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United States Nuclear Regulatory Commission
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NUREG–2221
Supplement 1

Technical Bases for Changes in the Subsequent License Renewal Guidance Documents, NUREG–2191, Revision 1, and NUREG–2192, Revision 1, Supplement 1

Final Report

Office of Nuclear Reactor Regulation

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ABSTRACT

This document, NUREG-2221, Revision 0, Supplement 1, “Technical Bases for Changes in the Subsequent License Renewal Guidance Documents, NUREG–2191, Revision 1, and NUREG–2192, Revision 1, Supplement 1 (NUREG-2221, Supplement 1) is a knowledge management and knowledge transfer document associated with NUREG–2191, Revision 1, “Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR),” (GALL-SLR Report, Revision 1, GALL-SLR Report, or simply GALL-SLR), and NUREG–2192, Revision 1, “Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants,” (SRP-SLR Revision 1, or simply SRP-SLR).

The initial iteration of NUREG-2221, (Agencywide Documents Access and Management System (ADAMS) Accession No. ML17362A126 [NRC 2017-TN9924]) documented the technical changes and bases that were made from the guidance contained in NUREG–1801, Revision 2, “Generic Aging Lessons Learned (GALL) Report,” (ADAMS Accession No. ML103490041 [NRC 2010-TN7791]), for utilities applying for first license renewal, to the updated guidance for utilities wishing to apply for subsequent license renewal (i.e., for operation from 60 to 80 years), published as NUREG-2191, Revision 0 (ADAMS Accession Nos. ML17187A031 [NRC 2017-TN7797], and ML17187A204 [NRC 2017-TN9902], for Volumes 1 and 2 respectively) (GALL-SLR, Revision 0) in July 2017. The initial iteration NUREG-2221, also documented the technical changes and bases for SLR that were made from the guidance contained in Revision 2 of NUREG–1800, “Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants,” (ADAMS Accession No. ML103490036) (SRP-LR) to the updated guidance of NUREG–2192, Revision 0,“Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants” (ADAMS Accession No. ML17188A158 [NRC 2017-TN9323])(SRP-SLR, Revision 0). Consequently, that document (initial NUREG-2221) provided the underlying rationale that the U.S. Nuclear Regulatory Commission staff had used to develop the subsequent license renewal guidance documents.

This publication is a supplement to the initial NUREG-2221, and it documents the technical changes that were made in concurrent updates to the subsequent license renewal guidance documents in 2024. This document provides the underlying rationale that the NRC staff used to develop NUREG-2191, Revision 1, and NUREG-2192, Revision 1.

Supporting documents and references are listed in Chapters 5 and 6, respectively. Supporting documents are not specifically referenced in the report but are included because they contain relevant background information.

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EXECUTIVE SUMMARY

On July 14, 2017 (82 FR 32588-TN9861), the U.S. Nuclear Regulatory Commission (NRC) announced the issuance and availability of the following final subsequent license renewal guidance documents:

- “Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report” (NUREG–2191), and
- “Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants” (SRP-SLR) (NUREG–2192)

Those subsequent license renewal (SLR) guidance documents describe methods acceptable to the staff for implementing the license renewal regulations in Title 10 of the *Code of Federal Regulations* (10 CFR) Part 54, “Requirements for Renewal of Operating Licenses for Nuclear Power Plants,” as well as techniques used by the staff in evaluating applications for nuclear power plant license renewals for operations from 60 to 80 years. Those guidance documents incorporated changes described in Interim Staff Guidance issued since Revision 2 of NUREG-1801, “Generic Aging Lessons Learned (GALL) Report,” and Revision 2 of NUREG-1800, “Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants,” published in 2010, as well as findings from NRC staff aging management program effectiveness audits, and comments from NRC staff and interested stakeholders.

The initial NUREG-2221, Revision 0, provided a summary of changes and a synopsis of the bases for those changes made as part of the development of the SRP-SLR, Revision 0, and the GALL-SLR Report, Revision 0. NUREG-2221, Supplement 1, published herewith provides a summary of changes and a synopsis of the bases for those changes made as part of the development of the SRP-SLR, Rev, 1, published herewith and the GALL-SLR Report, Revision 1. This supplement includes those changes initiated by NRC staff as well as changes made by the staff in response to public comments, as appropriate. This document provides the underlying rationale that the NRC used in developing the revised SLR guidance.

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ABBREVIATIONS AND ACRONYMS

°C	degree(s) Celsius
°F	degree(s) Fahrenheit
ADAMS	Agencywide Documents Access and Management System
A/LAI	applicant or licensee action item
AMPs	aging management programs
AMR	aging management review
ASM	American Society for Metals
ASME	American Society of Mechanical Engineers
ASME Code	American Society of Mechanical Engineers Boiler and Pressure Vessel Code
AMPP	Association for Materials Protection and Performance
ASTM	ASTM International (formerly American Society for Testing and Materials)
B&W	Babcock & Wilcox
BMI	bottom mounted instrumentation
BWR	boiling water reactor
BWRVIP	Boiling Water Reactor Vessel and Internals Project
CASS	cast austenitic stainless steel
CE	Combustion Engineering
CEA	control element assembly
CFR	*Code of Federal Regulations*
CFRP	carbon fiber reinforced polymer
CRGT	control rod guide tube
CLB	current licensing basis
CRD	control rod drive
CSB	core support barrel
CSS	core support shield
EPRI	Electric Power Research Institute
FAC	flow-accelerated corrosion
FD	flow distributor
FE	further evaluation
ft	foot/feet
ft^2	square-foot
FR	*Federal Register*
FRN	*Federal Register Notice*
FSAR	Final Safety Analysis Report
GALL	Generic Aging Lessons Learned

GALL-SLR	Generic Aging Lessons Learned for Subsequent License Renewal
HDPE	high density polyethylene
HPSI	high-pressure safety injection
I&E	inspection and evaluation
IASCC	irradiation-assisted stress corrosion cracking
IE	irradiation embrittlement
IMI	incore monitoring instrument
IN	Information Notice
in	inch/inches
ISGs	Interim Staff Guidance
ISI	inservice inspection
ISP	integrated surveillance program
ISR	irradiation-enhance stress relaxation
ksi	kilo pound(s) per square inch
LAW	lower vertical (axial) weld
LBB	leak-before-leak
LCB	lower core barrel
LERs	licensee event reports
LFW	lower flange weld
LGWs	lower girth welds
LOM	loss of material
LR	license renewal
LRA	license renewal application
LR-ISG	license renewal Interim Staff Guidance
MAW	middle vertical (axial) weld
MEAP	material, environment, aging effect program
MeV	mega electron-volt(s)
Mg	magnesium
MGWs	middle girth welds
mm/yr	millimeter per year
MRP	Materials Reliability Program
mV	millivolt (mV)
N/A	not applicable
NACE	National Association of Corrosion Engineers
NEI	Nuclear Energy Institute
NFPA	National Fire Protection Association
NRC	U.S. Nuclear Regulatory Commission
OD	outside diameter

OE	operating experience
ONWs	outlet nozzle welds
PTS	pressurized thermal shock
PVC	polyvinyl chloride
PWR	pressurized water reactor
PWRVI	Pressurized Water Reactor Vessel and Internals
PWSCC	primary water stress corrosion cracking
QA	quality assurance
RAI	request for additional information
RIS	Regulatory Issue Summary
RG	Regulatory Guide
RMI	reflective metal insulation
RPV	reactor pressure vessel
RV	reactor vessel
RVI	reactor vessel internal
SCs	structures and components
SCC	stress corrosion cracking
SG	steam generator
Si	silicon
SLC	Standby Liquid Control
SLR	subsequent license renewal
SLRA	subsequent license renewal application
SRP	standard review plan
SRP-SLR	Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants
SS	stainless steel
SSHT	surveillance specimen holder tube
TE	thermal embrittlement
TMI-1	Three Mile Island Unit 1 facility
TLAA	time-limited aging analysis
TSTF	technical specification task force
UAW	upper axial weld
UGW	upper girth weld
U.S.	United States
USACE	U.S. Army Corps of Engineers
UTS	upper thermal shield
VS	void swelling

1 INTRODUCTION

The initial NUREG–2221 (NRC 2017-TN9924), “Technical Bases for Changes in the Subsequent License Renewal Guidance Documents NUREG–2191 and NUREG–2192,” describes the bases for the changes that guide the changes incorporated in NUREG–2191, Revision 0,“Generic Aging Lessons Learned for Subsequent License Renewal Report,” (GALL-SLR Revision 0; NRC 2017-TN7797, TN9902) and NUREG–2192, Revision 0, “Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants” (SRP-SLR, Revision 0; NRC 2017-TN9323). Those two subsequent license renewal (SLR) guidance documents were published on July 12, 2017.

This document NUREG–2221, Supplement 1, provides a summary of the technical bases for the changes made by the U.S. Nuclear Regulatory Commission (NRC) staff in 2024, to generate the Revision 1 version of the GALL-SLR Report, and Revision 1 of the SRP-SLR.

1.1 Purpose and Organization of the Document

This document is organized into four sections followed by the references for each section. Section 1 contains background and overview information. Section 2 summarizes the changes to the GALL-SLR Report and the technical bases of these changes. Section 3 presents similar information for changes to the SRP-SLR. Section 4 summarizes the changes to the “Summary of Significant Changes” and “Technical Bases for Changes” information in the initial NUREG-2221.

Tables are used to summarize technical materials whenever possible. Generic changes are discussed in the content at the beginning of each subsection of Sections 2, 3, and 4, followed by tables showing changes to the documents.

Table 1-1 helps the reader navigate between the tables that summarize the notable changes and their technical bases.

Table 1-1 Crosswalk Between NUREG–2191/NUREG–2192 and the Change Summaries and Technical Bases Tables in NUREG–2221

Source Document and Chapter	Tables With Change Summaries and Technical Bases
New aging management reviews (AMRs) – Structural Generic Aging Lessons Learned forSubsequent License Renewal (GALL-SLR Report), Revision 1, Chapters II and III	Table 2-5 and Table 2-6
New AMRs – Mechanical GALL-SLR Report, Revision 1, Chapters IV, VI, VII, and VIII	Table 2-7, Table 2-8, Table 2-10, Table 2-11
New AMRs – Electrical GALL-SLR Report, Revision 1, Chapter VI	Table 2-9
Deleted AMRs – Structural GALL-SLR Report, Revision 1, Chapters II and III	Table 2-12, Table 2-13
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Revised AMRs – Mechanical GALL-SLR Report, Revision 1, Chapters IV, V, VII, and VIII	Table 2-21, Table 2-22, Table 2-24, Table 2-25
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2 CHANGES TO GENERIC AGING LESSONS LEARNED REPORT, SUBSEQUENT LICENSE RENEWAL REVISION 0 AND THEIR TECHNICAL BASES

The technical changes in the Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report, Revision 1 were made to clarify or improve the guidance provided in GALL-SLR Report Revision 0. The U.S. Nuclear Regulatory Commission (NRC) staff believes that these changes make the GALL-SLR Report, Revision 1 more useful to applicants and to NRC staff reviewing the safety aspects of applications for subsequent license renewal (SLR). The final version of the Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants (SRP-SLR) NUREG–2192, Revision 1, incorporates the revisions to the SRP-SLR, Revision 0, based on these technical changes.

2.1 Overview of Changes to GALL-SLR Report Chapter I – Application of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code

Section 1 provides a listing of American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code) Section XI Editions and Addenda that are acceptable for use in aging management programs (AMPs). Since publication of the GALL-SLR Report in July 2017, the NRC has promulgated several Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50.55a (TN249) rulemakings, incorporating them by reference in later editions of Section XI. Further, the Commission issued SRM-SECY-21-0029 (NRC 2021-TN9928), directing the staff to extend the inservice inspection and inservice testing Code of record update interval specified in 10 CFR 50.55a (TN249). Therefore, the NRC staff updated Table I-1 to include the latest Editions of Section XI incorporated by reference in 10 CFR 50.55a (TN249). Also, the staff eliminated explicit reference to 10-year intervals, given the NRC's plans to update the Code of record update requirements.

2.2 Overview of Changes to GALL-SLR Report, Chapters II, III, IV, V, VI, VII, and VIII

The aging management review (AMR) items in Chapters II, III, IV, V, VI, VII, and VIII of the GALL-SLR Report, Revision 1, are divided into five categories:

1. The AMR items where the material/environment/aging effect/program combination have not changed from an equivalent item in Revision 0 of the GALL-SLR Report and there is no change in the recommendation regarding further evaluation (FE). The unchanged items contain no entry (i,e, are blank) in the column that identify new (N), modified (M), edited (E), or deleted (D) items in the tables in the GALL-SLR Report.
2. The AMR items that are new in Revision 1 of the GALL-SLR Report. For these items, there is not a clear relationship with a similar item in the same chapter of Revision 0 of the GALL-SLR Report. These items are identified as new (N) in the column that identifies new (N), modified (M), edited (E), or deleted (D) items in the tables of the GALL-SLR Report.
3. The AMR items where there is some change from Revision 0 of the GALL-SLR Report with regard to the material, environment, aging effect, and AMP combination or the recommendation regarding FE. However, there is a clear relationship between the AMR item in Revision 1 of the GALL-SLR Report and a related AMR item in Revision 0 of the

GALL-SLR Report. These items are identified as modified (M) in the column that identifies new (N), modified (M), edited (E), or deleted (D) items in the tables of the GALL-SLR Report.

4. The changes to some AMR items were minor and editorial in nature. These items are identified as editorial (E) in the column that identifies new (N), modified (M), edited (E), or deleted (D) items in the tables of the GALL-SLR Report.
5. The AMR items that were in Revision 0 but have been deleted in Revision 1 of the GALL-SLR Report are identified as deleted (D) in the column that identifies new (N), modified (M), edited (E), or deleted (D) items in the tables of the GALL-SLR Report.

Table 2-1 through Table 2-25 present the changes to the AMR items that have been made for the GALL-SLR Report, Revision 1. The following describes the information presented in each column of these tables.

Table 2-1 Description of Table Columns for GALL-SLR Chapters II through VIII

Column Heading	Description
Aging management reviews (AMR) Item No.	Identifies the item number in GALL-SLR Report Chapters II through VIII presenting the detailed information summarized by this row. *Using II.B1.2.CP-114 as an example*: The first Roman numeral presents the GALL-SLR Chapter (II) which is followed by the subchapter (B1.2). The following letter identifies the discipline(s) that the precedent (P) is associated with (i.e., "A" for Auxiliary Systems, "E" for Engineered Safety Features Systems, "L" for Electrical Systems, "R" for Reactor Coolant Systems, "T" for "Structures and Component Supports, "S" for Steam and Power Conversion Systems, and "C" for Containment Structures). The second letter "P" identifies that there is a precedent for the material-environment-aging effect-program combination. This nomenclature convention is found throughout NUREG–2191 and NUREG–2192.
Technical Bases for Changes	Provides background on the staff's technical position for making the change.

2.3 Chapter IX—Use of Terms General Changes

Changes are made to Chapter IX to include new structures and components, materials, environments, and aging effects/mechanisms, and to help standardize expressions. Changes are also made to clarify some of the use of terms that were included in GALL-SLR Report, Revision 0. Specific changes to the use of terms for subchapters IX.B through IX.G are summarized in Table 2-26 through Table 2-31. The following describes the information presented in each column of these tables.

Table 2-2 Description of Table Columns for GALL-SLR Chapter IX

Column Heading	Description
Defined Term	Identifies the term.
Summary of Significant Changes	Provides a summary of the change.
Technical Bases for Changes	Provides background on the staff's technical position for making the change.

2.4 Chapter X — Aging Management Programs That May Be Used to Demonstrate Acceptability of Time-Limited Aging Analyses in Accordance with 10 CFR 54.21(c)(1)(iii)

The title of Chapter X was revised as this chapter provides a list of AMPs (and the program element criteria for the AMPs) that are commonly used to demonstrate the acceptance of generic or plant-specific time-limited aging analyses (TLAAs) in accordance with Title 10 of the *Code of Federal Regulations* (10 CFR) 54.21(c)(1) (TN4878). Revisions to the TLAAs for mechanical, structural, and electrical analyses are discussed in Table 2-32. The following describes the information presented in each column of the table.

Table 2-3 Description of Table Columns for GALL-SLR Chapter X

Column Heading	Description
Location of Change	Identifies the AMP element that changed.
Summary of Significant Changes	Provides a summary of the change.
Technical Bases for Changes	Provides background on the staff's technical position formaking the change.

2.5 Chapter XI – Aging Management Programs

Table 2-33 through Table 2-35 present the changes to the AMPs that have been made for the GALL-SLR Report, Revision 1. The following describes the information presented in each column of these tables.

Table 2-4 Description of Table Columns for GALL-SLR Chapter XI

Column Heading	Description
Location of Change	Identifies the AMP element that changed.
Summary of Significant Changes	Provides a summary of the change.
Technical Basis for Change	Provides background on the staff's technical position for making the change.

2.5.1 Mechanical Aging Management Programs (XI.M Series of AMPs)

A summary of specific changes to the mechanical AMPs and their technical bases is provided in Table 2-33.

2.5.2 Structural Aging Management Programs (XI.S Series of AMPs)

A summary of specific changes to the structural AMPs and their technical bases is provided in Table 2-34.

2.5.3 Electrical Aging Management Programs (XI.E Series of AMPs)

A summary of specific changes to the electrical AMPs and their technical bases is provided in Table 2-35.

Table 2-5 New Aging Management Review Items Added in GALL-SLR Report Revision 1, Chapter II, Containment Structures

New Aging Management Review Item No.	Technical Bases for Changes
No new aging management review (AMR) items were added to Chapter II of the GALL-SLR Report, Revision 0.	

Table 2-6 New Aging Management Review Items Added in GALL-SLR Report, Revision 1, Chapter III, Structures and Component Supports

New Aging Management Review (AMR) Item No.	Technical Bases for Changes
III.A4.T-36	This new item addresses irradiation aging effects for the reduction in fracture toughness and potential loss of intended function on reactor vessel (RV) steel structural supports and their assembled components (e.g., girder and columns, neutron shield tank, support skirt). Such aging effects could occur due to neutrons of energy spectrum E > 0.1 mega electron-volt (MeV) at potentially damaging radiation exposure levels that may be reached during the subsequent period of extended operation. To assess potential irradiation aging effects, applicants would perform a plant-specific further evaluation as recommended in the new Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants (SRP-SLR) Section 3.5.2.2.2.8 described in Table 3-7. Or, if necessary, this new item also addresses monitoring through volumetric or surface examination of RV steel structural support assemblies for potential defect growth in areas of combined aging effects associated with radiation exposure and high tensile stresses > 6 kilo pounds per square inch [ksi]) due to any of current licensing basis (CLB) loading conditions. In areas where there is evidence of combined aging effects and high tensile stresses, recommended ongoing examination methods are to be consistent with American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI [ASME 2017-TN9258], IWA-2220 and/or 2230, with qualification of personnel to be in accordance with IWA-2300. III.A4.T-37 was rolled into III.A4.T-36 because the only difference between line items III.A4.T-36 and III.A4.T-37 is that line item III.A4.T-37 has a contingency when there is evidence of combined aging effects in areas of high tensile stresses.
III.A4.TP-37	This new item addresses irradiation aging effects for loss of intended function on non-metallic, nonferrous components other than concrete (e.g., lubricants and manganese bronze alloy) used in the RV structural support assembly. Such aging effects could occur with neutrons of energy spectrum E > 0.1 MeV at potentially damaging radiation exposure levels that may be reached during the subsequent period of extended operation. To assess potential irradiation aging effects, applicants perform a plant-specific further evaluation, as recommended in new SRP-SLR Section 3.5.2.2.2.8 described in Table 3-7.

