CLB values. By letter dated June 27, 2007 (ADAMS Accession No. ML071160287), the staff approved the exemption for Dominion's use of the master curve methodology for Surry. For the other RPV beltline and extended beltline materials, the staff verified that Dominion applied acceptable methodologies—Paragraph NB-2331 of Section III of the ASME Code, Branch Technical Position 5-3, BWRVIP-173-A, and fabrication information from Supplement 1 of BAW-2313, Revision 7—for determining $RT_{NDT(U)}$, as the staff observed in

the in-office audit report section entitled "SLRA TLAA Section 4.2.4, Adjusted Reference Temperature" (ADAMS Accession No. ML19128A079). The staff noted that although the RPV nozzle-to-shell welds are Linde 80 welds (Heat Nos. 8T1762 or 8T1554), Dominion did not apply the master curve methodology in BAW-2308, Revisions 1-A and 2-A, in determining the $RT_{NDT(U)}$ for these welds but instead appropriately applied the fabrication information from Supplement 1 of BAW-2313, Revision 7.

The staff verified that Dominion applied the methodology in Position 2.1 of RG 1.99, Revision 2, to determine ΔRT_{NDT} for base and weld materials in the RPV beltline that had available credible surveillance capsule data as identified in SLRA Tables 4.2.4-6 and 4.2.4-8. Furthermore, the staff verified that Dominion included surveillance capsule data from the appropriate, non-Surry sources for weld heats that are irradiated in non-Surry plants, as the staff observed in the in-office audit report section entitled "SLRA TLAA Section 4.2.4, Adjusted Reference Temperature" (ADAMS Accession No. ML19128A079).

The staff reviewed SLRA Table 4.2.4-9 to confirm the limiting materials. The staff verified that Dominion correctly applied the guidance in Position 2.1 of RG 1.99, Revision 2, for using credible surveillance data in calculating the 68 EFPY ART values.

Therefore, based on the review above, the staff finds Dominion has projected, pursuant to 10 CFR 54.21(c)(1)(ii), the ART values of the RPV beltline and extended beltline materials to the end of the subsequent period of extended operation. Additionally, the analyses of the TLAA on ART for these materials meet the acceptance criteria in SRP-SLR Section 4.2.2.1.4.2 because Dominion has projected the ART values for the RPV beltline and extended beltline materials of Surry to the end of the subsequent period of extended operation.

4.2.4.3 UFSAR Supplement

SLRA Section A3.2.4, "Adjusted Reference Temperature," provides the UFSAR supplement summarizing the ART TLAA. The staff reviewed SLRA Section A3.2.4 consistent with the acceptance criteria in SRP-SLR Section 4.2.2.2 and the review procedures in SRP-SLR Section 4.2.3.2.

Based on its review of the UFSAR supplement, the staff finds it meets the acceptance criteria in SRP-SLR Section 4.2.2.2 and is therefore acceptable. Additionally, the staff finds that Dominion provided an adequate summary description of its actions to address the ART TLAA as required by 10 CFR 54.21(d).

4.2.4.4 Conclusion

On the basis of its review, the staff concludes that Dominion has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(ii), that the ART values of the RPV materials have been projected to the end of the subsequent period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.2.5 Pressure-Temperature Limits

4.2.5.1 Summary of Technical Information in the Application

SLRA Section 4.2.5, “Pressure-Temperature Limits,” summarizes Dominion’s evaluation of the TLAA related to pressure-temperature (P-T) limit calculations for the RPV components at Surry. Dominion amended this SLRA section by letters dated April 2, 2019, and June 10, 2019. Dominion dispositioned the TLAA in accordance with 10 CFR 54.21(c)(1)(iii) by demonstrating that the effects of neutron embrittlement on the intended functions of the RPV materials will be adequately managed during the subsequent period of extended operation.

Dominion stated that the P-T limits for the subsequent period of extended operation (68 EFPY) need not be submitted as a part of the SLRA because the P-T limits are required to be updated through the 10 CFR 50.90 licensing process when necessary for P-T limits that are located in the Surry TSs. Dominion also stated that the CLB will ensure that the P-T limits for the subsequent period of extended operation will be updated prior to exceeding the 48 EFPY for which they are valid. Furthermore, Dominion stated that the Reactor Vessel Material Surveillance aging management program (AMP) in SLRA Section B2.1.19, and Surry’s TS will ensure that the updated P-T limits will be based on the updated adjusted reference temperatures.

4.2.5.2 Staff Evaluation

The staff reviewed Dominion’s P-T limits TLAA and the corresponding disposition in accordance with 10 CFR 54.21(c)(1)(iii), consistent with the acceptance criteria in SRP-SLR Section 4.2.2.1.4.3 and the review procedures in SRP-SLR Section 4.2.3.1.4.3.

The staff noted that the applicant’s basis for dispositioning the TLAA under 10 CFR 54.21(c)(1)(iii) is consistent with the basis in SRP-SLR Section 4.2.2.1.4.3. This section of the SRP-SLR specifies that an applicant’s 10 CFR 50.90 license amendment process is adequate for dispositioning P-T limit TLAAs under 10 CFR 54.21(c)(1)(iii) and applies to licensing bases that have P-T limit curves in the limiting conditions of operation of the plant-specific TS. Since Dominion will update the P-T limits through the 10 CFR 50.90 process for the subsequent period of extended operation prior to exceeding the 48 EFPY for which the CLB P-T limits remain valid, the staff finds that Dominion’s disposition of the P-T limits TLAA under 10 CFR 54.21(c)(1)(iii) is consistent with the acceptance criteria in SRP-SLR Section 4.2.2.1.4.3, and is therefore acceptable.

Therefore, pursuant to 10 CFR 54.21(c)(1)(iii), the staff finds Dominion will adequately manage the P-T limits through the subsequent period of extended operation.

4.2.5.3 UFSAR Supplement

SLRA Section A3.2.5, “Pressure-Temperature Limits,” provides the UFSAR supplement summarizing the P-T limits TLAA. The staff reviewed SLRA Section A3.2.5 consistent with the acceptance criteria in SRP-SLR Section 4.2.2.2 and the review procedures in SRP-SLR Section 4.2.3.2.

Based on its review of the UFSAR supplement, the staff finds it meets the acceptance criteria in SRP-SLR Section 4.2.2.2 and is therefore acceptable. Additionally, the staff finds that Dominion

provided an adequate summary description of its actions to address the P-T limits TLAA as required by 10 CFR 54.21(d).

4.2.5.4 Conclusion

On the basis of its review, the staff concludes that Dominion has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(iii), that the P-T limits will be adequately managed during the subsequent period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.2.6 Low Temperature Overpressure Protection

4.2.6.1 Summary of Technical Information in the Application

SLRA Section 4.2.6, “Low Temperature Overpressure Protection,” summarizes Dominion’s evaluation of the TLAA that assesses the low-temperature overpressure protection (LTOP) arming temperature and power-operated relief valves (PORVs) pressure setpoint applicable to Surry for the subsequent period of extended operation. Dominion amended this SLRA section by letter dated April 2, 2019. Dominion determined the LTOP arming temperature for 68 EFPY and the PORV pressure setpoints for 68 EFPY using the methodology in WCAP-14040-A, Revision 4, and stated that the corresponding values currently in the Surry TSs bound and establish the LTOP system arming temperature setpoint and pressure lift values that apply to 68 EFPY. Dominion dispositioned the TLAA in accordance with 10 CFR 54.21(c)(1)(ii) by demonstrating that the LTOP arming temperature and PORV pressure setpoint have been projected to the end of the subsequent period of extended operation.

4.2.6.2 Staff Evaluation

The staff reviewed Dominion’s TLAA on LTOP and the corresponding disposition of the TLAA in accordance with 10 CFR 54.21(c)(1)(ii), consistent with the acceptance criteria in SRP-SLR Sections 4.2.2.1.4.2, and the review procedures in SRP-SLR Sections 4.2.3.1.4.2 and 5.1.3.

The staff verified that the applicant projected the LTOP system enable temperatures and PORV pressure lift setpoints to 68 EFPY using the staff-approved methodology in Revision 4 of WCAP-14040-NP-A (ADAMS Accession No. ML050120209) and that the value of 283 ºF established for the LTOP system arming temperature and the value of 399.6 psig established for the PORV pressure lift setpoint are valid for 68 EFPY. The staff observed that the required LTOP system arming temperature projected to 68 EFPY (i.e., 283 ºF) is lower than and therefore bounded by the actual LTOP arming temperature specified for the system in TS Section 3.1.G (i.e., 350 ºF). Similarly, the staff observed that the required PORV pressure lift setpoint projected to 68 EFPY (i.e., 399.6 psig) is higher than and therefore bounded by the actual PORV pressure setpoint specified for the system in TS Section 3.1.G (i.e., 390 psig). Thus, the staff confirmed that the applicant has projected the LTOP setpoints to the end of the subsequent period of extended operation to demonstrate continued validity of the LTOP system enable temperature and pressure lift setpoints established for the LTOP system in TS Section 3.1.G.

Therefore, based on its review, the staff finds Dominion has projected, pursuant to 10 CFR 54.21(c)(1)(ii), the temperature enable and PORV pressure setpoints for the LTOP system to the end of the subsequent period of extended operation. Additionally, the analyses of

the TLAA on LTOP meet the acceptance criteria in SRP-SLR Section 4.2.2.1.4.2 because (a) the applicant has projected the LTOP system arming setpoints and pressure lift setpoints for Surry to the end of the subsequent period of extended operation, and (b) the applicant has demonstrated that the existing TS Section 3.1.G requirements for these setpoints remain valid for the subsequent period of extended operation.

4.2.6.3 UFSAR Supplement

SLRA Section A3.2.6, "Low Temperature Overpressure Protection," provides the UFSAR supplement summarizing the LTOP TLAA. The staff reviewed SLRA Section A3.2.6 consistent with the acceptance criteria in SRP-SLR Section 4.2.2.2 and the review procedures in SRP-SLR Section 4.2.3.2.

Based on its review of the UFSAR supplement, the staff finds it meets the acceptance criteria in SRP-SLR Section 4.2.2.2 and is therefore acceptable. Additionally, the staff finds that Dominion provided an adequate summary description of its actions to address the LTOP TLAA, as required by 10 CFR 54.21(d).

4.2.6.4 Conclusion

On the basis of its review, the staff concludes that Dominion has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(ii), that the LTOP arming temperature and PORV pressure setpoint 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 <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. SLRA Section 4.3.1 documents transient cycle projections for 80 years. Evaluation of fatigue analyses of Class 1 components is provided in SLRA Section 4.3.2. Fatigue analysis of piping components is discussed in SLRA Section 4.3.3. Evaluation of environmentally assisted fatigue (EAF) is documented in SLRA Section 4.3.4. Evaluation of fatigue of reactor vessel internals is documented in SLRA Section 4.3.5.

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 Dominion's projection basis for projecting transient-specific design cycles to the end of the subsequent period of extended operation. The applicant provided the cycle-specific projection results for design transients applying to Surry in SLRA Table 4.3.1-1. The applicant did not identify this aspect of the fatigue analysis as a TLAA for the application.

4.3.1.2 Staff Evaluation

The staff reviewed the applicant's cycle projection basis against the acceptance criteria and review procedures defined in SRP-SLR Report Section 4.3. 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 staff observed that the applicant's cycle projection basis is based on (a) the number of cycles for analyzed design transients that have been accrued through June 30, 2016, and (b) a cycle projection basis for the units from July 1, 2016, onward that applies the design cycle accumulation rates for given transients over the last 10 years of operation and uses this accumulation rate to project the number of cycles of the transients to the end of the subsequent period of extended operation. The staff also noted that the applicant has had a declining trend of transient occurrences since initial operations of the Surry units. The staff finds that the applicant's projection basis is acceptable because the declining trend in the accumulation rate of transients since initial plant operation provides sufficient justification for using the transient-specific accumulation rates over the last 10 years as the cycle projection basis for the SLRA.

The SLRA also states that, using this projection methodology, the projected cycles for 80 years of operation are less than the 40-year design cycles. The applicant will also use the Fatigue Monitoring program to track the cycles for significant fatigue transients and will take corrective actions prior to the cycles exceeding the fatigue design limits. The applicant used this projection basis, the projected 80-year cycle counts, and/or the Fatigue Monitoring program to support its disposition of its metal fatigue TLAAs in accordance with 10 CFR Part 54.21(c)(1)(i), (ii), or (iii), respectively. The staff's evaluation of these TLAAs is provided below in the remaining SER Section 4.3 subsections. The staff's evaluation of the Fatigue Monitoring program is documented in SER Section 3.0.3.2.35, which determined that the AMP, when enhanced, will be adequate to manage the applicable aging effects.

4.3.1.3 UFSAR Supplement

In SLRA Section A3.3.1, 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 A3.3.1 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 Dominion provided an adequate summary description of its actions to address the design transient cycle projections.

4.3.1.4 Conclusion

On the basis of its review, the staff concludes that Dominion has provided an acceptable basis for projecting the number of cycles for evaluated transients 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 described in SLRA Section A3.3.1.

4.3.2 ASME Code, Section III, Class 1 Fatigue Analyses

4.3.2.1 Summary of Technical Information in the Application

SLRA Section 4.3.2 describes Dominion's TLAAs for the ASME Code, Section III fatigue analyses for Safety Class 1 components. Dominion dispositioned the TLAAs for the control rod drive mechanism (CRDM), pressurizer, reactor coolant pump, reactor vessel, steam generators (SGs), and pressurizer surge line in accordance with 10 CFR 54.21(c)(1)(iii) by demonstrating that the effects of metal fatigue on the intended functions will be adequately managed by the Fatigue Monitoring program for the subsequent period of extended operation. The applicant also dispositioned the TLAAs for the pressurizer surge line and charging and accumulator piping in accordance with 10 CFR 54.21(c)(1)(iii) by demonstrating that the effects of metal fatigue on the intended functions will be adequately managed by the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program for the subsequent period of extended operation. Further, the applicant dispositioned the TLAA for the Safety Class 1 component fatigue waivers in accordance with 10 CFR 54.21(c)(1)(iii) by demonstrating that the effects of metal fatigue on the intended functions will be adequately managed by the Fatigue Monitoring program for the subsequent period of extended operation.

4.3.2.2 Staff Evaluation

4.3.2.2.1 Control Rod Drive Mechanism, Pressurizer, Reactor Coolant Pump, Reactor Vessel, and Steam Generators

The staff reviewed Dominion's metal fatigue TLAAs for the control rod drive mechanism, pressurizer, reactor coolant pump, reactor vessel, and steam generators, provided in SLRA Sections 4.3.2.1 through 4.3.2.5, and the corresponding disposition of the TLAAs in accordance with 10 CFR 54.21(c)(1)(iii), consistent with the review procedures in SRP-SLR Section 4.3.3.1.1.3 and the acceptance criteria in SRP-SLR Section 4.3.2.1.1.3.

The SLRA states that metal fatigue for these components will be managed by the enhanced Fatigue Monitoring program, which is described in SLRA Section B3.1. The staff's evaluation of the Fatigue Monitoring program is documented in SER Section 3.0.3.2.35, which determined that the AMP, when enhanced, will be adequate to manage the applicable aging effects.

Based on the applicant's implementation of the enhanced Fatigue Monitoring program, the staff finds Dominion has demonstrated pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of metal fatigue on the intended functions of the control rod drive mechanism, pressurizer, reactor coolant pump, reactor vessel, and steam generators will be adequately managed for the subsequent period of extended operation.

Additionally, the TLAAs meet the acceptance criteria in SRP-SLR Section 4.3.2.1.1.3 because (a) the use of the Fatigue Monitoring program is consistent with the SRP-SLR, (b) the program continually monitors and ensures the validity of these TLAAs, and (c) the program will trigger corrective actions prior to analyses becoming invalid during the subsequent period of extended operation.

4.3.2.2.2 Pressurizer Surge Line

The staff reviewed Dominion's metal fatigue TLAA for the pressurizer surge line, provided in SLRA Section 4.3.2.6, and the corresponding disposition of the TLAA in accordance with 10 CFR 54.21(c)(1)(iii), consistent with the review procedures in SRP-SLR Section 4.3.3.1.1.3.

The applicant stated that during initial license renewal, thermal stratification of the pressurizer surge line was managed by the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program. More recently, Dominion submitted a revised re-inspection schedule for the pressurizer surge line. The re-inspection schedule was based on an ASME Code, Section XI, Appendix L evaluation that used transients tracked by the Fatigue Monitoring program. The staff approved the revised re-inspection interval of 10 years (ADAMS Accession No. ML18166A329) and noted that the projected growth rate of a postulated crack would not challenge the structural integrity of the surge line prior to its re-inspection, by a conservative margin. Additionally, the estimated 80-year transient cycle counts are not projected to exceed the current CLB limits used in the Appendix L evaluation. Consequently, the staff finds there is reasonable assurance that the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program will adequately manage fatigue of the pressurizer surge line during the subsequent period of extended operation. The staff's evaluation of the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program is documented in SER Section 3.0.3.2.1, which determined that the AMP will be adequate to manage the applicable aging effects.

The staff finds Dominion has demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of metal fatigue on the intended functions of the pressurizer surge line will be adequately managed for the subsequent period of extended operation.

Additionally, the TLAA meets the acceptance criteria in SRP-SLR Section 4.3.2.1.1.3 because (a) the Fatigue Monitoring program will monitor and track the applicable transients used in the ASME Code, Section XI, Appendix L flaw tolerance evaluation, and (b) the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program will manage the effects of fatigue for the pressurizer surge line, such that the intended functions will be maintained for the subsequent period of extended operation.

4.3.2.2.3 Charging and Accumulator Piping

The staff reviewed Dominion's metal fatigue TLAA for the charging and accumulator piping, provided in SLRA Section 4.3.2.7, and the corresponding disposition of the TLAA in accordance with 10 CFR 54.21(c)(1)(iii), consistent with the review procedures in SRP-SLR Section 4.3.3.1.1.3.

The applicant stated that, during initial license renewal, detailed fatigue evaluations were performed for the charging and accumulator piping. Dominion also stated that the effects of fatigue for the charging and accumulator piping will be managed by the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program. The staff noted that Dominion used ASME Code, Section XI, Appendix L flaw tolerance evaluations to establish the re-inspection intervals for the subject piping. Based on these evaluations, it was determined that the projected growth rate of a postulated crack would not challenge the integrity of the charging and accumulator piping prior to re-inspection by a conservative margin. Therefore, the staff finds that Dominion's ASME Section XI Inservice Inspection, Subsections IWB, IWC, and

IWD program will adequately manage the charging and accumulator piping for fatigue during the subsequent period of extended operation.

The staff finds Dominion has demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of metal fatigue on the intended functions of the charging and accumulator piping will be adequately managed for the subsequent period of extended operation.

Additionally, it meets the acceptance criteria in SRP-SLR Section 4.3.2.1.1.3 because the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program will manage the effects of fatigue for the charging and accumulator cold leg nozzles, such that the intended functions will be maintained for the subsequent period of extended operation.

4.3.2.2.4 ASME Code, Section III, Class 1 Component Fatigue Waivers

The staff reviewed Dominion's TLAA for the Safety Class 1 component fatigue waivers, provided in SLRA Section 4.3.2.8, and the corresponding disposition of the TLAA in accordance with 10 CFR 54.21(c)(1)(iii), consistent with the review procedures in SRP-SLR Section 4.3.3.1.1.3.

In SLRA Section 4.3.2.8, Dominion identified several ASME Code, Section III, Class 1 components that did not require a detailed fatigue evaluation because they conformed to the fatigue waiver requirements of ASME Code Section III. As a part of its metal fatigue evaluation, Dominion considered each of the transients applicable to these components and consolidated them into overall transients applicable to the components identified in SLRA Section 4.3.2.8. Specifically, Dominion's analysis considered transients and the associated CLB cycle limits included in SLRA Table 4.3.1-1. As described in SER Section 4.3.1, the staff finds Dominion's cycle projection methodology acceptable because it incorporated actual cycle accumulation history over the past 10 years and used actual plant operating characteristics and anticipated future operation to calculate the appropriate 80-year projected cycle counts.

SLRA Section 4.3.2.8 identified that the applicant is relying on its Fatigue Monitoring program as the basis for dispositioning the applicable fatigue waiver analyses in accordance with 10 CFR 54.21(c)(1)(iii). The staff noted that this approach is in accordance and consistent with the acceptance criteria given in SRP-SLR Section 4.3.2.1.1.3, which indicate that cycle monitoring programs (such as the Fatigue Monitoring program) may be used to manage fatigue waiver analyses in accordance with 10 CFR 54.21(c)(1)(iii).

The staff's evaluation of the Fatigue Monitoring program is documented in SER Section 3.0.3.2.35, which determined that the AMP, when enhanced, will be adequate to manage the applicable aging effects.

The staff finds Dominion has demonstrated pursuant to 10 CFR 54.21(c)(1)(iii), that the ASME Code, Section III, Class 1 component fatigue waivers 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 (a) the use of the Fatigue Monitoring program is consistent with the SRP-SLR, (b) the program continually monitors and ensures the validity of these TLAAs, and (c) the program will trigger corrective actions prior to analyses becoming invalid during the subsequent period of extended operation.

4.3.2.3 *UFSAR Supplement*

SLRA Section A3.3.2 provides the UFSAR supplement summarizing the TLAAs for the ASME Code, Section III fatigue analyses for Class 1 components. The staff reviewed SLRA Section A3.3 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 Dominion provided an adequate summary description of its actions to address the TLAAs for the ASME Code, Section III fatigue analyses for Class 1 components, as required by 10 CFR 54.21(d).

4.3.2.4 *Conclusion*

On the basis of its review, the staff concludes that Dominion has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of metal fatigue on the intended functions of the control rod drive mechanism, pressurizer, reactor coolant pump, reactor vessel, steam generators, pressurizer surge line, and Class 1 component fatigue waivers will be adequately managed by the Fatigue Monitoring program for the subsequent period of extended operation. On the basis of its review, the staff concludes that Dominion has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of metal fatigue on the intended functions of ASME Code, Section III fatigue analyses for the pressurizer surge line as well as the charging and accumulator piping will be adequately managed by the Fatigue Monitoring program and the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program for the subsequent period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.3.3 ANSI B31.1 Allowable Stress Analyses

4.3.3.1 *Summary of Technical Information in the Application*

SLRA Section 4.3.3 describes Dominion’s allowable stress range reduction factor TLAAs for the reactor coolant primary piping and balance-of-plant piping in accordance with American National Standards Institute (ANSI) B31.1 piping. Dominion dispositioned the TLAA evaluation for the subject ANSI B31.1 piping in accordance with 10 CFR 54.21(c)(1)(i) by demonstrating that the analyses remain valid for the subsequent period of extended operation.

4.3.3.2 *Staff Evaluation*

The staff reviewed Dominion’s TLAA for the subject ANSI B31.1 piping and the corresponding disposition of the TLAA in accordance with 10 CFR 54.21(c)(1)(i), consistent with the review procedures in SRP-SLR Section 4.3.3.1.1.1.

The SLRA states that for piping systems designed in accordance with ANSI B31.1, allowable thermal stresses are reduced using a stress range reduction factor based on a number of anticipated thermal cycles during the expected life of a component. Additionally, no reduction of allowable stresses is required for piping that is subject to less than 7,000 equivalent full temperature cycles. Dominion summarized these evaluations for the applicable ANSI B31.1 piping in SLRA Table 4.3.3-1. The staff reviewed the applicant’s methodology to project the 80-year cycles. The staff finds the projection methodology acceptable because it incorporated conservative projections to calculate the appropriate 80-year projected cycles. The staff noted

that for the ANSI B31.1 piping described in SLRA Table 4.3.3-1, the total 80-year projected cycle counts were lower than 7,000 cycles. Therefore, the staff determined that the allowable thermal stresses do not need to be reduced and the stress analysis for the subject ANSI B31.1 piping remains valid for the subsequent period of extended operation.

The staff finds Dominion has demonstrated pursuant to 10 CFR 54.21(c)(1)(i), that the allowable stress analysis for the subject ANSI B31.1 piping remains valid for the subsequent period of extended operation.

Additionally, the allowable pipe stress analysis meets the acceptance criteria in SRP-SLR Section 4.3.2.1.1.1 because: (a) the applicant determined the 80-year projected cycles based on conservative projections, and (b) the transient cycles are not projected to exceed the 7,000-cycle threshold during the subsequent period of extended operation.

4.3.3.3 UFSAR Supplement

SLRA Section A3.3.3 provides the UFSAR supplement summarizing the allowable stress analysis for the applicable ANSI B31.1 piping in SLRA Table 4.3.3-1. The staff reviewed SLRA Section A3.3.3 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 Dominion provided an adequate summary description of its actions to address the allowable stress analysis for the applicable ANSI B31.1 piping in SLRA Table 4.3.3-1, as required by 10 CFR 54.21(d).

4.3.3.4 Conclusion

On the basis of its review, the staff concludes that Dominion has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(i), that the allowable stress analysis for the applicable ANSI B31.1 piping 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).

4.3.4 Environmentally-Assisted Fatigue

4.3.4.1 Summary of Technical Information in the Application

SLRA Section 4.3.4 describes Dominion’s TLAA for environmentally assisted fatigue (EAF). Dominion dispositioned the TLAA for the ASME Code, Section III components and ANSI B31.1 piping that contact reactor coolant in accordance with 10 CFR 54.21(c)(1)(iii) by demonstrating that the effects of EAF on the intended functions will be adequately managed by the Fatigue Monitoring program, the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program, and the Steam Generators program for the subsequent period of extended operation.

4.3.4.2 Staff Evaluation

The staff reviewed Dominion’s TLAA for the ASME Code, Section III components and ANSI B31.1 piping that contact reactor coolant and the corresponding disposition of the TLAA in accordance with 10 CFR 54.21(c)(1)(iii), consistent with the review procedures in SRP-SLR

Section 4.3.3.1.2.3. Per SRP-SLR Section 4.3.3.1.2, the EAF assessment should include the locations identified in NUREG/CR-6260, “Application of NUREG/CR-5999 Interim Fatigue Curves to Selected Nuclear Power Plant Components,” and additional plant-specific locations in the reactor coolant pressure boundary (RCPB) that may be more limiting.

SLRA Section 4.3.4 provides separate EAF assessment discussions for ASME Code, Section III components and ANSI B31.1 piping. For both discussions, the applicant described the screening criteria used to select sentinel locations and how the applicable AMPs will be used to manage the effects of EAF on these sentinel locations. The sentinel locations are the component or piping locations, including the NUREG/CR-6260 locations, which have bounding environmentally-adjusted cumulative usage factors (CUF_{en}) values and that will be evaluated further for more detailed analysis, monitoring, inspection, or replacement.

ASME Code, Section III Components

To select sentinel locations, the applicant first reviewed and categorized all applicable ASME Code, Section III components with existing fatigue usage values into thermal zones, which are groups of components that are subject to the same thermal and pressure transients. In its next step, the applicant developed screening environmental fatigue correction factors (F_{en}) values for each component to calculate and compare the CUF_{en} values. The applicant used NUREG/CR-6909, “Effect of LWR Coolant Environments on the Fatigue Life of Reactor Materials,” for stainless steels, carbon and low-alloy steels, and Ni-Cr-Fe alloys.