Table 2-7 New Aging Management Review Items Added in GALL-SLR Report Revision 1, Chapter IV, Reactor Vessel, Internals, and Reactor Coolant System

New Aging Management Review (AMR) Item No.	Technical Bases for Changes
IV.A1.R-457 IV.A2.R-457	New aging management review (AMR) items to relate to new further evaluation (FE) Section 3.1.2.2.10.3.
IV.B2.RP-296a	The new line item applies to aging management of cracking that may occur in Westinghouse-designed control rod guide tube (CRGT) assembly guide plates (guide cards). In Electric Power Research Institute (EPRI) Materials Reliability Program (MRP) Comment #8, EPRI questioned the basis for including the new “RP-296a” item in the Interim Staff Guidance (ISG). The EPRI commented that the control rod guide tube (CRGT) guide cards did not screen in for any cracking mechanisms in MRP-227, Revision 1-A [NRC 2019-TN9222]. The staff did not accept that comment as a basis omitting IV.B2.RP-296a as a new GALL-SLR item in Appendix B.1 of the ISG or the analogous comment in EPRI MPR Comment #1, which challenged the basis for referencing the new “RP-296a” item in the update of SRP-SLR Table 3.1-1 Item 053a, as given in Appendix A of the ISG. The staff acknowledges that the EPRI MRP did not identify the CRGT guide plates as being susceptible to any cracking mechanisms in Item W1 of Table 4-3 in EPRI Report MRP-227, Revision 1-A [NRC 2019-TN9222]. However, based on lessons learned from the staff’s processing of the Surry subsequent license renewal application (SLRA), the staff confirmed that the guide cards screened in for SCC and fatigue cracking mechanisms, as referenced to the EPRI MRP’s 80-year Expert Panel assessment of the components in MRP-2018-022 report [EPRI 2018-TN9890]. Therefore, the staff found it appropriate to include GALL-SLR Item IV.B2.RP-296a as the new AMR line item that addresses potential cracking in Westinghouse-design CRGT guide plates. The new “RP-296a” item appropriately cites SCC and fatigue as potential cracking mechanisms, as based on lessons learned from the processing of the Surry SLRA. Management of non-cracking effects in the guide plates is addressed by the staff’s modification of GALL-SLR Item IV.B2.RP-296, with the technical bases for changes made to the “RP-296” line item being addressed in Table 2-1 of this report. The CRGT guide plates remain as EPRI MRP-defined “Primary” category components for Westinghouse-designed programs per Item W1 in Table 4-3 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222].

Table 2-7 New Aging Management Review Items Added in GALL-SLR Report Revision 1, Chapter IV, Reactor Vessel, Internals, and Reactor Coolant System (Continued)

New Aging Management Review (AMR) Item No.	Technical Bases for Changes
IV.B2.RP-297a IV.B2.RP-298a	The new line items apply to aging management of cracking and non-cracking effects that may occur in Westinghouse-designed CRGT lower flange welds (LFWs). In the MRP-227, Revision 1-A Report [NRC 2019-TN9222], the EPRI MRP divided its augmented inspection criteria for Westinghouse-design CRGT LFWs into those that would be performed on the LFWs in the peripheral (outer) CRGT assemblies (which were defined as “Primary” category components per Item W2 in Table 4-3 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222]), and those that would be performed on the LFWs in the remaining CRGT assemblies (i.e., the LFWs in the non-peripheral assemblies, which were defined as “Expansion” category components per Item W2.1 in Table 4-6 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222]). Table IV.B2 in the GALL-SLR Report already includes Items IV.B2.RP-298 and IV.B2.RP-297 as applicable AMR line items for the managing cracking effects and non-cracking effects in peripheral CRGT assembly LFWs as the “Primary” designated components. However, the previous version of the GALL-SLR Report did not include any AMR line items to address aging management of LFWs located in the non-peripheral CRGT assemblies. Thus, the staff developed the new IV.B2.RP-298a and IV.B2.RP-297a items to be the new AMR line items for cracking and non-cracking effect and mechanism combinations that apply to the LFWs in non-peripheral CRGT assemblies. The cracking mechanisms cited for the non-peripheral CRGT LFWs in the new “RP-298a” item and the non-cracking mechanisms cited for the non-peripheral CRGT LFWs in the “RP-297a” item are based on lessons learned from the staff’s processing and review of the RVI gap analysis in the Surry SLRA and the aging mechanisms that were cited for CRGT LFWs, as referenced to the EPRI MRP’s 80-year Expert Panel assessment of the components in MRP-2018-022 report [EPRI 2018-TN9890]. This includes the cracking mechanisms of stress corrosion cracking (SCC), irradiation-assisted stress corrosion cracking (IASCC) and fatigue, and the non-cracking mechanism of neutron irradiation embrittlement (IE), with thermal embrittlement (TE) being potentially applicable if the CRGT lower flanges are made from cast austenitic stainless steel (SS).
IV.B2.RP-345a	The new line item applies to aging management of cracking that may occur in the core barrel flange of Westinghouse-designed reactor units. In EPRI MRP Comment #10, EPRI questioned the basis for including the new IV.B2.RP-345a item in the ISG. Specifically, EPRI commented that: (1) cracking of the core barrel flange base metal did not need to be addressed by a new AMR line item and (2) the core barrel flange weld that is the flange location is susceptible to potential cracking mechanisms. The staff did not accept that comment or EPRI’s analogous comment in EPRI MRP Comment #1 for referencing the new “RP-345a” Item in the update of SRP-SLR Table 3.1-1 Item 053c, as provided in Appendix A of the ISG.

Table 2-7 New Aging Management Review Items Added in GALL-SLR Report Revision 1, Chapter IV, Reactor Vessel, Internals, and Reactor Coolant System (Continued)

New Aging Management Review (AMR) Item No.	Technical Bases for Changes
	The staff acknowledges that the EPRI MRP did not cite any cracking mechanisms for the core barrel flanges in Item W10 of Table 4-9 in the MRP-227, Revision 1-A Report [NRC 2019-TN9222]. However, the need for development of the new “RP-345a” Items is based on lessons learned from the staff’s review and processing of the RVI gap analysis in the Surry SLRA. Specifically, in reactor vessel internal (RVI) gap analysis of the Surry SLRA, the staff confirmed that the applicant of the SLRA cited SCC and fatigue as applicable cracking mechanisms for the core barrel flanges, as based on the results of the EPRI MRP’s 80-year Expert Panel process performed for the components in MRP-2018-022 [EPRI 2018-TN9890]. Thus, the staff developed the new IV.B2.RP-345a line item to address potential cracking in Westinghouse-design core barrel flanges, as based on the lessons learned from the staff’s review and processing of the Surry SLRA. The core barrel flange remains as an “Existing Program” component for Westinghouse-designed aging management programs (AMPs) per Item W10 in Table 4-9 of the MRP-227-A or MRP-227, Revision 1-A Report [NRC 2019-TN9222].
IV.B2.RP-280a	The new line item applies to aging management of loss of fracture toughness or changes in dimension that may occur in Westinghouse-design core barrel assembly LFWs. In EPRI MRP Comment #12, EPRI commented that the new line item is not appropriate or needed for the ISG because the core barrel LFWs are located near the bottom of the core barrel, where the excepted fluence exposures would not be high enough to induce irradiation-assisted or enhanced mechanisms in the welds (e.g., IE, void swelling [VS], or irradiated stress corrosion cracking [IASCC, as mentioned in another analogous comment, EPRI MRP Comment #11]). The staff did not accept that the rationale made in EPRI MRP Comment #12 was sufficient to exclude the GALL-SLR IV.B2.RP-280a item as a newly developed item for the ISG. Specifically, the staff acknowledges that the EPRI MRP did not identify the core barrel LFWs as being RVI components that are susceptible to irradiation mechanisms (IE, VS, or IASCC) in Item W3.3 of Table 4-6 in the MRP-227, Revision 1-A Report [NRC 2019-TN9222]. However, the MRP-227, Revision 1-A Report [NRC 2019-TN9222] is based on a 60-year aging assessment, and the need for development of the new “RP-280a” item is based on lessons learned from the staff’s review and processing of the RVI gap analysis in the Surry SLRA. Specifically, in the 80-year RVI gap analysis of the Surry SLRA, the staff confirmed that the applicant for the SLRA indicated that the core barrel LFWs are located in fluence exposure zones high enough to screen the components in for IE and VS (and IASCC) mechanisms, as based on the results of the EPRI MRP’s 80-year Expert Panel process performed for the components in MRP-2018-022 [EPRI 2018-TN9890]. Thus, the staff developed the new IV.B2.RP-280a line item is based on the lessons learned and criteria docketed in the Surry SLRA and not on the 60-year assessment basis for the LFWs in Item W3.3 of Table 4-6 in the MRP-227, Revsion 1-A Report.

Table 2-7 New Aging Management Review Items Added in GALL-SLR Report Revision 1, Chapter IV, Reactor Vessel, Internals, and Reactor Coolant System (Continued)

New Aging Management Review (AMR) Item No.	Technical Bases for Changes
	The core barrel LFWs continue to be defined as EPRI MRP "Expansion" category components for Westinghouse-design RVI management programs.
IV.B3.RP-333a	The new line item applies to aging management of loss of fracture toughness due IE in Combustion Engineering (CE)-design core support barrel (CSB) lower girth welds (LGWs), which may be referenced as LFWs). In EPRI MRP Comment #21, EPRI commented that the new "RP-333a" Item is unnecessary and not needed for the objectives of the ISG because the LGWs/LFWs are located in portions of the core support barrel that do not receive sufficient fluence exposures to warrant initiation of irradiation mechanisms (e.g., IE or irradiation-assisted stress corrosion cracking [IASCC], as mentioned in the analogous comment for the welds in EPRI MRP Comment #20). The staff did not accept that the rationale made in EPRI MRP Comment #21 was sufficient to exclude the GALL-SLR IV.B2.RP-333a item as a newly developed item for ISG Appendix B.1 or to exclude IE as an applicable irradiation mechanism for the CSB LGWs/LFWs. Specifically, the staff developed the new "RP-333a" Item to be consistent with Item C5.1 in Table 4-5 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222], as modified by the EPRI MRP's response to RAI 26, Item a (ADAMS Accession ML17305A056), which was evaluated and approved in the staff's April 25, 2019 safety evaluation for the MRP-227, Revision 1 Report (ADAMS Accession No. ML19081A001). In the request for additional information (RAI) response, the EPRI MPR downgraded the CSB LGWs as "Expansion" category components for CE-designed pressurized water reactors (PWRs), but screened the CSB LGWs/LFWs in for SCC, irradiation-assisted stress corrosion cracking (irradiation-assisted SCC or IASCC), fatigue, and neutron IE aging mechanisms. The EPRI MRP-227, Revision 1-A Report [NRC 2019-TN9222], as supplemented by the RAI response, is based on a 60-year assessment. Thus, any additional neutron fluence exposures to the CSB LGWs/LFWs over an 80-year licensed life would further support the screening of IASCC and IE as applicable irradiation mechanisms for the LGWs/LFWs. Thus, the staff developed the new IV.B2.RP-333a line item for the CSB LGWs/LFWs based on the aging mechanisms identified in the EPRI MPR's response to RAI 26, Item a (as referenced in ADAMS Accession ML17035A056), and not on the 60-year assessment basis for the LFWs in Item W3.3 of Table 4-6 in the MRP-227, Revision 1-A Report [NRC 2019-TN9222]. The CSB LGWs/LFWs remain as EPRI-defined "Expansion" category components for CE PWR RVI management programs per Item C5.1 in Table 4-5 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222].
IV.B3.RP-338a	The new line item applies to aging management of loss of fracture toughness due to neutron IE in the fuel alignment plates of CE-designed PWRs whose core shrouds are assembled from welded full height shroud plates.

Table 2-7 New Aging Management Review Items Added in GALL-SLR Report Revision 1, Chapter IV, Reactor Vessel, Internals, and Reactor Coolant System (Continued)

New Aging Management Review (AMR) Item No.	Technical Bases for Changes
	For CE-designed plants with this type of shroud design, the fuel alignment plate in the upper internals assembly remains as a "Primary" category component per Item C10 in Table 4-2 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222]. In Item C10, the EPRI MRP screened the fuel alignment plate as being potentially susceptible to the cracking mechanism of fatigue and the non-cracking mechanism of IE. Management of cracking in the fuel alignment plate is addressed by the existing AMR line item in GALL-SLR Item IV.B3.RP-338, as administratively edited in Table B.2 of the ISG. However, the previous version of the GALL-SLR Report did not include any AMR line item to address loss of fracture due to neutron IE in the fuel alignment plates. Thus, the staff developed the new IV.B2.RP-338a line item based on the EPRI MRP's criteria for the plates in Item C10 of Table 4-2 in the MRP-227, Revision 1-A Report [NRC 2019-TN9222]. The fuel alignment plates remain as EPRI-defined "Primary" category components for CE PWR RVI management programs per Item C10 in Table 4-2 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222].
IV.B3.RP-320a	The new line item applies to aging management of SCC in core stabilizing lugs and shims (as associated bolting) of CE-design PWRs. The staff did not receive any Nuclear Energy Institute (NEI) or EPRI MRP comments specific to the new IV.B2.RP-320a line item. In Item C17 of Table 4-8 in the MRP-227, Revision 1-A [NRC 2019-TN9222], the EPRI MRP report added the core stabilizing lugs and shims (and their associated bolts) in CE-designed PWRs as "Existing Program" components for CE-designed reactor units, with the applicable aging mechanism being identified and cited as SCC. However, the previous version of the GALL-SLR Report did not include any AMR line item to address cracking due to SCC in the core stabilizing lugs and shims. Thus, the staff developed the new IV.B2.RP-320a line item based on the EPRI MRP's criteria for the plates in Item C17 of Table 4-8 in the MRP-227, Revision 1-A Report [NRC 2019-TN9222].
IV.B4.RP.245c	The new line item applies to aging management of loss of material due to wear and loss of preload due to thermal or irradiation-enhanced stress relaxation or creep in surveillance specimen holder tube (SSHT) bolts or studs. The line item only applies to the SSHT bolts or studs in the Babcock & Wilcox (B&W)-designed PWR at the Davis-Besse Nuclear Plant. The staff did not receive any Nuclear Energy Institute (NEI) or EPRI MRP comments specific to the new IV.B2.RP-245c line item. In Item B7.2 of Table 4-4 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222], the EPRI MRP identified that the SSHT bolts or studs as "Expansion' category components for the EPRI MRP PWR internals program that applies to the Davis-Besse Nuclear Plant, with the applicable cracking mechanisms being identified and cited as SCC and fatigue and the applicable non-cracking mechanism being identified and cited as wear and

Table 2-7 New Aging Management Review Items Added in GALL-SLR Report Revision 1, Chapter IV, Reactor Vessel, Internals, and Reactor Coolant System (Continued)

New Aging Management Review (AMR) Item No.	Technical Bases for Changes
	irradiation-enhance stress relaxation or creep (ISR/IC). However, the previous version of the GALL-SLR Report did not include any AMR line item to address loss of material due to wear or loss of preload due to ISR/IC in the SSHT bolts or studs. Thus, the staff developed the new IV.B2.RP-245c line item for the cited SSHT bolts based on the EPRI MRP's criteria for the SSHT bolts in Item B7.2 of Table 4-4 in the MRP-227, Revision 1-A Report [NRC 2019-TN9222]. The SSHT bolts remain as “Expansion” category components for the Davis-Besse RVI management program per Item B7.2 in Table 4-4 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222].
IV.B4.RP-247c	The new line item applies to aging management of loss of material due to wear and loss of preload due to thermal or irradiation-enhanced stress relaxation or creep in the lower core barrel (LCB) bolts of B&W-designed PWRs. In Item B8 of Table 4-1 in the MRP-227, Revision 1-A Report [NRC 2019-TN9222], the EPRI MRP added the LCB bolts and their locking devices as “Primary” category components for B&W-designed PWRs, with the applicable aging mechanisms for the bolts being identified and cited as SCC, IC/ISR, fatigue, and wear. The GALL-SLR Report already included Item IV.B4.RP-247 to address cracking in the LCB bolts and Items IV.B4.RP-247a and IV.B4.RP-247b to address cracking and non-cracking effects in the LCB bolt locking devices. However, the previous version of the GALL-SLR Report did not include any AMR line item to address non-cracking effect and mechanism combinations (i.e., loss of material due to wear and loss of preload due to thermal and irradiation-enhanced stress relaxation or creep) in the LCB bolts. Thus, the staff developed the new IV.B2.RP-247c line item for the referenced LCB bolts based on the EPRI MRP's criteria for the bolts in Item B8 of Table 4-1 in the MRP-227, Revision 1-A Report [NRC 2019-TN9222]. The LCB bolts (and the associated LCB bolt locking devices) remain as “Primary” category components for B&W-design RVI management programs per Item B8 in Table 4-1 of the MRP=227, Revision 1-A Report [NRC 2019-TN9222].
IV.B4.RP-252a	In SLR-ISG-2021-01-PWRVI [NRC 2021-TN9958], the staff deleted the old version of GALL-SLR Item IV.B4.RP-252a (which pertained to management of cracking in vent valve top and bottom retaining rings and associated locking devices) and instead replaced it with a new version of the GALL-SLR Item IV.B4.RP-252a that serves as the new AMR line item for managing loss of fracture toughness due to thermal aging embrittlement in the vent valve bodies that are included in B&W PWR internal designs. In Item B2.1 of Table 4-4 in the MRP-227, Revision 1-A Report [NRC 2019-TN9222], the EPRI MRP included the vent valve bodies as designated

Table 2-7 New Aging Management Review Items Added in GALL-SLR Report Revision 1, Chapter IV, Reactor Vessel, Internals, and Reactor Coolant System (Continued)

New Aging Management Review (AMR) Item No.	Technical Bases for Changes
	"Expansion" category components for B&W-design PWRs, with the need for inspecting the components being tied to the results of "Primary" inspections that will be performed on the CRGT spacer casting as the lead "Primary" cast austenitic stainless steel (CASS) components for the B&W programs. The EPRI identified that TE is an applicable loss of fracture toughness mechanism for the vent valve bodies because the valve bodies are made from CASS. However, the previous version of the GALL-SLR Report did not include any AMR line items to address loss of fracture toughness in the vent valve bodies. Thus, the staff developed the IV.B4.RP-252a item for the vent valve bodies to be consistent with Item B2.1 in Table 4-4 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222], and for practical purposes, the "RP-252a" item is being treated as a new item for the objectives of the ISG. The vent valve bodes are "Expansion" category components for B&W-designed reactor units per Item B2.1 in Table 4-4 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222].
IV.B4.RP-252b	The new line item applies to aging management of non-cracking effect and mechanism combinations in specific types of original locking devices that are included the vent valve assemblies of B&W-design PWRs. The staff developed the new IV.B4.RP-252b item to be consistent with Items B4 and B5 in Table 4-1 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222]. The staff did not receive any NEI or EPRI MRP comments specific to the IV.B2.RP-252b item. In Item B4 of Table 4-1, the EPRI MRP identified that the locking devices associated with the pressure plate, spring and spring retainer, and U-cover in the vent value assembly may be susceptible to loss of material that is induced by a wear mechanism in the components. Similarly, in Item B5 of Table 4-1, the EPRI MRP identified that the locking devices associated with the key ring and pin in the assembly may be susceptible to loss of fracture toughness that is induced by a TE mechanism. However, the previous version of the GALL-SLR Report did not include any AMR line item to address loss of material due to wear and loss of fracture toughness in specified types of original locking device components. Thus, the staff developed the new IV.B4.RP-252b item for the referenced original locking devices to be consistent with Items B4 and B5 in Table 4-1 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222]. The referenced original locking devices are defined as "Primary" category components for B&W-designed reactor units per Items B4 and B5 in Table 4-1 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222].
IV.B4.RP-252c	The new line item applies to aging management of cracking in specific types of original locking devices and modified locking devices that may be included the vent value assemblies of B&W-designed PWRs.