During development of these screening F_{en} values, NUREG/CR-6909, Revision 1, was not finalized. The applicant evaluated Revision 0, pre-production Revision 1, and draft Revision 1 of NUREG/CR-6909 and chose to use the most limiting of these versions to develop the screening F_{en} values for each of the materials as a conservative approach. When NUREG/CR-6909, Revision 1, was issued, the applicant reviewed its calculated screening results and found that they were bounding compared to Revision 1 of NUREG/CR-6909. The applicant used Revision 0 for stainless steel and Ni-Cr-Fe alloys and draft Revision 1 for carbon and low-alloy steels. The staff finds this acceptable because the applicant took a conservative approach that evaluated the different versions of NUREG/CR-6909 and used the most limiting calculations for each material type.

In calculating the F_{en} values, the applicant used conservative values for the sulfur content, service temperature, strain rate, and dissolved oxygen (DO), following Electric Power Research Institute (EPRI) Technical Report 3002000505, “Pressurized Water Reactor Primary Water Chemistry Guidelines.” For the DO content, the applicant used periodic sampling results and discussed plant-specific operation activities used to control and monitor DO levels to justify that the DO content used in the calculations were conservative and bounding. The staff notes that, although the applicant did not specifically credit the Water Chemistry program to support the disposition of this TLAA, the Water Chemistry program will monitor and control the chemical environment of the reactor coolant system consistent with EPRI Report 3002000505. The staff finds the applicant’s input parameters acceptable because conservative values were used as well as actual plant-specific values for the DO, including plant-specific actions to monitor and control DO content levels and other parameters of the chemical environment of the reactor coolant system.

In its final step, the applicant compared the calculated CUF_{en} values for the components in each thermal zone to select the sentinel locations. The SLRA describes the criteria used to remove component locations for consideration as sentinel locations, including those locations that are

not part of the reactor coolant pressure boundary, are not in contact with primary coolant, have a CUF value of 0.0 or a screening CUF_{en} value of less than 1.0, or are bounded by the CUF_{en} calculation for a specified NUREG/CR-6260 component location. For the remaining components, the applicant performed a stress basis analysis ranking, which provided a consistent ranking approach to assess the level of technical rigor and qualification criteria for components within a thermal zone. In each thermal zone, the locations with the maximum screening CUF_{en} for each material were retained and selected as sentinel locations. The sentinel location results are listed in SLRA Table 4.3.4-1. For these component sentinel locations with CUF_{en} values greater than 1.0, the applicant performed ASME Code, Section III NB-3200 calculations to reduce conservatisms used in the analysis of record, resulting in CUF_{en} values of less than 1.0. The staff finds this acceptable because the sentinel selection methodology compared the CUF_{en} values of the components on a consistent and appropriate basis and selected the locations with the limiting CUF_{en} values for each material within each thermal zone.

The staff noted that the effects of fatigue on the intended functions of these ASME Code, Section III components will be managed by the Fatigue Monitoring program using the program's cycle counting methods. The staff finds this acceptable because (a) the Fatigue Monitoring program will monitor the appropriate transient cycles to ensure the validity of these EAF analyses and trigger corrective actions prior to the analyses becoming invalid, and (b) the applicant's basis is consistent with the acceptance criteria defined in SRP-SLR Section 4.3.2.1.2.3.

The staff's evaluation of the Fatigue Monitoring program is documented in SER Section 3.0.3.2.35, which determined that the AMP, when enhanced, will be adequate to manage the applicable aging effects.

The staff finds Dominion has demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of EAF on the intended functions of the ASME Code, Section III components that contact reactor coolant will be adequately managed for the subsequent period of extended operation.

Additionally, the Fatigue Monitoring program meets the acceptance criteria in SRP-SLR Section 4.3.2.1.2.3 because (a) the Fatigue Monitoring program will monitor and track the applicable transient cycles for the ASME Section III component sentinel locations, and (b) the chemistry environment of the reactor coolant system will be monitored and tracked.

ANSI B31.1 Piping

To select sentinel locations, the applicant first identified the following ANSI B31.1 piping locations that had been evaluated with a CUF analysis in accordance with the requirements in ASME Code, Section III: the pressurizer surge lines, charging nozzles, and accumulator nozzles. The applicant stated that the pressurizer surge lines will be included as a sentinel location. The applicant evaluated EAF for the charging nozzles and accumulator nozzles and determined that the CUF_{en} values were less than unity, and therefore could be removed from consideration as sentinel locations. The staff finds this acceptable because, consistent with NUREG/CR-6909, Revision 1, a calculated fatigue usage factor value of less than unity provides reasonable assurance that a fatigue crack has not formed and will not form.

For the remaining ANSI B31.3 piping locations, the applicant used a common basis stress evaluation (CBSE) method for estimating the fatigue usage. This CBSE method used estimated thermal transient stresses based on closed-form solutions and other stresses that were

calculated based on existing piping equations. The applicant stated that this method uses the same formulas and level of detail to calculate stress range and estimated fatigue usage so that the ANSI B31.1 piping locations can be evaluated and compared on a consistent and appropriate basis.

The applicant used NUREG/CR-6909, draft Revision 1, to calculate screening F_{en} values. The staff noted that the applicant used conservative values for the input parameters. The applicant also evaluated the screening results using the final Revision 1 report. The applicant found that there was no difference in the screening results between the draft Revision 1 report and final Revision 1 report. The applicant used a strain rate of 5 percent, which the staff finds acceptable because it used a more conservative value than the maximum strain rate used in the final Revision 1 to NUREG/CR-6909, which was 7 percent. Also, in calculating the screening F_{en} values, the applicant also used the chemical characteristics of the reactor coolant system similar to those used for the evaluation of ASME Code, Section III components, as discussed above. The staff finds this acceptable because the applicant used appropriate inputs to calculate the screening F_{en} values and evaluated both the draft Revision 1 and final Revision 1 to NUREG/CR-6909.

With calculated fatigue usage calculated for piping locations, the applicant then removed piping locations from consideration as sentinel locations if the piping location was not part of the reactor coolant pressure boundary or had a CUF_{en} value of less than 0.8. The applicant then selected the sentinel locations for each material type in a thermal zone based on the following criteria:

- highest estimated or maximum CUF_{en} selected
- location with the second highest CUF_{en} selected if the value is greater than 50 percent of the CUF_{en} value of the component with the highest CUF_{en} in the thermal zone
- location with the third highest CUF_{en} selected if the value is greater than 25 percent of the CUF_{en} value of the component with the highest CUF_{en} in the thermal zone

After using these selection criteria, the applicant compared sentinel locations across thermal zones such that "one thermal zone can bound another thermal zone in a system if the CUF and F_{en} values for one sentinel location in one thermal zone are each higher than those for the sentinel locations in other thermal zones, and the CUF_{en} value is more than twice those in the other zones." The applicant also included criteria that defined when a sentinel location of one material can bound locations of a different material. The staff does not find those criteria as a conservative and appropriate measure for component material comparisons. However, the staff reviewed the EAF calculations and noted that the applicant did not need to use those criteria to use a sentinel location of one material to bound locations of different materials. The sentinel location results are listed in SLRA Table 4.3.4-1.

The staff finds the applicant's selection criteria acceptable because (a) the applicant's approach calculates and screens the ANSI B31.1 piping locations using conservative input parameters or data from actual plant operations; (b) for each material in a thermal zone, the applicant will use the component location with the highest CUF_{en} value as the sentinel location for the given material in the thermal zone, with criteria that will be used to select additional sentinel locations for the material if certain CUF_{en}-based threshold criteria are exceeded; and (c) for sentinel components that are in different thermal zones and are made of the same material, the applicant will only allow the CUF_{en} assessment of one sentinel component to bound that for the

other location if the CUF_{en} value for the limiting location differs by more than a factor of two from that for less limiting components.

For the steam generator primary side tube sentinel location, the effects of fatigue will be managed by the Steam Generators program. The staff finds this acceptable because, consistent with the GALL-SLR Report AMP XI.M19, the tubes will be volumetrically examined such that fatigue cracks will be detected, and corrective actions will be initiated as appropriate to maintain the intended functions.

For the ANSI B31.1 piping sentinel locations, the effects of fatigue will be managed by the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program during the subsequent period of extended operation based on results of flaw tolerance evaluations conducted per the guidance of ASME Code, Section XI, Nonmandatory, Appendix L.

For the pressurizer surge line sentinel location, the applicant stated that the ASME Code, Section XI, Appendix L evaluation used transients tracked by the Fatigue Monitoring program. The applicant cited the staff's SE (ADAMS Accession No. ML18166A329), which approved the requested 10-year inspection interval for the surge lines for the initial period of extended operation. The staff's SE noted that the review only approved the inspection interval for the initial period of extended operation, and not for the subsequent period of extended operation. However, the staff's SE also noted that the projected growth rate of a postulated crack would not challenge the integrity of the surge line prior to its re-inspection. Furthermore, it is noted that the estimated 80-year transient cycle counts are not projected to exceed the current CLB limits that were used as input for the 10-year inspection interval. Therefore, the staff finds that the 10-year inspection interval is still valid for the subsequent period of extended operation, and that the Fatigue Monitoring program will monitor and track the transient cycles and will initiate corrective actions prior to the cycles exceeding the CLB cycle limits.

For the remaining ANSI B31.1 piping, 10 years of projected transient cycle counts were used to simulate the growth of postulated flaws used in the ASME Code, Section XI, Appendix L evaluations. The applicant stated that it conservatively selected the transient set used in the evaluations, which included transients associated with reactor coolant loop piping and branch line piping. The applicant determined its maximum allowable end-of-evaluation period flaw size based on the acceptance criteria and evaluation procedures in ASME Code, Section XI, Appendix C, 2004 editions, which is Surry's current code of record. The applicant also noted that no indications had been detected at these piping locations based on previous inspection records. Also, per ASME Code, Section XI, Appendix L, a postulated initial flaw size larger than the ASME Code, Section XI acceptance standards in Table IWB-3514-2 was used in the fatigue crack growth analysis.

The results of the ASME Code, Section XI, Appendix L evaluations are provided in SLRA Table 4.3.4-2. The staff reviewed this table and noted that the lowest allowable operating period was for the pressurizer spray line (4-inch diameter spray piping attached to pressurizer) with an axial flaw configuration, which was determined to be 21 years. The applicant used the results of this evaluation to justify an inservice inspection frequency for these piping locations of once every 10 years. The applicant noted that each weld in this inspection population will be ultrasonically inspected at least once prior to entering the 7th and 8th inspection intervals (i.e., the subsequent period of extended operation). After the first ultrasonic inspection, the applicant will ultrasonically inspect one weld in each of the sentinel piping groups every inspection interval. The staff finds this approach acceptable because based on a 10-year

inspection interval, the projected growth rate of a postulated crack would not challenge the structural integrity of the piping system prior to being detected during a scheduled inspection.

The staff's evaluation of the Fatigue Monitoring program is documented in SER Section 3.0.3.2.35, which determined that the AMP, when enhanced, will be adequate to manage the applicable aging effects. The staff's evaluation of the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program is documented in SER Section 3.0.3.2.1, which determined that the AMP will be adequate to manage the applicable aging effects. The staff's evaluation of the Steam Generators program is documented in SER Section 3.0.3.1.4, which determined that the AMP will be adequate to manage the applicable aging effects.

The staff finds Dominion has demonstrated pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of EAF on the intended functions of the subject ANSI B31.1 piping that contact reactor coolant will be adequately managed for the subsequent period of extended operation.

Additionally, it meets the acceptance criteria in SRP-SLR Section 4.3.2.1.2.3 because the Steam Generators program, Fatigue Monitoring program, or the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program will manage the effects of fatigue for locations identified as susceptible to EAF, with an appropriate inspection method and frequency, such that the intended functions will be maintained for the subsequent period of extended operation.

4.3.4.3 UFSAR Supplement

SLRA Section A3.3.3.4 provides the UFSAR supplement summarizing the TLAA for EAF. The staff reviewed SLRA Section A3.3.4 consistent with the review procedures in SRP-SLR Section 4.3.3.2.

Based on its review of the UFSAR supplement, the staff finds it meets the acceptance criteria in SRP-SLR Section 4.3.2.2 and is therefore acceptable. Additionally, the staff finds that Dominion provided an adequate summary description of its actions to address the effects of EAF on the intended functions of the ASME Code, Section III components and ANSI B31.1 piping that contact reactor coolant, as required by 10 CFR 54.21(d).

4.3.4.4 Conclusion

On the basis of its review, the staff concludes that Dominion 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 ASME Code, Section III components and ANSI B31.1 piping that contact reactor coolant will be adequately managed by the Fatigue Monitoring program, the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program, and the Steam Generators 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).

4.3.5 Reactor Vessel Internals Fatigue Analyses

4.3.5.1 Summary of Technical Information in the Application

SLRA Section 4.3.5 describes Dominion's TLAA for the fatigue analysis for the reactor vessel internals. Dominion dispositioned the TLAA for the reactor vessel internals in accordance with

10 CFR 54.21(c)(1)(i) by demonstrating that the analysis remains valid for the subsequent period of extended operation.

4.3.5.2 Staff Evaluation

The staff reviewed Dominion's TLAA for the reactor vessel internals and the corresponding disposition of the TLAA in accordance with 10 CFR 54.21(c)(1)(i), consistent with the review procedures in SRP-SLR Section 4.3.3.1.1.1.

The SLRA states that cumulative usage factors were determined for the lower core plate and upper core plate to support operation at MUR power uprate conditions. This fatigue analysis considered transients and the associated CLB cycle limits included in SLRA Table 4.3.1-1. The staff reviewed the applicant's methodology to project the 80-year cycles. The staff finds the projection methodology acceptable because it incorporated actual cycle accumulation history over the past 10 years and used actual plant operating characteristics and anticipated future operation to calculate the appropriate 80-year projected cycle counts. The staff noted that the CLB cycle limits bound the 80-year projected cycle counts, and therefore the fatigue analysis for the reactor vessel internals remains valid for the subsequent period of extended operation.

The staff finds Dominion has demonstrated pursuant to 10 CFR 54.21(c)(1)(i), that the analysis for the reactor vessel internals remains valid for the subsequent period of extended operation.

Additionally, it meets the acceptance criteria in SRP-SLR Section 4.3.2.1.1.1 because (a) the applicant determined the 80-year projected cycles based on historical plant operating characteristics and anticipated future operation, and (b) the transient cycles are not projected to exceed the CLB limits during the subsequent period of extended operation.

4.3.5.3 UFSAR Supplement

SLRA Section A3.3.5 provides the UFSAR supplement summarizing the fatigue analysis for the reactor vessel internals. The staff reviewed SLRA Section A3.3.5 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 Dominion provided an adequate summary description of its actions to address the fatigue analysis for the reactor vessel internals, as required by 10 CFR 54.21(d).

4.3.5.4 Conclusion

On the basis of its review, the staff concludes that Dominion has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(i), that the fatigue analysis for the reactor vessel internals 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).

4.4 <u>Environmental Qualification (EQ) of Electric Equipment</u>

4.4.1 Summary of Technical Information in the Application

SLRA Section 4.4 describes Dominion'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. Dominion 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 B3.3 for the subsequent period of extended operation.

4.4.2 Staff Evaluation

The staff reviewed Dominion's TLAA for the EQ of electric equipment and the corresponding disposition of the TLAA in accordance with 10 CFR 54.21(c)(1)(iii), consistent with the review procedures in SRP-SLR Section 4.4.3.1.3, 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 for electric equipment important to safety specified under 10 CFR 50.49(b), in accordance with the requirements of 10 CFR 50.49, is considered an adequate AMP for the purposes of license renewal. Electric components in Dominion'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 if Dominion's EQ program meets the requirement of 10 CFR 54.21(c)(1). Dominion's EQ program is implemented per the requirements of 10 CFR 54.21(c)(1)(iii) to show that components evaluated under Dominion's TLAA evaluation are adequately managed during the subsequent period of extended operation. The staff reviewed Dominion'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 B3.3 and the program basis documents, including reports provided to the staff during the audit. Based on the staff's review of SLRA Section B3.3 and the audit results, the staff concludes that Dominion's EQ program elements are consistent with the GALL-SLR Report AMP X.E1. The staff's evaluation of Dominion's Environmental Qualification of Electric Equipment AMP is documented in SER Section 3.0.3.2.36, which determined that the AMP will be adequate to manage the applicable aging effects.

The staff finds Dominion has demonstrated pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of thermal, radiation, and cyclical aging of plant electrical and instrumentation and control

components located in harsh environments, qualified to meet 10 CFR 50.49 requirements on the intended functions of the EQ electric equipment, will be adequately managed for the subsequent period of extended operation. Dominion's EQ program manages the effects of thermal, radiation, and cyclic aging using 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.

Additionally, Dominion's TLAA for environmental qualification of electric equipment meets the acceptance criteria in SRP-SLR Section 4.4.2.1.3 because (a) the EQ program is capable of programmatically managing the qualified life of components within the scope of program for license renewal, (b) the continued implementation of the EQ program provides assurance that the aging effects will be managed, and (c) thus EQ electric components will continue to perform their intended functions for the subsequent period of extended operation consistent with 10 CFR 54.21(c)(1)(iii).

4.4.3 UFSAR Supplement

SLRA Appendix A3.4 provides the UFSAR supplement summarizing the EQ of electric equipment TLAA. The staff reviewed SLRA Appendix A3.4 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 Dominion 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 Dominion has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of thermal, radiation, and cyclic aging on the intended functions of the EQ electric equipment will be adequately managed by the Environmental Qualification of Electric Equipment 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).

4.5 Concrete Containment Tendon Prestress

4.5.1 Summary of Technical Information in the Application

SLRA Section 4.5 describes Dominion's disposition for the Surry concrete containment tendon prestress. Dominion stated that the Surry containments utilize a reinforced concrete design without the use of prestressed tendons, and that loss of prestress is not applicable for the Surry containments.

The staff reviewed UFSAR Section 1.1.8 and noted that the containments are reinforced concrete structures without the use of prestressed tendons.

Therefore, there is no loss of prestress TLAA for the Surry containments.

4.6 Containment Liner Plate, Metal Containments, and Penetrations Fatigue Analysis

4.6.1 Containment Liner Plate

4.6.1.1 Summary of Technical Information in the Application

SLRA Section 4.6.1, as supplemented by response to RAI B2.1.29 1, dated June 27, 2019, describes Dominion's TLAA for fatigue of the steel containment liner. Dominion dispositioned the TLAA for the containment liner in accordance with 10 CFR 54.21(c)(1)(ii) by demonstrating that the analysis has been projected to the end of the subsequent period of extended operation

4.6.1.2 Staff Evaluation

The staff reviewed Dominion's TLAA for the containment liner plate and the corresponding disposition of the TLAA in accordance with 10 CFR 54.21(c)(1)(ii), consistent with the review procedures in SRP-SLR Section 4.6.3.1.1.2.

The staff reviewed UFSAR Section 15.5.1.8 and verified that the steel containment liner for each unit was evaluated for the effects of pressure, including subatmospheric operating pressure, temperature, and earthquake loads in accordance with the 1968 Edition of the ASME Code Section III, Subarticle N-415.1, to determine the need for a detailed fatigue analysis. The staff noted that the design cycles have been projected for 80 years of operation to 2,000 for operating pressure cycles, 8,000 for operating temperature cycles, and 40 for operating-basis earthquake (OBE) cycles. In its response to RAI B2.1.29-1, dated June 27, 2019, which the staff evaluated in SER Section 3.0.3.2.23, Dominion revised SLRA Table 4.6.1-1 to indicate that 1,500 projected design cycles are also acceptable for operating pressure cycles. The staff also noted that the corresponding projected expected cycles for 80 years of operation of 200, 800, and 16 to 20, respectively, remain within the allowed design limits. The staff further notes that infrequent extreme loads such as safe shutdown earthquake (SSE) need not be included for TLAA evaluations of fatigue aging effects.

The staff noted that the six conditions for fatigue waiver in Subarticle N-415.1, "Vessels Not Requiring Analysis for Cyclic Operation," of ASME Code, Section III were evaluated for the projected design cycles above for 80 years of operation and were determined to be satisfied. The corresponding anticipated number of cycles through the end of the subsequent period of extended operation were found to be less than the projected design cycles considered in the evaluation. As confirmed by Dominion by letter dated July, 11, 2019 (ADAMS Accession No. ML19198A059), based on the review of calculation 11448-EA-62, Addendum 00C, "Reactor Containment Liner Fatigue Evaluation for 80-Year Plant Life, Surry Unit 1 and Unit 2," Revision 0, the staff also noted that for satisfying Condition 2 – Normal Operation Pressure Fluctuation, of the ASME Code, Section III (1968), Paragraph N-415.1, the calculation evaluated the cumulative damage effect (usage factor) due to two types of pressure fluctuations. The calculated cumulative usage factor due to 100 cycles of the Type A test pressure fluctuation of 50.18 psi and 2,000 cycles of normal operating pressure fluctuation of 5.2 psi was 0.052, which is less than the acceptance criterion of 1.0.

The staff finds Dominion has demonstrated pursuant to 10 CFR 54.21(c)(1)(ii), that the analyses for fatigue of the containment liner plate have been projected to the end of the subsequent period of extended operation. Additionally, it meets the acceptance criteria in SRP-SLR Section 4.6.2.1.1.2 because the six fatigue waiver criteria in paragraph N-415.1 of the ASME

Code, Section III, 1968 Edition were satisfied for the projected design cycles for 80 years of operation due to fluctuations in operating pressure, temperature, and OBE loads. Further, the projected cycles considered in the evaluation were determined to be higher than the corresponding anticipated cycles for 80 years of operation; therefore, the evaluation is valid for the subsequent period of extended operation.

4.6.1.3 UFSAR Supplement

SLRA Section A3.6.1 provides the UFSAR supplement summarizing the containment liner plate fatigue analyses. The staff reviewed SLRA Section A3.6.1 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 Dominion provided an adequate summary description of its actions to address containment liner plate fatigue, as required by 10 CFR 54.21(d).

4.6.1.4 Conclusion

On the basis of its review, the staff concludes that Dominion has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(ii), that the analyses for fatigue of the containment liner plate have been projected to the end of the subsequent period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.6.2 Metal Containment

SLRA Section 4.6.2 states that the CLB does not include a metal containment fatigue analysis. The staff reviewed the UFSAR for the facility and verified that the UFSAR indicates that the containment structures for the units are made from concrete with internal steel liners. Therefore, the staff finds that the applicant does not need to evaluate a metal containment fatigue analysis as a TLAA in the SLRA because it is not contained or incorporated by reference in the CLB and does not conform to criterion 6 for defining TLAAs in 10 CFR 54.3(a).

4.6.3 Containment Penetrations Fatigue Analyses

SLRA Section 4.6.3 states that the CLB does not include fatigue analyses for the containment penetrations that would qualify as a TLAA in accordance with 10 CFR 54.3(a). The staff reviewed the UFSAR for the facility and verified that the UFSAR does not identify that cumulative usage factor analyses were performed for the containment penetrations as a part of the required design basis assessments that were required for the materials. Therefore, the staff finds that the applicant does not need to evaluate any fatigue analyses for the containment penetrations as TLAAs in the SLRA because they are not contained or incorporated by reference in the CLB and do not conform to criterion 6 for defining TLAAs in 10 CFR 54.3(a).

4.7 Other Plant-Specific TLAAs

4.7.1 Crane Load Cycle Limits

4.7.1.1 Summary of Technical Information in the Application

SLRA Section 4.7.1 describes Dominion's TLAAs related to crane load cycles. Dominion dispositioned the TLAAs for the containment polar cranes and spent fuel 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 Dominion's TLAA for the containment polar cranes and spent fuel crane and the corresponding disposition of the TLAA in accordance with 10 CFR 54.21(c)(1)(i), consistent with the review procedures in SRP-SLR 4.7.3.1.1. During its review, the staff noted that only the containment polar cranes and spent fuel crane are identified as TLAAs because they are subject to the guidance in NUREG-0612, "Control of Heavy Loads at Nuclear Power Plants," and have been evaluated to the load cycle requirements of Crane Manufacturers Association of America (CMAA) Specification 70 or its historical equivalent, Electric Overhead Crane Institute (EOCI) Specification 61, "Specifications for Electric Overhead Traveling Cranes."

SLRA Section 4.7.1 identified several cranes for which a fatigue cycle TLAA is not applicable because their design does not consider cyclic loading. These are:

- containment jib cranes,
- containment annulus monorails,
- Auxiliary Building 10-ton monorail (27-ft level),
- Auxiliary Building 5-ton monorail (13-ft level), and
- Fuel Building motor-driven platform.

By letter dated April 2, 2019 (ADAMS Accession No. ML19095A666), Dominion revised SLRA Section 4.7.1 to state that the residual heat removal pump motor lifting lugs are designed for the dead weight of the motors, their attachments, and rigging. The revised SLRA also states that design calculations for these lugs do not specify load cycle limits and are not TLAAs.

The staff reviewed Dominion's claim that the above cranes have no analyses that involve TLAAs and finds Dominion's claim acceptable because based on the staff's review of the UFSAR, audited documentation, and the staff's SER of Surry's LRA, there are no crane fatigue cycle TLAAs associated with these cranes.

SLRA Section 4.7.1 states that the containment polar cranes and the spent fuel crane are identified as subject to TLAA for load cycle requirements of CMAA Specification 70 and were designed to meet the intent of a Class A (Standby) Service crane, which includes consideration of 100,000 load cycles during operation of the crane. SLRA Table 4.7.1-1 provides a summary of the 80-year evaluations for the containment polar cranes and spent fuel crane, with more detailed evaluations in Tables 4.7.1-2 and 4.7.1-3, respectively, which are projected for the 80-year operating term of the plant.

The staff notes that the applicant's selection of a crane cycle limit of 100,000 cycles for all the above cranes is the cycle limit stated in CMAA-70 for a Class A (standby service crane). 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 containment polar cranes (2,726/2,620 for U-1/U-2, respectively), and the spent fuel crane (34,560 cycles) are well below the crane cycle limit, with the highest cycle count expected to be less than 35 percent of the allowable value of 100,000 cycles.

The staff finds Dominion has demonstrated pursuant to 10 CFR 54.21(c)(1)(i), that the analyses for the cranes load cycles of the containment building polar cranes and spent fuel crane remain valid for the subsequent period of extended operation. Additionally, it meets the acceptance criteria in SRP-SLR Section 4.7.2.1.1 because Dominion has demonstrated that the crane load cycle analyses remain below the bounds of the CMAA Specification 70 allowable load cycles and therefore are valid through the subsequent period of extended operation.

4.7.1.3 UFSAR Supplement

SLRA Section A3.7.1 provides the UFSAR supplement summarizing the crane load cycles for the containment building polar cranes and spent fuel crane. The staff reviewed SLRA Section A3.7.1 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 4.7.1 and is therefore acceptable. Additionally, the staff determines that Dominion provided an adequate summary description of its actions to address the crane load cycles for the containment building polar cranes and spent fuel crane, as required by 10 CFR 54.21(d).

4.7.1.4 Conclusion

On the basis of its review, the staff concludes that Dominion has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(i), that the analyses for the containment polar cranes and spent fuel crane 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 Coolant Pump Flywheel Fatigue Crack Growth Analysis

4.7.2.1 Summary of Technical Information in the Application

SLRA Section 4.7.2 describes Dominion's TLAA for the reactor coolant pump (RCP) flywheel fatigue crack growth analysis. Dominion dispositioned the TLAA for the RCP flywheel in accordance with 10 CFR 54.21(c)(1)(i) by demonstrating that the analysis remains valid for the subsequent period of extended operation.

4.7.2.2 Staff Evaluation

The staff reviewed Dominion's TLAA for the RCP flywheel and the corresponding disposition of the TLAA in accordance with 10 CFR 54.21(c)(1)(i), consistent with the review procedures in SRP-SLR Section 4.7.3.1.1. The staff reviewed the applicant's analysis by verifying that its implementation of the PWR Owners Group (PWROG)-17011-NP methodology is acceptable for demonstrating that the CLB analyses of the RCP flywheel remain valid for the subsequent period of extended operation.

The PWROG-17011-NP report provides generic deterministic and risk-informed analyses for Westinghouse RCP flywheels that are applicable to 80-year operating periods. PWROG-17011-NP extends the applicability of NRC-approved methodologies in WCAP-14535-A (ADAMS Accession No. ML18312A175) and WCAP-15666-A (ADAMS Accession No. ML18303A413) to the subsequent period of extended operation. These analyses form the basis for performing inservice inspections of the RCP flywheels on a 20-year inspection interval basis, as required by the provisions in TS Section 4.2, "Reactor Coolant Pump Flywheel Inspection."

The NRC staff approved the PWROG-17011-NP methodology as a generic topical report and found it to be acceptable for generic implementation in SLR TLAAs to support continuation of 20-year RCP flywheel inspection intervals for 80-year operating periods, as documented in the staff's SE, dated September 18, 2019 (ADAMS Accession No. ML19198A050). The staff's SE specifies that applications for implementing this methodology should confirm that 6,000 RCP start and stop cycles, which is the total number of cycles assumed for the generic fatigue crack growth calculation supporting WCAP-15666-A, remain bounding on a plant-specific basis for 80 years of operation.

SLRA Table 4.7.2-1 provides the total projected RCP start and stop cycles for 80 years, which is 1,158 cycles. The applicant stated that this was calculated from the projected 80-year heatup/cooldown cycles and the estimated RCP start/stop cycles per heatup/cooldown cycle. The staff reviewed the applicant's transient cycle projection methodology for 80 years, as discussed in SLRA Section 4.3.1, and finds that the applicant evaluated the accrued heatup/cooldown cycles and appropriately calculated the projected 80-year cycle count. The staff finds that the applicant appropriately calculated the projected RCP start and stop cycles for the subsequent period of extended operation. The staff notes that there is significant margin between the projected cycle count of 1,158 and the 6,000 cycles assumed in the PWROG-17011-NP methodology. Therefore, the staff finds acceptable the applicant's implementation of the PWROG-17011-NP methodology to support continuation of 20-year RCP flywheel inspection intervals for an 80-year operating periods. The staff also finds that that applicant's TLAA supports continued validity of the provisions of TS Section 4.2 for the subsequent period of extended operation.

The staff finds Dominion has demonstrated pursuant to 10 CFR 54.21(c)(1)(i), that the analysis for the RCP flywheel 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, as described above, the applicant demonstrated that the existing RCP flywheel fatigue crack growth analysis to support the current inspection interval remains bounded for the subsequent period of extended operation.

4.7.2.3 UFSAR Supplement

SLRA Section A3.7.2 provides the UFSAR supplement summarizing the RCP flywheel fatigue crack growth analysis. The staff reviewed SLRA Section A3.7.2 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 4.7.2.2 and is therefore acceptable. Additionally, the staff finds that Dominion provided an adequate summary description of its actions to address the RCP flywheel fatigue crack growth analysis, as required by 10 CFR 54.21(d).

4.7.2.4 Conclusion

On the basis of its review, the staff concludes that Dominion has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(i), that RCP flywheel fatigue crack growth analysis 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).

4.7.3 Leak-Before-Break Analysis

4.7.3.1 Summary of Technical Information in the Application

SLRA Section 4.7.3, as supplemented by letter dated April 2, 2019, describes Dominion's TLAA on the leak-before-break (LBB) analysis for the reactor coolant system (RCS) primary loop piping. The technical information for the LBB TLAA is summarized below. WCAP-15550, Revision 0 (August 2000), "Technical Justification for Eliminating Large Primary Pipe Rupture as the Structural Design Basis for the Surry Units 1 and 2 Nuclear Power Plants for the License Renewal Program," demonstrated the adequacy of LBB application for the primary loop piping for 60 years of operation based on a plant-specific analysis. Dominion updated the LBB analysis to address subsequent license renewal. The updated 80-year LBB analysis is documented in WCAP-15550, Revision 2 (March 2019), which was submitted to supplement the SLRA. The scope of the 60-year and 80-year LBB analyses is consistent with the CLB 60-year analysis and does not include branch lines of the primary loop piping.

The analysis in WCAP-15550, Revision 2, documents the plant-specific geometry, loading, and material properties used in the limit load and fracture mechanics analyses for the primary loop piping. Mechanical properties were determined at operating temperatures. Since the piping systems include cast austenitic stainless steel (CASS), fracture toughness properties considering thermal aging were determined for each heat of material in accordance with NUREG/CR-4513, Revision 2, in the 80-year LBB analysis. A fatigue crack growth analysis was also performed using the crack growth rates from ASME Code, Section XI. The fatigue analysis confirms that the fatigue crack growth for semi-elliptical surface flaws is insignificant and does not affect the application and conclusion of the LBB analysis.

Dominion dispositioned the LBB TLAA for the RCS primary loop piping in accordance with 10 CFR 54.21(c)(1)(ii) by demonstrating that the TLAA has been projected to the end of the subsequent period of extended operation.

4.7.3.2 Staff Evaluation

The staff reviewed Dominion's LBB TLAA for the RCS primary loop piping and the corresponding disposition of the TLAA in accordance with 10 CFR 54.21(c)(1)(ii), consistent with the review procedures in SRP-SLR Section 4.7.3.1.2 and acceptance criteria in SRP-SLR Section 4.7.2.1.2. These SRP-SLR sections provide the general guidance for plant-specific TLAAs. In addition, the Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants, LWR Edition, Section 3.6.3 provides detailed guidance for LBB analyses and the staff's review of the analyses. The SRP guidance also addresses acceptable methods to meet 10 CFR Part 50, Appendix A, General Design Criterion (GDC) 4 regarding LBB analyses.

The staff's review of this SLRA section focused on the time-dependent aspects of the 80-year LBB analysis and other differences between the 80-year LBB analysis and the CLB 60-year MUR LBB analysis. Other aspects of the 80-year LBB analysis that are not time dependent or do not change from the CLB are not evaluated in this section.

4.7.3.2.1 Load Calculations and Combinations

The staff noted that the 60-year LBB analysis (Revision 0 of WCAP-15550) indicates that location 4 is the critical elbow location for the hot leg. In comparison, the 80-year LBB analysis (Revision 2 of WCAP-15550) indicates that the critical elbow location for the hot leg is location 3. The staff needed clarification on the change in the critical location in the hot leg, which resulted in the issuance of RAI 4.7.3-7.

Dominion's response to RAI 4.7.3-7 is documented in ADAMS Accession Nos. ML19204A357 and ML19204A359 (non-proprietary and proprietary versions, respectively). In its response, Dominion stated that the change in the critical location in the different versions of the WCAP-15550 report is due to the updates and refinements in the stresses (i.e., deadweight, thermal expansion, and safe shutdown earthquake loadings) over time. Dominion also explained that the changes to the faulted stresses for the LBB analysis are attributed to the updates of the piping analysis model made after the publication of WCAP-15550, Revision 0, in 2000. In its review, the staff finds Dominion's response acceptable because Dominion clarified that the change in the critical location of the hot leg piping results from the updates and refinement in the piping stress analysis, and that the highest stress location is identified as the critical location based on the updated stress analysis results. RAI 4.7.3-7 is resolved.

The staff finds that the applicant's method for load calculations and combinations in the LBB analysis is consistent with the guidance in SRP 3.6.3 and therefore is acceptable.

4.7.3.2.2 Piping Material Characterization

The LBB analysis used the material tensile properties documented in Surry's certified material test reports (CMTRs). To consider the temperature dependency of the tensile properties, material property ratios at different temperatures (such as yield strength ratio between 609 °F and 650 °F) were determined by using the tensile property data in the 1999 Edition of ASME Boiler and Pressurized Vessel Code (ASME Code), Section II. Then, the CMTR tensile property values obtained at a specific test temperature (e.g., 650 °F) were multiplied by the ASME-Code-based tensile property ratio, which accounts for the temperature dependency. In this manner, plant-specific material properties could be determined at piping operating temperatures in the LBB analysis. The WCAP report further explains that the saturated fracture toughness properties (e.g., J_{Ic} and J_{max}) of the CASS materials were determined by considering the plant-specific material compositions in accordance with NUREG-4315, Revision 2.

In its review, the staff noted that Dominion adequately used the tensile property data of plant-specific CMTRs with reasonable adjustments to account for temperature effects on the material properties. However, the staff needed additional information regarding the material property characterization and determination of limiting materials. Specifically, it was not clear to the staff how the applicant determined that the weld materials are bounded by the base (stainless steel) and CASS materials in terms of tensile strength and fracture toughness. This item resulted in the issuance of RAI 4.7.3-1.

Dominion's response to RAI 4.7.3-1 is documented in ADAMS Accession No. ML19183A386. The staff finds Dominion's response acceptable because Dominion clarified that (1) the representative piping materials for the primary loop at Surry were tested to determine the tensile and fracture toughness properties and documented in WCAP-9787, "Tensile and Toughness Properties of Primary Piping Weld Metal for Use in Mechanistic Fracture Evaluation," and WCAP-9558, Revision 2, "Mechanistic Fracture Evaluation of Reactor Coolant Pipe Containing a Postulated Circumferential Through-Wall Crack," and (2) the test results and related material property evaluations confirmed that the tensile and fracture toughness properties of the wrought stainless steel and CASS materials are more limiting (lower) than the welds. RAI 4.7.3-1 is resolved.

The staff also noted that the 80-year LBB TLAA for subsequent license renewal (WCAP-15550, Revision 2) follows the guidance in NUREG/CR-4513, Revision 2, in the calculations of saturated fracture toughness of the CASS materials for piping elbows. In comparison, the existing 60-year LBB TLAA (WCAP-15550, Revision 0) follows the guidance in NUREG/CR-4513, Revision 1, which is referenced in the GALL-SLR Report guidance (AMP XI.M12). Both fracture toughness calculations used the known compositions of the CASS materials.

Since Revision 1 of NUREG/CR-4315 is referenced as a guidance document for estimating fracture toughness of CASS materials in the GALL-SLR Report, the staff needed to confirm that the use of the guidance in NUREG/CR-4315, Revision 2, would not lead to the less conservative crack stability analysis in comparison with the analysis using the guidance in NUREG/CR-4513, Revision 1.

With respect to the cross-over leg and cold leg, the staff noted that in each leg the limiting fracture toughness of CASS materials estimated per Revision 2 of NUREG/CR-4513 is less (i.e., more limiting) than that estimated per Revision 1 of NUREG/CR-4513. The staff finds that the use of the more limiting fracture toughness value in the 80-year LBB TLAA is a conservative approach and therefore is acceptable.

With respect to the hot leg, the staff noted that the limiting fracture toughness of CASS materials estimated per Revision 2 of NUREG/CR-4513 is greater than that estimated per Revision 1 of NUREG/CR-4513. However, the staff noted that both of the limiting fracture toughness values per Revisions 1 and 2 of NUREG/CR-4513 are high enough to ensure crack stability for the hot-leg piping. Therefore, the staff finds that the use of Revision 2 of NUREG/CR-4513 to project the fracture toughness does not cause a concern due to non-conservatism in the crack stability determination.

The staff finds that Dominion adequately performed piping material characterizations to prepare for the input values of material properties for the LBB analysis.

Crack Stability Analysis

Section 7.3 and Table 7-1 of WCAP-15550, Revision 2, suggest that different analysis approaches are used in the fracture analyses for critical locations 3 (for the hot leg) and 6 (for the cross-over leg). The staff found a need to clarify this item, which resulted in the issuance of RAI 4.7.3-2.

Dominion's response to RAI 4.7.3-2 is documented in ADAMS Accession Nos. ML19183A386 and ML19183A388 (non-proprietary and proprietary versions respectively). In its response as

clarified during a teleconference call on July 29, 2019 (ADAMS Accession No. ML19219A284), Dominion indicated that the fracture mechanics analysis for location 3 was performed consistent with the current licensing basis in accordance with NUREG/CR-3464, Section II-1, “The Effects of Shell Corrections on Stress Intensity Factors and the Crack Opening Area of Circumferential and a Longitudinal Through-Crack in a Pipe”. Dominion explained that the analysis approach used for location 3 was too conservative for location 6 and therefore the analysis for location 6 was performed in accordance with EPRI Reports NP-1931, “An Engineering Approach for Elastic-Plastic Fracture Analysis,” and NP-3607, “Advances in Elastic-Plastic Fracture Analysis”.

The staff finds Dominion’s response acceptable because Dominion clarified that (1) the fracture mechanics analysis for location 3 is consistent with the current licensing basis (Section 7.3 of WCAP-15550, Revision 0) and confirms that crack initiation would not occur, and (2) the fracture mechanics analysis for location 6 uses the J integral/tearing modulus (J/T) approach, which is consistent with the current licensing basis (Section 7.1 of WCAP-15550, Revision 0), and confirms that the initiated crack would be arrested before piping rupture. RAI 4.7.3-2 is resolved.

In its review, the staff finds that the crack stability analysis using the limit load method confirms a sufficient margin for crack stability at the critical locations. In addition, the staff finds that the crack stability analysis is based on relevant fracture mechanics principles and the current licensing basis. Therefore, the staff finds the applicant’s analysis acceptable.

4.7.3.2.3 Fatigue Crack Growth Analysis

In Section 8 of WCAP-15550, Revision 2, a fatigue crack growth analysis was performed to determine the sensitivity of the primary coolant system to the presence of a small crack. WCAP-15550, Revision 2, also indicates that the analyzed generic transients and associated cycles are bounding for those projected for 80 years of operation at Surry.

The staff noted that the fatigue crack growth analysis does not clearly discuss the aspect ratio of the initial crack size, and the basis for the postulated initial crack sizes for the crack growth analysis. The staff needed additional information on these items, which resulted in the issuance of RAI 4.7.3-3.

Dominion’s response to RAI 4.7.3-3 is documented in ADAMS Accession Nos. ML19183A386 and ML19183A388 (non-proprietary and proprietary versions, respectively). In its response, Dominion provided the aspect ratio of the initial crack size. Dominion also provided the range of the initial crack depths in terms of the ratio of the crack depth to the pipe thickness. Dominion further explained that the initial crack sizes are detectable by nondestructive examination (NDE). In addition, Dominion clarified that the intent of the fatigue crack growth analysis was to confirm that the postulated initial cracks would not grow to through-wall flaws over the 80-year operation of the plant. RAI 4.7.3-3 is resolved.

The staff finds the response acceptable because Dominion confirmed that: (1) the crack size and aspect ratio postulated in the fatigue crack growth analysis are large enough to be detectable in inspections, and (2) the fatigue crack growth does not adversely affect the structural integrity of the piping.

The staff noted Table 8-1 of the WCAP report lists the transients and transient cycle numbers that are used in the fatigue crack growth analysis for 80 years of operation. In comparison, Table 4.3.1-1 of the SLRA describes the 80-year transient cycle projections for the metal fatigue

TLAAs based on Surry UFSAR Table 4.1-8 and Section 18.4.2. The staff noted that in comparison with Table 4.3.1-1 of the SLRA, Table 8-1 of WCAP-15550, Revision 2, does not include the “[i]nadvertent auxiliary pressurizer spray” transient in the fatigue crack growth analysis for the LBB TLAA. The staff also noted that Section 8.0 of the WCAP report does not clearly describe why the “[i]nadvertent auxiliary pressurizer spray” transient is not included in the fatigue crack growth analysis, which resulted in the issuance of RAI 4.7.3-4.

Dominion’s response to RAI 4.7.3-4 is documented in ADAMS Accession No. ML19183A386. In its review, the staff finds Dominion’s response acceptable because Dominion confirmed that (1) the "[i]nadvertent auxiliary pressurizer spray" transient is not a design transient for the main loop piping of the reactor coolant system, and (2) the transient does not contribute to fatigue crack growth of the main loop piping. RAI 4.7.3-4 is resolved.

In its review, the staff noted that the 80-year fatigue crack growth of the postulated flaws is insignificant. The staff finds that the analysis results provide reasonable assurance that the potential fatigue crack growth would not affect the integrity of the primary coolant loop piping and the crack stability determined in the LBB analysis.

Summary

As discussed above, the staff finds Dominion has demonstrated pursuant to 10 CFR 54.21(c)(1)(ii), that the LBB analysis for the RCS primary loop piping has been projected to the end of the subsequent period of extended operation. Additionally, the LBB TLAA meets the acceptance criteria in SRP-SLR Section 4.7.2.1.2 because the applicant has demonstrated that the LBB analysis is updated in accordance with the guidance in SRP Section 3.6.3 for 80 years of operation. Therefore, the LBB TLAA demonstrates that the probability of a rupture in the RCS primary loop piping is extremely low under conditions consistent with the design basis for the piping.

4.7.3.3 UFSAR Supplement

SLRA Section A3.7.3 provides the UFSAR supplement, as amended by letter dated June 27, 2019, summarizing the LBB TLAA for the RCS primary loop piping. The staff reviewed SLRA Section A4.7.3, consistent with the review procedures in SRP-SLR Section 4.7.3.2.

In its review, the staff noted that in SLRA Section A4.7.3, the reference to the WCAP-15550 report does not identify a specific revision (i.e., Revision 2) that provides the 80-year LBB analysis. This concern resulted in the issuance of RAI 4.7.3-5. Dominion’s response to RAI 4.7.3-5 is documented in ADAMS Accession No. ML19183A386. In its response, Dominion revised SLRA Section A3.7.3 to include the specific revision (Revision 2) in the reference to the WCAP-15550 report. The staff finds Dominion’s changes to SLRA Section A3.7.3 acceptable because the change resulted in a specific identification of WCAP-15550, Revision 2, as the revision of the WCAP report that describes the 80-year LBB TLAA. RAI 4.7.3-5 is resolved.

Based on its review of the UFSAR supplement as amended, the staff finds that it meets the acceptance criteria in SRP-SLR Section 4.7.2.2 and is therefore acceptable. Additionally, the staff finds that Dominion provided an adequate summary description to address the LBB TLAA for the RCS primary loop piping, as required by 10 CFR 54.21(d).

4.7.3.4 Conclusion

On the basis of its review, the staff concludes that Dominion has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(ii), that the LBB TLAA for the RCS primary loop piping has been projected to the end of the subsequent period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.7.4 Spent Fuel Pool Liner Fatigue Analysis

4.7.4.1 Summary of Technical Information in the Application

SLRA Section 4.7.4 describes Dominion's TLAA for spent fuel pool (SFP) liner fatigue. Dominion dispositioned the TLAA for the spent fuel pool liner in accordance with 10 CFR 54.21(c)(1)(ii) by demonstrating that the analysis has been projected to the end of the subsequent period of extended operation.

4.7.4.2 Staff Evaluation

The staff reviewed Dominion's TLAA for the spent fuel pool liner fatigue analysis and the corresponding disposition of the TLAA in accordance with 10 CFR 54.21(c)(1)(ii), consistent with the review procedures in SRP-SLR Section 4.7.3.1.2.

The staff noted that the projected thermal cycles for 80 years of operation for the three design conditions of the SFP liner described in the SLRA were 108 (normal core offload), 11 (abnormal core offload), and 1 (faulted condition). The staff also noted that because the faulted condition as described in the SLRA is an extreme case (abnormal event) with a very low likelihood of occurrence, the number of cycles was not projected, and only a single cycle was considered. The staff further noted that considering the most conservative case of fatigue effects, evaluated using fatigue criteria for 80 years of operation, the maximum allowable number of cycles estimated in the original calculation for the controlling component were 1,200 cycles, 20 cycles, and 9 cycles, respectively, for the three design conditions identified in the SLRA. The thermal stresses in the spent fuel pool liner due to the conservatively assumed temperature gradients and projected thermal cycles for 80 years of operation were shown to satisfy the requirements of the ASME Code, Section III, Subsection NB, 2010 Edition, Paragraphs NB-3222.2, NB-3222.4, and NB-3228.5. As confirmed by Dominion by letter dated July, 11, 2019 (ADAMS Accession No. ML19198A059), and based on the audit review of calculation, CE-1272, Addendum 00B, "Fuel Pool Liner Fatigue Evaluation for 80 Years Plant Life, Surry Unit 1 and Unit 2," Revision 0, the staff noted that Dominion calculated the cumulative damage (or cumulative usage factor) due to fatigue effects of thermal cyclic loadings for the controlling component (i.e., plate-stiffener weld) of the SFP liner from the three design conditions described in the SLRA to be 0.75. This is less than the acceptance criterion of 1.0.

The staff finds Dominion has demonstrated pursuant to 10 CFR 54.21(c)(1)(ii), that the analysis for the spent fuel pool liner has been projected to the end of the subsequent period of extended operation. Additionally, it meets the acceptance criteria in SRP-SLR Section 4.7.2.1.2 because the cumulative fatigue damage due to fatigue effects from projected thermal cyclic loading conditions for 80 years of operation was shown to be less than the allowable fatigue usage factor limit of 1.0.

4.7.4.3 UFSAR Supplement

SLRA Section A3.7.4 provides the UFSAR supplement summarizing the spent fuel pool liner fatigue analysis. The staff reviewed SLRA Section A3.7.4 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 4.7.2.2 and is therefore acceptable. Additionally, the staff finds that Dominion provided an adequate summary description of its actions to address spent fuel pool fatigue analysis, as required by 10 CFR 54.21(d).

4.7.4.4 Conclusion

On the basis of its review, the staff concludes that Dominion has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(ii), that the fatigue analysis for the spent fuel pool liner 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 Piping Subsurface Indications

4.7.5.1 Summary of Technical Information in the Application

SLRA Section 4.7.5, “Piping Subsurface Flaw Evaluations,” describes Dominion’s TLAAs for the fatigue analysis for the embedded flaws. The piping subsurface flaw calculations were assessed for 80 years of operation. Dominion dispositioned the TLAAs in accordance with 10 CFR 54.21(c)(1)(ii) by demonstrating that the evaluations have been projected to the end of the subsequent period of extended operation.

4.7.5.2 Staff Evaluation

The staff reviewed Dominion’s TLAAs for the fuel pool cooling piping, the feedwater piping, and the Seismic I Category piping and the corresponding disposition of the TLAAs in accordance with 10 CFR 54.21(c)(1)(ii) for the subsurface flaws in these components, consistent with the review procedures in SRP-SLR Section 4.7.3.1.2.

The staff compared the calculated number of cycles assumed in the current analyses to the projected number of cycles the components would experience for 80 years of operation. The components are conservatively expected to receive 165 cycles using the 80-year projected number of heatups to bound the projected number of cycles for the listed piping. The number of allowed cycles for the components ranged from 6,255 cycles to 3,886,003 cycles, providing a significant margin in the calculations. The calculations were performed in accordance with ASME Code Section XI Nonmandatory Appendices A and C.

Based on the large margin, the staff finds Dominion has demonstrated pursuant to 10 CFR 54.21(c)(1)(ii), that the analyses have been projected to the end of the subsequent period of extended operation.

Additionally, it meets the acceptance criteria in SRP-SLR Section 4.7.3.1.2 because the projected number of cycles are significantly lower than the cycles required to grow the flaws to an unacceptable size, consistent with 10 CFR 54.21(c)(1)(ii).

4.7.5.3 UFSAR Supplement

SLRA Section A3.7.5 provides the UFSAR supplement summarizing the fatigue analyses of the subsurface flaws. The staff reviewed SLRA Section A3.7.5 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 Dominion provided an adequate summary description of its actions to address the fatigue analysis of the subsurface flaws, as required by 10 CFR 54.21(d).

4.7.5.4 Conclusion

On the basis of its review, the staff concludes that Dominion has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(ii), that the analyses for the subsurface flaws in the fuel pool cooling piping, the feedwater piping, and the Seismic I Category piping have been projected to the end of the subsequent period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.7.6 Reactor Coolant Pump Code Case N-481

4.7.6.1 Summary of Technical Information in the Application

SLRA Section 4.7.6 describes the applicant’s TLAA for the RCP casing as related to its use of ASME Code Case N-481. The TLAA aspects of the analysis are thermal aging of CASS and fatigue crack growth. Dominion dispositioned the TLAA in accordance with 10 CFR 54.21(c)(1)(i) by demonstrating that its analysis remains valid for the subsequent period of extended operation.

4.7.6.2 Staff Evaluation

The staff reviewed Dominion’s TLAA for the RCP casing integrity and the corresponding disposition of the TLAA in accordance with 10 CFR 54.21(c)(1)(i), consistent with the review procedures in SRP-SLR Section 4.7.3.1.1.

The staff focused its review on the validity of the time-dependent parameters in the analysis of the RCP casings at Surry through the subsequent period of extended operation.

In March 1990, the ASME Code Committees approved Code Case N-481 to provide an alternative to the volumetric inspection of the RCP casing. The NRC accepted Code Case N-481 in RG 1.147, “Inservice Inspection Code Case Acceptability ASME Section XI Division 1, Revision 9,” dated April 1992. ASME Code Case N-481 allowed the elimination of volumetric examination of the RCP casing with a fracture mechanics-based integrity evaluation supplemented by specific visual inspections.

In March 2004, ASME annulled the code case and incorporated the provisions of the code case into the 2008 addenda of ASME Code, Section XI.

In September 1991, Westinghouse published WCAP-13045, which presented the structural integrity evaluation of the RCP casing to demonstrate compliance with ASME Code

Case N-481, Item (d). WCAP-13045 was based on structural integrity evaluations for a 40-year service life.

In 2001, Dominion submitted for NRC review and approval the LRA for Surry Units 1 and 2. As a part of that application, Dominion stated that it performed RCP casing integrity analyses for the period of extended operation at Surry. By letter dated December 31, 2002, the staff approved the LRA for Surry (ADAMS Accession No. ML030160853).

The Dominion SLRA referenced PWROG-17033, Revision 1, as being applicable to this TLAA for Surry. The PWROG submitted PWROG-17033, Revision 1 for NRC review and generic approval by letter dated June 14, 2018 (ADAMS Accession No. ML18170A113). The staff's review of PWROG-17033, Revision 1, concluded that the report has demonstrated structural integrity of the Westinghouse-designed RCP casings for the subsequent period of extended operation (80 years) based on a crack stability analysis and a fatigue crack growth (FCG) analysis. The NRC staff concluded that PWROG-17033, Revision 1, is acceptable for generic use to address the TLAA of the RCP casing integrity to satisfy 10 CFR 54.21(c)(1). In addition, the NRC staff concluded that an applicant that utilizes PWROG-17033, Revision 1, in its subsequent license renewal application, needs to address four conditions that the NRC staff imposed as specified in the SE dated November 30, 2019 (ADAMS Accession No. ML19319A188).

Condition 1 requires that the applicant confirm that its RCPs are Westinghouse-designed models. Condition 2 requires that the applicant confirm that the Westinghouse-designed RCP is either a Model 63, Model 70, Model 93, Model 93A, Model 93A-1, Model 93D, Model 100A, or Model 100D, and fabricated with SA-351 CF8 or CF8M material. SLRA Section 4.7.6 specifies that the Surry RCPs are Westinghouse Model 93A, Grade CF-8 pump casings. Therefore, the staff finds that Dominion has satisfied Conditions 1 and 2 because the RCP pump design and fabrication materials are consistent with those addressed in PWROG-17033, Revision 1.