Table 2-7 New Aging Management Review Items Added in GALL-SLR Report Revision 1, Chapter IV, Reactor Vessel, Internals, and Reactor Coolant System (Continued)

New Aging Management Review (AMR) Item No.	Technical Bases for Changes
	In Item B6 of Table 4-1, the EPRI MRP identified that the original locking devices (as associated with key ring and pin in B&W-designed plants that include the components) and modified locking devices (as associated with the bolt locking cup, jackscrew locking cup, and bolted block in B&W plants that include the components) may be susceptible to cracking that is induced by a SCC mechanism. The EPRI MRP has designated these components as "Primary" category components for to the B&W-designed PWRs that have the types of modified locking devices in the plant designs. The previous version of the GALL-SLR Report did not include any AMR line item to address cracking in these types of components. Thus, the staff developed the new IV.B4.RP-252c Item to be consistent with Item B6 in Table 4-1 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222]. The referenced original locking devices and modified locking devices are defined as "Primary" category components per Items B5 and B6 in Table 4-1 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222]. Note 4 in Table 4-1 of MRP-227, Revision 1-A [NRC 2019-TN9222] defines which of the B&W-designed PWRs in the US include the referenced original locking devices and which of the B&W-designed PWRs in the US include the referenced modified locking devices.
IV.BR.RP-246c IV.B4.RP-246d IV.B4.RP-246e	The new line items apply to aging management B&W-design core barrel assembly upper thermal shield (UTS) bolts and their locking devises, as established in Item B7.1 of Table 4-4 in the MRP-227, Revision 1-A Report [NRC 2019-TN9222]. The staff did not receive any NEI or EPRI MRP comments specific to the development of the new IV.B4.RP-246c, IV.B4.RP-246d, and IV.B4.RP-246e line items. In Item B7.1 of Table 4-4 in the MRP-227, Revision 1-A Report [NRC 2019-TN9222], the EPRI MRP designated that the UTS bolts and their locking devices as "Expansion" category components for B&W-designed PWRs, with the need for inspecting the UTS bolts and locking devices being dependent on the results of "Primary" inspections that will be performed on UCB bolts, LCB bolts, and flow distributor (FD) bolts that are included in the plant design and are designated as "Primary" components for B&W-design programs. In Item B7.1, the EPRI MRP screened the UTS bolts in for the aging mechanism of SCC and the UTS bolt locking devices in for the aging mechanisms of fatigue, distortion (the staff assumes distortion may be associated with void swelling), and wear. The previous version of the GALL-SLR Report did not include any AMR line items to address aging in the UTS bolts and bolt locking devices. Thus, the staff developed the new line items to be consistent with the criteria in Item B7.1 of Table 4-4 in the MRP-227, Revision 1-A Report [NRC 2019-TN9222], where: (1) the IV.B4.RP-246c Item has been developed to address management of cracking due to SCC in the UTS bolts, (2) the IV.B4.RP-246d Item has been developed to address management of cracking due to fatigue in the UTS bolt locking devices, and (3) the IV.B4.RP-246e Item has been developed to address management of loss of

Table 2-7 New Aging Management Review Items Added in GALL-SLR Report Revision 1, Chapter IV, Reactor Vessel, Internals, and Reactor Coolant System (Continued)

New Aging Management Review (AMR) Item No.	Technical Bases for Changes
	material due to wear and changes in dimension due to void swelling or distortion in the UTS bolt locking devices.
IV.B4.RP-386	The new line item applies to aging management of loss of material due to neutron IE in the lower grid rib sections of B&W-design reactor units. The staff did not receive any NEI or EPRI MRP comments specific to the development of the new IV.B4.RP-386 Item. In Item B10.3 in Table 4-4 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222], the EPRI MRP established that the lower grid rib section may be susceptible to loss of fracture toughness that may be induced by a neutron IE mechanism. However, the previous version of the GALL-SLR Report did not include any AMR items to address loss of fracture toughness in the lower grid rib sections of B&W-design PWRs. Thus, the staff developed the new IV.B4.RP-386 item to be consistent with Item B10.3 in Table 4-4 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222]. The lower grid rib sections are defined as “Expansion” category components for B&W-designed reactor units per Item B10.3 in Table 4-4 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222].
IV.C1.R-456 IV.C2.R-456	As addressed in NRC Bulletin 88-08 [NRC 1988-TN8082], non-isolable branch lines connected to the reactor coolant system may be subject to unacceptable thermal stress that can cause thermal fatigue cracking and leakage failure. The NRC Bulletin 88-08 [NRC 1988-TN8082] states that, when such piping is identified, actions should be taken to ensure that the piping will not be subject to unacceptable thermal stress. Industry operating experience and evaluation indicate that, in some branch lines, thermal stratification or mixing cycles can occur due to the interaction between the hot swirl penetration from the reactor coolant system and the cold water in-leakage from a leaking valve. In other branch lines, thermal stratification or mixing cycles can result from the interaction of the hot swirl penetration and the cold water in the normally cool, stagnant branch lines without a leaking valve. In addition, cold or hot fluid injections can cause thermal fatigue in the reactor coolant system as indicated in ASME Code Case N-716-1 [ASME 2013-TN8107]. Therefore, cracking due to thermal fatigue can occur due to cyclic stresses from the thermal stratification, mixing or injection cycles. The industry guidance to manage the thermal fatigue in the PWR branch lines is described in EPRI MRP-146, Revision 2 [EPRI 2016-TN8114]. The guidance provides methods for screening and evaluating the susceptibility of non-isolable branch lines to thermal fatigue. The MRP-146, Revision 2 also provides general guidance for monitoring valve in-leakage and thermal stress as needed and performing volumetric examinations on the susceptible locations (e.g., examination areas, volumes and frequencies). These guidelines continue to be enhanced based on the lessons learned from relevant operating experience and research activities. The Boiling

Table 2-7 New Aging Management Review Items Added in GALL-SLR Report Revision 1, Chapter IV, Reactor Vessel, Internals, and Reactor Coolant System (Continued)

New Aging Management Review (AMR) Item No.	Technical Bases for Changes
	Water Reactor Vessel and Internals Project [BWRVIP-155; EPRI 2018-TN8115], Revision 1 also describes the evaluation of thermal fatigue susceptibility in the branch lines of BWR reactor coolant pressure boundary. In comparison, the inservice inspection (ISI) requirements in Table IWB-2500-1 of ASME Code, Section XI [ASME 2017-TN9258] do not include a specific examination item for thermal fatigue cracking in ASME Code Class 1 components (reactor coolant pressure boundary). However, alternative risk-informed ISIs typically include an examination item for thermal fatigue cracking (e.g., as specified in ASME Code Case N-716-1 [ASME 2013-TN8107] that has been approved in NRC Regulatory Guide (RG) 1.147, Revision 18 [NRC 2017-TN9957]). Therefore, the existing ISIs at plants may include the piping locations susceptible to thermal fatigue. Currently, the SRP-SLR does not include a further evaluation section that addresses aging management for the piping locations susceptible to thermal fatigue. Therefore, new SRP-SLR Sections 3.1.2.2.16a and 3.1.3.2.16a are added to address the adequacy of a plant-specific aging management program (e.g., adequate selection of susceptible locations for inspections, timely detection of cracks and preventive action for valve in-leakage). Changes are also made to the SRP-SLR section for references (Section 3.1.6). In addition, relevant changes are made to the AMR tables in the SRP-SLR and GALL-SLR Report.

Table 2-8 Table New Aging Management Review Items Added in GALL-SLR Report Revision 1, Chapter V, Engineered Safety Features

New Aging Management Review (AMR) Item No.	Technical Bases for Changes
V.A.E-443b V.A.E-443c V.A.E-443d V.B.E-443b V.B.E-443c V.B.E-443d V.D1.E-443b V.D1.E-443c V.D1.E-443d V.D2.E-443b V.D2.E-443c V.D2.E-443d	The staff added aluminum Alloy 6063T6 to the list of materials that are not susceptible to stress corrosion cracking (SCC). This is a wrought material alloyed primary with magnesium (Mg) and silicon (Si). It is a moderate strength precipitation hardened aluminum alloy in the peak-aged condition. The strengthening phase precipitated during the artificial aging of 6063 is Mg_2Si. Generally, 6xxx series alloys have satisfactory SCC resistance and inservice performance. However, some 6xxx series alloys are known to be susceptible to SCC when exposed to certain atypical processing histories. The majority of 6xxx series SCC testing and characterization has been performed on 6061T6, which is known to be resistant to SCC. Much more limited SCC testing and characterization has been performed on 6063T6; although, results have been consistent with those of 6061T6. Alloy 6063 is a compositionally leaner version of 6061 which has been optimized for extrusion. The two alloys have the same strengthening mechanism and their nominal Mg/Si ratios are also similar. Therefore, it is expected that the SCC performance is comparable. Additionally, the known inservice performance of aluminum Alloy 6063T6 has shown satisfactory SCC resistance across multiple industries. Based on the metallurgical characteristics, available laboratory testing, and known service history, the staff has determined that 6063T6 is not susceptible to SCC.
V.A.E-475 V.D1.E-475 V.D2.E-475	Subsequent to issuance of the GALL-SLR Report, the staff recognized that to be consistent with other GALL-SLR Report items associated with heat exchanger tubes, E-475 should have also cited reduction of heat transfer due to fouling. This is consistent with GALL Report Revision 2 item SP-41 where a material (i.e., stainless steel [SS]) that is not susceptible to loss of material (a potential source of fouling products), is susceptible to reduction of heat transfer due to fouling. Titanium components are subject to flow blockage due to fouling due to potential debris in the raw water environment.
V.B.R-457 V.C.R-457 V.D1.R-457 V.D2.R-457 V.E.R-457	New AMR items to relate to new further evaluation Section 3.2.2.2.11.
V.A.E-478	This new line item was added to support the new AMP, “GALL-SLR Report AMP XI.M43, High Density Polyethylene (HDPE) Piping and Carbon Fiber Reinforced Polymer (CFRP) Repaired Piping.” The technical basis for this new AMP can be found in Table 2-33, XI.M43 of this report.

Table 2-9 New Aging Management Review Items Added in GALL-SLR Report Revision 1, Chapter VI, Electrical Components

New Aging Management Review Item No.	Technical Bases for Changes
No new aging management review items were added to Chapter VI of the GALL-SLR Report, Revision 1.	

Table 2-10 New Aging Management Review Items Added in GALL-SLR Report Revision 1, Chapter VII, Auxiliary Systems

New Aging Management Review (AMR) Item No.	Technical Bases for Changes
VII.I.AP-182 VII.I.A-420 VII.I.A-538 VII.C1.A-792	The staff added new AMR items to add carbon fiber reinforced polymer (CFRP) repaired piping, crediting the new AMP XI.M43, "High Density Polyethylene (HDPE) Piping and Carbon Fiber Reinforced Polymer (CFRP) Repaired Piping." The new AMR items reflect the recent introduction and increasing use of CFRP repaired piping at reactor facilities. The unique aging issues and aging management approaches for CFRP repaired piping were considered to be most effectively addressed with a dedicated AMP.
VII.C1.A-400b VII.C3.A-400b	Based on industry request, included AMR items for managing recurring internal corrosion of metallic components exposed to raw water that are not covered by Generic Letter (GL) 89-13 [NRC 1989-TN9367] by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program.
VII.D.A-414 VII.D.A-416	Added new AMR items with air and condensation environments since these environments were added to the scope of the Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks program with the issuance of SLR-ISG-2021-02-MECHANICAL, "Updated Aging Management Criteria for Mechanical Portions of Subsequent License Renewal Guidance."
VII.E2.A-798	The staff modified the AMR Item V.A.E-434 and added AMR Item VII.E2.A-798, to note that the aging effects of loss of material, and long-term loss of material due to general corrosion on steel exposed to an environment of treated water and sodium pentaborate can be managed by the "Water Chemistry" and "One-Time Inspection" AMPs. No item was added to manage stress corrosion cracking of steel in this environment as the GALL-SLR already states that steel components typically are not susceptible to stress corrosion cracking and are mainly susceptible to loss of material. The staff determined that this material, environment, aging effect program (MEAP) may be managed with the AMPs cited above because the Water Chemistry AMP can monitor and control the concentration of deleterious species in the water storage tanks that provide water to the Standby Liquid Control (SLC) system which contains the sodium pentaborate solution. Additionally, the One-Time Inspection AMP can verify the corrosion rate of the steel components is low enough that loss of material is unlikely to cause a loss of intended function. Several reports were reviewed by the staff to make this determination ([NUREG/CR-6001; NRC 1992-TN8346] [EPRI Report 1010639; EPRI 2006-TN8195] [Metals Handbook Desk Edition, 2nd Edition] [EPRI Report 1000975; EPRI 2001-TN8200]). These reports concluded that even though the pH of the SLC system varies with temperature, it is generally greater than 6.8 pH which is close to neutral [NUREG/CR-6001; NRC 1992-TN8346]. Additionally, these reports noted that the pH range in SLC systems tends to be between 6.8–8.5 [EPRI Report 1010639; EPRI 2006-TN8195]. This would result in less corrosion of the steel as the corrosion rate of steel tends to decrease with an increasing pH (i.e., more basic) and would need additional impurities (e.g., salts, oxygen) for appreciable

Table 2-10 New Aging Management Review Items Added in GALL-SLR Report Revision 1, Chapter VII, Auxiliary Systems (Continued)

New Aging Management Review (AMR) Item No.	Technical Bases for Changes
	corrosion to occur in this environment (Metals Handbook Desk Edition, 2nd Edition). Additionally, one report found that corrosion rates of carbon and low-alloy steel, when exposed to varying concentrations of boric acid, were relatively low (0.05–1.1 millimeter per year [mm/yr] or 0.002–0.045 inches per year [in/yr]), when the temperature was below 60 degrees Celsius (°C) (140 degrees Fahrenheit [°F]) (EPRI Report 1000975 [EPRI 2001-TN8200]).
VII.G.A-805	A new AMR item for subliming compounds used as fireproofing/fire barriers is being added to NUREG-2191 because they are materials that are widely used throughout industry and are likely to be cited in future SLRAs. The aging effects and aging mechanisms for subliming compounds used as fireproofing/fire barriers exposed to air are based on the NRC staff's review and approval of applicants' programs for aging management of fire protection materials listed in previous SLRAs. In addition, the aging effects and aging mechanisms are consistent with Section 6, "Fire Barriers," of EPRI Report 3002013084, "Long-Term Operations: Subsequent License Renewal Aging Affects for Structures and Structural Components (Structural Tools)," issued November 2018 [EPRI 2018-TN9412], and those cited by industry as part of SLRA lessons learned activities and public comments on the AMR item. New AMR Item A-805 manages loss of material due to abrasion, flaking, and vibration; cracking/delamination due to chemical reaction and settlement; change in material properties due to gamma irradiation exposure; and separation for subliming compounds (Thermo-lag®, Darmatt™, 3M™ Interam™, and other similar materials) exposed to air. The periodic inspections recommended by AMP XI.M26, "Fire Protection," are capable of detecting these aging effects for these materials.
VII.G.A-806	A new AMR item for cementitious coatings used as fireproofing/fire barriers is being added to the GALL-SLR Report because they are materials that are widely used throughout industry and are likely to be cited in future SLRAs. The aging effects and aging mechanisms for cementitious coatings used as fireproofing/fire barriers exposed to air are based on the NRC staff's review and approval of applicants' programs for aging management of fire protection materials listed in previous SLRAs. In addition, the aging effects and aging mechanisms are consistent with Section 5, "Structural Concrete Members," and Section 6, "Fire Barriers," of EPRI 3002013084 [EPRI 2018-TN9412], and those cited by industry as part of SLRA lessons learned activities and public comments on the AMR item. This item manages loss of material due to abrasion, exfoliation, elevated temperature, flaking, and spalling; cracking/delamination; change in material properties; and separation for cementitious coatings (Pyrocrete, BIO™ K-10 Mortar, Cafecote, and other similar materials) exposed to air.

Table 2-10 New Aging Management Review Items Added in GALL-SLR Report Revision 1, Chapter VII, Auxiliary Systems (Continued)

New Aging Management Review (AMR) Item No.	Technical Bases for Changes
VII.G.A-807	A new AMR item for silicates used as fireproofing/fire barriers is being added to the GALL-SLR Report because they are materials that are widely used throughout industry and are likely to be cited in future SLRAs. The aging effects and aging mechanisms for silicates used as fireproofing/fire barriers exposed to air are based on the NRC staff's review and approval of applicants' programs for aging management of fire protection materials listed in previous SLRAs. In addition, the aging effects and aging mechanisms are consistent with Section 6 of EPRI Report 3002013084 [EPRI 2018-TN9412], and those cited by industry as part of SLRA lessons learned activities and public comments on the AMR item. New AMR Item A-807 manages loss of material due to abrasion and flaking; cracking/delamination due to settlement; change in material properties due to gamma irradiation exposure; and separation for silicates (Marinite®, Kaowool™, Cerafiber®, Cera® blanket, or other similar materials) exposed to air. The periodic inspections recommended by AMP XI.M26 are capable of detecting these aging effects for these materials.
VII.H2.A-799	A new AMR item on heat exchanger tubes is added to reflect that the Fuel Oil Chemistry program is capable of mitigating reduction of heat transfer for heat exchanger tubes by periodic sampling of fuel oil for contaminants that may cause the reduction of heat transfer due to fouling. The Fuel Oil Chemistry program can manage contaminants that would promote corrosion (e.g., water or microbial activity), particulate concentration, or other contaminants that tested for under ASTM D975 that could contribute to heat exchanger tube fouling. If operating experience, or plant specific configurations, indicate other fouling mechanisms for a fuel oil environment may be present or the Fuel Oil Chemistry program alone is not sufficient to manage aging, the staff may need to evaluate whether the Fuel Oil Chemistry program is appropriate to manage these aging effects and if other measures are needed for a given plant.
VII.H2.A-801	The staff noted that the GALL-SLR Report recommends the use of the Fuel Oil Chemistry AMP to manage loss of material of several different materials that are exposed to a fuel oil environment. This new AMR item credits the Fuel Oil Chemistry program to minimize contaminants which could lead to loss of material. The use of the Fuel Oil Chemistry program can minimize contaminants regardless of the material of the affected component. Therefore, the staff has reasonable assurance that it will be effective in managing loss of material for nickel alloy strainer elements exposed to fuel oil.
VII.C3.A-482a VII.C3.A-482b VII.C3.A-482c VII.E5.A-482a VII.E5.A-482b VII.E5.A-482c VII.H1.A-482a	The staff added aluminum Alloy 6063T6 to the list of materials that are not susceptible to systems, structures, and components. This is a wrought material alloyed primary with magnesium (Mg) and silicon (Si). It is a moderate strength precipitation hardened aluminum alloy in the peak-aged condition. The strengthening phase precipitated during the artificial aging of 6063 is Mg_2Si. Generally, 6xxx series alloys have satisfactory SCC resistance and inservice performance. However, some 6xxx series alloys

Table 2-10 New Aging Management Review Items Added in GALL-SLR Report Revision 1, Chapter VII, Auxiliary Systems (Continued)

New Aging Management Review (AMR) Item No.	Technical Bases for Changes
VII.H1.A-482b VII.H1.A-482c	are known to be susceptible to SCC when exposed to certain atypical processing histories. The majority of 6xxx series SCC testing and characterization has been performed on 6061T6, which is known to be resistant to SCC. Much more limited SCC testing and characterization has been performed on 6063T6; although, results have been consistent with those of 6061T6. Alloy 6063 is a compositionally leaner version of 6061 which has been optimized for extrusion. The two alloys have the same strengthening mechanism and their nominal Mg/Si ratios are also similar. Therefore, it is expected that the SCC performance is comparable. Additionally, the known inservice performance of aluminum Alloy 6063T6 has shown satisfactory SCC resistance across multiple industries. Based on the metallurgical characteristics, available laboratory testing, and known service history, the staff has determined that 6063T6 is not susceptible to SCC.
VII.C1.A-795a VII.C2.A-795b VII.C3.A-795a VII.E4.A-795a VII.H2.A-795a	Subsequent to issuance of the GALL-SLR Report, the staff recognized that to be consistent with item A-767, A-795a and A-795b should have also cited reduction of heat transfer due to fouling. This is consistent with GALL Report Revision 2, item SP-41 where a material (i.e., stainless steel [SS]) that is not susceptible to loss of material (a potential source of fouling products), is susceptible to reduction of heat transfer due to fouling. Titanium components are subject to flow blockage due to fouling due to potential debris in the raw water environment. Based on the staff’s review of industry operating experience, it is possible that flow blockage due to fouling can occur in the closed cycle cooling water environment.

Table 2-11 New Aging Management Review Items Added in GALL-SLR Report Revision 1, Chapter VIII, Steam and Power Conversion System

New Aging Management Review (AMR) Item No.	Technical Bases for Changes
VIII.E.S-450a VIII.E.S-450b VIII.E.S-450c VIII.G.S-450a VIII.G.S-450b VIII.G.S-450c	The staff added aluminum Alloy 6063T6 to the list of materials that are not susceptible to SCC. This is a wrought material alloyed primary with magnesium (Mg) and silicon (Si). It is a moderate strength precipitation hardened aluminum alloy in the peak-aged condition. The strengthening phase precipitated during the artificial aging of 6063 is Mg_2Si. Generally, 6xxx series alloys have satisfactory stress corrosion cracking (SCC) resistance and inservice performance. However, some 6xxx series alloys are known to be susceptible to SCC when exposed to certain atypical processing histories. The majority of 6xxx series SCC testing and characterization has been performed on 6061T6, which is known to be resistant to SCC. Much more limited SCC testing and characterization has been performed on 6063T6; although, results have been consistent with those of 6061T6. Alloy 6063 is a compositionally leaner version of 6061 which has been optimized for extrusion. The two alloys have the same strengthening mechanism and their nominal Mg/Si ratios are also similar. Therefore, it is expected that the SCC performance is comparable. Additionally, the known inservice performance of aluminum Alloy 6063T6 has shown satisfactory SCC resistance across multiple industries. Based on the metallurgical characteristics, available laboratory testing, and known service history, the staff has determined that 6063T6 is not susceptible to SCC.
VIII.D1.S-482 VIII.D2.S-482 VIII.E.S-482 VIII.F.S-482	Subsequent to issuance of the GALL-SLR Report, the staff recognized that to be consistent with other GALL-SLR Report items associated with heat exchanger tubes, S-482 should have also cited reduction of heat transfer due to fouling. This is consistent with GALL Report, Revision 2, Item SP-41 where a material (i.e., SS) that is not susceptible to loss of material (a potential source of fouling products), is susceptible to reduction of heat transfer due to fouling. Titanium components are subject to flow blockage due to fouling due to potential debris in the raw water environment.
VIII.H.S-484	The staff added a new AMR item to add carbon fiber reinforced polymer (CFRP) repaired piping, crediting the new AMP XI.M43, “High Density Polyethylene (HDPE) Piping and Carbon Fiber Reinforced Polymer (CFRP) Repaired Piping.” The new AMR item reflects the recent introduction and increasing use of CFRP repaired piping at reactor facilities. The unique aging issues and aging management approaches for CFRP repaired piping were considered to be most effectively addressed with a dedicated AMP.

Table 2-12 Deleted Aging Management Review Items From GALL-SLR Revision 0, Chapter II, Containment Structures

Aging Management Review Item No.	Technical Bases for Changes
No aging management review items were deleted from Chapter ll GALL-SLR Report, Revision 0.	

Table 2-13 Deleted Aging Management Review Items From GALL-SLR Revision 0, Chapter III, Structures and Component Supports

Aging Management Review (AMR) Item No.	Technical Bases for Changes
III.A6.TP-25	This item was deleted from NUREG-2191, Volume 1, since it is a duplicate to GALL-SLR Item no. III.A6.T-34. In addition, this GALL-SLR item is associated with Group 6 structures and the associated SRP-SLR AMR item (i.e., 3.5-1, 054) is only intended to address all groups of structures, except Group 6.

Table 2-14 Deleted Aging Management Review Items From GALL-SLR Revision 0, Chapter IV, Reactor Vessel, Internals, and Reactor Coolant System

Aging Management Review (AMR) Item No.	Technical Bases for Changes
IV.B2.RP-356	The staff deleted GALL-SLR Item IV.B2.RP-356 in SLR-ISG-2021-01-PWRVI [NRC 2021-TN9958]. The previous version of the “RP-356” item in Table IV.B2 of GALL-SLR Report was included to address loss of material due to wear in stainless steel or nickel alloy Westinghouse-design control rod guide tube (CRGT) support pins (split pins) that are exposed to a reactor coolant and neutron flux environment. For the Interim Staff Guidance (ISG) update, the staff modified the corresponding “cracking” item for the split pins in GALL-SLR Item IV.B2.RP-355 to limit the scope of line item only to CRGT spilt pins that are made from nickel alloy (X-750) materials and to include loss of material due wear as an additional aging effect and mechanism combination for the ”RP-355” item (i.e., in addition to cracking due to SCC or fatigue), where the Aging Management Program (AMP) XI.M16A aging management basis for the pins would be based on a component-specific evaluation per the MRP-227, Revision 1-A [NRC 2019-TN9222] guidelines. For spilt pins made from Type 316 or Type 316L stainless steel (SS) materials, the MRP-227, Revision 1-A [NRC 2019-TN9222] guidelines placed the components in the “No Additional Measures” category. Since loss of material for CRGT spilt pins made from X-750 nickel alloy materials is now addressed by the modification of GALL-SLR Item IV.B2.RP-355 in the ISG and since CRGT spilt pins made from Type 316 or Type 316L SS materials are now within the scope of the AMR for “No Additional Measures” components in GALL-SLR Item IV.B2.RP-265, GALL-SLR Item IV.2.RP-356 is no longer needed and has been deleted in SLR-ISG-2021-01-PWRVI [NRC 2021-TN9958].

Table 2-14 Deleted Aging Management Review Items From GALL-SLR Revision 0, Chapter IV, Reactor Vessel, Internals, and Reactor Coolant System (Continued)

Aging Management Review (AMR) Item No.	Technical Bases for Changes
IV.B2.RP-278 IV.B2.RP-278a	The staff deleted GALL-SLR Items IV.B2.RP-278 and IV.B2.RP-278a in SLR-ISG-2021-01-PWRVI [NRC 2021-TN9958]. The previous versions of the “RP-278” and “RP-278a” items in Table IV.B2 of the GALL-SLR Report were included to address management of cracking due to SCC or fatigue and loss of fracture toughness due to neutron irradiation embrittlement in Westinghouse-design core barrel outlet nozzle welds (ONWs). In EPRI’s MRP-227-A (Revision 0) report, the EPRI MRP designated that the core barrel ONWs were “Expansion” components for Westinghouse-design reactor vessel internal (RVI) management programs, where the need for inspecting the ONWs would be dependent on the results of primary inspections performed on the upper flange weld (UFW) in the core barrel assembly, as designated for inspection per Item W3 of Table 4-3 in MRP-227, Revision 1-A [NRC 2019-TN9222]. However, in Items W3.1, W3.2, W3.3 and W3.4 of Table 4-6 in the MRP-227, Revision 1-A Report [NRC 2019-TN9222], the EPRI MRP replaced the ONWs with the core barrel assembly upper girth weld (UGW), upper axial welds (UAWs), lower flange weld (LFW), and lower support forging or casting as the new “Expansion” components linked to the “Primary” core barrel UFW inspections. Since the core barrel assembly ONWs are now within the scope of the staff’s AMR line item for Westinghouse-design “No Additional Measures” category components (See GALL-SLR Item IV.B2.RP-265), the GALL-SLR Items IV.B2.RP-278 and IV.B2.RP-278a are no longer necessary and have been deleted in SLR-ISG-2021-01-PWRVI [NRC 2021-TN9958].
IV.B2.RP-382 IV.B3.RP-382 IV.B4.RP-382	The staff deleted GALL-SLR Items IV.B2.RP-382, IV.B3.RP-382 and IV.B4.RP-382 in SLR-ISG-2021-01-PWRVI [NRC 2021-TN9958]. The previous “RP-382” items in the GALL-SLR Report were the AMR line items that could be used for RVI component aging management if the applicant’s GALL-SLR AMP XI.M1, “ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD” program was credited for aging management of the component(s). However, the staff determined that the “RP-382” AMR line items are redundant with staff’s modification of GALL-SLR Item IV.E.R-444 in Appendix B.4 of the ISG. Similarly, Item 032 in NUREG-2192 (SRP-SLR Report) Table 3.1-1 has also been deleted in accordance with these line item changes (Refer to the line item entry for Item 032 in Table 3-3a in this report). The modified version of SRP-SLR Table 3.1-1, Item 114 in Appendix A of the ISG is the SRP-SLR item that references the staff’s modified version GALL-SLR Item IV.E.R-444 for pressurized water reactor (PWR) reactor internal components (RVI) that are defined as ASME Section XI Class 1 interior attachments to the reactor vessel (RV) or as ASME Section XI Class 1 core support structure components. Therefore, GALL-SLR Items IV.B2.RP-382, IV.B3.RP-382, and IV.B4.RP-382 have been deleted in SLR-ISG-2021-01-PWRVI [NRC 2021-TN9958].

Table 2-14 Deleted Aging Management Review Items From GALL-SLR Revision 0, Chapter IV, Reactor Vessel, Internals, and Reactor Coolant System (Continued)

Aging Management Review (AMR) Item No.	Technical Bases for Changes
IV.B3.RP-326a	The staff deleted GALL-SLR Item IV.B3.RP-326a in SLR-ISG-2021-01-PWRVI [NRC 2021-TN9958]. The previous version of the "RP-326a" item in Table IV.B3 of the GALL-SLR Report addressed cracking (due to SCC or fatigue) in the core shrouds of CE-designed PWRs. The "RP-326a" item applied to those CE PWR designs where the core shroud in the plant design is fabricated from two welded vertical shroud sections. Based on the staff's partial acceptance of NEI Comment #3 on SLR-ISG-PWRVI-2021-PWRVI, and the generic request in the comment, the staff confirmed that EPRI did not screen in any cracking mechanisms (i.e., SCC, irradiation-assisted stress corrosion cracking [IASCC], fatigue or overload) for these types of welded CE core shroud assemblies in Tables 3-2, 4-2 or 5-2 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222]. The assemblies did screen in for IE and void swelling (VS) in Item C4a of Table 4-2 in the MRP-227, Revision 1-A Report [NRC 2019-TN9222], which are covered by the "RP-326" item on the previous page. So consistent with the staff's basis for partially accepting NEI Comment #3, the staff confirmed that GALL-SLR Item IV.B2.RP-326a is no longer needed for the final version of the ISG and has been deleted in Appendix B.2 of SLR-ISG-2021-01-PWRVI [NRC 2021-TN9958].
IV.B3.RP-400	The staff deleted GALL-SLR Item IV.B3.RP-400 in SLR-ISG-2021-01-PWRVI [NRC 2021-TN9958]. The prior version of the IV.B3.RP-400 item in Table IV.B3 of GALL-SLR Report was included to address cracking and loss of material due to wear in CE-design thermal shield positioning pins. In the staff's review of EPRI Report MRP-227, Revision 1, the staff agreed that CE-design thermal shield positioning pins could be placed in the "No Additional Measures" category for CE-design RVI management programs. These components are now "No Additional Measures" category components per MRP-227, Revision 1-A [NRC 2019-TN9222] criteria and are now covered by the line item for CE-design "No Additional Measures" components, as given in GALL-SLR Item IV.B3.RP-306. Therefore, GALL-SLR Item IV.B3.RP-400 is no longer necessary and has been deleted in Appendix B.2 of SLR-ISG-2021-01-PWRVI [NRC 2021-TN9958].
IV.B3.RP-334a	The staff deleted GALL-SLR Item IV.B3.RP-334a in SLR-ISG-2021-01-PWRVI [NRC 2021-TN9958] based on the staff's decision to fold the CE plant design applicability statement of the "RP-334a" item into staff's modification of GALL-SLR Item IV.B3.RP-336 in Appendix B.2 of the ISG. The previous version of the IV.B3.RP-334a item applied to management of loss of material due to wear, loss of fracture toughness and loss of preload in fuel alignment pins of CE-designed PWRs that have welded shrouds fabricated from two vertical shroud sections. The existing GALL-SLR Item IV.B4.RP-336 is the corresponding item for the fuel alignment pins in welded core shrouds that use full height shroud plates. The staff's modification of the IV.B3/RP-336" item in SLR-ISG-2021-01-PWRVI [NRC 2021-TN9958] allows the "RP-336" item to be applied for the

Table 2-14 Deleted Aging Management Review Items From GALL-SLR Revision 0, Chapter IV, Reactor Vessel, Internals, and Reactor Coolant System (Continued)

Aging Management Review (AMR) Item No.	Technical Bases for Changes
	management of non-cracking effects in the fuel alignment pins of CE-design plants with welded core shrouds assembled from either two vertical sections or from full height shroud plates. Since the GALL-SLR Item IV.B4.RP-334a is no longer necessary, the staff deleted the GALL-SLR Item IV.B4.RP-334a in Appendix B.2 of SLR-ISG-2021-01-PWRVI [NRC 2021-TN9958].
IV.B4.RP-400 IV.B4.RP-401	The staff deleted GALL-SLR Items IV.B4.RP-400 and IV.B4.RP-401 in SLR-ISG-2021-01-PWRVI [NRC 2021-TN9958]. The previous versions of GALL-SLR Items IV.B4.RP-400 and IV.B4.RP-401 were included in Table IV.B4 of the GALL-SLR Report to address on aging management of cracking and loss of fracture toughness in the upper (top) flange welds that are located in the core shield assemblies of Babcock and Wilcox (B&W)-designed reactors. The staff confirmed that the core support shield top flange welds are no longer designated as B&W “Primary” category or “Expansion” category components in the MRP-227, Revision 1-A Report [NRC 2019-TN9222]. Thus, the staff deleted the GALL-SLR IV.B4.RP-400 and IV.B4.RP-401 line items in order to be consistent with the revised program in the MRP-227, Revision 1-A Report [NRC 2019-TN9222] and with Section 3.6.4 (Page 45) of the staff’s safety evaluation for the MRP-227, Revision 1-A Report [NRC 2019-TN9222]. Instead management of loss of material due to wear and loss of preload in the core support shield (CSS) top flange connections is covered by the existing item in GALL-SLR Item IV.B4.RP-251, and by Item B1.d in Table 4-1 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222], which identifies that the CSS top flanges are “Primary” category components for B&W-design RVI management programs.
IV.B4.RP-254 IV.B4.RP-254a IV.B4.RP-254b	The staff deleted GALL-SLR Items IV.B4.RP-254, IV.B4.RP-254a, and IV.B4.RP-254b in SLR-ISG-2021-01-PWRVI [NRC 2021-TN9958]. The previous versions of these line items in Table IV.B4 of the GALL-SLR Report only applied to specific types of internals components in the lower grid assembly of the Three Mile Island Unit 1 (TMI-1) facility. However, the licensee for TMI-1 has made an owner decision to decommission the plant. Since the GALL-SLR IV.B4.RP-254, IV.B4.RP-254a, and IV.B4.RP-254b line items are no longer necessary, the staff deleted them in Appendix B.3 of the ISG.
IV.B4.RP-249a IV.B4.RP-244a IV.B4.RP-250a IV.B4.RP-252a IV.B4.RP-258a IV.B4.RP-259a	The staff deleted GALL-SLR Items IV.B4.RP-249a, IV.B4.RP-244a, IV.B4.RP-250a, IV.B4.RP-252a, IV.B4.RP-258a and IV.B4.RP-259a in SLR-ISG-2021-01-PWRVI [NRC 2021-TN9958]. The prior versions of these GALL-SLR Items applied to cracking in B&W-design baffle plates, baffle-to-former bolt/core barrel core barrel-former bolt locking devices, core barrel assemblies and welds, vent valve top and bottom retaining rings and locking devices, incore monitoring instrument (IMI) guide tube spiders, and IMI guide tube spiders-to-lower grid rib sections welds. In MRP-227, Revision 1-A [NRC 2019-TN9222], the Electric Power Research Institute (EPRI) MRP identified that these components did

Table 2-14 Deleted Aging Management Review Items From GALL-SLR Revision 0, Chapter IV, Reactor Vessel, Internals, and Reactor Coolant System (Continued)

Aging Management Review (AMR) Item No.	Technical Bases for Changes
	not screen in for any cracking mechanisms (e.g., SCC, IASCC, fatigue or component overload). Therefore, consistent comments received by the EPRI MRP or Framatome on this matter, the staff deleted these AMR items in Appendix B.3 of the ISG.

Table 2-15 Deleted Aging Management Review Items From GALL-SLR Revision 0, Chapter V, Engineered Safety Features

Aging Management Review Item No.	Technical Bases for Changes
No aging management review items were deleted from Chapter V GALL-SLR Report, Revision 0.	

Table 2-16 Deleted Aging Management Review Items From GALL-SLR Revision 0, Chapter VI, Electrical Components

Aging Management Review Item No.	Technical Bases for Changes
No aging management review items were deleted from Chapter VI From GALL-SLR Report, Revision 0.	

Table 2-17 Deleted AMR Items, Chapter VII, Auxiliary Systems

Aging Management Review Item No.	Technical Bases for Changes
VII.G.AP-129a VII.G.AP-132a VII.G.AP-136a VII.G.AP-234a VII.H1.AP-129a VII.H1.AP-132a VII.H1.AP-136a VII.H1.AP-105a VII.H2.AP-129a VII.H2.AP-132a VII.H2.AP-136a VII.H2.AP-105a	The staff deleted some AMR items associated with AMP XI.M30, “Fuel Oil Chemistry,” that had become duplicative of other, modified AMR items. For example, item VII.G.AP-129 is being modified to remove XI.M32, "One-Time Inspection," and that modification made VII.G.AP-129 and VII.G.AP-129a identical. See the discussion in Table 2-24 on the AMR items modified to remove AMP XI.M32.

Table 2-18 Deleted Aging Management Review Items From GALL-SLR Revision 0, Chapter VIII, Steam and Power Conversion System

Aging Management Review Item No.	Technical Bases for Changes
No aging management review items were deleted from Chapter VIII of GALL-SLR Report, Revision 0	

Table 2-19 Changes to GALL-SLR Report, Revision 0, Chapter II Aging Management Review Items and Technical Bases

Aging Management Review Item No.	Technical Bases for Changes
II.A1.CP-147 II.A1.CP-67 II.A1.CP-102 II.A1.CP-34 II.A2.CP-70 II.A2.CP-104 II.A2.CP-53 II.A3.CP-37 II.B1.1.CP-49 II.B1.2.CP-99 II.B1.2.CP-110 II.B1.2.CP-57 II.B2.1.CP-107 II.B2.1.CP-142 II.B2.2.CP-99 II.B2.2.CP-110 II.B2.2.CP-57 II.B2.2.CP-64 II.B3.1.CP-53 II.B3.1.CP-83 II.B3.1.CP-65 II.B3.2.CP-135 II.B3.2.CP-121 II.B3.2.CP-122 II.B3.2.CP-108 II.B4.CP-37	Modifications to the GALL-SLR Report aging management review (AMR) items and Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants (SRP-SLR) Table 3.5-1 line items with associated further evaluations provide the option to use plant-specific enhancements to GALL-SLR Report AMP XI.S2, “ASME Section XI, Subsection IWL,” and/or GALL-SLR Report AMP XI.S6, “Structures Monitoring,” in lieu of a plant-specific AMP. The option to use plant-specific enhancements increases the efficiency of subsequent license renewal application reviews by limiting the use of AMR “Note E” designations for plant-specific aging management activities when aging effects are managed through a plant-specific AMP.
II.A3.CP-37 II.B1.1.CP-49 II.B2.1.CP-107 II.B4.CP-37	These GALL-SLR Report Vol. 1, Rev. 1, Table B.7, “Common Components,” AMR items, under column “Aging Management Program (AMP)/Time-Limited Aging Analyses (TLAA),” are revised to change the word “and” to “or” to make the wording for the AMR line items consistent with the corresponding description in the “detection of aging effects” program element of GALL-SLR AMP XI.S1 with regard to managing the aging effect of cracking due to cyclic loading (CLB fatigue analysis does not exist) for each of the components specified in the AMR item.