Condition 3 requires that for the crack stability analysis, the applicant must confirm that the screening loadings (forces, moments, $J_{app,}$ and T_{app}) used in WCAP-13045 bound the plant-specific loadings. The applicant must confirm that the limiting material fracture toughness values (J_{Ic}, T_{mat}, and J_{max}) used in WCAP-13045 and PWROG-17033, Revision 1, bound the plant-specific fracture toughness values. In response to the staff's RAI 4.7.6-1, dated June 27, 2019 (ADAMS Accession No. ML19183A386), the applicant confirmed that screening loads used in WCAP-13045 bound the plant-specific loadings at Surry. Dominion also confirmed that the fracture toughness values used in WCAP-13045 and PWROG-17033, Revision 1, bound the plant-specific fracture toughness values. Therefore, the NRC staff finds that Dominion has satisfied Condition 3 because the screening loads and fracture toughness values used in WCAP-13045 and PWROG-17033, Revision 1, bound the plant-specific values at Surry. RAI 4.7.6-1 is resolved.

Related to the FCG analysis, Condition 4 requires that the applicant confirm that the transient cycles specified in the WCAP-13045 or PWROG-17033 reports bound the plant-specific transient cycles for the 80 years of operation. The applicant must confirm that the loadings used in the FCG analysis in WCAP-13045 bound the plant-specific applied loadings, considering a potential increase in applied loading caused by plant-specific system operational changes, power uprate, or piping modifications. If the FCG analysis inputs in WCAP-13045 bound the plant-specific conditions, the applicant must discuss how they are bounding in the subsequent license renewal application. In its response to RAI 4.7.6-2, dated June 27, 2019 (ADAMS Accession No. ML19183A386), the applicant stated that the transient set used in

WCAP-13045 and PWROG-17033, Rev. 1, is generic, and the FCG cycles specified for 40 years in WCAP-13045 were doubled for 80 years in PWROG-17033, Revision 1. For the Surry SLR, the cycles for 80 years of plant operation are projected to remain within the 40-year number of design cycles. Any differences between the generic transient set and the Surry SLR transient set will have an insignificant effect on FCG since the combination of transient cycles and transient severity postulated in WCAP-13045 bound the FCG analysis for Surry. The loads for the Surry SLR are also within the screening values used in WCAP-13045. Based on the above, Dominion determined that the FCG information in PWROG-17033, Revision 1, bounds the plant-specific FCG for the 80 years of operation at Surry.

The NRC staff finds that Dominion has appropriately addressed Condition 4 because it verified that the FCG information in PWROG-17033, Revision 1, bounds the plant-specific FCG for the 80 years of operation at Surry. RAI 4.7.6-2 is resolved.

Based on this review, the staff concludes that the TLAA meets the acceptance criteria in SRP-SLR Section 4.7.2.1.1 because Dominion’s analyses related to its RCP casings remain valid for the subsequent period of extended operation and its TLAA meets 10 CFR Section 54.21(c)(1)(i).

4.7.6.3 UFSAR Supplement

SLRA Section A3.7.6 provides the UFSAR supplement summarizing the RCP casing integrity analysis TLAA. The staff reviewed SLRA Section A3.7.6 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 Dominion provided an adequate summary description of its actions to address the RCP casing integrity analysis TLAA, as required by 10 CFR 54.21(d).

4.7.6.4 Conclusion

On the basis of its review, the staff concludes that Dominion has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(i), that the analysis for the reactor RCP casing 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).

4.7.7 Cracking Associated with Weld Deposited Cladding

4.7.7.1 Summary of Technical Information in the Application

SLRA Section 4.7.7 describes Dominion’s TLAA that assesses flaw growth in underclad cracks that may develop in weld deposited RPV cladding. The SLRA states that the flaw tolerance analysis for the postulated RPV cladding cracks have been projected to the end of the subsequent period of extended operation.

Dominion dispositioned the TLAA in accordance with 10 CFR 54.21(c)(1)(ii) by demonstrating that the TLAA has been projected to the end of the subsequent period of extended operation.

4.7.7.2 Staff Evaluation

The staff reviewed Dominion's TLAA on underclad cracking and the corresponding disposition of the TLAA in accordance with 10 CFR 54.21(c)(1)(ii), consistent with the acceptance criteria defined in SRP-SLR Section 4.7.2.1.2 and the review procedures defined in SRP-SLR Section 4.7.3.1.2.

The staff noted that the SLRA states that the updated analysis in PWROG-17031-NP, Revision 1, provided an updated 80-year assessment of PWR underclad cracks and concluded that the previous 60-year analysis in WCAP-15338-A remains appropriate for Westinghouse PWRs that may be considering subsequent license renewal of their facilities. Specifically, the 40 years of design cycles bound the Surry projected cycles for 80 years. In addition, the fracture toughness values used in Appendix A of WCAP-15338-A are bounding for 80 years of operation at Surry.

The staff verified that, for the evaluation of RPV underclad crack growth under emergency or faulted condition loads (i.e., Service Level C and D loading condition transients), the assessment is limited by the applied hoop stress loads and crack growth assessment for axial cracks postulated to occur in the RPV forging materials under main steam line break (MSLB) loading conditions. For this assessment, the staff confirmed that the methodology in WCAP-15338-A establishes the limiting allowable flaw depth size (a_f) by setting it to a value that is one-half of critical flaw size (a_i) for SA-508 forging materials under MSLB loading conditions (i.e., $a_f = 0.5 * a_i = 1.25$ inches).

During its audit review of the TLAA (see section entitled "SLRA TLAA Section 4.7.7, Cracking Associated with Weld Deposited Cladding" in the audit report (ADAMS Accession No. ML19128A079)), the staff observed that the applicant provided an acceptable basis for projecting the RPV underclad cracking TLAA to the end of the subsequent period of extended operation, except for the basis of using a value of 200 ksi*√inch as a lower bound K_{Ic} fracture toughness value for the flaw tolerance evaluations that were performed on assumed flaw sizes in the WCAP-15338-A report.

Specifically, the staff noted that the use of a K_{IC} value of 200 ksi*√inch is, by convention, considered to be a conservative representation of the upper-shelf fracture toughness for the RPV material for linear elastic fracture mechanics (LEFM) analyses in accordance with IWB-3610. However, this presupposes that the material is in the upper-shelf temperature regime throughout the transient. Based on the equation for K_{IC} specified in Paragraph A-4200, the RPV metal temperature must exceed the adjusted RT_{NDT} value for the material by at least 104 °F for the analyzed flaw depths to ensure that the K_{IC} value is greater than or equal to 200 ksi*√inch for the analyzed transient conditions.

To address this issue, the staff issued RAI 4.7.7-1. This RAI and the applicant's responses are documented in ADAMS Accession No. ML19204A357.

In Dominion's response to RAI 4.7.7-1, the applicant stated that a linear elastic fracture toughness value of 200 ksi*√inch represents a conservative, non-time dependent lower bound fracture toughness value for the flaw tolerance evaluations in WCAP-15338-A if the value of "T – RT_{NDT}" is greater than or equal to 104 ºF.

The staff assessed the applicant's response using relevant Surry-specific design information that was included in Chapters 4 and 14 of the UFSAR and the actual RT_{NDT} value in the SLRA

that was reported for the most limiting of the RPV forging materials made from SA-508 Class 2 materials that were evaluated in SLRA Table 4.2.3-1 for Unit 1, and Table 4.2.3-2 for Unit 2. For the Surry-specific basis, this is the RPV upper shell forging (i.e., shell containing the RPV inlet and outlet nozzle forgings) in Unit 1 made from Heat No. 122V109VA1. The staff confirmed that this forging material has a conservative RT_{NDT} value of 144 ºF, as projected to the end of the subsequent period of extended operation (i.e., as projected to 68 EPFY). For the Surry-specific basis, the staff observed that 200 ksi*√inch represents a conservative, non-time-dependent linear elastic plastic fracture toughness value for the flaw tolerance evaluations if the lowest RCS fluid temperature during the progress of the transients is above 248 ºF (i.e., = 144 ºF + 104 ºF).

The staff noted that the Surry-specific P-T limit heatup and cooldown curves indicate that when the RCS is operating at RCS pressures approximately equal to those used and evaluated in the flaw analyses of the report (i.e., approximately 2,235 psi), the RCS will be operating at temperatures well above 248 ºF (i.e., above 370 ºF as confirmed from the RCS heatup curves, and above 360 ºF as confirmed from the RCS cooldown curves). The staff also observed that when the RCS is operating at temperatures less than 248 ºF, the unit-specific heatup and cooldown curves indicate that the RCS pressures will be well below those that were assumed and used in the flaw evaluations for analyzed Service Level A and B loading conditions. This provides sufficient verification that the use of 200 ksi*√inch represents a conservative linear elastic fracture toughness value for the flaw evaluations that were performed for Service Level A and B loading conditions in WCAP-15338-A.

For the flaw propagation assessments due to Service Level C and D transients, the staff reviewed the safety analysis assessments of MSLB events in Chapter 14 of the UFSAR. The staff verified that for the duration of MSLB events evaluated in the UFSAR (i.e., 5.28 minutes for an MSLB event with offsite power available and 7.85 minutes for an MSLB event with no available offsite power), the RCS cold leg temperature would remain above 459 ºF for cases where offsite power was available during the MSLB event, and above a value of 257.3 ºF for cases where offsite power was lost during the MSLB event. This provides sufficient verification that the use of 200 ksi*√inch represents a conservative, linear elastic fracture toughness value for the flaw growth evaluations that were assessed for Service Level C and D loading conditions in the WCAP-15338-A report.

Therefore, based on these confirmations, the staff finds that the use of 200 ksi*√inch represents a conservative linear elastic fracture toughness value for the flaw propagation evaluations that were performed for Service Level A and B and Service Level C and D loading conditions in the WCAP-15338-A report. The matter raised in RAI 4.7.7-1 is resolved.

For the projection basis, the staff noted that the applicant claims the TLAA is acceptable under the criterion in 10 CFR 54.21(c)(1)(ii) because the number of Surry-specific cycles for design transients included in the CLB and evaluated in WCAP-15338-A have been projected to the end of the subsequent period of extended operation. Specifically, for Westinghouse-design reactor heatup and cooldown transients, the methodology in WCAP-15338-A assumes that 300 heatups and 300 cooldowns will occur in a Westinghouse-designed PWR during a 60-year service life. The staff noted that in SLRA Table 4.3.1-1, the applicant projects that Unit 1 will incur 165 reactor heatups and 164 reactor cooldowns through the end of the subsequent period of extended operation. Similarly, the staff noted that the applicant projects that Unit 2 will incur 146 reactor heatups and 145 reactor cooldowns through the end of the subsequent period of extended operation. In contrast, no cycle projection basis is needed for the assessment of the MSLB transient basis because the event is defined as an emergency condition event that is only

postulated to occur once in the CLB. Thus, the staff's assessment of the MSLB event was performed only to demonstrate that 200 ksi*√inch represented a conservative, lower-bound linear elastic fracture toughness value for the evaluations of postulated flaws under MSLB loading conditions (both with and without the availability of offsite power during the commencement of a postulated MSLB event).

Therefore, based on this review, the staff finds that the number of cycles projected to occur for the sole Service Level A and B transients that were evaluated in WCAP-15338-A and included in the CLB have been projected to the end of the subsequent period of extended operation and demonstrate that the flaw tolerance evaluations in WCAP-15338-A are acceptable for the subsequent period of extended operation. Thus, the staff finds Dominion has demonstrated pursuant to 10 CFR 54.21(c)(1)(ii) that the TLAA on underclad cracking has been projected to the end of the subsequent period of extended operation. Additionally, the applicant's basis for dispositioning the TLAA in accordance with 10 CFR 54.21(c)(1)(ii) meets the acceptance criteria in SRP-SLR Section 4.7.2.1.2 because (a) the applicant has projected the number of cycles for design transients associated with the TLAA to the end of the subsequent period of extended operation, and (b) the applicant has demonstrated that the analysis in WCAP-15338-A remains acceptable for the subsequent period of extended operation.

4.7.7.3 UFSAR Supplement

SLRA Section A3.7.7. "Cracking Associated with Weld Deposited Cladding," provides the UFSAR supplement summarizing the TLAA on Underclad Cracking. The staff reviewed SLRA Section A3.7.7 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 Dominion provided an adequate summary description of its actions to address TLAA on Underclad Cracking, as required by 10 CFR 54.21(d).

4.7.7.4 Conclusion

On the basis of its review, the staff concludes that Dominion has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(ii), that the TLAA on underclad cracking 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).

4.7.8 Steam Generator Tube High Cycle Fatigue Evaluation

4.7.8.1 Summary of Technical Information in the Application

SLRA Section 4.7.8 describes Dominion's TLAA for the evaluation of steam generator tube high cycle fatigue. This TLAA is responsive to Westinghouse Nuclear Safety Advisory Letter (NSAL)-12-7, "Insufficient Insertion of Anti-Vibration Bars in Alloy 600 TT Steam Generators with Quatrefoil Tube Support Plates," which identified that flow-induced vibration and displacements caused by insufficient insertion of the anti-vibration bars (AVB) could create a potential for steam generator tube fatigue. Therefore, the potential for tube fatigue in the Surry steam generator tubes must be evaluated for 80 years of operation.

Dominion dispositioned the TLAA for Surry's steam generators in accordance with 10 CFR 54.21(c)(1)(ii) by demonstrating that the new steam generator tube fatigue analysis has been projected to the end of the subsequent period of extended operation.

4.7.8.2 Staff Evaluation

The staff reviewed Dominion's TLAA for the steam generator tube high cycle fatigue and the corresponding disposition of the TLAA in accordance with 10 CFR 54.21(c)(1)(ii), finding that the steam generator tube fatigue analysis has been projected to the end of the subsequent period of extended operation, consistent with the review procedures in SRP-SLR Section 4.7.3.1.2.

The applicant used eddy current inspection results to create maps of the AVB positions in the Surry steam generators. Because the Surry steam generators have some tubes that are not supported by an AVB but should be in accordance with the steam generator design, the applicant's disposition of steam generator tube high cycle fatigue relied on WCAP-18379-P (Proprietary), Revision 0, "Surry Units 1 and 2 Steam Generator U-Bend Tube Vibration and Fatigue Assessment." WCAP-18379-P concludes that fatigue failure of unsupported steam generator tubes is not predicted to occur through the subsequent period of extended operation for Surry. The NRC staff evaluated the WCAP approach that was used to reach that conclusion.

Using the as-built AVB insertion data, a local flow peaking factor was assigned for the susceptible tube rows. Stress ratios and relative stability ratios were calculated, assuming various amounts of tube support plate hole occlusion by deposits and denting of the tube within the tube support plate. The WCAP analyzed the fatigue usage factor based on three tube support plate conditions: (1) an open support with no restraint to tube movement, (2) a pinned condition with the tube constrained at a support by deposits, and (3) a fixed condition where the tube is constrained throughout the support plate thickness. A fixed condition is not a realistic condition for the Surry steam generators because the stainless steel quatrefoil design provides corrosion resistance that precludes tube denting throughout the support. Secondary side visual inspections showed the Surry quatrefoil support holes to be in an open condition. The WCAP analysis includes the pinned condition with various levels of deposit occlusion to bound the plant condition. Stress and fatigue analyses were performed for the most limiting unsupported tube in the susceptible tube rows. The analysis showed that the most limiting tubes are acceptable for an 80-year plant life with both no and moderate levels of deposit occlusion. For the most severe deposit occlusion level analyzed, and including other conservative inputs, all tubes except one tube in Unit 1 showed acceptable service with margin for an 80-year plant life. The WCAP states that the analysis showing the one tube in Unit 1 not meeting fatigue usage limits for the 80-year plant life is a result of modeling limitations. Using the limiting assumptions that predicted unacceptable fatigue behavior for this limiting tube, the model predicts the tube would have failed shortly after the Unit 1 steam generators were placed into service in 1981. This tube remains in service after 35 years with no signs of wear from tube instability at the tube support plate.

The applicant accounted for the potential issue of steam generator tube high cycle fatigue that has been discussed in NRC Bulletin 88-02, "Rapidly Propagating Fatigue Cracks in Steam Generator Tubes," and Westinghouse NSAL-12-7. The staff finds the assumptions that were used in the applicant's evaluation to be appropriate or conservative. The applicant has taken multiple steps, such as pressure pulse cleaning and deposit minimization treatments, to keep deposits from building up in the steam generator secondary side tube supports. The applicant

has analyzed for secondary side tube support plate deposit conditions well beyond the current condition to determine how the degree of deposits affects tube susceptibility to high cycle fatigue. Therefore, the staff finds the applicant's analysis for the Surry steam generator tubes contained in WCAP-18379-P that shows no remediation is needed through an 80-year plant life to be acceptable.

The staff finds Dominion has demonstrated pursuant to 10 CFR 54.21(c)(1)(ii), that the analysis for the steam generator tube high cycle fatigue evaluation has been projected to the end of the subsequent period of extended operation.

Additionally, it meets the acceptance criteria in SRP-SLR Section 4.7.2.1(ii) because the steam generator tube high cycle fatigue evaluation has been projected to the end of the subsequent period of extended operation.

4.7.8.3 UFSAR Supplement

SLRA Section A3.7.8 provides the UFSAR supplement summarizing the steam generator tube high cycle fatigue evaluation. The staff reviewed SLRA Section A3.7.8 consistent with the review procedures in SRP-SLR Section 4.7.3.1.2.

Based on its review of the UFSAR supplement, the staff finds it meets the acceptance criteria in SRP-SLR Section 4.7.2.1 and is therefore acceptable. Additionally, the staff finds that Dominion provided an adequate summary description of its actions to address steam generator tube high cycle fatigue, as required by 10 CFR 54.21(d).

4.7.8.4 Conclusion

On the basis of its review, the staff concludes that Dominion has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(ii), that the analysis for the steam generator tubes high cycle fatigue 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).

4.7.9 Steam Generator Tube Wear Evaluation

4.7.9.1 Summary of Technical Information in the Application

SLRA Section 4.7.9 describes Dominion's TLAA for the evaluation of steam generator tube wear. The applicant had previously evaluated steam generator tube wear as a part of a license amendment related to a MUR power uprate. The details of the tube wear evaluation are contained in CN-SGDA-02-121, "The Effect of an Uprate to 2609 MWt NSSS [nuclear steam supply system] Power for Surry Units 1 and 2 on Steam Generator Tube Wear."

Dominion dispositioned the TLAA for the Surry steam generators in accordance with 10 CFR 54.21(c)(1)(iii) by demonstrating that the effects of tube wear on the intended functions of the steam generator will be adequately managed by the Steam Generators program (SLRA Section B2.1.10) for the subsequent period of extended operation.

4.7.9.2 Staff Evaluation

The staff reviewed Dominion's TLAA for the steam generator tube wear and the corresponding disposition of the TLAA in accordance with 10 CFR 54.21(c)(1)(iii) that the Surry steam generators' tube wear will be managed by the Steam Generators program during the subsequent period of extended operation, consistent with the review procedures in SRP-SLR Section 4.7.3.1.3.

The NRC staff reviewed Westinghouse Electric document CN-SGDA-02-121, "The Effect of an Uprate to 2609 MWt NSSS Power for Surry Units 1 and 2 on Steam Generator Tube Wear." This document addressed the effects of a MUR power uprate on the Surry steam generator tube wear. These calculations determined that the amount of wear from 60 years of operation, including conservatively accounting for the time with uprate conditions, would result in less than 2 mils of new wear. Although the applicant does not rely on projecting the wear through 60 years of operation to 80 years of operation, the applicant stated that the evaluation for new wear through 60 years of operation demonstrates that wear of the steam generator tubes will be acceptable through 80 years of operation. The applicant based this conclusion, in part, on the amount of new wear projected through 60 years of operation being a small percentage of the tube wear that would cause a tube to be removed from service. Although the staff understands the technical basis for the applicant's statement that low steam generator tube wear rates calculated through 60 years provide support for operation through 80 years, the staff did not reach any conclusions on that statement because the applicant is relying on periodic inspections via the Steam Generators program to manage tube wear. Therefore, the staff review focused on the applicant's disposition of steam generator tube wear through management by the Steam Generators program.

The Surry Units 1 and 2 TS require the applicant to verify that steam generator tube integrity is maintained in accordance with the Steam Generators program (TS 6.4.Q). The staff's review of the Steam Generators program (SLRA Section B2.1.10) is documented in SER Section 3.0.3.1.4, which determined that the AMP will be adequate to manage the applicable aging effects.

The NRC staff reviewed the most recent steam generator tube inspection reports submitted by Surry in accordance with TS 6.6.A.3. These steam generator inspection reports are from the 2016 and 2018 refueling outages for Surry Units 1 and 2, respectively. The tube inspection results detailed in these reports demonstrate the applicant's capability to manage tube wear in the steam generators by detection and monitoring of wear indications. The reports state that the condition monitoring requirements for steam generator tube integrity were satisfied. No tubes were required to be plugged during the most recent steam generator inspections of Surry Units 1 and 2.

The NRC staff is also familiar with the EPRI Guidelines and eddy current inspection practices that are implemented by the applicant as a part of its Steam Generators program. Inspection procedures are qualified through industry guidelines for different tube locations and degradation mechanisms. Tube wear at support plates and antivibration bars is readily detected by the inspection procedures used by the applicant. In addition, the eddy current probes, inspection personnel, inspection techniques, data analysis, and reporting criteria are all managed by the Steam Generators program and qualified accordingly. Tube wear at support locations is typically slow growing and readily managed by periodic inspections. Therefore, for the reasons stated in this staff evaluation section, the NRC staff concludes the applicant's Steam Generators program is acceptable for managing tube wear.

The staff finds Dominion has demonstrated pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of tube wear on the intended functions of the steam generator will be adequately managed by the Steam Generators program for the subsequent period of extended operation.

Additionally, the Steam Generators program meets the acceptance criteria in SRP-SLR Section 4.7.2.1.3 because the applicant has demonstrated that steam generator tube wear will be adequately managed for the subsequent period of extended operation.

4.7.9.3 UFSAR Supplement

SLRA Section A3.7.9 provides the UFSAR supplement summarizing the steam generator tube wear evaluation. The staff reviewed SLRA Section A3.7.9 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 Dominion provided an adequate summary description of its actions to address steam generator tube wear as required by 10 CFR 54.21(d).

4.7.9.4 Conclusion

On the basis of its review, the staff concludes that Dominion has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of tube wear on the intended functions of the steam generator will be adequately managed by the Steam Generators 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).

4.8 <u>Conclusion for TLAAs</u>

The staff reviewed SLRA Section 4, “Time-Limited Aging Analyses.” Based on its review, the staff concludes that Dominion has provided a sufficient list of TLAAs, as defined in 10 CFR 54.3, and that Dominion has demonstrated that: (1) the TLAAs remain valid for the subsequent period of extended operation, as required by 10 CFR 54.21(c)(1)(i); (2) the TLAAs have been projected to the end of the subsequent period of extended operation, as required by 10 CFR 54.21(c)(1)(ii); or (3) the effects of aging on intended function(s) will be adequately managed during the subsequent period of extended operation, as required by 10 CFR 54.21(c)(1)(iii). The staff also reviewed the UFSAR supplement for the TLAAs and finds that 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 Dominion 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 Surry Power Station, Units 1 and 2 (Surry). The ACRS Subcommittee on Plant License Renewal also reviews the U.S. Nuclear Regulatory Commission staff’s safety evaluation report for the Surry subsequent license renewal application. The applicant and the NRC staff attend ACRS subcommittee and full committee meetings to discuss issues associated with the Surry 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.

6 CONCLUSION

The staff of the U.S. Nuclear Regulatory Commission (NRC) reviewed the subsequent license renewal application (SLRA) for Surry Power Station, Units 1 and 2 (Surry) 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, the Commission may issue a renewed license if it finds, among other things, that: (a) actions have been identified and have been or will be taken, such that there is reasonable assurance that the activities authorized by the renewed license will continue to be conducted in accordance with the current licensing basis (CLB); and (b) the applicable requirements of Subpart A of 10 CFR Part 51 (addressing environmental review) have been satisfied.

On the basis of its review of the Surry 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).

Concerning 54.29(b), the staff’s 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 6, Second Renewal, Regarding Subsequent License Renewal for Surry Power Station, Units 1 and 2.”

APPENDIX A
LICENSE RENEWAL COMMITMENTS

During the review of the Surry Power Station, Units 1 and 2 (Surry) subsequent license renewal application by the staff of the U.S. Nuclear Regulatory Commission (NRC or the staff), Virginia Electric and Power Company (Dominion Energy Virginia or the applicant) made commitments related to the aging management programs (AMPs) used to manage aging effects for structures and components. The following table lists these commitments along with the implementation schedules and sources for each commitment. The subsequent period of extended operation (SPEO) for Surry begins on May 25, 2032, for Unit 1 and January 29, 2033, for Unit 2.