Table 2-20 Changes to GALL-SLR Report, Revision 0, Chapter III Aging Management Review Items and Technical Bases

Aging Management Review Item No.	Technical Bases for Changes
III.A1.TP-204 III.A1.TP-67 III.A1.TP-108 III.A1.TP-114 III.A2.TP-204 III.A2.TP-67 III.A2.TP-108 III.A2.TP-114 III.A3.TP-204 III.A3.TP-67 III.A3.TP-108 III.A3.TP-114 III.A4.TP-204 III.A4.TP-305 III.A4.TP-114 III.A4.T-35 III.A5.TP-204 III.A5.TP-67 III.A5.TP-108 III.A5.TP-114 III.A6.TP-220 III.A6.TP-110 III.A6.TP-109 III.A7.TP-204 III.A7.TP-67 III.A7.TP-108 III.A8.TP-204 III.A8.TP-67 III.A8.TP-108 III.A9.TP-204 III.A9.TP-67 III.A9.TP-108	Modifications to the GALL-SLR Report aging management review (AMR) items and Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants (SRP-SLR) Table 3.5-1 line items with associated further evaluations provide the option to use, in lieu of a plant-specific AMP, plant-specific enhancements to GALL-SLR Report AMP XI.S6, “Structures Monitoring,” or other selected AMPs. The option to use plant-specific enhancements increases the efficiency of subsequent license renewal applications reviews by limiting the use of AMR “Note E” to plant-specific aging management activities when aging effects are managed through a plant-specific AMP.

Table 2-21 Changes to GALL-SLR Report, Revision 0, Chapter IV Aging Management Review Items and Technical Bases

Aging Management Review (AMR) Item No.	Technical Bases for Changes
IV.B1.R-95 IV.B1.R-94 IV.B1.R-92 IV.B1.R-96 IV.B1.R-93 IV.B1.R-97 IV.B1.R-99 IV.B1.R-105 IV.B1.R-100 IV.B1.R-422 IV.B1.R-98	To reflect the deletion of Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants (SRP-SLR) Section 3.1.2.2.12.

Table 2-21 Changes to GALL-SLR Report, Revision 0, Chapter IV Aging Management Review Items and Technical Bases (Continued)

Aging Management Review (AMR) Item No.	Technical Bases for Changes
IV.B1.RP-182 IV.B1.RP-200 IV.B1.RP-219 IV.B1.RP-220 IV.B1.R-416 IV.B1.R-417 IV.B1.R-419	To reflect the deletion of SRP-SLR Section 3.1.2.2.13.
IV.B2.RP-301	The upper core plate alignment pins that are the subject of GALL-SLR Item IV.B2.RP-301 remain as “Existing Program” components for Westinghouse-design reactor vessel internal (RVI) management programs per Item W15 in Table 4-9 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222]. The “RP-301” item applies to management of cracking in the alignment pins. In Item W15 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222], the Electric Power Research Institute (EPRI) MRP only screened the upper core plate alignment pins in for stress corrosion cracking (SCC) as the applicable cracking mechanism. However, based on lessons learned from the staff’s processing of the Surry Subsequent License Renewal Application (SLRA) RVI gap analysis results, the staff confirmed that the applicant included fatigue as additional cracking mechanism for the core plate alignment pins (i.e., in addition to SCC) by referencing the assessment for the core plate alignment pins in Electric Power Research Institute's (EPRI’s) MRP-2018-022 report [EPRI 2018-TN9890]. The administrative edits of the IV.B2.RP-301 item and the cracking mechanisms cited for the “RP-301” item are consistent with the cracking mechanisms cited for the fuel alignment pins in the Surry SLRA.
IV.B2.RP-271 IV.B2.RP-272	The baffle-to-former bolts (which are the topic of the “RP-271” item for cracking effect and mechanism combinations and the “RP-272” item for non-cracking effect and mechanism combinations) remain as leading “Primary” category components for Westinghouse-design RVI management programs per Item W6 in Table 4-3 of the MRP-227, Revision 1-A report [NRC 2019-TN9222]. Based on lessons learned from the staff’s review of the RVI gap analysis in the Surry SLRA, the staff confirmed that the applicant screened the baffle-to-former bolts in for irradiation stress corrosion cracking (irradiation-assisted stress corrosion cracking [SCC] or irradiation-assisted stress corrosion cracking [IASCC]), fatigue, wear, neutron irradiation embrittlement (IE), void swelling (VS), and irradiation-enhanced stress relaxation or creep (ISR/IC) aging mechanisms, as cited consistent with the EPRI MRP’s 80-year Expert Panel assessment for the baffle-to-former bolts in EPRI’s MRP-2018-022 report [EPRI 2018-TN9890]. Loss of material due to wear was added to the RP-272 item based on the information in the Surry SLRA. The edited version of the “RP-271” item includes cracking due to IASCC and fatigue. The edited version of the “RP-272” item appropriately includes the IE, VS/distortion, ISR/IC and wear aging mechanisms.

Table 2-21 Changes to GALL-SLR Report, Revision 0, Chapter IV Aging Management Review Items and Technical Bases (Continued)

Aging Management Review (AMR) Item No.	Technical Bases for Changes
	The MRP-227, Revision 1-A Report [NRC 2019-TN9222] includes and adequately addresses accessibility criteria for specified “Primary,” “Expansion” or “Existing Program” components. Therefore, from a generic perspective, there is no need for the staff to reference or address accessibility criteria in any of the AMR line items for pressurized water reactor (PWR) reactor vessel internal (RVI) components in the SRP-SLR or GALL-SLR Reports, including the staff’s updates of GALL-SLR Items IV.B2.RP-271 and IV.B2.RP-272 in SLR-ISG-2021-01-PWRVI [NRC 2021-TN9958]. The change to include the parenthetical clause “(includes corner bolts)” in the updates of the “Structure and/or Component” column entries of the GALL-SLR Items IV.B2.RP-271 and IV.B2.RP-272 is based on the staff’s receipt and acceptance of EPRI MPR Comment #4 on SLR-ISG-PWRVI-2021-PWRVI, in which EPRI had clarified that the corner bolts are a subset of the baffle-to-former bolts. The change in the “RP-271” item to cite irradiation-assisted SCC as “IASCC” is strictly administrative edit to make the line item consistent with other GALL-SLR AMR line items that cite IASCC as a referenced mechanism.
IV.B2.RP-270 IV.B2.RP-270a	The baffle and former plates (which are the topic of the “RP-270a” item for cracking effect and mechanism combinations and the “RP-270” item for non-cracking effect and mechanism combinations) remain as leading “Primary” category components for Westinghouse-design RVI management programs per Item W7 in Table 4-3 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222]. The staff acknowledges that in Item W7 of Table 4-3 in the MRP-227, Revision 1-A Report [NRC 2019-TN9222], the EPRI MRP only screened the baffle and former plates for irradiation-assisted stress corrosion cracking (irradiation-assisted SCC or IASCC) and distortion (VS) as applicable mechanisms for the plates. However, based on lessons learned from the staff’s review of the RVI gap analysis in the Surry SLRA, the staff confirmed that the applicant screened the baffle and former plates in for IASCC, fatigue, neutron IE and VS aging mechanisms, as assessed with the EPRI MRP’s 80-year Expert Panel assessment of the plates in EPRI’s MRP-2018-022 report [EPRI 2018-TN9890]. Thus, the staff revised GALL-SLR Item IV.B2.RP-270 in the Interim Staff Guidance (ISG) to reference the applicable non-cracking effect and mechanism combinations cited for the plates in the Surry SLRA; similarly, the staff revised GALL-SLR Item IV.B2.RP-270a in the ISG to reference the cracking mechanisms cited for the plates in the Surry SLRA. The change in the “RP-270a” item to cite irradiation-assisted SCC as “IASCC” is strictly administrative edit to make the line item consistent with other GALL-SLR AMR line items that cite IASCC as a referenced mechanism.

Table 2-21 Changes to GALL-SLR Report, Revision 0, Chapter IV Aging Management Review Items and Technical Bases (Continued)

Aging Management Review (AMR) Item No.	Technical Bases for Changes
IV.B2.RP-275 IV.B2.RP-354	The baffle edge bolts (which are the topic of modified versions of the "RP-275" item for cracking effect and mechanism combinations and the "RP-354" item for non-cracking effect and mechanism combinations) remain as leading "Primary" category components for Westinghouse-design RVI management programs per Item W7 in Table 4-3 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222]. The staff acknowledges that, in EPRI MRP Comment #4 for these line items, EPRI commented that: "The modified text deleted 'all plants with baffle-edge bolts' and replaced it with 'corner bolts.' This is not correct. Corner bolts are a subset of baffle-former bolts, not baffle-edge bolts. Note that bracket bolts are a subset of baffle-edge bolts." The staff acknowledges that in Item W7 of Table 4-3 in the MRP-227, Revision 1-A Report [NRC 2019-TN9222], the EPRI MRP only screened the baffle edge bolts in for IASCC and distortion (VS) as applicable mechanisms for the bolts. However, based on lessons learned from the staff's review of the RVI gap analysis in the Surry SLRA, the staff confirmed that the applicant screened the baffle edge bolts in for IASCC, fatigue, wear, neutron IE, VS, and ISR/IC mechanisms, as referenced to the EPRI MRP's 80-year Expert Panel assessment of the baffle edge bolts in EPRI's MRP-2018-022 report [EPRI 2018-TN9890]. Thus, the staff revised GALL-SLR Item IV.B2.RP-354 in the ISG to reference the applicable non-cracking effect and mechanism combinations cited for the baffle edge bolts in the Surry SLRA; similarly, the staff revised GALL-SLR Item IV.B2.RP-275 in the ISG to reference the cracking mechanisms cited for the baffle edge bolts in the Surry SLRA. The staff also partially accepted EPRI's perspective in Comment #4 and agreed that the component descriptions for the "RP-275" and "RP-354" line items in the SLR-ISG-PWRVI-2021-PWRVI should not have been adjusted to include reference of corner bolts, as previously designated by a change of the component-specific parenthetical explanation in the line items "(corner bolts)". To resolve the EPRI comment, the staff administratively edited the GALL-SLR Items IV.B2.RP-275 and IV.B2.RP-354 by removing the parenthetical clause "(all plants with baffle edge bolts)" from the scope of the line items. Therefore, for the final ISG, the component descriptions in the "RP-275" and "RP-354" items now state: "Baffle-to-former assembly: baffle edge bolts."
IV.B2.RP-273 IV.B2.RP-274	The barrel-to-former bolts (which are the topic of the "RP-273" item for cracking effect and mechanism combinations and the "RP-274" item for non-cracking effect and mechanism combinations) remain as "Expansion" category components for Westinghouse-design RVI management programs per Item W6.1 in Table 4-6 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222]. The staff acknowledges that, in Item W6.1 of Table 4-6 in the MRP-227, Revision 1-A Report [NRC 2019-TN9222], the EPRI MRP only screened the barrel-to-former bolts in for IASCC, fatigue, neutron IE, VS, ISR/IC aging mechanisms. However, based on lessons learned from the staff's

Table 2-21 Changes to GALL-SLR Report, Revision 0, Chapter IV Aging Management Review Items and Technical Bases (Continued)

Aging Management Review (AMR) Item No.	Technical Bases for Changes
	review of the RVI gap analysis in the Surry SLRA, the staff confirmed that the applicant screened the barrel-to-former bolts in for wear as an additional aging mechanism for the bolts (i.e., in addition to IASCC, fatigue, IE, VS, and ISR/IC), as referenced to the EPRI MRP's 80-year Expert Panel assessment of the barrel-to-former bolts in EPRI's MRP-2018-022 report [EPRI 2018-TN9890]. Thus, the staff revised GALL-SLR Item IV.B2.RP-274 in the ISG to reference the applicable non-cracking effect and mechanism combinations cited (including loss of material due to wear) for the baffle edge bolts in the Surry SLRA; similarly, the staff revised GALL-SLR Item IV.B2.RP-273 in the ISG to reference the cracking mechanisms (i.e., IASCC and fatigue) cited for the barrel-to-former bolts in the Surry SLRA. The change in the "RP-273" item to cite irradiation-assisted SCC as "IASCC" is strictly administrative edit to make the line item consistent with other GALL-SLR AMR line items that cite IASCC as a referenced mechanism.
IV.B2.RP-292 IV.B2.RP-293	The bottom mounted instrumentation (BMI) column bodies (which is the topic of the "RP-293" Item for cracking effect and mechanism combinations and the "RP-292" Item for non-cracking effect and mechanism combinations) remains as the "Expansion" category component for Westinghouse-design RVI management programs per Item W2.2 in Table 4-6 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222]. The staff acknowledges that, in Item W2.2 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222], EPRI screened the BMI column bodies only in for fatigue and neutron IE aging mechanisms. However, based on lessons learned from the staff's review of the RVI gap analysis in the Surry SLRA, the staff confirmed that the applicant screened wear in as an additional aging mechanism for the BMI column bodies, as referenced to the EPRI MRP's 80-year Expert Panel assessment of the BMI column bodies in EPRI's MRP-2018-022 report [EPRI 2018-TN9890]. Thus, for the final ISG, the staff edited the GALL-SLR IV.B2.RP-293 to cite SCC and fatigue as the applicable cracking mechanisms for the BMI column bodies and modified the IV.B2.RP-292 to cite "loss or material due to wear" as an additional non-cracking effect and mechanism combination for the BMI column bodies (i.e., in addition to "loss of fracture toughness due to neutron irradiation embrittlement"). Based on the staff's response to and acceptance of EPRI MRP Comments #5 and #6 in Appendix H of SLR-ISG-2021-01-PWRVI [NRC 2021-TN9958], the staff confirmed that "IASCC" did not need to be included as a cited cracking mechanism for GALL-SLR Item IV.B2.RP-293 and that "changes in dimension due to void swelling or distortion" did not need to be included as a cited non-cracking effect and mechanism combination for GALL-SLR Item IV.B2.RP-292.

Table 2-21 Changes to GALL-SLR Report, Revision 0, Chapter IV Aging Management Review Items and Technical Bases (Continued)

Aging Management Review (AMR) Item No.	Technical Bases for Changes
IV.B2.RP-296	The guide plates (guide cards) in the control rod guide tube (CRGT) assemblies of Westinghouse-designed PWRs (which are the topic of the amended version of Item IV.B2.RP-296 for cited non-cracking effect and mechanism combinations) remain as leading “Primary” category components for Westinghouse-design RVI management programs per Item W1 in Table 4-3 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222]. The staff acknowledges that, in Item W1 of Table 4-3 in the MRP-227, Revision 1-A Report [NRC 2019-TN9222], the EPRI MRP screened the CRGT guide cards in only for the aging mechanism of wear, as based on relevant operating experience (OE) with wear occurring in the components. However, based on lessons learned from the staff’s review of the RVI gap analysis in the Surry SLRA, the staff confirmed that the applicant identified that the CRGT guide cards could also be susceptible to the aging mechanism of thermal embrittlement (TE) if the guide cards were fabricated from cast austenitic stainless steel materials (e.g., CF8 cast austenitic stainless steel [CASS] materials). Thus, for the final ISG, the revised the GALL-SLR IV.B2.RP-296 items were made to account for the lessons learned taken from the staff’s past processing of the Surry SLRA, as evaluated in the staff’s final safety evaluation report for the application (ADAMS Accession No. ML20052F523, dated March 9, 2020).
IV.B2.RP-297 IV.B2.RP-298	The lower flange welds (LFWs) in the peripheral CRGT assemblies of Westinghouse-designed PWRs (which are the topic of the amended ”RP-298” item for cited non-cracking effect and mechanism combinations and the “RP-297” item for cited non-cracking effect and mechanism combinations) remain as leading “Primary” category components for Westinghouse-design RVI management programs per Item W2 in Table 3 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222]. The LFWs in the remaining (non-peripheral) CRGT assemblies (which are the topics of the new GALL-SLR IV.B2.RP-297a and IV.B2.RP-298a Items) were identified as “Expansion” category components per Item W2.1 in Table 4-6 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222]. Based on the staff’s review of the RVI gap analysis for RVI components in the Surry SLRA, the staff confirmed that the applicant screened the CRGT LFWs in for SCC, IASCC, fatigue, and irradiation embrittle mechanisms, and additionally for thermal aging embrittlement if the components were made from cast austenitic stainless steel materials. Therefore, based on the EPRI MRP criteria for peripheral and non-peripheral CRGT LFWs in the MRP-227, Revision 1-A Report [NRC 2019-TN9222] and the lessons learned from the staff’s review of the Surry SLRA, the staff modified the GALL-SLR IV.B2.RP-297 and IV.B2.RP-298 items in the ISG to limit the scope of the line items only to those CRGT LFWs in the peripheral (outer) CRGT assemblies (as assigned as the appropriate “Primary” category components), with the updated of the “RP-298” item citing the applicable SCC, IASCC, and fatigue cracking mechanisms, and the updated of the “RP-297” appropriately citing the applicable loss of fracture toughness IE

Table 2-21 Changes to GALL-SLR Report, Revision 0, Chapter IV Aging Management Review Items and Technical Bases (Continued)

Aging Management Review (AMR) Item No.	Technical Bases for Changes
	mechanism, with TE also being applicable if the CRGT LFWs are made from CASS materials. Additionally, the MRP-227, Revision 1-A Report [NRC 2019-TN9222] adequately addresses accessibility of PWR RVI components. Therefore, from a generic perspective, there is no need for the staff to reference or address accessibility criteria in any of the AMR line items for PWR RVI components in the SRP-SLR or GALL-SLR Reports, including GALL-SLR Items IV.B2.RP-297 and IV.B2.RP-298.
IV.B2.RP-355	The prior version of the “RP-355” item in the GALL-SLR Report addressed cracking in the CRGT spilt pins independent of whether the spilt pins were made from stainless steel or nickel alloy materials; similarly, the prior version of the “RP-356” item addressed loss of material in Westinghouse-design CRGT split pins independent of whether the pins were made from stainless steel or nickel alloy materials. In the MRP-227, Revision 1-A Report [NRC 2019-TN9222], the EPRI MRP adjusted its aging management criteria for CRGT spilt pins to require aging management as “Existing Program” category components only if the pins were made from nickel alloy (X-750) materials, where the pins had not be replaced with pins made from either Type 316 or 316L austenitic SS materials and where aging management of the nickel alloy pins would need to be based on a component-specific evaluation of the pins. For replacement pins made from stainless steel 316 or 316L materials, EPRI placed the pins in the “No Additional Measures” category of the MRP-227, Revision 1-A Report [NRC 2019-TN9222] (Refer to GALL-SLR Item IV.B2.RP-265, as referenced in this SLR-ISG). The staff has amended SRP-SLR Table 3.1-1, Item 028 and the GALL-SLR “RP-355” and “RP-356” items to be consistent with the updated basis in MRP-227, Revision 1-A [NRC 2019-TN9222] for the components. This required: (1) restricting the scope of the “RP-355” item only to CRGT split pins made of nickel alloy (X-750) materials, (2) adding loss of material due to wear to the “RP-355” item, and (3) clarifying that the AMP XI.16A, “PWR Vessel Internals” basis would be based on a plant-specific evaluation of the pins. Since CRGT spilt pins made from Type 316 or Type 316L SS materials are now designated as EPRI MRP “No Additional Measures” components, the RP-356” item is no longer necessary for the scope of GALL-SLR AMR line items specified in SLR-ISG-2021-01-PWRVI [NRC 2021-TN9958]. Instead, license renewal (LR) or subsequent license renewal (SLR) applicants of Westinghouse-designed PWRs may now use GALL-SLR Item IV.B2.RP-265 (which is the generic GALL-SLR AMR item for Westinghouse-design “No Additional Measures components if the CRGT spilt pins are made from either Type 316 or 316L stainless steel material).
IV.B2.RP-345	The core barrel flanges in the core barrel assemblies of Westinghouse-designed PWRs (which are the topic of the amended version of Item IV.B2.RP-345 for managing loss of material due to wear in the flanges)

Table 2-21 Changes to GALL-SLR Report, Revision 0, Chapter IV Aging Management Review Items and Technical Bases (Continued)

Aging Management Review (AMR) Item No.	Technical Bases for Changes
	remain as "Existing Program" category components for Westinghouse-design RVI management programs per Item W10 in Table 4-9 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222]. Water Chemistry programs are not designed to monitor for loss of material that may be induced by a physical degradation mechanism, such as wear, erosion, or abrasion. Thus, the staff deleted reference of GALL-SLR AMP XI.M2, "Water Chemistry," from the "Aging Management Program (AMP)/TLAA" column entry in Item IV.B2.RP-345.
IV.B2.RP-280	The upper girth welds (UGWs), upper axial welds (UAWs), and lower flange welds (LFWs) in the core barrel assemblies of Westinghouse-designed PWRs (which are the topic of Item IV.B2.RP-280) are designated as "Expansion" category components for Westinghouse-design RVI management programs per Items W3.1, W3.2, and W3.3 in Table 4-6 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222]. Item IV.B2.RP-280 now addresses cracking in the core barrel assembly UGWs, UAWs, and LFWs. The inspections of these core barrel "Expansion" category welds are linked to the "Primary" inspections of the core barrel UFW per Item W3 in Table 4-3 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222]. The staff modified the "RP-280" Item in order to: (1) keep all of the core barrel "Expansion" category welds linked to EPRI MRP Item W3 in a singular AMR line item that addresses cracking of the components, including the core barrel UGW, UAWs, and LFW and (2) reflect the change in the inspection category for the components from "Primary" category (as previously indicated by the SRP Table 3.1-1, Item 053a reference in the line item) to "Expansion" category (as now indicated by the SRP-SLR Table 3.1-1, 053b reference in the line item). The staff also used lessons learned from the staff's processing of the Surry SLRA RVI gap analysis results for the cracking mechanisms cited in the "RP-280" line item. Specifically, in the RVI gap analysis of the Surry SLRA, the applicant cited EPRI's MRP-2018-022 [EPRI 2018-TN9890] Expert Panel process for these core barrel "Expansion" category welds and screened the core barrel assembly LFWs for SCC, irradiation-assisted SCC or IASCC, and fatigue cracking mechanisms and the core barrel assembly UAWs and UGWs in for SCC and fatigue cracking mechanisms. Thus, the staff also adjusted the GALL-SLR IV.B2.RP-280 item to cite SCC, IASCC, and fatigue as the applicable cracking mechanisms for the final version of the line item in the ISG. Based on the past review of the Surry SLRA RVI gap analysis results, the staff did not rely on EPRI's Comment #11 rationale that IASCC should not be cited as a referenced cracking mechanism for the core barrel LFWs.
IV.B2.RP-387 IV.B2.RP-388	The core barrel assembly lower girth welds (LGWs) (which are the topic of the "RP-387" item for cracking effects and the "RP-388" item for non-cracking effects) remain as "Primary" category components for Westinghouse-design RVI management programs per Item W4 in Table 4-

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	3 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222]. Item W4 in Table 4-3 does not include core barrel UGWs as components for the line item. Therefore, the staff removed the core barrel UGWs from the scope of the IV.B2.RP-387 and IV.B2.RP-388 line items. The staff also used lessons learned from the staff's processing of the Surry SLRA RVI gap analysis results for the cracking mechanisms cited in the "RP-387" Item and the non-cracking effect and mechanisms cited in the "RP-388" Item. Specifically, in the Surry SLRA, the applicant screened the core barrel assembly LGWs in for stress corrosion cracking (SCC), irradiation-assisted stress corrosion cracking (irradiation-assisted SCC or IASCC), fatigue, neutron IE, and void swelling aging mechanisms, by referencing the EPRI MRP's 80-year Expert Panel results for the components in MRP-2018-022 [EPRI 2018-TN9890]. However, the previous version of GALL-SLR Item IV.B2.RP-388 did not address void swelling in the LGWs. Thus, the staff added "changes in dimension due to void swelling or distortion" as an additional non-cracking effect and mechanism combination in the revised version of GALL-SLR Item IV.B2.RP-388, as updated in Appendix B.1 of the final ISG. Cracking of the core barrel assembly UGWs has been incorporated into and is now addressed by the staff's revision of GALL-SLR Item IV.B2.RP-280 in Appendix B.1 of the final ISG (refer to the staff's technical basis statement for the "RP-280" item on the previous page of this report table). Management of loss of fracture toughness due to neutron IE and changes in dimension due to void swelling or distortion in the UGWs is addressed by the staff's development of the new GALL-SLR IV.B2.RP-280a line item in Appendix B.1 of the ISG (refer to staff's technical basis statement for the new "RP-280a" Item as provided in the Table 2-7 Supplement of this report).
IV.B2.RP-387a IV.B2.RP-388a	The core barrel assembly middle vertical (axial) welds (MAWs) and lower vertical (axial) welds (LAWs) (which are the topic of the "RP-387a" Item for cracking effects and the "RP-388a" Item for non-cracking effects) are identified as "Expansion" category components for Westinghouse-design RVI management programs per Items W4.2 and W4.3 in Table 4-6 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222]. Therefore, to be consistent with the EPRI MRP's criteria in the W4.2 and W4.3 items, the staff modified GALL-SLR Items IV.B2.RP-387a and IV.B2.RP-388a to include both the core barrel MAWs and LAWs as the referenced core barrel assembly components cited in the line items. Based on lessons learned from the staff's review of the RVI gap analysis in the SLRA for Surry Nuclear Plant, Units 1 and 2, the past applicant screened the core barrel assembly MAWs and LAWs screened in for the aging mechanisms of SCC, irradiation-assisted SCC or IASCC, fatigue, IE, and VS, as referenced to in the EPRI MRP's 80-year Expert Panel assessment of the components in MRP-2018-022 [EPRI 2018-TN9890]. However, the previous version of the Item IV.B2.RP-388a did not address void swelling in the MAWs and LAWs. Therefore, the staff added "changes

Table 2-21 Changes to GALL-SLR Report, Revision 0, Chapter IV Aging Management Review Items and Technical Bases (Continued)

Aging Management Review (AMR) Item No.	Technical Bases for Changes
	in dimension due to void swelling or distortion" as an additional non-cracking effect and mechanism combination for the revised version of the "RP-388a" Item in Appendix B.1 of the final ISG.
IV.B2.RP-276	The core barrel assembly UFWs in Westinghouse-designed PWRs (which are the topic of the "RP-276 Item for cracking effects and mechanisms) remain as leading "Primary" category components for Westinghouse-design RVI management programs per Item W3 in Table 4-3 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222]. Based on lessons learned from the staff's review of the RVI gap analysis in the SLRA for Surry Nuclear Plant, Units 1 and 2, the staff confirmed that the past applicant screened the core barrel assembly UFWs in for the aging mechanisms of SCC and fatigue, as referenced to the EPRI MRP's 80-year Expert Panel assessment of the components in MRP-2018-022 [EPRI 2018-TN9890]. Therefore, the staff edited GALL-SLR Item IV.B2.RP-276 in the ISG to reference both of these cracking mechanisms.
IV.B2.RP-285 IV.B2.RP-399	The staff's update of the "RP-399" Item addresses cracking in the clevis insert components and the staff's update of the "RP-285" item addresses non-cracking effect and mechanisms in the clevis insert components. Specifically, the clevis insert assemblies and their components are treated by the EPRI MRP as applicable "Existing Program" components, as reflected in Item W14 of Table 4-9 in the MRP-227, Revision 1-A Report [NRC 2019-TN9222]; however, dowels were not included in the scope of Item W14. However, based on lessons learned from the staff's review of the RVI gap analysis in the SLRA for Surry Nuclear Plant, Units 1 and 2, the past applicant included three types of clevis insert assembly components would be inspected under the program, as linked to the EPRI MRP's 80-year Expert Panel assessment of the clevis insert assemblies in MRP-2018-022 [EPRI 2018-TN9890]: (1) clevis insert bolts or screws, (2) clevis insert dowels, and (3) clevis insert surfaces. The Surry SLRA gap analysis identified that the clevis insert components are either susceptible to SCC or fatigue (but not both) as an applicable cracking mechanisms. For purposes of this review, the staff is assuming that the clevis insert assembly components can be susceptible to either of the SCC or fatigue cracking mechanisms. The MRP-227, Revision 1-A [NRC 2019-TN9222] guidelines list the components as being made of nickel alloy materials, but the staff has conservatively included stainless steel in the "RP-285" and "RP-399" Items just in case a plant has specific clevis insert assembly components made from stainless steel. The design of a plant's clevis inserts may have had the nickel alloy base metal modified with an outer layer of stellite as a precaution for protecting the components against wear, so stellite has been added to the "RP-285" Item as a potential material for the clevis insert surfaces.

Table 2-21 Changes to GALL-SLR Report, Revision 0, Chapter IV Aging Management Review Items and Technical Bases (Continued)

Aging Management Review (AMR) Item No.	Technical Bases for Changes
	The staff's inclusion of "changes in dimension due to void swelling or distortion" in the final version of the GALL-SLR Item IV.B2.RP-285 is based on recently reported OE with distortion of a clevis insert assembly at the Ginna Nuclear Plant facility. Inclusion of "changes in dimension" in GALL-SLR Item IV.B2.RP-285 does not alter the EPRI MRP's basis for inspecting the clevis insert assemblies or their components in Item W14 of Table 4-9 in the MRP-227, Revision 1-A Report [NRC 2019-TN9222].
V.B2.RP-285	In the update of AMR Item IV.B2.RP-285 in SLR-ISG-2021-01-PWRVI [NRC 2021-TN9958], the staff cited the description of the material as "Stellite (for insert surfaces only)," which carried over into the version of Item IV.B2.RP-285 in Table IV.B2 of the NUREG-2191, Vol. 1, Rev. 1 (GALL-SLR, Vol. 1, Rev. 1) report. However, in this SLR-ISG, the staff also added Stellite as a new material for Table IX.C, "Use of Terms for Materials," (i.e., the material description table) in the GALL-SLR report to indicate that the material may be used as a wear resistant material. The staff revised this AMR to specify the materials as "Stellite (for insert wear surfaces only),"per the request of EPRI in a public comment.
IV.B2.RP-288 IV.B2.RP-289	The lower core plates (including XL types, which are the topic of the "RP-289" Item for cracking effects and the "RP-288" Item for non-cracking effects) remain as "Existing Program" category components for Westinghouse-design plants per Items W12a and W12b in Table 4-9 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222]. In the MRP-227, Revision 1-A Report [NRC 2019-TN9222], the EPRI MRP explained that the lower internals assemblies in Westinghouse-designed PWRs include either a normal sized lower core plate or an XL lower core plate for plants with 1.4-foot (ft) cores. The prior versions of the line items could have been interpreted that the lower internals assemblies of the plants included both types of core plates. The line items have been administratively edited to correct this. Based on lessons learned from the staff's review of the RVI gap analysis in the SLRA for Surry Nuclear Plant, Units 1 and 2, the staff confirmed that the applicant screened the lower core plate in for the aging mechanisms of IASCC, fatigue, wear, IE and VS, as linked to the EPRI MRP's 80-year Expert Panel assessment of the components in MRP-2018-022 [EPRI 2018-TN9890]. The revised version of GALL-SLR Item IV.B2.RP-288 in the ISG now includes both the IASCC and fatigue cracking mechanisms. The revised version of GALL-SLR Item IV.B2.RP-289 in the ISG now includes the aging effects associated with the wear, IE, and VS mechanisms.
IV.B2.RP-290a IV.B2.RP-291a	The lower support forging or casting in Westinghouse-designed PWRs (which are the topic of the RP-291a" Item for cracking effects and the "RP-290a" Item for non-cracking effects) remain as an "Expansion" category component for Westinghouse-design RVI management programs per Item W3.4 in Table 4-6 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222].

Table 2-21 Changes to GALL-SLR Report, Revision 0, Chapter IV Aging Management Review Items and Technical Bases (Continued)

Aging Management Review (AMR) Item No.	Technical Bases for Changes
	The previous versions of the “RP-290a” and “RP-291a” Items in the GALL-SLR Report reported that the lower support casting or forging was located in the lower support structure. However, the MRP-227, Revision 1-A Report [NRC 2019-TN9222] identifies that the lower support casting or forging is located in the lower internals assembly of the plants. The line items have been edited to reference the assembly cited for the components referenced in the MRP-227, Revision 1-A Report [NRC 2019-TN9222]. In item W3.4 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222], EPRI screened the lower support forging or casting in for SCC, and additionally for TE if the lower support was a casting made from CASS. In the gap analysis of the Surry SLRA, the staff confirmed that the applicant screened lower support forgings for the units in for both SCC and fatigue cracking mechanisms. The scope of GALL-SLR Item IV.B2.RP-291a in the ISG includes both the SCC and fatigue mechanisms. The scope of GALL-SLR Item IV.B2.RP-290a in the ISG is now limiting only to lower support castings made from CASS, with the applicable aging effect and mechanism combination being cited as “loss of fracture toughness due to thermal embrittlement.” Thus, the revised versions of the “RP-290a” and “RP-291a” Items are now consistent with Item W3.4 in the MRP-227, Revision 1-A Report [NRC 2019-TN9222], as adjusted in “RP-291a” for lessons learned obtained from the staff’s review of Surry SLRA.
IV.B2.RP-291 IV.B2.RP-294 IV.B2.RP-290 IV.B2.RP-295	The lower support column bodies (both cast on non-cast types) remain as “Expansion” category components for Westinghouse-design RVI management programs per Item W4.4 in Table 4-6 of the MRP227, Revision 1-A Report [NRC 2019-TN9222]. The staff acknowledges that in Item W4.4 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222], EPRI only screened the lower support column bodies in for a SCC mechanism, with TE being applicable if the column bodies were made from CASS. However, based on lessons learned obtained from the staff’s review of the past Surry SLRA, the staff confirmed that the Surry applicant screened the lower support column bodies in for the aging mechanisms of IASCC , fatigue, wear, IE, and VS, and additionally for TE if the components are fabricated from CASS. Thus, the staff used lessons learned from the past SLRA review as the main basis for the adjustments of GALL-SLR Items IV.B2.RP-291 and IV.B2.RP-294 and cited “cracking due to IASCC or fatigue” as the listed cracking effect and mechanisms for the AMR line items. The staff also used these lessons learned as the main basis for revising GALL-SLR Item IV.B2.RP-290 and cited the applicable non-cracking effect and mechanism combinations as “loss of fracture toughness due to thermal aging embrittlement and neutron irradiation embrittlement” and “changes in dimension due to void swelling or distortion” for the cast column body types. In a similar fashion, the staff used these lessons learned as the main basis for revising GALL-SLR Item IV.B2.RP-295 and

Table 2-21 Changes to GALL-SLR Report, Revision 0, Chapter IV Aging Management Review Items and Technical Bases (Continued)

Aging Management Review (AMR) Item No.	Technical Bases for Changes
	cited the applicable non-cracking effect and mechanism combinations as “loss of fracture toughness due to neutron irradiation embrittlement” and “changes in dimension due to void swelling or distortion” for the forged column body types.
IV.B2.RP-286 IV.B2.RP-287	The lower support column bolts located in the lower support assemblies of Westinghouse-designed PWRs (which are the topic of the “RP-286” Item for cracking effects and the “RP-287” Item for non-cracking effects) have been identified as “Expansion” category components for Westinghouse-design RVI management programs per Item W6.2 in Table 4-6 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222]. The existing version of the Item IV.B2.RP-286 in the GALL-SLR Report already addresses cracking due to IASCC or fatigue of the lower support column bolts and the staff’s edit of the item to cite the stress corrosion mechanism as “IASCC” is strictly an administrative change to make the item consistent with other AMR line items that cite IASCC as an applicable mechanism. In regard to the staff’s modification of GALL-SLR Item IV.B2.RP-287, the staff acknowledges that Item W6.2 of the MRP-227, Revision 1-A [NRC 2019-TN9222] Report only screened the lower support column bolts in for IASCC, fatigue, IE, and ISR/IC mechanisms. However, based on lessons learned obtained from the staff’s review of the past Surry SLRA, the staff confirmed that the past applicant screened the lower support column bolts in for wear and VS as additional aging mechanisms for the lower support column bolts. Thus, the staff used lessons learned from the SLRA review as the main basis for the modification of GALL-SLR Item IV.B2.RP-287 and, although the line item appropriately addressed IE and ISR/IC of the bolts, it did not address changes in dimension that could be induced by distortion or a VS mechanism or loss of material due to wear in the bolts. Therefore, the staff modified GALL-SLR Item IV.B2.RP-287 to include “changes in dimension due to void swelling or distortion” and “loss of material due to wear” as additional non-cracking effect and mechanism combinations for the line item.
IV.B2.RP-302	The thermal shield flexures located in the thermal shield assemblies of Westinghouse-designed reactors (which are the topic of the “RP-302” Item for cracking effects and the topic of the “RP-302a” Item for non-cracking effects) remain as “Primary” category components for Westinghouse-design RVI management programs per Item W9 in Table 4-3 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222]. Based on lessons learned from the staff’s review of the Surry SLRA gap analysis, the staff confirmed that the past applicant did not screen the thermal shield flexures in the Surry units for VS, IE, or ISR/IC, as assessed per EPRI’s 80-year Expert Panel analysis of the components in MRP-2018-022 [EPRI 2018-TN9890]. Specifically, the gap analysis

Table 2-21 Changes to GALL-SLR Report, Revision 0, Chapter IV Aging Management Review Items and Technical Bases (Continued)