Table A-1 Surry License Renewal Commitments

Item No.	UFSAR Supplement Section	Commitment	Implementation Schedule	Source
1	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program	The *ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD* program is an existing condition monitoring program that will be enhanced as follows: 1. Procedures will be revised to require inspections be performed for welds associated with sentinel locations assessed under ASME Code, Section XI, Appendix L for the following auxiliary lines: • Safety injection • Residual heat removal • Spray • Charging • Accumulator • Surge	Program enhancements for SLR will be implemented 6 months prior to the subsequent period of extended operation.	SLRA, Appendix A, Table A4.0-1 (ML18291A842, ML18291A828)
2	Water Chemistry program	The *Water Chemistry* program is an existing preventive program that is credited.	Ongoing	SLRA, Appendix A, Table A4.0-1 (ML18291A842, ML18291A828)
3	Reactor Head Closure Stud Bolting program	The *Reactor Head Closure Stud Bolting* program is an existing condition monitoring program that will be enhanced as follows: 1. Procurement documents for reactor head closure studs will be revised to incorporate guidance from RG 1.65, Revision 1 and NUREG-2191, Section XI.M3, to add a limit for the maximum measured yield strength of 150 ksi and a limit for maximum tensile strength of 170 ksi. 2. Procedures will be revised to require the performance of a one-time visual inspection of the bottom plates in Unit 2 vessel flange closure stud holes #36 and #37 to confirm that no corrosion, cracking, or degradation is occurring.	Program enhancements for SLR will be implemented 6 months prior to the subsequent period of extended operation.	SLRA, Appendix A, Table A4.0-1 (ML18291A842, ML18291A828)
4	Boric Acid Corrosion program	The *Boric Acid Corrosion* program is an existing condition monitoring program that is credited.	Ongoing	SLRA, Appendix A, Table A4.0-1 (ML18291A842, ML18291A828)

Item No.	UFSAR Supplement Section	Commitment	Implementation Schedule	Source
5	Cracking of Nickel-Alloy Components and Loss of Material Due to Boric Acid-Induced Corrosion in Reactor Coolant Pressure Boundary Components program	The *Cracking of Nickel-Alloy Components and Loss of Material Due to Boric Acid-Induced Corrosion in Reactor Coolant Pressure Boundary Components* program is an existing condition monitoring program that is credited.	Ongoing	SLRA, Appendix A, Table A4.0-1 (ML18291A842, ML18291A828)
6	Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS) program	The *Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)* program is an existing condition monitoring program that is credited.	Ongoing	SLRA, Appendix A, Table A4.0-1 (ML18291A842, ML18291A828)
7	PWR Vessel Internals program	The *PWR Vessel Internals* program is an existing condition monitoring program that will be enhanced as follows: 1. Procedures will be revised for each reload to summarize the average power density, the heat generation figure-of-merit, and the dimensional parameter for the distance between the active fuel and the upper core plate. 2. Procedures will be revised to require the visual inspection (EVT-1) of the control rod guide tube (CRGT) lower flange weld to require that the inspection include 100% of the outer CRGT lower flange weld surfaces and 0.25-inch of the adjacent base metal. 3. Procedures will be revised to require the visual inspection (VT-3) of the accessible surfaces for the control rod guide tube support pins and support pin nuts for Unit 1 only (plant-specific component). 4. Procedures will be revised to require the addition of a note indicating that a bolting inspection can be credited only if at least 75% of the total bolt population is examined. 5. Procedures will be revised to require visual inspection (VT-3) for 100% of the baffle-edge bolts that are accessible from the core side. 6. Procedures will be revised to require volumetric (UT) examinations for 100% of accessible baffle-former bolts (including corner bolts) at least every 10 years. MRP-2017-009 states that baseline volumetric (UT) examinations shall be performed no later than 30 EFPY for NSAL 16-1 Tier 2 plants, including the Surry units. The guidance further states that initial baseline UT exams performed prior to 1/1/2018 are acceptable.	Program, accounting for the impacts of a gap analysis, will be implemented 6 months prior to the subsequent period of extended operation, or alternatively, a plant-specific program may be implemented 6 months prior to the subsequent period of extended operation.	SLRA, Appendix A, Table A4.0-1 (ML18291A842, ML18291A828) First Annual Update/Supplement #4 to SLRA (ML19294A044) Supplement to SLRA: Change Notice 7 (ML20054B996)

Item No.	UFSAR Supplement Section	Commitment	Implementation Schedule	Source
7 (cont'd)		Examinations were performed in 2010 for Unit 1 and in 2011 for Unit 2. For the Surry units with the down-flow configuration that have <3% indications and no clustering, subsequent UT examinations are performed on a 10-year interval. 7. Procedures will be revised to address expansion criteria when degradation occurs for clusters of baffle-former bolts. MRP 2018-002 identifies expansion criteria as a Needed requirement (per NEI 03-08) to include one-time visual (VT-3) examination of barrel-former bolts if large clusters of baffle-former bolts are found during the initial volumetric (UT) examination. Confirmation that one or more large clusters of baffle-former bolts with unacceptable indications are detected by the UT inspection of the baffle-former bolts shall require a visual (VT-3) inspection of the accessible barrel-former bolts adjacent to the large cluster of baffle-former bolt indications within three refueling cycles. A large cluster is defined (MRP 2018-002, Item 3.b) as any group of adjacent baffle-former bolts at least 3 rows high by at least 10 columns wide, or at least 4 rows high by at least 6 columns wide where 80% or greater of the baffle-former bolts have unacceptable UT indications or are visibly degraded. The barrel-former bolts adjacent to the cluster include: • Barrel-former bolts in the same area as the cluster of baffle-former bolts with indications if that area is projected radially onto the core barrel. • Barrel-former bolts on the two rows above and the two rows below the projected area. • Barrel-former bolts on each of the two columns of bolts that are circumferentially adjacent to the projected area. Confirmation that more than 5% of the lower support column bolts actually examined contain unacceptable UT indications shall require UT inspection of the accessible barrel-former bolts within three refueling cycles of identifying lower support column bolts with unacceptable UT indications. 8. Procedures will be revised to require visual examinations (EVT-1) for 100% of one side (ID or OD) of the circumference for the core barrel upper flange weld, and ¾" of adjacent base metal (minimum 50% examination coverage). (Primary component) 9. Procedures will be revised to require visual examinations (EVT-1) for 100% of the OD surface of the core barrel lower flange weld and ¾" adjacent base metal (minimum 75% examination coverage unless access limitations prevent examination of more than 50% of the weld). (Expansion component)		

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7 (cont'd)		10. Procedures will be revised to perform inspections of control rod guide tube (CRGT) thermal sleeves as indicated in MRP 2018-027. MRP 2018-027 refers to the Westinghouse NSAL 18-1 recommendation that, based on operating experience (OE) from international PWR plants related to wear of reactor vessel closure head control rod drive mechanism (CRDM) thermal sleeve flanges resulting in control rod stoppage during plant restart operations, a visual inspection should be performed during the next refueling outage after issuance of the NSAL, and during each subsequent refueling outage, for the tops of the CRGTs to determine whether any thermal sleeves have lowered significantly or are in a failed state. For the Surry plants, the guidance is to look for shiny marks on the top edge of the upper guide tube enclosure. Also, during the next under-head inspection, the guidance is to perform a visual inspection of the bottom of the thermal sleeve guide funnels to look for any shiny surfaces on the bottom surface of the guide funnel that would indicate that the thermal sleeve guide funnels have dropped to a point where they are in contact with the top of the guide tube. A visual inspection of thermal sleeve guide funnel elevations is recommended to identify whether any sleeves are noticeably lower than others (Primary component). 11. Procedures will be revised to require visual examinations (VT-3) for the following: a. Top and bottom edges of baffle plates to identify misalignment (Primary component). b. General condition of the baffle plates to identify warping or void swelling (Primary component). c. Surfaces of the upper internals fuel alignment pins to identify wear of the malcomized surface (Existing Programs component). d. Surfaces of the lower internals fuel alignment pins to identify wear of the malcomized surface (Existing Programs component). e. Clevis insert bolts and clevis insert dowels (Primary component). 12. Procedures will be revised for contingency tasks to require inspection of the following expansion components if necessitated by relevant indications being found for associated primary components: a. Remaining control rod guide tube lower flange welds not inspected as Primary component (EVT-1) b. Control rod guide tube (CRGT) continuous section sheaths and C-tubes in accordance with the requirements of WCAP-17451-P, Revision 2.		

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7 (cont'd)		c. Bottom-mounted instrumentation column bodies (100% of BMI column bodies for which difficulty is detected during flux thimble insertion / withdrawal; VT-3) d. Lower support column bodies (25% of column bodies as visible from above the core plate; VT-3) e. Barrel-former bolts (100% of accessible bolts, minimum of 75% of the total population; UT) f. Lower support column bolts (100% of accessible bolts, minimum of 75% of the total population; UT) 13. Procedures will be revised to require that the inspections for the radial support keys and clevis inserts are to include the Stellite wear surfaces (Primary component, MRP 2018-022). 14. Procedures will be revised to require visual inspections (VT-3) of the guide cards in at least 37 of the 48 control rod guide tubes, and will include associated acceptance criteria. Guidance from WCAP-17451-P, "Reactor Internals Guide Tube Wear – Westinghouse Domestic Fleet Operational Projections," and MRP 2018-07, "Transmittal of NEI 03-08 Needed Guidance to Address Accelerated Guide Card Wear Operating Experience (OE) Discussed in NSAL-17-1," will be included for the inspection of control rod guide cards. 15. Procedures will be revised to require visual examinations (EVT-1), and will include associated acceptance criteria, for 100% of the accessible weld length of the OD of the LGW and ¾" of adjacent base metal (minimum 50% examination coverage). (Primary component) 16. Procedures will be revised for contingency tasks to inspect the following expansion components if necessitated by relevant indications being found for associated primary components, and will include associated acceptance criteria: a. Core barrel upper, middle, and lower axial welds (100% of weld length and 3/4" of adjacent base metal – minimum 75% examination coverage unless access limitations prevent examination of more than 50% of the weld; EVT-1) • A one-time enhanced visual (EVT-1) examination of the core barrel middle axial weld (MAW) and lower axial weld (LAW) will be performed during the sixth inservice inspection interval (i.e., a "50-year inspection") no later than six months prior to the subsequent period of extended operation. The examination will include coverage for 100% of the accessible		

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7 (cont'd)		weld lengths from the core barrel OD and ¾" of base metal of each side the weld AND a vertical zone on each side of the inaccessible portion of the barrel containing the known location of the axial weld. Each vertical zone shall be a minimum of ¾" wide and cover the full distance parallel to the inaccessible height of the weld. b. Core barrel upper girth weld (100% of weld length and 3/4" of adjacent base metal – minimum 75% examination coverage unless access limitations prevent examination of more than 50% of the weld; EVT-1) c. Lower support forging (25% of bottom (non-core side) surface; VT-3) d. Upper core plate (25% of core-side surfaces; VT-3) 17. A procedure for visual examinations will be revised to identify the examiner qualifications which are applicable for EVT-1 examinations.		
8	Flow-Accelerated Corrosion program	The *Flow-Accelerated Corrosion* program is an existing condition monitoring program that will be enhanced as follows: 1. An engineering evaluation will be performed for systems that have been excluded from the FAC program due to no flow or infrequently used lines with a total operating and testing time that is less than 2% of the plant operating time. The purpose of the engineering evaluation is to confirm the scope of components that will qualify for the exclusion being extended into the subsequent period of extended operation. The engineering evaluation and modeling changes for the FAC program will be completed prior to entering the subsequent period of extended operation. 2. A re-evaluation of the erosion susceptibility determination that identified plant systems in the scope of subsequent license renewal that were previously excluded from monitoring will be performed to re-affirm that the appropriate basis for exclusion either is in-service operational and testing time less than 100 hours per year, or is a technical evaluation specifically developed to exclude such a system. 3. A re-evaluation will be performed to determine whether plant conditions (e.g., valve throttling) have changed such that susceptibility to erosion has increased for plant systems within the scope of subsequent license renewal. 4. Procedure will be revised to confirm that inspection scope expansions include the items noted below and to confirm that independent reviews of inspection scope expansions are independently reviewed by a qualified FAC engineer.	Program enhancements for SLR will be implemented 6 months prior to the subsequent period of extended operation.	SLRA, Appendix A, Table A4.0-1 (ML18291A842, ML18291A828) Supplement to SLRA: Change Notice 2 (ML19095A666, ML19095A602) Response to RAIs – Set 2 (ML19204A357) Response to RAIs – Set 3 & 4 (ML19253B330) Correction to Response to RAIs – Set 3 & 4 (ML19269B734)

Item No.	UFSAR Supplement Section	Commitment	Implementation Schedule	Source
8 (cont'd)		• Any component within two pipe diameters downstream of the component displaying significant wear, or within two pipe diameters upstream if that component is an expander or expanding elbow. • The two most susceptible components from the CHECWORKS relative wear rate ranking in the same train containing the piping component displaying significant wear. • Corresponding components from other trains. • Inspections of additional components until no additional components with significant wear are detected.		
9	Bolting Integrity program	The *Bolting Integrity* program is an existing condition monitoring program that will be enhanced as follows: 1. Procedures will be revised to provide inspection guidance related to lighting, distance, offset, surface coverage, presence of protective coatings, and cleaning processes. The procedure will specify adequate lighting be verified at the inspection location to detect degradation. Lighting may be permanently installed, temporary, or portable (e.g., flashlight), as appropriate. For accessible surface inspections, inspecting from a distance of two feet to four feet (or less) will be appropriate. For viewing angles which may prevent adequate inspection, a viewing aid such as an inspection mirror or boroscope should be used. 2. Procedures will be revised for inspections of pressure-retaining closure bolting in locations that preclude detection of joint leakage, such as in submerged environments or where the piping system contains air for which leakage is difficult to detect. The inspections will be performed to detect loss of material. A requirement will be included to inspect bolt heads when made accessible, and bolt threads if joints are disassembled. At a minimum, in each 10-year interval during the subsequent period of extended operation, inspections shall be completed for a representative sample of at least 20% of the population, up to a maximum of nineteen, for each material/environment combination. 3. A new procedure will be developed to provide guidance for a situation in which an acceptance criterion for allowable degradation is exceeded, and the aging effect causing the degradation for the material/environment combination is not corrected by repair or replacement, thus requiring that additional inspections be performed. The number of additional inspections will be determined in accordance with the Corrective Action Program; however no fewer than five additional (or 20%, whichever is less)	Program enhancements for SLR will be implemented 6 months prior to the subsequent period of extended operation.	SLRA, Appendix A, Table A4.0-1 (ML18291A842, ML18291A828)

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9 (cont'd)		inspections of different components having the same material/environment/aging effect combination are required for each inspection that did not meet the acceptance criterion. For a two-unit site, the additional inspections include inspections at the same unit, and at the opposite unit, for components having the same material, environment, and aging effect combination. The additional inspections are to be completed within the same interval (e.g., refueling outage or 10-year inspection interval). If any projected inspection results will not meet acceptance criteria prior to the next scheduled inspection, sampling frequencies are adjusted as determined by the Corrective Action Program.		
10	Steam Generators program	The *Steam Generators* program is an existing condition monitoring program that is credited.	Ongoing	SLRA, Appendix A, Table A4.0-1 (ML18291A842, ML18291A828)
11	Open-Cycle Cooling Water program	The *Open-Cycle Cooling Water* program is an existing preventive, mitigative, condition monitoring, and performance monitoring program that will be enhanced as follows: 1. Selected fiberglass reinforced plastic (FRP) piping in the service water system will be replaced with a more degradation resistant material such as copper-nickel (Cu-Ni) prior to entering the subsequent period of extended operation. FRP piping associated with the Units 1 and 2 charging pump cooling water subsystems, service water rotating strainers, and the control room chillers may be replaced as part of a time-phased program. 2. Modifications necessary to provide new chemical injection site upstream of the service water rotating strainers will be completed prior to entering the subsequent period of extended operation. 3. The internal lining of 30 inch and larger service water inlet piping with carbon fiber reinforced polymer, with the exception of the recirculation spray heat exchanger piping downstream of the inlet motor-operated valves, will be completed prior to entering the subsequent period of extended operation. 4. Procedures will be revised to provide additional guidance for identifying and evaluating applicable concrete aging effects such as loss of material due to delamination, exfoliation, spalling, popout, scaling, or cavitation; and cracking due to chemical reaction, or corrosion of reinforcement. 5. Procedures will be revised to provide guidance for internal inspection of carbon fiber reinforced polymer piping for aging effects such as voids, blistering, bubbles, cracking, crazing and delamination.	Program enhancements for SLR will be implemented 6 months prior to the subsequent period of extended operation.	SLRA, Appendix A, Table A4.0-1 (ML18291A842, ML18291A828) Supplement to SLRA: Change Notice 1 (ML19042A137) Response to RAIs – Set 1 (ML19183A440, ML19183A386) Response to RAIs – Set 2 (ML19204A357) Response to RAIs – Set 3 & 4 (ML19253B330) Correction to Response to RAIs – Set 3 & 4 (ML19269B734) Supplement to SLRA: Change Notice 4 (ML19294A044)

Item No.	UFSAR Supplement Section	Commitment	Implementation Schedule	Source
11 (cont'd)		6. Procedures will be revised to require personnel who perform inspections and evaluation of concrete components to be qualified consistent with the qualifications identified in the Structures Monitoring program (B2.1.34) that are consistent with the requirements of ACI 349.3R. 7. Procedures will be revised to require personnel who perform visual inspections and evaluation of carbon fiber reinforced polymer piping to be VT-1 qualified consistent with IWA-2300 of ASME Section XI and Mandatory Appendix II of ASME Code Case N-871. Examination procedures and personnel who perform acoustic examinations of CFRP lined piping will be qualified consistent with mandatory Appendix VI and section 5400 of ASME Code Case N-871. 8. Procedures will be revised to require installed CFRP linings be 100% visually examined in accordance with ASME Code Case N-871 section 5213 during an inspection period between three and six years following return of the repaired area to service; and a minimum of once per 10 year inservice inspection interval thereafter in the same inspection period of each succeeding inspection interval. 9. Procedures will be revised to require accessible surfaces of the CFRP linings at each terminal end to be acoustically impact tap examined in accordance with Mandatory Appendix V, "Inservice Examination," Section V-2500, ASME Code Case N-871 section 5250(a), section 5250(c), and Section 5350. The acoustic examination of terminal ends will be capable of detecting and sizing delaminations and voids in any composite or bonding layer with dimensions equal to or less than those permitted by Section 4390(b)(3). The acoustic impact tap examination procedure sections will also be enhanced to add Section 5111(d), that provides consideration of the impact of in-situ ambient noise levels on application of the procedure and qualification of procedures and personnel. The qualification testing will be conducted in an area where the ambient noise level is equal to or higher than the noise level where the in-situ testing will be performed. The expansion rings need not be removed for this examination provided examinations of adjacent surfaces do not indicate the presence of new unacceptable indications that could extend beneath the rings. 10. Procedures will be revised to periodically inspect for evidence of concrete aging in accessible internal surfaces of the concrete circulating water lines. One hundred percent of the accessible circulating water line internal surfaces will be inspected in a ten year period.		Supplement to SLRA: Change Notice 5 (ML19310E716)

Item No.	UFSAR Supplement Section	Commitment	Implementation Schedule	Source
11 (cont'd)		11. Procedures will be revised to require trending of charging pump lube oil cooler and emergency service water pump engine heat exchanger inspection results by Engineering. 12. Procedures will be revised to require trending of wall thickness measurements. The frequency and number of wall thickness measurements will be based on trending results. 13. Procedures will be revised to require all areas previously documented in accordance with ASME Code Case N-871 Section V-1100(b) shall be re-examined, measured, and compared with the previous inspection records. Any indications of flaw growth will be required to be repaired consistent with ASME Code Case N-871. Documentation of the repair, location and dimensions will be required. Any new flawed areas shall be evaluated consistent with ASME Code Case N-871. 14. Procedures will be revised to include verification that predicted wall thicknesses at the next scheduled inspection will be greater than the minimum wall thicknesses. 15. Procedures will be revised to include criteria for the extent and rate of on-going degradation that will prompt additional corrective actions. 16. Procedures will be revised to identify acceptance criteria for visual inspection of concrete piping and components such as the absence of cracking and loss of material, provided that minor cracking and loss of material in concrete may be acceptable where there is no evidence of leakage, exposed rebar or reinforcing "hoop" bands or rust staining from such reinforcing elements. 17. Procedures will be revised to include the following CFRP defect inspection acceptance criteria for air voids, bubbles, blisters, delaminations and other defects (such as cracking and crazing): <u>Air Voids</u> For embedded air voids of area less than or equal to 25 square inches that have been visually detected in layers beneath the topcoat, they shall be repaired in accordance with ASME Code Case N-871 section 4390 (b)(1) and (b)(2) unless otherwise specified in the design documents. All other defects and all voids larger greater than 25 square inches shall be rejected, and a repair designed to maintain water tightness of the system. <u>Bubbles, blisters or other defects</u> If bubbles or blisters with major dimension exceeding one inch are detected anywhere within the protective epoxy topcoat, they shall be		

Item No.	UFSAR Supplement Section	Commitment	Implementation Schedule	Source
11 (cont'd)		removed and repaired in accordance with ASME Code Case N-871 Section 4380(d). Delaminations or Voids Unless permitted by design documents, acceptance criteria for acoustic tap examination of terminal ends shall be consistent with ASME Code Case N-871 section 5350 (a) and (b). 18. Procedures will be revised to include the following defect repair criteria as part of the corrective actions.: For air void defects Repairs shall be consistent with ASME Code Case N-871 section 4390 (b)(3) and (b)(4) For bubbles, blisters or other surface defects Repairs shall be consistent with ASME Code Case N-871 section 4390 (d) For all other defects and all voids larger than 25 square inches A repair shall be designed to maintain water-tightness of the system consistent with ASME Code Case N-871 section 4390 (d) A final visual inspection shall be performed to verify the CFRP system has achieved the percentage of cure corresponding to achievement of required mechanical properties before placing the repaired piping back in service. In no case shall the system be placed in service before achieving 85% cure. 19. Procedures will be revised to ensure that for ongoing degradation mechanisms (e.g., MIC), the frequency and extent of wall thickness inspections at susceptible locations are increased commensurate with the significance of the degradation. 20. Procedures will be revised to ensure that when measured parameters do not meet the acceptance criteria, additional inspections are performed, when the cause of the aging effect is not corrected by repair or replacement for components with the same material and environmental combination. The number of inspections will be determined by the Corrective Action Program, but no fewer than five additional inspections will be performed for each inspection that did not meet the acceptance criteria, or 20% of the applicable material, environment, and aging effect combination inspected, whichever is less. The additional inspections will include inspections at both Unit 1 and Unit 2 with the same material, environment, and aging effect combination.		

12	Closed Treated Water Systems program	The *Closed Treated Water Systems* program is an existing condition monitoring and mitigation program that will be enhanced as follows: 1. Procedures will be revised to provide non-ASME Code inspection guidance related to lighting, distance, offset, surface coverage, presence of protective coatings, and cleaning processes. The procedure will specify adequate lighting be verified at the inspection location to detect degradation. Lighting may be permanently installed, temporary, or portable (e.g., flashlight), as appropriate. For accessible surface inspections, inspecting from a distance of two feet or less will be appropriate. For viewing angles which may prevent adequate inspection, a viewing aid such as an inspection mirror or boroscope should be used. For component internal inspections, accessible surfaces will be inspected, subject to a minimum 20% surface area examination coverage. If inspecting piping internal surfaces, a minimum of one linear foot will be inspected, if accessible. Cleaning will be performed as necessary to allow for a meaningful examination. The surface to be examined should be clean and free of corrosion products, slag, dirt, grease, and scale, loose or cracked paint or any foreign material that interferes with examination results. If protective coatings are present, the condition of the coating will be documented. 2. A new procedure will be developed to specify that in each 10-year period during the subsequent period of extended operation, the minimum number of inspections is completed for the various sample populations (each material, water treatment program, and aging effect combination). If opportunistic inspections will not fulfill the minimum number of inspections by the end of each 10-year period, the program owner will initiate work orders as necessary to request additional inspections. A representative sample of 20% of the population (defined as components having the same material, water treatment program, and aging effect combination) or a maximum of nineteen components per population at each unit will be inspected. The new procedure will specify that the inspections focus on the bounding or lead components most susceptible to aging due to time in service, and severity of operating conditions. 3. A new procedure will be developed to specify that, where practical, the rate of any degradation is evaluated and projected until the end of the subsequent period of extended operation or the next scheduled inspection, whichever is shorter. The sampling bases (e.g., selection, size, frequency) will be adjusted as necessary based on the projection. 4. A new procedure will be developed to specify that additional inspections will be performed if any inspections do not meet the acceptance criteria, unless the cause of the aging effect for each applicable material and environment is corrected by repair or replacement. There will be no fewer than five additional inspections for each inspection that did not meet	Program enhancements for SLR will be implemented 6 months prior to the subsequent period of extended operation.	SLRA, Appendix A, Table A4.0-1 (ML18291A842, ML18291A828)

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12 (cont'd)		acceptance criteria, or 20% of each applicable material, environment, and aging effect combination inspected, whichever is less. If any subsequent inspections do not meet acceptance criteria, an extent of condition and extent of cause analysis will be conducted to determine the further extent of inspections required. Additional samples will be inspected for any recurring degradation to ensure corrective actions appropriately address the associated causes. The additional inspections will include inspections of components with the same material, environment, and aging effect combination at both Unit 1 and Unit 2. The additional inspections will be completed within the interval (e.g., refueling outage interval, 10-year inspection interval) in which the original inspection was conducted.		
13	Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems program	The *Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems* program is an existing condition monitoring program that will be enhanced as follows: 1. Procedures will be revised to specify visual inspections for the effects of general corrosion, deformation, cracking, and wear on the rails in the rail system. 2. Procedures will be revised to specify visual inspections for general corrosion, deformation, cracking, wear and loose or missing fasteners and other conditions indicative of loss of bolting preload for the new fuel transfer elevator.	Program enhancements for SLR will be implemented 6 months prior to the subsequent period of extended operation.	SLRA, Appendix A, Table A4.0-1 (ML18291A842, ML18291A828)
14	Compressed Air Monitoring program	The *Compressed Air Monitoring* program is an existing condition monitoring program that will be enhanced as follows: 1. Procedures will be revised to perform opportunistic visual inspections of internal surfaces of compressed air system components downstream of the dryers to verify the effectiveness of the compressed air system control of moisture (dewpoint) and particulate. Visual inspection results will be compared to previous results to ascertain if adverse long-term trends exist. Deficiencies will be documented in the Corrective Action Program and evaluations performed for test or inspection results that do not satisfy established criteria as defined in the applicable procedures.	Program enhancements for SLR will be implemented 6 months prior to the subsequent period of extended operation.	SLRA, Appendix A, Table A4.0-1 (ML18291A842, ML18291A828)

Item No.	UFSAR Supplement Section	Commitment	Implementation Schedule	Source
15	Fire Protection program	The *Fire Protection* program is an existing condition and performance monitoring program that will be enhanced as follows: 1. Procedures will be enhanced to require fire damper assemblies (rather than fire damper housings) to be visually inspected for loss of material and determined to be acceptable if there are no signs of degradation that could result in loss of fire protection capability due to loss of material. 2. Carbon dioxide and halon systems air flow testing procedures will be enhanced to trend air flow test data. In addition, procedures will be enhanced to specify that inspection results for the halon and CO_2 systems meet the acceptance criteria if there are no indications of excessive loss of material. 3. Procedures will be revised to require an assessment for additional inspections to be conducted if one of the inspections does not meet acceptance criteria due to current or projected degradation. For sampling-based inspections, results are evaluated against acceptance criteria to confirm that the sampling bases (e.g., selection, size, frequency) will maintain the components' intended functions throughout the subsequent period of extended operation based on the projected rate and extent of degradation. If degradation is detected within the inspection sample of penetration seals, the scope of the inspection is expanded to include additional seals in accordance with the plant's corrective action program. Additional inspections would be 20% of each applicable inspection sample; however, additional inspections would not exceed five. If any projected inspection results will not meet acceptance criteria prior to the next scheduled inspection, inspection frequencies are adjusted as determined by the site's corrective action program.	Program enhancements for SLR will be implemented 6 months prior to the subsequent period of extended operation.	SLRA, Appendix A, Table A4.0-1 (ML18291A842, ML18291A828) Response to RAIs – Set 2 (ML19204A357)

16	Fire Water System program	The *Fire Water System* program is an existing condition monitoring program that will be enhanced as follows: 1. Prior to 50 years in service, sprinkler heads will be submitted for field-service testing by a recognized testing laboratory consistent with NFPA 25, 2011 Edition, Section 5.3.1. Additional representative samples will be field-service tested every 10 years thereafter to ensure signs of aging are detected in a timely manner. For wet pipe sprinkler systems, a one-time test of sprinklers that have been exposed to water including the sample size, sample selection criteria, and minimum time in service of tested sprinklers will be performed. At each unit, a sample of 3% or a maximum of ten sprinklers with no more than four sprinklers per structure shall be tested. Testing is based on a minimum time in service of fifty years and severity of operating conditions for each population. 2. Procedures will be revised to specify: a. Standpipe and system flow tests for hose stations at the hydraulically most limiting locations for each zone of the system on a five year interval to demonstrate the capability to provide the design pressure at required flow. 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% reduction in full flow pressure when compared to previously performed tests. The Corrective Action Program will determine the cause and necessary corrective action. c. If a flow test or a main drain test does not meet acceptance criteria due to current or projected degradation additional tests are conducted. The number of increased tests is determined in accordance with the corrective action process; however, there are no fewer than two additional tests for each test that did not meet acceptance criteria. The additional inspections are completed within the interval in which the original test was conducted. If subsequent tests do not meet acceptance criteria, an extent of condition and extent of cause analysis is conducted to determine the further extent of tests. The additional tests include at least one test at the other unit with the same material, environment, and aging effect combination. d. Main drains for the standpipes associated with hose stations within the scope of subsequent license renewal will also be added to main drain testing procedures. 3. Procedures will be revised to perform internal visual inspections of sprinkler and deluge system piping to identify internal corrosion, foreign material, and obstructions to flow. Follow-up volumetric examinations will be performed if internal visual inspections detect age-related degradation in excess of what would be expected accounting for design, previous	Program will be implemented and inspections or tests begin 5 years before the subsequent period of extended operation. Inspections or tests that are to be completed prior to the subsequent period of extended operation are completed 6 months prior to the subsequent period of extended operation or no later than the last refueling outage prior to the subsequent period of extended operation.	SLRA, Appendix A, Table A4.0-1 (ML18291A842, ML18291A828) Supplement to SLRA: Change Notice 1 (ML19042A137) Supplement to SLRA: Change Notice 2 (ML19095A666, ML19095A602) Supplement to SLRA: Change Notice 3 (ML19168A028) Response to RAIs – Set 3 & 4 (ML19253B330) Correction to Response to RAIs – Set 3 & 4 (ML19269B734)