Aging Management Review (AMR) Item No.	Technical Bases for Changes
	indicated that the projected 80-year fluence exposures of the thermal shield flexures are in a fluence zone lower than the threshold for screening the thermal shield flexures in for Surry's referenced irradiation mechanisms. The staff confirmed that the gap analysis did screen the thermal shield flexures in for the aging mechanisms of SCC, fatigue, and wear. Thus, the staff accepted EPRI's comment implications that the "RP-302" and "RP-302a" line Items for the thermal shield flexures should not include citation of irradiation-induced aging mechanisms. Based on these confirmations, the staff edited GALL-SLR Item IV.B2.RP-302 item to cite both SCC and fatigue as the applicable cracking mechanisms for the line item. Based on the staff's acceptance of the EPRI MRP Comment #18, the staff confirmed that GALL-SLR Item IV.B2.RP-302a did not need to be edited or modified in the ISG, as the existing version of the line item in GALL-SLR already addresses "loss of material due to wear" in the thermal shield flexures.
IV.B2.RP-290b IV.B2.RP-291b	The upper core plate in the upper internals assembly of Westinghouse-designed PWRs (which are the topic of the "RP-291b" item for cracking effects and the topic of the "RP-290b" item for non-cracking effects) remains as an "Expansion" category component for Westinghouse-design RVI management programs per Item W4.1 in Table 4-6 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222]. In Item W4.1 of the MRP-227, Revision 1-A Report, the EPRI MRP screened Westinghouse-design upper core plates in for fatigue, wear, and IE aging mechanisms. However, based on lessons learned obtained from the staff's review of the Surry SLRA, the staff confirmed that the applicant screened the upper core plates in the Surry units in for IASCC as an additional aging mechanism for the plates (i.e., in addition to fatigue, wear, and IE). Thus, the staff used MRP-227, Revision 1-A, as supplemented by lessons learned from the staff's past review of the Surry SLRA review, as the basis for adjusting GALL-SLR Items IV.B2.RP-290b and IV.B2.RP-291b in the final ISG. Therefore, for the staff's update of GALL-SLR Item IV.B2.RP-290b item, the staff added "loss of fracture toughness due to neutron irradiation embrittlement" as an additional non-cracking effect and mechanism combination for the line item (i.e., in addition to citation of "loss of material due to wear". Similarly, for the staff's update of GALL-SLR Item IV.B2.RP-291b, the staff added "IASCC" as an additional cracking mechanism for the line item (i.e., in addition to the reference of "fatigue" as an applicable cracking mechanism).
IV.B3.RP-312 IV.B3.RP-313	The instrument guide tubes in the peripheral (outer) control element assembly (CEA) shroud assemblies of Combustion Engineering (CE)-designed PWRs have been designated as "Primary" category components for CE-design RVI management programs per Item C11 in Table 4-2 of the report. The linked expansion components are the instrument guide tubes in the remaining (non-peripheral) CEA shrouds assemblies per Item

Table 2-21 Changes to GALL-SLR Report, Revision 0, Chapter IV Aging Management Review Items and Technical Bases (Continued)

Aging Management Review (AMR) Item No.	Technical Bases for Changes
	C11.1 in Table 4-6 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222]. Therefore, staff edited GALL-SLR Item IV.B3.RP-312 to clearly identify that the scope of the line item applies to management of cracking in the instrument guide tubes of the peripheral CEA shroud assemblies, as identified as EPRI "Primary" category in MRP-227, Revision 1-A. Similarly, the staff edited GALL-SLR Item IV.B3.RP-313 to clearly indicate that the scope of the line item applies to the management of cracking in the guide tubes of the remaining CEA shroud assemblies, as identified as "Expansion" category components in MRP-227, Revision 1-A. The "RP-312" and "RP-313" line items appropriately identifying the applicable effect and mechanism combination as "cracking due to SCC or fatigue."
IV.B3.RP-319 IV.B3.RP-320	The guide lugs in the core shroud assemblies and guide lug inserts and bolts in the upper internals assemblies of CE-designed PWRs (which are the topic of the "RP-320" item for cracking effects and the topic of the "RP-319" Item for non-cracking effects) remains as "Existing Program" category components for CE-design RVI management programs per Items C13 and C14 in Table 4-8 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222]. The core shroud/upper internals assembly lugs and lug inserts and bolts were screened in for fatigue, wear and ISR/IC in Table 3-2 of the MRP-227, Revision 1-A Report. The aging effect and mechanism combinations in amended versions of the "RP-319" and "RP-320" Items are consistent with those in the MRP-227, Revision 1-A basis, with the "RP-319" Item citing the non-cracking basis as "loss of material due to wear; loss of preload due to thermal and irradiation-enhanced stress relaxation or creep," and the "RP-320" Item citing the cracking basis as "cracking due to fatigue."
IV.B3.RP-358 IV.B3.RP-318	The GALL-SLR Items IV.B3.RP-358 and IV.B3.RP-318 apply to specific referenced components (including the core side surfaces, core shroud plates and plate joints, and core shroud bolts and locking devices) that are located in the core shroud assemblies of CE-designed PWRs that have bolted core shroud designs. The information in Item C4 in Table 4-2 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222] has designated the specified components as being "Primary" category components for CE-design RVI management programs. These core shroud assembly components were screened in for IASCC , VS, and neutron IE aging mechanisms per Table 3-2 of the MRP-227, Revision 1-A Report. To be consistent with this screening basis, the staff amended GALL-SLR Item RP-358, which addresses cracking due to IASCC in the specified components. The staff also amended the GALL-SLR Item IV.B3.RP-318, which addresses loss of fracture toughness due

Table 2-21 Changes to GALL-SLR Report, Revision 0, Chapter IV Aging Management Review Items and Technical Bases (Continued)

Aging Management Review (AMR) Item No.	Technical Bases for Changes
	to neutron IE and changes in dimension due to void swelling or distortion in the specified components. The change in the "RP-358" Item to cite irradiation-assisted SCC as "IASCC" is strictly administrative edit to make the line item consistent with other GALL-SLR AMR line items that cite IASCC as a referenced mechanism.
IV.B3.RP-316	Other than the minor adjustment of the "RP-316" Item, the existing versions of these line items are consistent with the EPRI MRP's criteria for barrel-shroud bolts in bolted CE core shroud assembly designs, as designated in Item C1.2 of Table 4-5 in the MRP-227, Revision 1-A Report [NRC 2019-TN9222]. In Item C1.2 of the MRP-227, Revision 1-A Report, EPRI MRP designate that the barrel-shroud bolts are "Expansion" category components for CE-design PWRs that have these types of bolted core shroud designs. The EPRI MRP screened the bolts in for IASCC, fatigue, neutron IE, and ISR/IC aging mechanisms. The staff's edit of GALL-SLR Item IV.B3.RP-316 in the ISG addresses cracking due to IASCC or fatigue in the barrel-shroud bolts and the existing version of the GALL-SLR Item IV.B3.RP-317 in NUREG-2191, Volume 1 addresses management of loss of fracture toughness due to neutron IE and loss of preload due to thermal ISR or creep in the barrel-shroud bolts.
IV.B3.RP-314 IV.B3.RP-315	The referenced core shroud bolts are the topic of the "RP-314" item for cracking effect and mechanism combinations and the "RP-315" Item for non-cracking effect and mechanism combinations. The referenced core shroud bolts remain as "Primary" category components for CE plants that have bolted core shroud designs, as designated in Item C1 of Table 4-2 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222]. In Table 3-2 of the MRP-227, Revision 1-A Report, EPRI screened the core shroud bolts in for IASCC, fatigue, neutron IE, VS, and ISR/IC aging mechanisms. Therefore, the staff amended GALL-SLR Item IV.B3.RP-314 to cite the aging effect and mechanism combination in the line item as "Cracking due to IASCC or fatigue" and GALL-SLR Item IV.B3.RP-315 to cite the aging effect and mechanism combinations in the line item as "loss of preload due to thermal and irradiation-enhanced stress relaxation or creep; loss of fracture toughness due to neutron IE; changes in dimension due to void swelling or distortion." The change in the "RP-315" Item to cite irradiation-assisted SCC mechanism as "IASCC" is strictly administrative edit to make the line item consistent with other GALL-SLR AMR line items that cite IASCC as a referenced mechanism.
IV.B3.RP-326	The core shroud assemblies referenced in GALL-SLR Item IV.B3.RP-326 apply to CE-designed plants whose core shrouds are welded in two

Table 2-21 Changes to GALL-SLR Report, Revision 0, Chapter IV Aging Management Review Items and Technical Bases (Continued)

Aging Management Review (AMR) Item No.	Technical Bases for Changes
	vertical shroud sections. These assemblies are the topic of the “RP-326” Item for referenced non-cracking effect and mechanism combinations. For CE-designed plants that are designed with this type of shroud assembly, the shroud assemblies (including the weld seams between the shroud segments) remain as “Primary” components for CE-design RVI management programs per Item C4a in Table 4-2 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222]. The existing version of the Item IV.B3.RP-326 in Table IV.B3 of NUREG-2191, Volume 1 (i.e., the GALL-SLR Report) included a parenthetical phrase in the “Structure and/or Component” column entry of the line that relates to the component accessibility and coverage criteria that apply to the components. However, these criteria are already adequately established and addressed in the MRP-227, Revision 1-A Report. As a result, there is no need to include such descriptions in the line items. Instead the staff edited parenthetical phrase in “Structure and/or Component” column entry of the line item to clarify used as the replacement phrases relate to the actual core shroud components that will be inspected in accordance with Item C4a of the MRP-227, Revision 1-A Report. In Item C4a of Table 4-2 of the MRP-227, Revision 1-A Report, the EPRI MRP only cited neutron IE and void swelling as listed aging mechanisms for these types of shroud assemblies. The “RP-326” Item continues to cite “loss of fracture toughness due to neutron IE; changes in dimension due to void swelling or distortion” as the applicable non-cracking effect and mechanism combinations for the shroud assembly components, which is consistent with non-cracking mechanisms cited for the components in the MRP-227, Revision 1-A Report.
IV.B3.RP-322 IV.B3.RP-359	The core shroud plate-to-former plate welds referenced in GALL-SLR Items IV.B3.RP-322 and IV.B3.RP-359 apply to CE-designed plants whose core shrouds are welded in two vertical shroud sections. These welds are the topic of the “RP-322” Item for cracking effect and mechanism combinations and the “RP-359” Item for non-cracking effect and mechanism combinations. For CE-designed PWRs whose core shrouds are designed and assembled with two vertical sections, the core shroud-plate-to-former plate welds remain as “Primary” components for the RVI management programs per Item C2 in Table 4-2 of the MRP-227, Revision 1-1 report. In Table 3-2 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222], the EPRI MRP screened the shroud plates and former plates (and their plate-to-plate welds) in for IASCC, neutron IE, and VS aging mechanisms. The staff revised GALL-SLR Items IV.B3.RP-322 and IV.B3.RP-359a to be consistent with the aging mechanisms cited for the core shroud plate-to-former plate welds in Item C2 of MRP-227, Revision 1-A, with the “RP-322” Item citing those associated with cracking of the welds (i.e., IASCC) and the “RP-359” Item citing those associated with the non-cracking effects (i.e., IE and VS/distortion) that are attributed to the welds.

Table 2-21 Changes to GALL-SLR Report, Revision 0, Chapter IV Aging Management Review Items and Technical Bases (Continued)

Aging Management Review (AMR) Item No.	Technical Bases for Changes
	The change in the “RP-322” Item to cite irradiation-assisted SCC mechanism as “IASCC” is strictly administrative edit to make the line item consistent with other GALL-SLR AMR line items that cite IASCC as a referenced mechanism.
IV.B3.RP-323 IV.B3.RP-359a	The “remaining“ core shroud axial welds referenced in the “RP-323” and “RP-359a” Items apply to CE-designed plants whose core shrouds are welded in two vertical shroud sections. These welds are the topic of the “RP-323” Item for cracking effect and mechanism combinations and the “RP-359a” Item for non-cracking effect and mechanism combinations. For CE-designed PWRs whose core shrouds are designed and assembled with two vertical sections, the referenced axial welds are identified as “Expansion” category components for the RVI management programs per Item C2.1 in Table 4-5 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222]. In Item C2.1 the EPRI MRP screened the remaining core shroud axial welds in for IASCC and neutron IE aging mechanisms. The staff revised GALL-SLR Items IV.B3.RP-323 and IV.B3.RP-359a to be consistent with the aging mechanisms cited for the remaining axial welds in Item C2.1 of MRP-227, Revision 1-A, with the “RP-322” citing those associated with cracking of the welds (i.e., IASCC) and the “RP-359” citing those associated with the non-cracking effects that are attributed to the welds (i.e., IE, but not VS or distortion). The change in the “RP-323” Item to cite irradiation-assisted SCC mechanism as “IASCC” is strictly administrative edit to make the line item consistent with other GALL-SLR AMR line items that cite IASCC as a referenced mechanism.
IV.B3.RP-325 IV.B3.RP-361	The “remaining“ core shroud axial welds and the core shroud ribs and rings referenced in GALL-SLR Items IV.B3.RP-325 and IV.B3.RP-361 apply to CE-designed plants whose core shrouds are fabricated from welded full height shroud plates. These components are the topic of the “RP-325” Item for cracking effect and mechanism combinations and the “RP-361” Item for non-cracking effect and mechanism combinations. For CE-designed PWRs with these types of core shroud designs, the referenced axial welds, ribs and rings are identified as “Expansion” category components for the RVI management programs per Item C3.1 or C3.2 in Table 4-5 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222]. In Items C3.1 and C3.2, the EPRI MRP screened the components in for IASCC and neutron IE aging mechanisms. The staff revised GALL-SLR Items IV.B3.RP-325 and IV.B3.RP-361 to be consistent with the collective set of components and aging mechanisms cited in Items C3.1 and C3.2 of MRP-227, Revision 1-A, with the “RP-325” citing those associated with cracking of the components (i.e., IASCC) and the “RP-361” citing those associated with the non-cracking effects that are attributed to the welds (i.e., IE).

Table 2-21 Changes to GALL-SLR Report, Revision 0, Chapter IV Aging Management Review Items and Technical Bases (Continued)

Aging Management Review (AMR) Item No.	Technical Bases for Changes
	The change in the “RP-325” Item to cite irradiation-assisted SCC mechanism as “IASCC” is strictly administrative edit to make the line item consistent with other GALL-SLR AMR line items that cite IASCC as a referenced mechanism.
IV.B3.RP-324 IV.B3.RP-360	The core shroud plates referenced in GALL-SLR Items IV.B3.RP-324 and IV.B3.RP-360 apply to Combustion Engineering (CE)-designed plants whose core shrouds are fabricated from welded full height shroud plates. These components are the topic of the “RP-324” Item for cracking effect and mechanism combinations and the “RP-360” Item for non-cracking effect and mechanism combinations. The referenced shroud plates are identified as “Primary” category components for the RVI management programs per Item C3 in Table 4-2 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222]. In Table 3-2 of the MRP-227, Revision 1-A Report, the EPRI MRP screened the shroud plates in for IASCC, IE, and VS aging mechanisms. The edited or modified versions of the “RP-324” and “RP-360” Items are consistent with the cited aging mechanisms, with “RP-324” citing those associated with cracking of the components (i.e., IASCC) and “RP-360” citing those associated with the non-cracking effects attributed to the components (i.e., IE and VS). This required the staff’s addition of “changes in dimension due to void swelling or distortion” as an additional non-cracking effect and mechanism combination for the “RP-360” Item. Additionally, for the “RP-324” Item, the previous inclusion of the phrase “at the core mid plane (+3 ft in height) as visible from the core side of the shroud” in the component description of the line item related to specific location and coverage criteria for the axial weld seams that were defined in the earlier MRP-227 Revision 1-A Report [NRC 2019-TN9222]. These criteria are no longer included in the updated guidelines in MRP-227, Revision 1-A Report [NRC 2019-TN9222]. As a result of this change in the MRP-227, Revision 1-A Report [NRC 2019-TN9222], the staff deleted this phrase from the scope of component description in the revised GALL-SLR IV.B3.RP-324 Item. The change in the “RP-324” Item to cite irradiation-assisted SCC mechanism as “IASCC” is strictly administrative edit to make the line item consistent with other GALL-SLR AMR line items that cite IASCC as a referenced mechanism.
IV.B3.RP-328	The core support barrel (CSB) assembly flexure weld cited in the modified version of GALL-SLR Item IV.B3.RP-328 applies to all CE-designed plants with welded core shroud assembly designs. The flexure welds are the topic of the “RP-328” item for cracking effect and mechanism combinations. In EPRI MRP Letter No. MRP 2020-012 (dated May 4, 2020), the EPRI MRP clarified that the CSB flexure weld in CE-designed plants was one of

Table 2-21 Changes to GALL-SLR Report, Revision 0, Chapter IV Aging Management Review Items and Technical Bases (Continued)

Aging Management Review (AMR) Item No.	Technical Bases for Changes
	two circumferential welds in the lower flange of the CSB assembly, with the flexure weld being identified as a "Primary" category component per Item C7 in Table 4-2 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222]. The EPRI MRP explained that the weld joins the CSB lower flange to a flexure in the lower support structure. In line item C7, the EPRI MRP cites fatigue and SCC as the applicable cracking mechanisms for the CSB flexure weld. The EPRI MRP also explained that the other circumferential weld adjoins the lower flange to the core support barrel and has been renamed and referenced as the CSB LGW in Item C5.1 of Table 4-5 of the MRP-227, Revision 1-A Report (in order to avoid confusion with the flexure weld). The CSB LGW was downgraded to the "Expansion" category for CE-designed plants and is now addressed by the staff's revision of GALL-SLR Item IV.B3.RP-333 for cracking mechanisms. The IE in the CSB LGW is now addressed by the new GALL-SLR Item IV.B2.RP-333a (refer to the technical basis statement for the "RP-333a" item in Table 2-7 of this report).. Since the "RP-328" Item is the GALL-SLR item that correlates to the applicable "Primary" category LFW component, the component for the RP-328" Item has been changed to reflect the CSB flexure weld as the applicable "Primary" category component for the line item. The revised version of GALL-SLR Item IV.B2.RP-328 continues to reference the applicable cracking mechanisms as "SCC" and "fatigue."
IV.B3.RP-362 IV.B3.RP-362a	The CSB middle girth welds (MGWs) cited in the modified versions of GALL-SLR Items IV.B3.RP-362 and IV.B3.RP-362a apply to all CE-designed plants. The MGWs are the topic of the "RP-362a" Item for cracking effect and mechanism combinations and the topic of the "RP-362" Item for non-cracking effect and mechanism combinations. The CSB MGWs have been identified as "Primary" category components per Item C6 in Table 4-2 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222]. In Item C6, the EPRI MRP screened the CSB MGWs in for SCC, IASCC, and neutron IE aging mechanisms. The staff modified GALL-SLR Items IV.B3RP-362 and IV.B3.RP-362a to cite the CSB MGWs as the applicable "Primary" category components for the line items and to reference the aging mechanisms cited in Item C6 of MRP-227, Revision 1-A, with "RP-362a" citing those associated with cracking of the MGWs (i.e., SCC and IASCC) and "RP-362" citing those associated with the non-cracking effects attributed to the components (IE). The change in the "RP-362a" Item to cite irradiation-assisted SCC mechanism as "IASCC" is strictly administrative edit to make the line item consistent with other GALL-SLR AMR line items that cite IASCC as a referenced mechanism.
IV.B3.RP-362b IV.B3.RP-362c	The CSB MAWs and LAWs cited in the modified versions of the "RP-362" and "RP-362a" Items apply to all CE-designed plants. The CSB MAWs

Table 2-21 Changes to GALL-SLR Report, Revision 0, Chapter IV Aging Management Review Items and Technical Bases (Continued)

Aging Management Review (AMR) Item No.	Technical Bases for Changes
	and LAWs are the topic of the “RP-362c” Item for cracking effect and mechanism combinations and the topic of the “RP-362b” Item for non-cracking effect and mechanism combinations. The CSB MAWs and LAWs have been identified as “Expansion” category components per Items C6.1 and C6.2 in Table 4-5 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222]. In Items C6.1 and C6.2 of the MRP-227, Revision 1-A Report, the EPRI MRP screened the CSB MAWs and LAWs in for SCC, IASCC, and neutron IE aging mechanisms. However, the prior versions of the “RP-362b” and RP-362c” Items did not include the MAWs. Therefore, the staff modified GALL-SLR Items IV.B3.RP-362b and IV.B3.RP-362c to cite the CSB MAWs and LAWs as the applicable “Primary” category components for the line items and to reference the aging mechanisms cited in Items C6.1 and C6.2 of MRP-227, Revision 1-A, with “RP-362c” citing those associated with cracking of the components (i.e., SCC and IASCC) and “RP-362b” citing those associated with the non-cracking effects attributed to the components (i.e., IE). The change in the “RP-362c” Item to cite irradiation-assisted SCC mechanism as “IASCC” is strictly administrative edit to make the line item consistent with other GALL-SLR AMR line items that cite IASCC as a referenced mechanism.
IV.B3.RP-333	The CSB LGW cited in the “RP-333” Item applies to all CE-designed plants. The LGW is the topic of the “RP-333” Item for cited cracking effect and mechanisms combinations. In EPRI’s MRP-2020-012 letter (dated May 4, 2020), EPRI clarified that this girth weld is the CE-design circumferential weld that adjoins the CSB lower flange to the CSB. The EPRI MRP confirmed that the weld is an “Expansion” component per Item C5.1 in Table 4-5 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222]. In Item C5.1, EPRI MRP cited that the CSB LGW is susceptible to SCC and fatigue aging mechanisms. However, in EPRI’s response to request for additional information (RAI) 26 on MRP-227, Revision 1 dated October 16, 2017 (ADAMS Accession No. ML17305A056), the EPRI MRP clarified that the referenced CSB LGW is also susceptible to IASCC and neutron IE as additional aging mechanisms for the weld (i.e., in addition to SCC and fatigue). Thus the staff modified the scope of GALL-SLR Item IV.B3.RP-333 to cite the CSB LGW (LFW) that is referenced in Item C5.1 of the MRP-227, Revision 1-A Report and to reference the cracking mechanisms (i.e., SCC, IASCC and fatigue) referenced for CSB LGWs in EPRI Letter of October 16, 2017. Management of the remaining aging effect and mechanism combination (i.e., loss of fracture toughness due to neutron irradiation embrittlement) in the CSB LGW is being address by the development of a new line item, GALL-SLR Item IV.B3.RP-333a (Refer to the technical basis for the new