16 (cont'd)		inspection experience, and inspection interval. 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, 2011 Edition, Annex D.5, Flushing Procedures. The internal visual inspections will consist of the following: a. Wet pipe sprinkler systems - 50% of the wet pipe sprinkler systems in scope for subsequent 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 subsequent 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 - deluge systems in scope for subsequent 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. 4. Procedures will be revised to perform system flow testing at flows representative of those expected during a fire. A flow resistance factor (C-factor) will be calculated to compare and trend the friction loss characteristics to the results from previous flow tests. 5. Prior to the subsequent period of extended operation, the insulation on the exterior surfaces of the fire water storage tanks (FWSTs) will be permanently removed. Wall thickness measurements will be performed on external tank areas exhibiting unexpected degradation. Refurbishment/recoating will be performed consistent with the severity of the degradation identified and commensurate with the potential for loss of intended function. Inspections of external tank surfaces will be on a refueling cycle frequency. 6. A procedure will be created to provide a Turbine Building oil deluge systems spray nozzle air flow test to ensure that patterns are not impeded by plugged nozzles, to ensure that nozzles are correctly positioned, and to ensure that obstructions do not prevent discharge patterns from wetting surfaces to be protected. 7. Procedure will be revised to provide inspection guidance related to lighting, distance and offset for non-ASME Code inspections. The procedure will specify adequate lighting be verified at the inspection location to detect		

16 (cont'd)		degradation. Lighting may be permanently installed, temporary, or portable (e.g., flashlight), as appropriate. For accessible surface inspections, inspecting from a distance of two to four feet (or less) will be appropriate. For distant surface inspections, viewing aids such as binoculars may be used. For viewing angles which may prevent adequate inspection, a viewing aid such as an inspection mirror or boroscope should be used. 8. The Unit 1 hydrogen seal oil system deluge sprinkler pipe and Unit 1 station main transformer '1A' deluge sprinkler piping will be reconfigured to allow drainage. As part of the drainage reconfiguration, visual inspections and wall thickness measurements will be performed on the Unit 1 hydrogen seal oil system deluge sprinkler pipe that does not drain. In addition, wall thickness examination of the Unit 1 main transformer deluge sprinkler piping that does not allow drainage will also be performed as part of the drainage reconfiguration. Piping with unexpected degradation will be replaced. 9. The program will be revised to require inspections and tests be performed by personnel qualified in accordance with site procedures and programs for the specified task. 10. Procedures will be revised to require when degraded coatings are detected by internal coating inspections, acceptance criteria and corrective action recommendations consistent with the Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers and Tanks (B2.1.28) program are followed in lieu of NFPA 25 section 9.2.7 (1), (2), and (4). When interior pitting or general corrosion (beyond minor surface rust) is detected, tank wall thickness measurements are conducted as stated in NFPA 25 Section 9.2.7(3) in vicinity of the loss of material. Vacuum box testing as stated in NFPA 25 Section 9.2.7(5) is conducted when pitting, cracks, or loss of material is detected in the immediate vicinity of welds. 11. The activity of the jockey pump will be monitored consistent with the "detection of aging effects" program element of NUREG-2191, Section XI.M41. 12. Procedures will be revised to address recurring internal corrosion with the use of Low Frequency Electromagnetic Technique (LFET) or a similar technique on 100 feet of piping during each refueling cycle to detect changes in the pipe wall thickness. LFET screening or a similar technique will also be performed on accessible interior fire water storage tank bottoms during periodic inspections. The procedure will specify thinned areas found during the LFET screening be followed up with pipe wall thickness examinations to ensure aging effects are managed and wall thickness is within acceptable limits. In addition to the pipe wall thickness examination, the performance of opportunistic visual inspections of the fire protection system will be required whenever the fire water system is opened for maintenance.		

17	Outdoor and Large Atmospheric Metallic Storage Tanks program	The *Outdoor and Large Atmospheric Metallic Storage Tanks* program is an existing condition monitoring program that will be enhanced as follows: 1. Procedures will be revised to require periodic visual inspections of the refueling water storage tanks (RWSTs) be performed at each outage to confirm that the insulation caulking/sealant at the RWST concrete foundation is intact. The visual inspections of caulking/sealant will be supplemented with physical manipulation to detect any degradation. If there are any identified flaws, the caulking/sealant will be repaired or replaced and follow-up examination of the tank's surfaces conducted if deemed appropriate. An inspection of the caulk at the tank and concrete foundation interface will be included in the sample when the RWST external insulation is removed and sampled for external surface visual examinations. 2. Procedures will be revised to require visual and surface examination of the exterior surfaces of the RWSTs and CATs be performed to identify any loss of material or cracking. A minimum of either 25, one square foot sections or 20% of the surface area of insulation will be required to be removed to permit inspection of the exterior surface of each tank. The procedure will specify that sample inspection points be distributed in such a way that inspections occur near the bottoms, at points where structural supports, pipe, or instrument nozzles penetrate the insulation, and where water could collect such as on top of stiffening rings. If no unacceptable loss of material or cracking is observed, subsequent external surface examinations of insulated tanks will inspect for indications of damage to the jacketing, evidence of water intrusion through the insulation, or evidence of damage to the moisture barrier of tightly adhering insulation. 3. Procedures will be revised to require ECST weep holes be inspected for water leakage/condensation once each refueling cycle and corrective action taken if excessive leakage is observed. Accessible external metallic tank surfaces visible from inside the ECST piping penetration house will also require inspection once each refueling cycle as an indication of external ECST surface condition. Volumetric examination thickness measurements of the bottom of both ECMTs (100% of the surface exposed to soil) and both emergency condensate storage tanks will be performed and will occur during each 10-year period starting ten years before the subsequent period of extended operation. Results will be forwarded to engineering for evaluation and the need for additional inspections will be determined based on projected corrosion rates. One-time thickness measurements of a sample of the ECSTs vertical wall will be performed prior to the SPEO to assess potential degradation due to removable access plug leakage. The sample will examine the ECST vertical steel shell region between the three weep holes at the tank bottom associated with removable access plug leakage and vertically from that	Program will be implemented and inspections or tests begin 10 years before the subsequent period of extended operation. Inspections or tests that are to be completed prior to the subsequent period of extended operation are completed 6 months prior to the subsequent period of extended operation or no later than the last refueling outage prior to the subsequent period of extended operation.	SLRA, Appendix A, Table A4.0-1 (ML18291A842, ML18291A828) Response to RAIs – Set 2 (ML19204A357)

17 (cont'd)		tank bottom junction to a distance of six feet along the vertical shell at the tank as a region potentially most susceptible to degradation. The inspection results will be projected to end of the SPEO to confirm the ECSTs intended functions will be maintained throughout the SPEO based on the projected rate of degradation. Any degradation not meeting acceptance criteria will require periodic 10-year thickness measurements and a sample expansion along the leakage path consistent with the observed degradation. 4. Procedures will be revised to require volumetric examination thickness measurements of the bottom of both FWSTs and both RWSTs be performed each 10-year period during the subsequent period of extended operation starting ten years before the subsequent period of extended operation. Results will be forwarded to Engineering for evaluation and the need for additional inspections will be determined based on projected corrosion rates. 5. For the carbon steel tanks (FWST, ECST, ECMT), procedures will be revised to provide non-ASME Code inspection guidance related to lighting, distance, offset, and surface conditions. The revised procedure will require the inspector confirm adequate lighting is available at the inspection location to detect degradation. Lighting may be permanently installed, temporary, or portable (e.g., flashlight), as appropriate. For accessible surface inspections, inspecting from a distance of two feet or less is recommended. For distant surface inspections, viewing aids such as binoculars may be used. For internal inspections, accessible surfaces will be inspected. Cleaning will be performed as necessary to allow for a meaningful examination. If protective coatings are present, the condition of the coating will be noted. 6. A new procedure will be developed to specify that additional inspections be performed consistent with NUREG-2191. If any inspections do not meet the acceptance criteria, additional inspections are conducted if one of the inspections does not meet acceptance criteria due to current or projected degradation (i.e., trending). a. For inspections where only one tank of a material, environment, and aging effect was inspected, all tanks in that grouping are inspected. b. For other sampling based inspections there will be no fewer than five additional inspections for each inspection that did not meet acceptance criteria, or 20% of each applicable material, environment, and aging effect combination inspected, whichever is less. If any subsequent inspections do not meet acceptance criteria, an extent of condition and extent of cause analysis will be conducted to determine the further extent of inspections required. Additional samples will be inspected for any recurring degradation to ensure corrective actions appropriately address the associated causes. The additional		

Item No.	UFSAR Supplement Section	Commitment	Implementation Schedule	Source
17 (cont'd)		inspections will include inspections of components with the same material, environment, and aging effect combination at the other unit. The additional inspections will be completed within the interval (i.e., 10-year inspection interval) in which the original inspection was conducted or, if identified in the latter half of the current inspection interval, within the next refueling outage interval. These additional inspections conducted in the next inspection interval cannot also be credited towards the number of inspections in the latter interval. If any projected inspection results will not meet acceptance criteria prior to the next scheduled inspection, inspection frequencies are adjusted as determined by the Corrective Action Program. However, for one-time inspections that do not meet acceptance criteria, inspections are subsequently conducted at least at 10-year inspection intervals.		
18	Fuel Oil Chemistry program	The *Fuel Oil Chemistry* program is an existing mitigative and condition monitoring and preventive program that will be enhanced as follows: 1. Procedures will be revised to include the emergency diesel generator (EDG) fuel oil base tanks within the scope of the *Fuel Oil Chemistry* program. 2. Existing procedures will be revised to include a requirement for quarterly sampling of the EDG auxiliary fuel oil tanks and EDG fuel oil base tanks for particulates and water. 3. Procedures will be revised to require the following fuel oil storage tanks within the scope of subsequent license renewal be drained, cleaned, and the internal surfaces visually inspected for degradation within ten years of entering the subsequent period of extended operation, and every ten years during the subsequent period of extended operation: • Underground fuel oil storage tanks • AAC diesel generator fuel oil tank If degradation is found during the internal visual inspection, bottom thickness measurements will be performed. Visual and volumetric examinations will be performed by personnel qualified in accordance with the standards of the American Petroleum Institute. 4. Procedures will be developed to perform periodic bottom thickness measurements of the following tanks within ten years of entering the subsequent period of extended operation, and every ten years during the subsequent period of extended operation: • EDG auxiliary fuel oil tanks • Diesel fire pump fuel oil tank	Program will be implemented and inspections begin 10 years before the subsequent period of extended operation. Inspections that are to be completed prior to the subsequent period of extended operation are completed 6 months prior to the subsequent period of extended operation or no later than the last refueling outage prior to the subsequent period of extended operation.	SLRA, Appendix A, Table A4.0-1 (ML18291A842, ML18291A828) Supplement to SLRA: Change Notice 2 (ML19095A666, ML19095A602)

Item No.	UFSAR Supplement Section	Commitment	Implementation Schedule	Source
18 (cont'd)		• Emergency service water pump fuel oil tank Volumetric examinations will be performed by personnel qualified in accordance with the standards of the American Petroleum Institute. 5. Procedures will be developed to require an engineering evaluation be performed to document, evaluate, and trend visual and volumetric (as applicable) inspection results for the following fuel oil storage tanks: • Underground fuel oil storage tanks • AAC diesel generator fuel oil tank • EDG auxiliary fuel oil tanks • Diesel fire pump fuel oil tank • Emergency service water pump fuel oil tank The procedures will require unacceptable inspection results, as determined in the engineering evaluation, be documented in the Corrective Action Program. Bottom thickness measurements will be required to be evaluated against the design thickness and corrosion allowance. The frequency of future inspections will not be allowed to be reduced if bottom thickness measurements indicate the corrosion allowance will be exceeded prior to the next scheduled inspection. If a tank does not have a stated corrosion allowance, the tank will be evaluated for acceptability in the engineering evaluation. The engineering evaluation will evaluate the need to reduce the time period between future inspections based on inspection results. 6. Prior to the subsequent period of extended operation, a one-time inspection will be performed on the accessible internal surfaces on one EDG fuel oil base tank at SPS. Inspection will be limited due to the restricted accessibility through the tank sampling port. A visual inspection will be performed using a boroscope or equivalent instrument which will provide an acceptable level of information regarding tank degradation on the accessible internal surfaces. 7. Procedures will be revised to require a biocide be added when biological activity is detected or if there is evidence of tank internal corrosion.		

Item No.	UFSAR Supplement Section	Commitment	Implementation Schedule	Source
19	Reactor Vessel Material Surveillance program	The *Reactor Vessel Material Surveillance* program is an existing condition monitoring program that will be enhanced as follows: 1. The RV Material Surveillance program for Unit 1 will be amended for Capsule Y to be pulled during the subsequent period of extended operation. Capsule Y will be pulled during the first refueling outage after the capsule reaches fluence greater than 100-year vessel irradiation which is between one and two times the projected peak vessel neutron fluence at the end of the subsequent period of extended operation. 2. The RV Material Surveillance program for Unit 2 will be amended for Capsule T to be pulled during the subsequent period of extended operation. Capsule T will be pulled during the first refueling outage after the capsule reaches fluence greater than 100-year vessel irradiation which is between one and two times the projected peak vessel neutron fluence at the end of the subsequent period of extended operation.	Program and SLR enhancements will be implemented 6 months prior to the subsequent period of extended operation. This program includes removal and testing of at least one capsule during the subsequent period of extended operation, with a neutron fluence of the capsule between one and two times the projected peak vessel neutron fluence at the end of the subsequent period of extended operation.	SLRA, Appendix A, Table A4.0-1 (ML18291A842, ML18291A828)
20	One-Time Inspection program	The *One-Time Inspection* 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 subsequent 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. The One-Time Inspection program will perform a magnetic particle test inspection of the continuous circumferential transition cone closure weld on each steam generator (essentially 100% examination coverage of each weld) prior to the subsequent period of extended operation. Industry and plant-specific operating experience will be evaluated in the development of this program.	Program will be implemented and inspections begin 10 years before the subsequent period of extended operation. Inspections that are to be completed prior to the subsequent period of extended operation are completed 6 months prior to the subsequent period of extended operation or no later than the last refueling outage prior to the subsequent period of extended operation.	SLRA, Appendix A, Table A4.0-1 (ML18291A842, ML18291A828) Response to RAIs – Set 1 (ML19183A440, ML19183A386)

Item No.	UFSAR Supplement Section	Commitment	Implementation Schedule	Source
21	Selective Leaching program	The *Selective Leaching* 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. Industry and plant-specific operating experience will be evaluated in the development of this program.	Program will be implemented and inspections begin 10 years before the subsequent period of extended operation. Inspections that are to be completed prior to the subsequent period of extended operation are completed 6 months prior to the subsequent period of extended operation or no later than the last refueling outage prior to the subsequent period of extended operation.	SLRA, Appendix A, Table A4.0-1 (ML18291A842, ML18291A828)
22	ASME Code Class 1 Small-Bore Piping program	The *ASME Code Class 1 Small-Bore Piping* 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. Industry and plant-specific operating experience will be evaluated in the development of this program.	Program will be implemented and inspections are completed within 6 years before the subsequent period of extended operation. Inspections that are to be completed prior to the subsequent period of extended operation are completed 6 months prior to the subsequent period of extended operation or no later than the last refueling outage prior of extended operation.	SLRA, Appendix A, Table A4.0-1 (ML18291A842, ML18291A828)

23	External Surfaces Monitoring of Mechanical Components program	The *External Surfaces Monitoring of Mechanical Components* program is an existing condition monitoring program that will be enhanced as follows: 1. The Engineering walkdown procedure will be revised to include an item in the walkdown checklist to inspect insulation metallic jacketing for any damage that would permit in-leakage of moisture. 2. The Engineering walkdown procedure will be revised to add the following requirements: a. Metallic Components • No surface imperfections, loss of wall thickness, flaking, or oxide coated surfaces • No blistering of protective coating • No evidence of leakage (for detection of cracks) on the surfaces of stainless steel, aluminum, and copper alloy (>15% Zn or >8% Al) components • No accumulation of debris on air-side heat exchanger surfaces b. Elastomers and Flexible Polymers • No exposure of reinforcing fibers, mesh or underlying metal (for elastomers or flexible polymers with internal reinforcement) • No blistering, loss of thickness, dimensional change, or scuffing • No hardening of elastomeric elements as evidenced by a loss of suppleness during tactile inspection c. Insulation Metallic Jacketing • Inspect insulation metallic jacketing for any damage that would permit in-leakage of moisture. d. HVAC Closure Bolting • Check that a sample of closure bolting that is in reach is not loose 3. The Engineering walkdown procedure will be revised to specify that walkdowns will be performed at a frequency not to exceed one refueling cycle. Since some surfaces are not readily visible during both plant operations and refueling outages, the enhancement will also specify that such surfaces will be inspected when they are made accessible and at such intervals that would ensure the components' intended functions are maintained. 4. The Engineering walkdown procedure will be revised to provide non-ASME Code inspection guidance related to lighting, distance and offset for walkdown inspections. The procedure will specify adequate lighting be verified at the inspection location to detect degradation. Lighting may be permanently installed, temporary, or portable (e.g., flashlight), as appropriate. For accessible surface inspections, inspecting from a distance	Program enhancements for SLR will be implemented 6 months prior to the subsequent period of extended operation.	SLRA, Appendix A, Table A4.0-1 (ML18291A842, ML18291A828) Supplement to SLRA: Change Notice 1 (ML19042A137)

23 (cont'd)		of two to four feet (or less) will be appropriate. For distant surface inspections, viewing aids such as binoculars may be used. For viewing angles which may prevent adequate inspection, a viewing aid such as an inspection mirror or boroscope should be used. 5. A new procedure will be developed to specify that in each 10-year period during the subsequent period of extended operation, the minimum number of inspections is completed. A minimum of 25 inspections for cracking will be performed from each of the stainless steel, aluminum, and copper alloy (>15% Zn or >8% Al) component populations assigned to the program every ten years. For insulated components exposed to condensation, a minimum of 25 one foot axial length sections and components for each material and environment combination will be inspected for loss of material and cracking after the insulation is removed. The new procedure will specify that the inspections focus on the components most susceptible to aging because of time in service, severity of operating conditions, and lowest design margin. 6. The Engineering walkdown procedure will be revised to specify that visual inspection of elastomers and flexible polymers will be supplemented by tactile inspection to detect hardening. Visual inspections will cover 100% of accessible component surfaces. The minimum surface area for tactile inspections will be at least 10% of the accessible surface area. 7. A new procedure will be developed to evaluate and project the rate of any degradation until the end of the subsequent period of extended operation or the next scheduled inspection, whichever is shorter. The inspection sampling bases (e.g., selection, size, frequency) will be adjusted as necessary based on the projection. 8. A new procedure will be developed to specify that, where practical, acceptance criteria are quantitative (e.g., minimum wall thickness). For quantitative analyses, the required minimum wall thickness to meet applicable design standards will be used. For qualitative evaluations, applicable parameters such as ductility, color, and other indicators will be addressed to ensure a decision is based on observed conditions. 9. A new procedure will be developed to specify that additional inspections will be performed if any sampling-based inspections to detect cracking in aluminum, stainless steel, and copper alloy (>15% Zn or >8% Al) components do not meet the acceptance criteria, unless the cause of the aging effect for each applicable material and environment is corrected by repair or replacement. There will be no fewer than five additional inspections for each inspection that did not meet acceptance criteria, or 20% of each applicable material, environment, and aging effect combination inspected, whichever is less. If any subsequent inspections do not meet acceptance criteria, an extent of condition and extent of cause analysis will be conducted to determine the further extent of inspections		

Item No.	UFSAR Supplement Section	Commitment	Implementation Schedule	Source
23 (cont'd)		required. Additional samples will be inspected for any recurring degradation to ensure corrective actions appropriately address the associated causes. The additional inspections will include inspections of components with the same material, environment, and aging effect combination at both Unit 1 and Unit 2. The additional inspections will be completed within the interval (e.g., 10-year inspection interval) in which the original inspection was conducted.		
24	Flux Thimble Tube Inspection program	The *Flux Thimble Tube Inspection* program is an existing condition monitoring program that will be enhanced as follows: 1. An inspection procedure will be developed specifically for flux thimble tube eddy-current inspections, rather than continuing to use a generic procedure for tubing inspection. The procedure will include the acceptance criterion, with the basis, for loss of material for the inner flux thimble tube, and identify remediating actions to be implemented if the acceptance criterion is exceeded.	Program enhancements for SLR will be implemented 6 months prior to the subsequent period of extended operation.	SLRA, Appendix A, Table A4.0-1 (ML18291A842, ML18291A828)
25	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program	The *Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components* program is an existing condition monitoring program that will be enhanced as follows: 1. Procedures will be revised to require inspection of metallic components for flaking or oxide-coated surfaces. 2. Procedures will be revised to require inspection of elastomeric and flexible polymeric components for the following: a. Surface crazing, scuffing, loss of sealing, blistering, and dimensional change (e.g., "ballooning" and "necking") b. Loss of wall thickness c. Exposure of internal reinforcement (e.g., reinforcing fibers, mesh, or underlying metal) for reinforced elastomers 3. Procedures will be revised to specify that visual inspection of elastomeric and flexible polymeric components is supplemented by tactile inspection to detect hardening or loss of suppleness. The minimum surface area for tactile inspections will be at least 10% of the accessible surface area. 4. Procedures will be revised to provide non-ASME Code inspection guidance related to lighting, distance, offset, surface coverage, presence of protective coatings, and cleaning processes. The procedure will specify adequate lighting be verified at the inspection	Program enhancements for SLR will be implemented 6 months prior to the subsequent period of extended operation.	SLRA, Appendix A, Table A4.0-1 (ML18291A842, ML18291A828) Supplement to SLRA: Change Notice 2 (ML19095A666, ML19095A602)

Item No.	UFSAR Supplement Section	Commitment	Implementation Schedule	Source
25 (cont'd)		location to detect degradation. Lighting may be permanently installed, temporary, or portable (e.g., flashlight), as appropriate. For accessible surface inspections, inspecting from a distance of two feet or less will be appropriate. For viewing angles which may prevent adequate inspection, a viewing aid such as an inspection mirror or boroscope should be used. For internal inspections, accessible surfaces will be inspected. If inspecting piping internal surfaces, a minimum of one linear foot will be inspected, if accessible. Cleaning will be performed, as necessary, to allow for a meaningful examination. If protective coatings are present, the procedure will require the condition of the coating to be documented. 5. Procedures will be revised to specify that follow-up volumetric examinations are performed where irregularities that could be indicative of an unexpected level of degradation are detected for steel components exposed to raw water, raw water (potable), or waste water. 6. A new procedure will be developed to specify that in each 10-year period during the subsequent period of extended operation, the minimum number of inspections is completed for the various sample populations (each material, environment, and aging effect combination). If opportunistic inspections will not fulfill the minimum number of inspections by the end of each 10-year period, the program owner will initiate work orders as necessary to request additional inspections. A representative sample of 20% of the population (defined as components having the same material, environment, and aging effect combination) or a maximum of nineteen components per population at each unit will be inspected. The new procedure will specify that the inspections focus on the bounding or lead components most susceptible to aging due to time in service and severity of operating conditions. 7. A new procedure will be developed to evaluate and project the rate of any degradation until the end of the subsequent period of extended operation or the next scheduled inspection, whichever is shorter. The inspection sampling bases (e.g., selection, size, frequency) will be adjusted as necessary based on the projection. 8. A new procedure will be developed to specify that, where practical, acceptance criteria are quantitative (e.g., minimum wall thickness). For quantitative analyses, the required minimum wall thickness to meet applicable design standards will be used. For qualitative evaluations,		

Item No.	UFSAR Supplement Section	Commitment	Implementation Schedule	Source
25 (cont'd)		applicable parameters such as ductility, color, and other indicators will be addressed to ensure a decision is based on observed conditions. 9. A new procedure will be developed to specify that additional inspections will be performed if any sampling-based inspections do not meet the acceptance criteria, unless the cause of the aging effect for each applicable material and environment is corrected by repair or replacement. There will be no fewer than five additional inspections for each inspection that did not meet acceptance criteria, or 20% of each applicable material, environment, and aging effect combination are inspected, whichever is less. If any subsequent inspections do not meet acceptance criteria, an extent of condition and extent of cause analysis will be conducted to determine the further extent of inspections required. Additional samples will be inspected for any recurring degradation to ensure corrective actions appropriately address the associated causes. The additional inspections will include inspections of components with the same material, environment, and aging effect combination at both Unit 1 and Unit 2. The additional inspections will be completed within the interval (e.g., refueling outage interval, 10-year inspection interval) in which the original inspection was conducted or, if identified in the latter half of the current inspection interval, within the next refueling outage interval.		
26	Lubricating Oil Analysis program	The *Lubricating Oil Analysis* Program is an existing preventive program that will be enhanced as follows: 1. Procedures will be revised to incorporate existing guidelines for lube oil and electro-hydraulic control fluids into sampling procedures. 2. Procedures will be revised to include a statement that phase-separated water in any amount is not acceptable.	Program enhancements for SLR will be implemented 6 months prior to the subsequent period of extended operation.	SLRA, Appendix A, Table A4.0-1 (ML18291A842, ML18291A828)

27	Buried and Underground Piping and Tanks program	The *Buried and Underground Piping and Tanks* program is an existing condition monitoring program that will be enhanced as follows: 1. Procedures will be revised to establish an upper limit of -1200mV for pipe-to-soil potential measurements of coated pipes so as to preclude potential damage to coatings. 2. Procedures will be revised to obtain pipe-to-soil potential measurements for piping in the scope of SLR during the next soil survey within 10 years prior to entering the subsequent period of operation. 3. Procedures will be revised to require uncoated buried stainless steel tubing segments in the fuel oil system be inspected prior to the subsequent period of extended operation. After inspection, each uncoated stainless steel segment will be coated consistent with Table 1 of NACE SP0169-2007, "Control of External Corrosion on Underground or Submerged Metallic Piping Systems." 4. A cathodic protection system will be installed for protection of the 24-inch service water piping at the Low Level Intake Structure five years before entering the subsequent period of operation. 5. A cathodic protection system will be installed for protection of each unit's buried carbon steel condensate system and auxiliary feedwater system piping from the emergency condensate storage tank and the emergency condensate makeup tank to the service building five years before entering the subsequent period of operation. 6. Procedures will be enhanced to perform two soil corrosivity samples: one adjacent to the Unit 1 circulating water inlet piping and another adjacent to the Unit 2 circulating water inlet piping. Sampling will be performed on a ten year interval. Data collected at each location will include: soil resistivity, soil consortia (bacteria), pH, moisture, chlorides, sulfates, and redox potential. In addition to evaluating each individual parameter, corrosivity of carbon steel reinforcement and concrete degradation in high sulfate, high chlorides, and acidic environments will be evaluated. 7. Procedures will be developed to perform a one-time inspection (one excavation) for evidence of concrete aging (below grade) associated with the south side of the Turbine Building, with the following requirements: a. Prior to excavation, it shall be confirmed that the south side of the Turbine Building is bare concrete below grade. b. If bare concrete is confirmed, then: • A minimum of 50 ft^2 concrete surface area below groundwater level will be inspected by the one-time inspection. • The evaluation of the one-time inspection results shall include evaluation of the acceptability of the eight	Program will be implemented and inspections begin 10 years before the subsequent period of extended operation. Inspections that are to be completed prior to the subsequent period of extended operation are completed 6 months prior to the subsequent period of extended operation or no later than the last refueling outage prior to the subsequent period of extended operation.	SLRA, Appendix A, Table A4.0-1 (ML18291A842, ML18291A828) Supplement to SLRA: Change Notice 2 (ML19095A666, ML19095A602) Response to RAIs – Set 1 (ML19183A440, ML19183A386) Response to RAIs – Set 3 & 4 (ML19253B330) Correction to Response to RAIs – Set 3 & 4 (ML19269B734) Supplement to SLRA: Change Notice 4 (ML19294A044) Supplement to SLRA: Change Notice 5 (ML19310E716) Supplement to SLRA: Change Notice 6 (ML19329A287)

27 (cont'd)		inaccessible 96-inch CW pipes located between the High Level Intake Structures and the Turbine Building using the guidance in ACI 349.3R. • If observed age-related degradation exceeds ACI 349.3R Tier-1 criteria, then the area containing the degradation will be evaluated for acceptability by a responsible Civil Engineer using the Corrective Action Program. The evaluation shall include the acceptability of the eight inaccessible 96-inch CW pipes located between the High Level Intake Structures and the Turbine Building using the guidance in ACI 349.3R. • If observed age-related degradation exceeds ACI 349.3R Tier-1 criteria, a subsequent inspection will be performed within ten years to determine if the previously observed degradation remains within the parameters evaluated during the previous inspection. If the degradation during the subsequent inspection more than marginally exceeds the evaluated parameters from the previous inspection, then within five years an excavation of one 96-inch CW pipe will be performed to inspect a surface area of 50 ft^2 located below groundwater level. c. If bare concrete is not confirmed, then: • Excavation of one 96-inch CW pipe will be performed to inspect a surface area of 50 ft^2 located below groundwater level. 8. Procedures will be revised to specify that cathodic protection surveys use the -850mV polarized potential, instant off criterion specified in NACE SP0169-2007 for steel piping acceptance criteria unless a suitable alternative polarization criteria can be demonstrated. Alternatives include the -100mV polarization criteria, -750mV criterion (soil resistivity is less than 100,000 ohm-cm), -650mV criterion (soil resistivity is greater than 100,000 ohm-cm), or verification of less than 1 mpy loss of material rate. The external loss of material rate is verified: • Every year when verifying the effectiveness of the cathodic protection system by measuring the loss of material rate. • Every 2 years when using the 100 mV minimum polarization. • Every 5 years when using the -750 or -650 criteria associated with higher resistivity soils. The soil resistivity is verified every 5 years. As an alternative to verifying the effectiveness of the cathodic protection system every five years, soil resistivity testing is conducted annually during a period of time when the soil resistivity would be expected to be at its lowest value (e.g., maximum rainfall periods). Upon completion of ten annual consecutive soil samples,		

Item No.	UFSAR Supplement Section	Commitment	Implementation Schedule	Source
27 (cont'd)		soil resistivity testing can be extended to every five years if the results of the soil sample tests consistently have verified that the resistivity did not fall outside of the range being credited (e.g., for the -750 mV relative to a CSE, instant off criterion, measured soil resistivity values were greater than 10,000 ohm-cm). When using the electrical resistance corrosion rate probes: a. The individual determining the installation of the probes and method of use will be qualified to NACE CP4, “Cathodic Protection Specialist” or similar b. The impact of significant site features and local soil conditions will be factored into placement of the probes and use of the data 9. Procedures will be revised to specify that soil samples results indicating corrosivity of greater than 10 points using the “carbon steel” column in Table 9-4, “Soil Corrosivity Index from BPWORKS,” of EPRI Report 3002005294, “Soil Sampling and Testing Methods to Evaluate the Corrosivity of the Environment for Buried Piping and Tanks at Nuclear Power Plants,” require evaluation of potential scope expansion or category transition. 10. Procedures will be revised to specify that when an aggressive groundwater/soil environment is confirmed, corrective actions are required, including confirmatory groundwater resampling, as well as groundwater sampling on a quarterly basis for at least one year (i.e., four quarters). The results of the quarterly groundwater samples will be trended, and if groundwater chemistry continues to exceed the aggressive environment thresholds, additional corrective actions will be determined. The additional corrective actions may include items such as further sampling, installation of more wells, more frequent inspections of the surrogate structure, and/or the development of a plant specific aging management activity.		

28	Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks program	The *Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks* program is an existing condition monitoring program that will be enhanced as follows: 1. Procedures will be revised to require baseline inspections (100% of accessible coatings/linings) of the following tanks, piping, and miscellaneous components within the scope of subsequent license renewal and inspection intervals will not exceed those specified in NUREG-2191, Table XI.M42-1, “Inspection Intervals for Internal Coatings/Linings for Tanks, Piping, Piping Components, and Heat Exchangers.” • Circulating water system waterbox air separating tanks • Condensate polishing outlet piping (short segment; entire length is inspected) • Vacuum priming tanks • Vacuum priming seal water separator tanks • Auxiliary steam drain receiver tank • Water treatment piping (short segment; entire length is inspected) • Flash evaporator demineralizer isolation valve • Brominator mixing tank • Pressurizer relief tanks 2. Programs will be revised to consistently reference coating aging mechanisms and add definitions for rusting, wear/erosion, and physical damage. 3. Procedures will be revised to require alignment of the internal coating/lining inspection criteria with the inspection criteria and aging mechanisms specified in the Coatings Condition Assessment Program. 4. Procedures will be revised to require inspections of cementitious coatings/linings and include aging mechanisms associated with cementitious coatings/linings described as cracking due to chemical reaction, weathering, settlement, or corrosion of reinforcement; loss of material due to delamination, exfoliation, spalling, popout, scaling, or cavitation. 5. Procedures will be revised to require cementitious coatings/linings inspectors to have a minimum of five years of experience inspecting or testing concrete structures or cementitious coatings/linings or a degree in the civil/structural discipline and a minimum of one year of experience. 6. Procedures will be revised to require opportunistic inspections of piping internally lined with concrete and include aging associated with cementitious coatings/linings described as cracking due to chemical reaction, weathering, settlement, or corrosion of reinforcement; loss of	Program will be implemented and inspections begin 10 years before the subsequent period of extended operation. Inspections that are to be completed prior to the subsequent period of extended operation are completed 6 months prior to the subsequent period of extended operation or no later than the last refueling outage prior to the subsequent period of extended operation.	SLRA, Appendix A, Table A4.0-1 (ML18291A842, ML18291A828) Supplement to SLRA: Change Notice 2 (ML19095A666, ML19095A602) Response to RAIs – Set 1 (ML19183A440, ML19183A386) Response to RAIs – Set 3 & 4 (ML19253B330) Correction to Response to RAIs – Set 3 & 4 (ML19269B734)

28 (cont'd)		material due to delamination, exfoliation, spalling, popout, scaling, or cavitation. 7. Component cooling heat exchanger channel head coatings are inspected on a one-year inspection interval. Procedures will be revised to require that if two subsequent inspections demonstrate no change in coating condition (i.e. at least three consecutive inspections with no change in condition), inspection frequencies at those locations may be conducted consistent with inspection Category B of NUREG-2191 Table XI.M42-1. 8. Procedures will be revised to require a coatings specialist to prepare the coatings post-inspection condition assessment report. A pre-inspection review will be performed of the coating inspections and any subsequent repair activities from the previous two coatings post-inspection condition assessment reports, when available. 9. Procedures will be revised to require inspection results are evaluated against acceptance criteria to confirm that the components' intended functions will be maintained throughout the subsequent period of extended operation based on the projected rate and extent of degradation. Where practical, (e.g., wall thickness measurements, blister size and (frequency), degradation is projected until the next scheduled inspection. 10. Procedures will be revised to: a. Specify there are no indications of peeling or delamination. b. Require inspection of cementitious coatings/linings. Minor cracking and spalling is acceptable provided there is no evidence that the coating/lining is debonding from the base material. c. Require, as applicable wall thickness measurements, projected to the next inspection, meet design minimum wall requirements. 11. Procedures will be revised to permit the "removal" of coatings/linings that do not meet acceptance criteria, with the required evaluation and documentation. 12. Procedures will be revised to include as an alternative to repair, rework, or removal, internal coatings/linings exhibiting indications of peeling and delamination. The component may be returned to service if: a. Physical testing is conducted to ensure that the remaining coating is tightly bonded to the base metal b. the potential for further degradation of the coating is minimized, (i.e., any loose coating is removed, the edge of the remaining coating is feathered) c. adhesion testing using ASTM International Standards endorsed in RG 1.54 (e.g., pull-off testing, knife adhesion testing) is conducted at a minimum of 3 sample points adjacent to the defective area		

28 (cont'd)		d. an evaluation is conducted of the potential impact on the system, including degraded performance of downstream components due to flow blockage and loss of material or cracking of the coated component and e. follow-up visual inspections of the degraded coating are conducted within two years from detection of the degraded condition, with a re-inspection within an additional two years, or until the degraded coating is repaired or replaced 13. Procedures will be revised to require when a blister does not meet acceptance criteria, and it is not repaired, physical testing is conducted to ensure that the blister is completely surrounded by sound coating/lining bonded to the surface. Physical testing consists of adhesion testing using ASTM International standards endorsed in RG 1.54. Where adhesion testing is not possible due to physical constraints, another means of determining that the remaining coating/lining is tightly bonded to the base metal is conducted such as lightly tapping the coating/lining. Acceptance of a blister to remain inservice should be based both on the potential effects of flow blockage and degradation of the base material beneath the blister. 14. Procedures will be revised to require additional inspections be conducted if one of the inspections does not meet acceptance criteria due to current or projected degradation (i.e., trending) unless the cause of the aging effect for each applicable material and environment is corrected by repair or replacement for all components constructed of the same material and exposed to the same environment. The number of increased inspections will be determined in accordance with the Corrective Action Program. However, there are no fewer than five additional inspections for each inspection that did not meet acceptance criteria, or 20% of each applicable material, environment, and aging effect combination inspected, whichever is less. When inspections are based on the percentage of piping length, an additional 5% of the total length will be inspected. The timing of the additional inspections will be based on the severity of the degradation identified and will be commensurate with the potential for loss of intended function. However, in all cases, the additional inspections will be completed within the interval in which the original inspection was conducted, or if identified in the latter half of the current inspection interval, within the next refueling outage interval. These additional inspections conducted in the next inspection interval cannot also be credited towards the number of inspections in the latter interval. If subsequent inspections do not meet acceptance criteria, an extent of condition and extent of cause analysis will be conducted to determine the further extent of inspections. Additional samples will be inspected for any recurring degradation to provide reasonable assurance that corrective actions appropriately address the associated causes. The additional inspections will include inspections with		

Item No.	UFSAR Supplement Section	Commitment	Implementation Schedule	Source
28 (cont'd)		the same material, environment, and aging effect combination at both Unit 1 and Unit 2. 15. Physical testing is performed where physically possible (i.e., sufficient room to conduct testing) or examination is conducted to ensure that the extent of repaired or replaced coatings/linings encompasses sound coating/lining material.		
29	ASME Section XI, Subsection IWE program	The *ASME Section XI, Subsection IWE* program is an existing condition monitoring program that will be enhanced as follows: 1. Procedures will be revised to specify that whenever replacement of bolting is required, bolting material, installation torque or tension, and use of lubricants and sealants are in accordance with the guidelines of EPRI NP-5769, "Degradation and Failure of Bolting in Nuclear Power Plants," EPRI TR-104213, "Bolted Joint Maintenance & Application Guide," and the additional recommendations of NUREG-1339, "Resolution of Generic Safety Issue 29: Bolting Degradation of Failure in Nuclear Power Plants." 2. Procedures will be revised to specify that for structural bolting consisting of ASTM A325, ASTM F1852, and/or ASTM A490 bolts, the preventive actions for storage, lubricants, and stress corrosion cracking potential discussed in Section 2 of RCSC (Research Council for Structural Connections) publication "Specification for Structural Joints Using ASTM A325 or A490 Bolts," will be used. 3. Procedures will be revised to augment visual examinations with surface examinations to manage cracking in the containment pressure retaining portions of the fuel transfer tube, fuel transfer tube enclosure, fuel transfer tube blind flange, dissimilar metal weld penetrations, and high-temperature steel piping penetrations. Surface examinations will be performed once during each ten year interval. 4. Procedures will be revised to specify a one-time volumetric examination of metal liner surfaces that are inaccessible from one side if triggered by plant-specific operating experience. The trigger for this supplemental examination is plant-specific occurrence or recurrence of measurable metal liner corrosion (base metal material loss exceeding 10% of nominal plate thickness) initiated on the inaccessible side or areas, identified since the date of issuance of the initial 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 operating experience and/or other relevant considerations such as environment. Any identified degradation is addressed in accordance with the applicable provisions of the ASME	Program and SLR enhancements, will be implemented 6 months prior to the subsequent period of extended operation.	SLRA, Appendix A, Table A4.0-1 (ML18291A842, ML18291A828) Supplement to SLRA: Change Notice 2 (ML19095A666, ML19095A602)

Item No.	UFSAR Supplement Section	Commitment	Implementation Schedule	Source
29 (cont'd)		Section XI, Subsection IWE program. The sample size, locations, and any needed scope expansion (based on findings) for this one-time set of volumetric examinations should be determined on a plant-specific basis to demonstrate statistically, with 95% confidence, that 95% of the accessible portion of the containment liner is not experiencing corrosion degradation with greater than 10% loss of nominal thickness.		
30	ASME Section XI, Subsection IWL program	The *ASME Section XI, Subsection IWL* program is an existing condition monitoring program that will be enhanced as follows: 1. Procedures will be revised to specify that inspection results be compared to previous results to identify changes from prior inspections, and that quantitative measurements are recorded and trended for applicable parameters monitored or inspected. 2. Procedures will be revised to specify that inspection results be compared to previous results to determine if degradation is passive for application of second-tier acceptance criteria as specified in ACI 349.3R-02, "Evaluation of Existing Nuclear Safety-Related Concrete Structures."	Program enhancements for SLR will be implemented 6 months prior to the subsequent period of extended operation.	SLRA, Appendix A, Table A4.0-1 (ML18291A842, ML18291A828)
31	ASME Section XI, Subsection IWF program	The *ASME Section XI, Subsection IWF* program is an existing condition monitoring program that will be enhanced as follows: 1. Procedures will be enhanced to evaluate the acceptability of inaccessible areas (e.g., portions of supports encased in concrete, buried underground, or encapsulated by guard pipe) when conditions in accessible areas that could indicate the presence of, or result in, degradation to such inaccessible areas. 2. Procedures will be revised to specify that whenever replacement of bolting is required, bolting material, installation torque or tension, and use of lubricants and sealants will be in accordance with the guidelines of EPRI NP-5769, EPRI TR-104213, and the additional recommendations of NUREG-1339. 3. Procedures will be revised to specify that for structural bolting consisting of ASTM A325, ASTM F1852, and/or ASTM A490, the preventive actions for storage, lubricants, and stress corrosion cracking potential discussed in Section 2 of RCSC (Research Council for Structural Connections) publication, "Specification for Structural Joints Using ASTM A325 or A490 Bolts," will be used. 4. Procedures will be revised to specify that for NSSS component supports, Class 1 high strength bolting greater than one inch nominal diameter, including ASTM A325 and/or ASTM A490 bolts (including respective	Program will be implemented and a one-time inspection of an additional 5% of the sample size specified in Table IWF-2500-1 for Class 1, 2, and 3 piping supports is conducted within 5 years prior to the subsequent period of extended operation, and are to be completed prior to the subsequent period of extended operation, are completed 6 months prior to the subsequent period of extended operation or no later than the last refueling outage prior to the subsequent period of extended operation.	SLRA, Appendix A, Table A4.0-1 (ML18291A842, ML18291A828) Supplement to SLRA: Change Notice 2 (ML19095A666, ML19095A602)

Item No.	UFSAR Supplement Section	Commitment	Implementation Schedule	Source
31 (cont'd)		equivalent twist-off type ASTM F1852 and/or ASTM F2280 bolts), will be monitored for SCC. 5. Procedures will be revised to specify a one-time inspection within five years prior to entering the subsequent period of extended operation of an additional 5% of the sample populations for Class 1, 2, and 3 piping supports. The additional supports will be selected from the remaining population of IWF piping supports and will include components that are most susceptible to age-related degradation. 6. Procedures will be revised to specify that, for NSSS component supports, high-strength bolting greater than one inch nominal diameter, volumetric examination comparable to that of ASME Code, Section XI, Table IWB-2500-1, Examination Category B-G-1 will be performed to detect cracking in addition to the VT-3 examination. In each 10-year period during the subsequent period of extended operation, a representative sample of bolts will be inspected. The sample will be 20% of the population (for a material / environment combination) up to a maximum of 25 bolts. 7. Procedures will be revised to specify that, if a component support does not exceed the acceptance standards of IWF-3400, but is electively repaired to as-new condition, then 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 50, Appendix J program	The *10 CFR 50, Appendix J* program is an existing performance monitoring program that is credited.	Ongoing	SLRA, Appendix A, Table A4.0-1 (ML18291A842, ML18291A828)
33	Masonry Walls program	The *Masonry Walls* program is an existing condition monitoring program that will be enhanced as follows: 1. Procedures will be revised to clarify qualifications for personnel performing inspections of masonry walls and concrete to be consistent with ACI 349.3R-02. 2. Procedures will be revised to explicitly address the trending of inspection results and projection to the next inspection interval. The procedure will be revised to include acceptance criteria for masonry wall inspections that will be used to ensure observed aging effects (cracking, loss of material, or gaps between the structural steel supports and masonry walls) do not invalidate the evaluation basis of the wall or impact its intended function.	Program enhancements for SLR will be implemented 6 months prior to the subsequent period of extended operation.	SLRA, Appendix A, Table A4.0-1 (ML18291A842, ML18291A828)

34	Structures Monitoring program	The *Structures Monitoring* program is an existing condition monitoring program that will be enhanced as follows: 1. Procedures will be revised to include inspection of the following structures that are within the scope of subsequent license renewal: decontamination building, radwaste facility, health physics yard office building, laundry facility, and machine shop. Inspections for the added structures will be performed under the enhanced program in order to establish quantitative baseline inspection data prior to the subsequent period of extended operation. 2. Procedures will be revised to add the oiled-sand cushion to the inspection of the fire protection/domestic water tank foundation. 3. Procedures will be revised to include preventive actions to ensure bolting integrity for replacement and maintenance activities by specifying 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. For structural bolting consisting of ASTM A325, ASTM A490, ASTM F1852 and/or ASTM F2280 bolts, the preventive actions for storage, lubricant selection, and bolting and coating material selection discussed in Section 2 of the Research Council for Structural Connections publication, “Specification for Structural Joints Using High-Strength Bolts,” will be used. 4. The checklist for structural and support steel will be revised to indicate: “Are any connection members loose, missing or damaged (bolts, rivets, nuts, etc.)?”. 5. Procedures will be revised to require at least five years of experience (or ACI inspector certification) for concrete inspectors to be consistent with ACI 349.3R-002. Procedures will be revised to eliminate options for inspector qualifications that are not consistent with ACI 349.3R-002. 6. Procedures will be revised to specify that wooden pole inspections will be performed at a frequency not to exceed every eight years. Visual examinations will detect loss of material and change in material properties. Visual examinations will be augmented, as required to detect change in material properties, with soundings or other techniques appropriate for the type, condition, and treatment of the wooden poles, including borings and excavations. 7. Procedures will be revised to specify that evaluation of inspection results includes consideration of the acceptability of inaccessible areas when conditions exist in accessible areas that could indicate the presence of, or result in, degradation to such inaccessible areas. 8. Procedures will be enhanced to specify VT-1 inspections to identify cracking on stainless steel and aluminum components. A minimum of 25 inspections will be performed every ten years during the subsequent	Program enhancements for SLR will be implemented 6 months prior to the subsequent period of extended operation. A baseline inspection for wooden poles will be performed prior to January 1, 2031.	SLRA, Appendix A, Table A4.0-1 (ML18291A842, ML18291A828) Supplement to SLRA: Change Notice 2 (ML19095A666, ML19095A602) Supplement to SLRA: Change Notice 3 (ML19168A028) Response to RAIs – Set 2 (ML19204A357) Response to RAIs – Set 3 & 4 (ML19253B330) Correction to Response to RAIs – Set 3 & 4 (ML19269B734)

34 (cont'd)		period of extended operation from each of the stainless steel and aluminum component populations assigned to the Structures Monitoring program. If the component is measured in linear feet, at least one foot will be inspected to qualify as an inspection. For other components, at least 20% of the surface area will be inspected to qualify as an inspection. The selection of components for inspection will consider the severity of the environment. For example, components potentially exposed to halides and moisture would be inspected, since those environmental factors can facilitate stress corrosion cracking. 9. Procedures will be enhanced to specify that for the neutron shield tank (NST), loss of material due to corrosion, other than superficial corrosion, will be evaluated to ensure that the NST will continue to perform its intended functions, including structural support of the RPV. 10. Procedures will be enhanced to specify for the sampling-based inspections to detect cracking in stainless steel and aluminum components, additional inspections will be conducted if one of the inspections does not meet acceptance criteria due to current or projected degradation, unless the cause of the aging effect for each applicable material and environment is corrected by repair or replacement for all components constructed of the same material and exposed to the same environment. No fewer than five additional inspections for each inspection that did not meet acceptance criteria or 20 percent of each applicable material environment and aging effect combination will be inspected, whichever is less. Additional inspections will be completed within the 10-year inspection interval in which the original inspection was conducted. The responsible engineer will initiate condition reports to generate work orders to perform the additional inspections. The responsible engineer will evaluate the inspection results, and if the subsequent inspections do not meet acceptance criteria, an extent of condition and extent of cause analysis will be conducted. The responsible engineer will then determine the further extent of inspections. Additional samples will be inspected for any recurring degradation to ensure corrective actions appropriately address the associated causes. The additional inspections will include inspections of components with the same material, environment, and aging effect combination at both Unit 1 and Unit 2. If any projected inspection results will not meet acceptance criteria prior to the next scheduled inspection, inspection frequencies will be adjusted as determined by the Corrective Action Program. 11. Procedures will be enhanced to specify that evaluation of neutron shield tank findings consider its structural support function for the reactor pressure vessel.		

Item No.	UFSAR Supplement Section	Commitment	Implementation Schedule	Source
34 (cont'd)		12. Procedures will be enhanced to also include LOCAs as events that require evaluation for potentially degraded structures by Civil/Mechanical Design Engineering.		
35	Inspection of Water Control Structures Associated with Nuclear Power Plants program	The *Inspection of Water Control Structures Associated with Nuclear Power Plants* program is an existing condition monitoring program that will be enhanced as follows: 1. Procedures will be revised to provide guidance for specification of bolting material, lubricants and sealants, and installation torque or tension to prevent degradation and assure structural bolting integrity. 2. Procedures will be revised to specify the preventive actions for storage discussed in Section 2 of Research Council for Structural Connections publication "Specification for Structural Joints Using ASTM A325 or A490 Bolts" for ASTM A325, ASTM F1852, ASTM F2280, and/or ASTM A490 structural bolts. 3. Procedures will be revised for concrete inspection to require at least five years of experience (or ACI inspector certification) to be consistent with ACI 349.3R-2002.	Program enhancements for SLR will be implemented 6 months prior to the subsequent period of extended operation.	SLRA, Appendix A, Table A4.0-1 (ML18291A842, ML18291A828)
36	Protective Coating Monitoring and Maintenance program	The *Protective Coating Monitoring and Maintenance* program is an existing mitigative and condition monitoring program that will be enhanced as follows: 1. Procedures will be revised to require that a pre-inspection review of the previous "two" condition assessment reports be performed prior to each refueling outage.	Program enhancements for SLR will be implemented 6 months prior to the subsequent period of extended operation.	SLRA, Appendix A, Table A4.0-1 (ML18291A842, ML18291A828)
37	Electrical Insulation for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program	The *Electrical Insulation for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements* program is an existing condition monitoring program that will be enhanced as follows: 1. A new procedure will be developed that will include guidance for the identification of adverse localized environments of temperature, moisture, radiation, contamination, and oxygen. 2. A new procedure will be developed that includes a description of testing methodology. Should testing be deemed necessary based on unacceptable visual indications of surface anomalies, a sample size of 20% of each cable and connection insulation material type found within the adverse localized environment with a maximum sample size of 25 will be tested. The following factors will be considered in the development of the cable and connection insulation test sample: environment including identified adverse localized environments (high temperature, high humidity,	Program enhancements for SLR will be implemented 6 months prior to the subsequent period of extended operation.	SLRA, Appendix A, Table A4.0-1 (ML18291A842, ML18291A828)

Item No.	UFSAR Supplement Section	Commitment	Implementation Schedule	Source
37 (cont'd)		vibration, etc.), voltage level, circuit loading, connection type, location (high temperature, high humidity, vibration, etc.), and insulation material. Testing may include thermography and other proven condition monitoring test methods applicable to the cable and connection insulation. Testing as part of an existing maintenance, calibration or surveillance program may be credited. The technical basis for the sample selected is provided. 3. A new procedure will be developed that includes an inspection frequency of at least once every ten years. 4. A new procedure will be developed that includes the addition of jacket surface and connection covering material anomalies including embrittlement, melting, swelling, and surface contamination. 5. A new procedure will be developed that includes the performance of a review of previously identified and mitigated adverse localized environments cumulative aging effects applicable to in-scope cable and connection electrical insulation. 6. A new procedure will be developed that describes acceptance criteria for both tests and visual inspections of the electrical cable and connection insulation material. 7. A new procedure will be developed that includes performance of an engineering evaluation of unacceptable test results and visual indications of cable and connection electrical insulation abnormalities. The evaluation will consider the age and operating environment of the component, as well as the severity of the abnormality and whether such an abnormality has previously been correlated to degradation of cable or connection insulation. Corrective actions include, but are not limited to, testing, shielding, or otherwise mitigating the environment or relocation or replacement of the affected cables or connections. When an unacceptable condition or situation is identified, a determination is made as to whether the same condition or situation is applicable to additional in-scope accessible and inaccessible cables or connections (extent of condition).		

Item No.	UFSAR 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 program	The *Electrical Insulation for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits* program is an existing performance monitoring program that will be enhanced as follows: 1. A new procedure will be developed for testing the post-accident neutron monitoring system cables and connections external to containment to evaluate reduced electrical insulation resistance by measuring cable resistance and capacitance. 2. A new procedure will be developed for testing the post-accident neutron monitoring system cables and connections external to containment that includes recommendations for types of electrical insulation tests including insulation resistance tests, time domain reflectometry tests, or other tests judged to be effective in determining cable system insulation physical, mechanical, and chemical properties. 3. A new procedure will be developed for testing the post-accident neutron monitoring system cables and connections external to containment that includes a test frequency of at least once every ten years with the first test completed prior to the subsequent period of extended operation. 4. A new procedure will be developed for testing the post-accident neutron monitoring system cables and connections external to containment that includes acceptance criteria for the recommended test methods. 5. A new procedure will be developed for testing the post-accident neutron monitoring system cables and connections external to containment. The new procedure will include corrective actions and a requirement for an engineering evaluation to be performed when acceptance criteria are not met. The engineering evaluation will include a determination of whether the test frequency needs to be increased.	Program enhancements for SLR will be implemented 6 months prior to the subsequent period of extended operation.	SLRA, Appendix A, Table A4.0-1 (ML18291A842, ML18291A828)

39	Electrical Insulation for Inaccessible Medium-Voltage Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program	The *Electrical Insulation for Inaccessible Medium-Voltage Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements* program is an existing condition monitoring program that will be enhanced as follows: 1. Procedures will be revised to require inspection of in-scope manholes after event driven occurrences, such as heavy rain, rapid thawing of ice and snow, or flooding. 2. Procedures will be revised to add a step stating that automatic or passive drainage features of manholes are operating properly. 3. A procedure will be created for testing medium-voltage cable that includes a requirement for testing medium-voltage cables that are exposed to significant moisture to determine the condition of the electrical insulation. 4. Procedures will be revised to add a step to evaluate adjusting the inspection frequency of manholes based on plant-specific operating experience over time with water collection. 5. A new recurring event and maintenance schedule will be created for testing the “A” RSST cables at least once every six years. 6. A new recurring event and maintenance schedule will be created for testing the “B” RSST cables at least once every six years. 7. A new recurring event and maintenance schedule will be created for testing the “C” RSST cables at least once every six years. 8. A new procedure will be created for testing medium-voltage cable that includes a requirement that the specific type of test performed will be a proven test, utilizing one or more tests such as dielectric loss (dissipation factor (Tan-Delta)/power factor), AC voltage withstand, partial discharge, step voltage, time domain reflectometry, insulation resistance and polarization index, or line resonance analysis, for detecting deterioration of the insulation system due to submergence (e.g., selected test is applicable to the specific cable construction: shielded and non-shielded, and the insulation material under test). 9. A plant-specific inaccessible medium-voltage cable test matrix that documents inspection methods, test methods, and acceptance criteria for the in-scope inaccessible medium-voltage power cables will be developed based on OE. 10. A new procedure will be created for testing medium-voltage cable that includes a requirement to review visual inspection and physical test results that are trendable and repeatable to provide additional information on the rate of cable or connection insulation degradation. 11. A new procedure will be created for testing medium-voltage cable that includes acceptance criteria for tests and inspections.	Program enhancements for SLR will be implemented 6 months prior to the subsequent period of extended operation.	SLRA, Appendix A, Table A4.0-1 (ML18291A842, ML18291A828) Supplement to SLRA: Change Notice 2 (ML19095A666, ML19095A602)

Item No.	UFSAR 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 program	The *Electrical Insulation for Inaccessible Instrument and Control Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements* 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. Industry and plant-specific operating experience will be evaluated in the development of this program.	Program will be implemented 6 months prior to the subsequent period of extended operation.	SLRA, Appendix A, Table A4.0-1 (ML18291A842, ML18291A828)
41	Electrical Insulation for Inaccessible Low-Voltage Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program	The *Electrical Insulation for Inaccessible Low-Voltage Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements* 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. Industry and plant-specific operating experience will be evaluated in the development of this program.	Program will be implemented 6 months prior to the subsequent period of extended operation.	SLRA, Appendix A, Table A4.0-1 (ML18291A842, ML18291A828)
42	Metal-Enclosed Bus program	The *Metal-Enclosed Bus* program is an existing condition monitoring program that will be enhanced as follows: 1. Inspection procedures similar in scope and content to the procedures used to inspect other metal enclosed bus within scope of subsequent license renewal will be developed for the in-scope metal enclosed bus (MEB) associated with the 1A2 480V bus. 2. For inaccessible MEB internal or external segments, procedures will be revised to require initiation of a condition report that will result in an engineering evaluation of the inaccessible MEB segments that, together with the accessible MEB inspection and test program, will continue to maintain the MEB consistent with the current licensing basis during the subsequent period of extended operation. 3. Procedures will be revised to require inspection of accessible internal portions (bus enclosure assemblies) of MEBs for cracks, corrosion, and foreign debris. Accessible bus electrical insulation material will be inspected for signs of reduced insulation resistance due to thermal/thermoxidative degradation of organics/thermoplastics, radiation-induced oxidation, moisture/debris intrusion, or ohmic heating, as indicated by embrittlement, cracking, chipping, melting, discoloration, or swelling,	Program enhancements for SLR will be implemented 6 months prior to the subsequent period of extended operation.	SLRA, Appendix A, Table A4.0-1 (ML18291A842, ML18291A828)

Item No.	UFSAR Supplement Section	Commitment	Implementation Schedule	Source
42 (cont'd)		indicating overheating or aging degradation. Accessible internal bus insulating supports will be inspected for structural integrity and signs of cracks. Accessible gaskets, boots, and sealants will be inspected for elastomer degradation including surface cracking, crazing, scuffing, dimensional change (e.g., "ballooning" and "necking"), shrinkage, discoloration, hardening, and loss of strength that could permit water or foreign debris to enter the bus. 4. Procedure revisions will include a requirement for a sample of accessible bolted connections not covered with heat shrink tape or boots to be inspected for loose or corroded bolted connections and damaged hardware including cracked or split washers. 5. Inspection procedures will be revised to add a note stating that 20% of the accessible bolted connection population, with a maximum of 25, is a representative sample. 6. A new recurring event and maintenance schedule will be created to inspect MEB associated with the 0-AAC-SW-0L bus on a maximum ten-year frequency. The first occurrence will be scheduled prior to the subsequent period of operation. 7. A new recurring event and maintenance schedule will be created to inspect MEB associated with the 1-EP-LCC-1A2 bus on a maximum ten-year frequency. The first occurrence will be scheduled prior to the subsequent period of operation. 8. Procedures will be revised to trend bus connection resistance values to provide information on the rate of connection degradation. 9. Accessible electrical insulation materials will be verified free from regional indications of surface anomalies such as embrittlement, cracking, chipping, melting, discoloration, and swelling. Accessible MEB internal surfaces will be verified to show no indications of corrosion, cracks, and foreign debris. Accessible elastomers (e.g., gaskets, boots, and sealants) will be verified to show no indications of surface cracking, crazing, scuffing, dimensional change (e.g., "ballooning" and "necking"), shrinkage, discoloration, hardening, and loss of strength. 10. Procedures will be revised to specify that when any acceptance criterion is not met, the unacceptable results are entered into the Corrective Action Program.		

Item No.	UFSAR Supplement Section	Commitment	Implementation Schedule	Source
43	Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program	The *Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements* program is a new condition monitoring program that consists of a representative sample of electrical connections tested prior to the subsequent 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. Industry and plant-specific operating experience will be evaluated in the development of this program.	Program will be implemented 6 months prior to the subsequent period of extended operation.	SLRA, Appendix A, Table A4.0-1 (ML18291A842, ML18291A828)
44	High-Voltage Insulators program	The *High-Voltage Insulators* program is a new condition monitoring program that visually inspects high voltage insulator surfaces and metallic parts at least once every two years initially with the frequency adjusted based on plant specific operating experience. For high-voltage insulators that are coated, the visual inspection will be performed at least once every five years. Industry and plant-specific operating experience will be evaluated in the development of this program.	Program will be implemented 6 months prior to the subsequent period of extended operation. Inspections that are to be completed prior to the subsequent period of extended operation are completed 6 months prior to the subsequent period of extended operation or no later than the last refueling outage prior to the subsequent period of extended operation.	SLRA, Appendix A, Table A4.0-1 (ML18291A842, ML18291A828)

Item No.	UFSAR Supplement Section	Commitment	Implementation Schedule	Source
45	Fatigue Monitoring program	The *Fatigue Monitoring* program is an existing preventive program that will be enhanced as follows: 1. The program cycle counting procedures will be revised to add the "Normal Charging and Letdown Shutdown and Return to Service" transient cycle associated with the ASME Code, Section XI, Appendix L analysis. 2. Procedures will be revised to require monitoring and tracking of transient cycles associated with the ASME Code, Section XI, Appendix L analysis be performed between the inspections for each ASME Code, Section XI, Appendix L location. Consistent with existing program cycle counting, a surveillance limit will be established to initiate corrective action prior to exceeding transient cycle assumptions in the ASME Code, Section XI, Appendix L analysis. 3. Procedures will be revised to expand existing corrective action guidance associated with exceeding a cycle counting surveillance limit to recommend consideration of component repair, component replacement, performance of a more rigorous analysis, performance of an ASME Code, Section XI, Appendix L flaw tolerance analysis, or scope expansion to consider other locations with the highest expected U_{en} values.	Program enhancements for SLR will be implemented 6 months prior to the subsequent period of extended operation.	SLRA, Appendix A, Table A4.0-1 (ML18291A842, ML18291A828)
46	Neutron Fluence Monitoring program	The *Neutron Fluence Monitoring* program is an existing condition monitoring program that is credited.	Ongoing	SLRA, Appendix A, Table A4.0-1 (ML18291A842, ML18291A828)

Item No.	UFSAR Supplement Section	Commitment	Implementation Schedule	Source
47	Environmental Qualification of Electric Equipment program	The *Environmental Qualification of Electric Equipment* program is an existing program that will be enhanced as follows: 1. Existing procedures will be enhanced to include a requirement for plants that are entering or have entered their subsequent period of extended operation to perform a walkdown once prior to the subsequent period of extended operation and every ten years thereafter. Accessible electrical EQ equipment will be visually inspected and the EQ environment evaluated to identify in-scope electrical equipment subjected to an adverse localized environment (ALE). If an ALE is found, evaluation of the impact of the ALE on EQ electrical equipment, including qualified life, will be performed. 2. Existing procedures will be enhanced to evaluate and take appropriate corrective actions, which may include changes to qualified life, when an unexpected adverse localized environment or condition is identified during operational or maintenance activities that affect the qualification of electrical equipment.	Program enhancements for SLR will be implemented 6 months prior to the subsequent period of extended operation.	SLRA, Appendix A, Table A4.0-1 (ML18291A842, ML18291A828)

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 Virginia Electric and Power Company (Dominion or the applicant). This appendix also lists other correspondence under Surry Power Station, Units 1 and 2 (Surry) Docket Nos. 50-280 and 50-281 related to the staff's review of the Surry subsequent license renewal application.

Table B-1 Chronology

Date	ADAMS Accession No.	Subject
10/15/2018	ML18291A842	Surry Power Station, Units 1 & 2 – Submittal of Application for Subsequent Renewed Operating Licenses
10/15/2018	ML18295A197	Surry Power Station, Units 1 and 2 - Application for Subsequent Renewed Operating Licenses Information to Support NRC Staff Review
10/26/2018	ML18297A093	Surry Power Station, Unit Nos. 1 and 2 - Receipt and Availability of the Subsequent License Renewal Application (EPID Nos. L-2018-RNW-0023 and L-2018-RNW-0024)
11/16/2018	ML18319A252	Surry Power Station, Units 1 and 2 – Subsequent License Renewal Application Online Reference Portal (EPID Nos. L-2018-RNW-0023 and L-2018-RNW-0024)
11/26/2018	ML18319A184	Surry Power Station, Units 1 and 2 – Plan for the Operating Experience Audit Regarding the Subsequent License Renewal Application Review (EPID Nos. L-2018-RNW-0023 and L-2018-RNW-0024)
12/03/2018	ML18320A188	Surry Power Station, Units Nos. 1 and 2 – Acceptance, Scheduling, and Opportunity for Hearing – Letter and Federal Register Notice
12/18/2018	ML18351A050	Surry Power Station, Unit Nos. 1 and 2 – Correction and Extension of Date To Request a Hearing and Petition for Leave to Intervene Regarding the Virginia Electric and Power Company's Application for Subsequent License Renewal (EPID Nos. L-2018-RNW-0023 and L-2018-RNW-0024)
12/20/2018	ML18351A257	U.S. Nuclear Regulatory Commission Approval of Virginia Electric And Power Company's Request For Withholding Information From Public Disclosure, Regarding The Application For Subsequent License Renewal Of Surry Power Station, Unit Nos. 1 And 2 (EPID Nos. L-2018-RNW-0023 and L-2018-RNW-0024)
1/22/2019	ML19015A243	Surry Power Station, Unit Nos. 1 and 2, Plan for the In-Office Regulatory Audit Regarding the Subsequent License Renewal Application Review (EPID Nos. L-2018-RNW-0023 and L-2018-RNW-0024)
1/29/2019	ML19042A137	Virginia Electric and Power Company – Surry Power Station (SPS) Units 1 and 2 – Supplement to Subsequent License Renewal Operating Licenses Application for Sufficiency Review Change Notice 1
3/4/2019	ML19046A433	Surry Power Station, Units Nos. 1 and 2 – Report for the Operating Experience Review Audit Regarding the Subsequent License Renewal Application Review (EPID Nos. L-2018-RNW-0023 and L-2018-RNW-0024)
4/2/2019	ML19095A666	Surry Power Station, Units 1 and 2, Submittal of Supplement to Subsequent License Renewal Application Change Notice 2
4/3/2019	ML19151A651	E-mail from Emmanuel Sayoc (NRC) to Paul Aitken (Dominion), "First Batch of Draft Surry RAIs," dated April 3, 2019
4/16/2019	ML19156A111	E-mail from Emmanuel Sayoc (NRC) to Paul Aitken (Dominion), "Draft RAI Appendix J," dated April 16, 2019

Date	ADAMS Accession No.	Subject
4/17/2019	ML19098A810	Surry Power Station, Units 1 and 2 – On-Site Regulatory Audit Regarding the Subsequent License Renewal Application Review (EPID Nos. L-2018-RNW-0023 and L-2018-RNW-0024)
4/29/2019	ML19100A254	Surry Power Station, Units 1 and 2 - Schedule Revision For The Subsequent License Renewal Application Review (EPID Nos. L-2018-RNW-0023 and L-2018-RNW-0024)
4/30/2019	ML19155A190	E-mail from Emmanuel Sayoc (NRC) to Paul Aitken (Dominion), "More Surry Draft SLRA Draft RAIs," dated April 30, 2019
5/1/2019	ML19157A287	E-mail from Emmanuel Sayoc (NRC) to Paul Aitken (Dominion), "More Draft RAIs – TR014 Surry Buried Pipe," dated May 1, 2019
5/8/2019	ML19156A378	E-mail from Emmanuel Sayoc (NRC) to Paul Aitken (Dominion), "Draft RAIs on Leak Before Break," dated May 8, 2019
5/8/2019	ML19155A300	E-mail from Emmanuel Sayoc (NRC) to Paul Aitken (Dominion), "Draft RAIs on Internal Coatings," dated May 8, 2019
5/13/2019	ML19156A352	E-mail from Emmanuel Sayoc (NRC) to Paul Aitken (Dominion), "Draft RAIs for Surry Review," dated May 13, 2019
5/15/2019	ML19162A348	E-mail from Emmanuel Sayoc (NRC) to Paul Aitken (Dominion), "Next Batch of Draft Surry RAIs," dated May 15, 2019
5/15/2019	ML19168A066	E-mail from Emmanuel Sayoc (NRC) to Paul Aitken (Dominion), "RE: Next Batch of Draft Surry RAIs," dated May 15, 2019
5/22/2019	ML19148A766	E-mail from Emmanuel Sayoc (NRC) to Paul Aitken (Dominion), "Surry SLRA - Transmittal of Draft RAIs for Your Review," dated May 22, 2019
5/23/2019	ML19148A761	E-mail from Emmanuel Sayoc (NRC) to Paul Aitken (Dominion), "Surry SLRA - Transmittal of Draft RAIs for Your Review," dated May 23, 2019
5/30/2019	ML19128A079	Surry Power Station, Units Nos. 1 and 2 – Report for the In Office Regulatory Audit Regarding the Subsequent License Renewal Application Review (EPID Nos. L-2018-RNW-0023 and L-2018-RNW-0024)
5/30/2019	ML19155A050	E-mail from Emmanuel Sayoc (NRC) to Daniel Stoddard (Dominion), "Final Requests for Additional Information for the Safety Review of the Surry Power Station, Units 1 and 2, Subsequent License Renewal Application (L-2018-RNW-0023/000951) – Set 1," dated May 30, 2019
6/4/2019	ML19156A213	E-mail from Emmanuel Sayoc (NRC) to Paul Aitken (Dominion), "Draft Surry SLRA RAI," dated June 4, 2019
6/4/2019	ML19155A274	E-mail from Emmanuel Sayoc (NRC) to Paul Aitken (Dominion), "Surry SLRA Draft RAIs – Irradiation Effects on CBS and RV Steel Supports, ASME Section XI, Subsection IWF," dated June 4, 2019
6/5/2019	ML19157A283	E-mail from Emmanuel Sayoc (NRC) to Paul Aitken (Dominion), "One More Draft RAI Scoping and Screening of Pressurizer Spray Head," dated June 5, 2019
6/7/2019	ML19176A281	E-mail from Emmanuel Sayoc (NRC) to Paul Aitken (Dominion), "Draft RAI 4.7.3-7 Surry SLR 4.7.3 LBB TLAA," dated June 7, 2019
6/10/2019	ML19168A028	Surry Power Station, Units 1 and 2, Submittal of Supplement to Subsequent License Renewal Application Change Notice 3
6/11/2019	ML19163A396	E-mail from Emmanuel Sayoc (NRC) to Paul Aitken (Dominion), "Draft RAI Surry TRP 20 Open Cycle Cooling Water," dated June 11, 2019
6/11/2019	ML19164A333	E-mail from Emmanuel Sayoc (NRC) to Daniel Stoddard (Dominion), "Final Requests for Additional Information for the Safety Review of the Surry Power Station, Units 1 and 2, Subsequent License Renewal Application (L-2018-RNW-0023/000951) – Set 2", dated June 11, 2019
6/12/2019	ML19169A242	Requests for Confirmation of Information for the Safety Review of the Surry Power Station, Units 1 and 2, Subsequent License Renewal Application (L-2018-RNW-0023/000951) – (Attachment 4D)

Date	ADAMS Accession No.	Subject
6/20/2019	ML19169A329	Surry Power Station, Units Nos. 1 and 2 – Report for the Site Regulatory Audit Regarding the Subsequent License Renewal Application Review (EPID Nos. L-2018-RNW-0023 and L-2018-RNW-0024)
6/27/2019	ML19183A440	Surry Power Station Units 1 and 2 Subsequent License Renewal Application Response to Requests for Additional Information – Set 1; non-public version of package, includes ML19183A388
6/27/2019	ML19183A386	Surry Power Station Units 1 and 2 Subsequent License Renewal Application Response to Requests for Additional Information – Set 1; public version
7/01/2019	ML19184A139	E-mail from Emmanuel Sayoc (NRC) to Paul Aitken (Dominion), "One More RAI – Sorry!" dated July 1, 2019
7/11/2019	ML19192A247	Email from Emmanuel Sayoc (NRC) to Daniel Stoddard (Dominion), "Final Disposition List of Request for Additional Information for the Safety Review of the Surry Power Station, Units 1 and 2 Subsequent License Renewal Application (L-2018-RNW-0023/000951), dated July 11, 2019.
7/11/2019	ML19198A059	Surry Power Station, Units 1 and 2 – Subsequent License Renewal Application – Response to NRC Requests for Confirmation of Information
7/17/2019	ML19204A357	Surry Power Station, Units 1 and 2 – Subsequent License Renewal Application Response to Request for Additional Information – Set 2
7/31/2019	ML19206A651	Surry Power Station, Units 1 and 2 – Schedule Revisions for the Subsequent License Renewal Application Review (EPID: Nos. L-2018-RNW-0024)
8/2/2019	ML19217A358	E-mail from Emmanuel Sayoc (NRC) to Daniel Stoddard (Dominion), "Final Requests for Additional Information for the Safety Review of the Surry Power Station, Units 1 and 3 Subsequent License Renewal Application (L-2018-RNW-0023/000951) – Set #3," dated August 2, 2019
8/5/2019	ML19304C206	E-mail from Emmanuel Sayoc (NRC) to Daniel Stoddard (Dominion), "Revised Requests for Additional Information B3.2-1-a for the Safety Review of the Surry Power Station, Units 1 and 2 Subsequent License Renewal Application (7-2018-RNW-0023/000951)—Set 3," dated August 5, 2019
8/13/2019	ML19219A284	Summary of July 29, 2019, Category 2 Public Meeting Related to the Safety Review of the Surry Power Station, Units 1 and 2, Subsequent License Renewal Application
8/14/2019	ML19231A153	E-mail from Emmanuel Sayoc (NRC) to Daniel Stoddard (Dominion), "Final Requests for Additional Information for the Safety Review of the Surry Power Station, Units 1 and 2, Subsequent License Renewal Application (L-2018-RNW-0023/000951) – Set 4," dated August 14, 2019
08/20/2019	ML19333B912	Surry SLRA Transmittal Email Attachment – 4D Confirmation Letter – August 20, 2019.
9/3/2019	ML19253B330	Surry, Units 1 and 2, Response to Requests for Additional Information – Sets 3 and 4 – Subsequent License Renewal Application (publicly available version)
9/4/2019	ML19248C228	Surry Power Station, Units 1 and 2 – Project Manager Change For The Subsequent License Renewal Application Review (EPID No. L-2018-RNW-0023)
9/16/2019	ML19267A042	Surry Power Station, Units 1 and 2 – Subsequent License Renewal Application Response to NRC Requests for Confirmation of Information Set 2
9/19/2019	ML19269B734	Surry, Units 1 and 2, Subsequent License Renewal Application, Response to Requests for Additional Information – Sets 3 and 4 Revised SLRA Mark-Ups

Date	ADAMS Accession No.	Subject
9/24/2019	ML19262F338	Announcement and Summary of August 13, 2019, Category 2 Public Meeting Related to the Safety Review of the Surry Power Station, Units 1 and 2, Subsequent License Renewal Application
10/3/2019	ML19270E741	Surry Power Station, Units 1 and 2 – Project Manager Change For The Subsequent License Renewal Application Review (EPID No. L-2018-RNW-0023)
10/10/2019	ML19283B620	Memo to File: Documenting 3rd Round RAIs
10/14/2019	ML19294A044	Surry Power Station, Units 1 and 2- Subsequent License Renewal Application First 10 CFR 54.21(b) Annual Amendment and Supplement to Subsequent License Renewal Application Change Notice 4. Package includes proprietary information.
10/14/2019	ML19183A386	Surry Power Station, Units 1 and 2- Subsequent License Renewal Application First 10 CFR 54.21(b) Annual Amendment and Supplement to Subsequent License Renewal Application Change Notice 4. Non-proprietary version of ML19294A044.
10/31/2019	ML19310E716	Surry Power Station, Units 1 and 2 – Subsequent License Renewal Application (SLRA) Supplement to Subsequent License Renewal Application Change Notice 5
11/19/2019	ML19329A287	Surry Power Station, Units 1 and 2 – Subsequent License Renewal Application (SLRA) Supplement to Subsequent License Renewal Application Change Notice 6
11/20/2019	ML19305C709	Memo to File: Documenting Questions on Annual Update / Supplement #4
11/20/2019	ML19304C146	Correction to Summary of August 13, 2019, Category 2 Public Meeting Related to the Safety Review of the Surry Power Station, Units 1 and 2, Subsequent License Renewal Application
11/27/2019	ML19316A834	Surry Power Station, Units 1 and 2 - Schedule Revision For The Subsequent License Renewal Application Review (EPID NO. L-2018-RNW-0024)
12/17/2019	ML19333B959	Surry Power Station, Units 1 and 2, Subsequent License Renewal Application Safety Review – Documentation of Questions on Dominion Energy's October 31, 2019 Letter
2/20/2020	ML20054B996	Surry Power Station, Units 1 and 2 – Subsequent License Renewal Application (SLRA) Supplement to Subsequent License Renewal Application Change Notice 7

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
Alley, David	Management Oversight
Allik, Brian	Reviewer—Mechanical and Materials
Anderson, Shaun	Management Oversight
Bloom, Steve	Management Oversight
Borromeo, Joshua	Management Oversight
Bradford, Anna	Management Oversight
Buford, Angela	Reviewer—Structural
Chereskin, Alexander	Reviewer—Chemical
Cheruvenki, Ganesh	Reviewer—Mechanical and Materials
Colaccino, Joseph	Management Oversight
Cuadrado DeJesús, Samuel	Reviewer—Structural
Cumblidge, Stephen	Management Oversight, Reviewer—Mechanical and Materials
Dijamco, David	Reviewer—Mechanical and Materials
Davis, Robert	Reviewer—Scoping and Screening Methodology
Donoghue, Joe	Management Oversight
Fu, Bart	Reviewer—Mechanical and Materials
Gardner, William (Tony)	Reviewer—Mechanical and Materials
Gavula, James	Reviewer—Mechanical and Materials
Gibson, Lauren Kate	Project Manager
Hiser, Allen	Senior Technical Advisor
Hoang, Dan	Reviewer—Structural
Holston, William	Reviewer—Mechanical and Materials
Hsu, Caroline	Technical Editor
Huynh, Alan	Reviewer—Mechanical and Materials
Heida, Bruce	Reviewer—Scoping and Screening Methodology
Iqbal, Naeem	Reviewer—Scoping and Screening Methodology
Johnson, Andrew	Reviewer—Mechanical and Materials
Jones, Steve	Reviewer—Mechanical and Materials
Kalikian, Roger	Reviewer—Mechanical and Materials
Karipineni, Nageswara	Reviewer—Scoping and Screening Methodology
Khanna, Meena	Management Oversight
Klein, Paul	Reviewer—Scoping and Screening Methodology
Krepel, Scott	Reviewer—Mechanical and Materials
Lehman, Bryce	Reviewer—Structural
López, Juan	Reviewer—Structural
Lukes, Robert	Management Oversight

Name	Responsibility
Martinez Navedo, Tania	Management Oversight
Mitchell, Jeffrey	Special Assistant
Medoff, James	Reviewer—Mechanical and Materials
Min, Seung	Reviewer—Mechanical and Materials
Murray, Demetrius	Reviewer—Electrical
Nold, David	Reviewer—Mechanical and Materials
Nguyen, Duc	Reviewer—Electrical
Oesterle, Eric	Management Oversight
Peng, Shie-Jeng	Reviewer—Mechanical and Materials
Pettis, Robert	Reviewer—Scoping and Screening Methodology
Prinaris, Andrew	Reviewer—Structural
Ray, Sheila	Reviewer—Electrical
Rezai, Ali	Reviewer—Vessel Internals
Reisi Fard, Mehdi	Management Oversight
Rogers, Bill	Project Manager, Reviewer—Scoping and Screening Methodology
Sadollah, Mohammad (Mo)	Reviewer—Electrical
Sayoc, Emmanuel	Project Manager
Sheng, Simon	Reviewer—Scoping and Screening Methodology
Thomas, George	Reviewer—Structural
Tsao, John	Reviewer—Vessel Internals
Wang, George	Reviewer—Scoping and Screening Methodology
Wilson, George	Management Oversight
Wittick, Brian	Management Oversight
Whitman, Jennifer	Management Oversight
Wu, Angela	Project Manager
Yoder, Matthew	Reviewer—Mechanical and Materials
Yoo, Mark	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 Surry Power Station, Units 1 and 2 (Surry) subsequent license renewal application.

Table D-1 References

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