Table 2-21 Changes to GALL-SLR Report, Revision 0, Chapter IV Aging Management Review Items and Technical Bases (Continued)

Aging Management Review (AMR) Item No.	Technical Bases for Changes
	"RP-333a" line in the NUREG-2221, Table 2-14 Supplement of this report).
IV.B3.RP-332	The CSB assembly upper flange cited in the edited version of GALL-SLR Item IV.B3.RP-332 applies to all CE-designed plants. The CSB upper flange is the topic of the "RP-332" Item for cited non-cracking effect and mechanism combinations. The CSB upper flange remains as an "Existing Program" category component for CE-design RVI management programs per Item C16 in Table 4-8 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222]. In Table 4-8 of the report, the EPRI MRP screened the CSB upper flange in for wear as the applicable aging mechanism of concern. The staff's change to GALL-SLR Item IV.B3.RP-332 is a simple administrative change to make the component description consistent with Item C16 in Table 4-8 of the MRP-227, Revision 1-A Report, and the line item remains consistent with aging mechanism basis in Item C16 by citing the applicable aging effect and mechanism combination as "loss of material due to wear."
IV.B3.RP-327	The CSB UFW cited in the edited version of GALL-SLR Item IV.B3.RP-327 applies to all CE-designed plants. The CSB UFW is the topic of the "RP-332" Item for cited cracking effect and mechanism combinations. The CSB UFW is identified as a "Primary" category component for CE-design RVI management programs per Item C5 in Table 4-2 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222]. In Table 3-2 of the MRP-227, Revision 1-A Report, the EPRI MRP screened the UFW in for SCC and wear aging mechanisms. The staff's change to GALL-SLR Item IV.B3.RP-327 is a simple administrative change to make the component description consistent with Item C5 in Table 4-2 of the MRP-227, Revision 1-A Report, and the line item remains consistent with aging mechanism basis in Item C5 by citing the applicable aging effect and mechanism combination as "cracking due to SCC." Management of loss of material due to wear in the CSB UFW is adequately addressed in GALL-SLR Item IV.B3.RP-332 and by implementation of the EPRI MRP's "Existing Program" protocols for inspecting the upper flange containing the welds for evidence of wear, as defined in Item C16 in Table 4-8 of the MRP-227, Revision 1-A Report. Refer to the technical basis statement for edits to GALL-SLR Item IV.B3.RP-332 described above in this technical basis statement table.
IV.B3.RP-329 IV.B3.RP-455	The CSB assembly UGW and UAWs cited in GALL-SLR Items IV.B3.RP-329 and IV.B3.RP-455 apply to all CE-designed plants. The CSB UGW and UAWs are the topic of the "RP-329" Item for cited cracking effect and mechanism combinations and the "R-455" Item for cited non-cracking effect and mechanism combinations. The CSB UGW and UAWs are identified as "Expansion" category components for CE-design RVI management programs per Items C5.2

Table 2-21 Changes to GALL-SLR Report, Revision 0, Chapter IV Aging Management Review Items and Technical Bases (Continued)

Aging Management Review (AMR) Item No.	Technical Bases for Changes
	and C5.3 in Table 4-5 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222]. In Table 4-5 of the MRP-227, Revision 1-A Report, the EPRI MRP screened the CSB UGWs and UAWs in for SCC and neutron IE aging mechanisms. The staff modified the component descriptions in GALL-SLR Items IV.B3.RP-329 and IV.B3.RP-455 to be consistent with the component descriptions in Items C5.2 and C5.3 of Table 4-5 in the MRP-227, Revision 1-A Report. The modified version of GALL-SLR Item IV.B3.RP-329 continues to cite the applicable aging effect and mechanism as "cracking due to SCC and the modified version of GALL-SLR Item IV.B3.RP-455 continues to cite the applicable non-cracking effect and mechanism as "loss of fracture toughness due to neutron irradiation embrittlement."
IV.B3.RP-357	The incore instrumentation (ICI) thimble tubes cited in GALL-SLR Item IV.B3.RP-357 apply to all CE-designed plants. The ICI thimble tubes are the topic of the "RP-357" Item for loss of material due wear. For the SLR-ISG-2021-01-PWRVI [NRC 2021-TN9958] updates, the staff decided to break the SRP-SLR line item reference for CE-designed ICI thimble tubes out of SRP-SLR Table 3.1-1, Item 028 in order to decouple the mixing Westinghouse-designated components (i.e., CRGT support pins [split pins]) and CE-designated components in the same SRP-SLR Item. The ICI thimble tubes (which were previously referenced in the SRP-SLR Table 3.1-1 028 Item) are referenced in the MRP-227, Revision 1-A Report [NRC 2019-TN9222]. Specifically, in Table 3-2 (page 3-26) of the MRP-227, Revision 1-A Report, the EPRI MRP designates that the ICI thimble tubes (lower) are "Existing Program" components for CE-design RVI management programs. Therefore, the staff realigned reference of the "RP-357" Item out of SRP-SLR Table 3.1-1, Item 028, and into SRP-SLR Table 3.1-1, Item 056c. This also resulted in the need for the staff to edit and re-align the SRP-SLR Table 3.1-1 item reference in GALL-SLR Item IV.B3.RP-357 as "3.1-1, 056c" in order to ensure appropriate cross linking with SRP-SLR Table 3.1-1, Item 056c.
IV.B3.RP-363 IV.B3.RP-364	The core support columns cited in GALL-SLR Items IV.B3.RP-363 and IV.B3.RP-364 apply to all CE-designed plants that are designed with full height bolted core shroud assemblies or half height welded core shroud assemblies (i.e., shroud assemblies assembled from two vertical sections). The core support columns are the topic of the "RP-363" Item for cracking effect and mechanism combinations and the "RP-364" Item for non-cracking effect and mechanism combinations. The core support columns in these CE plant designs are identified as "Expansion" category components for the RVI management programs per Item C6.3 in Table 4-5 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222]. In Table 3-2 of the MRP-227, Revision 1-A Report, the EPRI MRP screened the core support columns in for SCC, IASCC, fatigue, and

Table 2-21 Changes to GALL-SLR Report, Revision 0, Chapter IV Aging Management Review Items and Technical Bases (Continued)

Aging Management Review (AMR) Item No.	Technical Bases for Changes
	neutron IE aging mechanisms, and additionally for TE if the components were fabricated from CASS. The staff's modified version of GALL-SLR Item IV.B3.RP-363 is consistent with the cited cracking mechanism basis by citing the applicable aging effect and mechanism combination as "cracking due to SCC, IASCC, or fatigue." The staff's modified version of GALL-SLR Item IV.B3.RP-364 is consistent with the cited non-cracking mechanism basis by citing the applicable aging effect and mechanism combination as "Loss of fracture toughness due to neutron irradiation and thermal embrittlement (TE for CASS materials only)." The change in the "RP-363" Item to cite irradiation-assisted SCC mechanism as "IASCC" is strictly administrative edit to make the line item consistent with other GALL-SLR AMR line items that cite IASCC as a referenced mechanism.
IV.B3.RP-334 IV.B3.RP-336	The fuel alignment pins referenced in GALL-SLR Item IV.B3.RP-334 apply to CE-designed plants with welded core shroud assemblies that are assembled from two vertical sections and address cracking in the pins. The fuel alignment pins referenced in the modified version of GALL-SLR Item IV.B3.RP-336 apply to all CE-designed plants with welded core shrouds that are fabricated from two vertical sections or with core shrouds that are fabricated from full height shroud plates, and address non-cracking effect and mechanism combinations in the pins. The fuel alignment pins in these plant designs are identified as "Existing Program" category components for CE-design RVI management programs per Item C15a or C15b in Table 4-8 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222]. In Table 4-8, the EPRI MRP screened the fuel alignment pins in for the following aging mechanisms: (1) for those in CE plants with core shrouds assembled from full height plates, SCCIASCC, fatigue, IE, and ISR/IC and (2) for those in CE plants with welded core shrouds assembled from two vertical sections, wear, IE, and ISR/IC. The staff's edited version of GALL-SLR Item-334 is consistent with the cited cracking mechanism basis by citing the applicable aging effect and mechanism combination as "cracking due to SCC, IASCC, or fatigue." The change in the "RP-334" Item to cite the irradiation SCC mechanisms as "IASCC" is strictly an administrative change. The staff's modified version of GALL-SLR Item-336 is consistent with the cited non-cracking mechanism basis by citing the applicable aging effect and mechanism combinations as "loss of material due to wear; loss of fracture toughness due to neutron irradiation embrittlement; loss of preload due to thermal and irradiation-enhanced stress relaxation or creep." The scope of the staff's modification of GALL-SLR Item IV.B3.RP-336 incorporates the fuel alignment pins previously in the scope of GALL-SLR Item IV.B3.RP334a, which was deleted in the ISG.

Table 2-21 Changes to GALL-SLR Report, Revision 0, Chapter IV Aging Management Review Items and Technical Bases (Continued)

Aging Management Review (AMR) Item No.	Technical Bases for Changes
IV.B3.RP-335	The lower core support beams cited in the modified version of the "RP-335" item apply to all CE-designed PWRs, except for those with core shroud assembles assembled from full height shroud plates. The lower core support beams are the topic of the "RP-335" Item for cracking effect and mechanism combinations. The lower core support beams in these plant designs have been identified as "Expansion" category components for CE-design RVI management programs per Item C5.4 in Table 4-5 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222]. In Table 4-5 of the MRP-227, Revision 1-A Report, the EPRI MRP screened the lower core support beams in for SCC and fatigue. The edited version of the "RP-335" Item is consistent with the cited cracking mechanism basis by citing the applicable aging effect and mechanism combination as "cracking due to SCC or fatigue."
IV.B3.RP-343 IV.B3.RP-365	The core support plates cited in the edited versions of the "RP-343" and "RP-365" Items apply to all CE-designed PWRs whose plant designs include core support plates in the lower support structure of the reactor. The core support plates are the topic of the "RP-343" Item for cracking effect and mechanism combinations and the "RP-365" Item for non-cracking effect and mechanism combinations. The core support plates in these plant designs have been identified as "Primary" category components for CE-design RVI management programs per Item C9 in Table 4-2 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222]. In Table 4-2 of the MRP-227, Revision 1-A Report, the EPRI MRP screened the core support plates in for fatigue and neutron IE aging mechanisms. The edited version of the "RP-343" Item is consistent with the cited cracking mechanism basis and the edited version of the "RP-365" item is consistent with the "IE" mechanism basis.
IV.B3.RP-342 IV.B3.RP-366	The deep beams cited in the edited versions of the "RP-342" and "RP-366" Items apply to those CE-designed PWRs that have welded core shrouds made from full height shroud plates. The deep beams are the topic of the "RP-342" Item for cracking effect and mechanism combinations and the "RP-366" Item for non-cracking effect and mechanism combinations. The deep beams in these plant designs have been identified as "Primary" category components for CE-design RVI management programs per Item C12 in Table 4-2 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222]. In Table 3-2 of the MRP-227, Revision 1-A Report, the EPRI MRP screened the deep beams in for SCC, IASCC, fatigue and neutron IE aging mechanisms. The edited version of the "RP-342" Item is consistent with the cited cracking mechanism basis and the edited version of the "RP-366" Item is consistent with the "IE" mechanism basis.
IV.B3.RP-330 IV.B3.RP-331	As clarified in EPRI MRP Letter No. MRP 2020-012 (dated May 4, 2020), the core support column bolts cited in the "RP-330" and "RP-331" Items only apply to the reactor internals design at the Palisades Nuclear Power Plant. The core support column bolts are the topic of the "RP-330" Item for

Table 2-21 Changes to GALL-SLR Report, Revision 0, Chapter IV Aging Management Review Items and Technical Bases (Continued)

Aging Management Review (AMR) Item No.	Technical Bases for Changes
	cracking effect and mechanism combinations and the “RP-331” Item for non-cracking effect and mechanism combinations. The core support column bolts at Palisades have been identified as “Expansion” category components for CE-design RVI management programs per Item C1.1 in Table 4-5 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222]. In Table 4-5 of the MRP-227, Revision 1-A Report, the EPRI MRP screened the core support column bolts in for IASCC, fatigue and neutron IE aging mechanisms. The edited version of the “RP-330” Item is consistent with the cited cracking mechanism basis and the edited version of the “RP-331” Item is consistent with the “IE” mechanism basis.
IV.B3.RP-338	The fuel alignment plates cited in the “RP-338” Item apply to all CE-designed PWRs with welded core shrouds made from full height shroud plates. The fuel alignment plates are the topic of the “RP-338” Item for cracking effect and mechanism combinations (a new item, GALL-SLR Item IV.B3.RP-338a, has been developed to address non-cracking effect and mechanism combinations that apply to the fuel alignment plates). The fuel alignment plates in these plant designs have been identified as “Primary” category components for CE-design RVI management programs per Item C10 in Table 4-2 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222]. In Item C10 of Table 4-2 of the MRP-227, Revision 1-A Report, the EPRI MRP screened the fuel alignment plates in for fatigue and neutron IE aging mechanisms. The edited version of the “RP-338” Item is consistent with the cited cracking mechanism basis and the new “RP-338a” Item is consistent with the “IE” mechanism basis.
IV.B4.RP-245	The surveillance specimen holder tube (SSHT) bolts/studs cited in the “RP-245” Item and the associated bolt locking devices cited in the “RP-245a” and “RP-245b” Items only apply to the Davis-Besse Nuclear Plant. The SSHT bolts/studs are the subject of the “RP-245” Item for cracking effect and mechanism combinations. The SSHT bolt locking devices are the subject of the “RP-245a” Item for cracking effect and mechanism combinations and the “RP-245b” Item for non-cracking effect and mechanism combinations. The SSHT bolts/studs, and locking devices, remain as “Expansion” category components for the RVI program of the Davis-Besse plant per Item B7.2 in Table 4-4 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222]. The line item does not list “nuts” as a component subject to aging management. In the “B7.2” item, the EPRI MRP screened the SSHT bolts/studs in for SCC, fatigue, wear, and ISR/IC aging mechanisms, and the associated locking devices in for fatigue and wear mechanisms. The modified version of the “RP-245” Item is consistent cited cracking mechanisms of SCC and fatigue. The existing versions of the “RP-245a” and “RP-245b” Items are consistent with the identification of fatigue and wear as applicable mechanisms for the locking devices.

Table 2-21 Changes to GALL-SLR Report, Revision 0, Chapter IV Aging Management Review Items and Technical Bases (Continued)

Aging Management Review (AMR) Item No.	Technical Bases for Changes
	Loss of material due to wear and loss of preload in the SSHT bolts/studs are addressed by the new GALL-SLR Item IV.B4.RP-245c (refer to the Appendix B.9 entry for the "RP-245c" Item).
IV.B4.RP-247	The lower core barrel (LCB) bolts cited in the "RP-247" Item and the associated bolt locking devices cited in the "RP-247a" and "RP-247b" Items apply to all Babcock and Wilcox (B&W)-designed PWRs. The LCB bolts are the subject of the "RP-247" Item for cracking effect and mechanism combinations. The LCB bolt locking devices are the subject of the "RP-247a" Item for cracking effect and mechanism combinations and the "RP-247b" Item for non-cracking effect and mechanism combinations. The LCB bolts and LCB bolt locking devices remain as "Primary" category components for the B&W-design RVI management programs per Item B8 in Table 4-1 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222]. In the "B8" Item, the EPRI MRP screened the LCB bolts in for SCC, fatigue, wear, and ISR/IC aging mechanisms, and the associated locking devices in for fatigue and wear mechanisms. The modified version of the "RP-247" Item is consistent cited cracking mechanisms of SCC and fatigue. The staff deleted "LCB bolt locking devices" from the scope of the "RP-247" because they are already within the scope of the AMRs in the "RP-247a" and "RP-247b" Items. The existing versions of the "RP-247a" and "RP-247b" Items for the LCB bolt locking devices are consistent with the identification of fatigue and wear as applicable mechanisms for the components. Loss of material due to wear and loss of preload in the LCB bolts are addressed by the new GALL-SLR Item IV.B4.RP-247c (refer to the SLR-ISG-2021-01-PWRVI [NRC 2021-TN9958] Appendix B.9 technical basis entry for the new "RP-247c" Item).
IV.B4.RP-240 IV.B4.RP-241	The baffle-to-former bolts cited in the modified "RP-240" and "RP-241" Items apply to all B&W-designed PWRs. The baffle-to-former bolts are the subject of the "RP-241" Item for cracking effect and mechanism combinations and the "RP-240" Item for non-cracking effect and mechanism combinations. The baffle-to-former bolts remain as "Primary" category components for the B&W-design RVI management programs per Item B9 in Table 4-1 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222]. In the "B9" Item, the EPRI MRP screened the baffle-to-former bolts in for IASCC, fatigue, overload, wear, IE, and ISR/IC aging mechanisms. The modified "RP-241" Item is consistent with the citing of the applicable cracking mechanisms of IASCC, overload, and fatigue and the modified "RP-240" Item is consistent with the citing of the applicable non-cracking mechanisms of wear, IE, and ISR/IC. Screws do not need to be referenced in the modified versions of the line items because the terminology is considered to be somewhat redundant with the referencing of bolts in the line items.

Table 2-21 Changes to GALL-SLR Report, Revision 0, Chapter IV Aging Management Review Items and Technical Bases (Continued)

Aging Management Review (AMR) Item No.	Technical Bases for Changes
IV.B4.RP-243 IV.B4.RP-244	The baffle-to-baffle bolts and core barrel-to-former bolts cited in the edited versions of the “RP-243” and “RP-244” Items apply to all B&W-designed PWRs. The baffle-to-baffle bolts and the core barrel-to-former bolts are the subject of the “RP-244” Item for cracking effect and mechanism combinations and the “RP-243” Item for non-cracking effect and mechanism combinations. The baffle-to-baffle bolts and core barrel-to-former bolts remain as “Expansion” category components for the B&W-design RVI management programs per Items B9.1 and B9.2 in Table 4-4 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222]. In the “B9.1” and “B9.2” Items, the EPRI MRP screened the bolts for IASCC, neutron IE, fatigue, overload, wear, and ISR/IC aging mechanisms. The edited version of the “RP-244” Item is consistent with the cited cracking mechanisms of IASCC, fatigue, and overload. The edited version of the “RP-243” Item is consistent with the cited non-cracking mechanisms of IE, wear, and ISR/IC. Item “B9.1” in Table 4-4 of the MRP-227, Revision 1-A Report already adequately defines and differentiates between “Expansion”-based aging management criteria for external baffle-to-baffle bolts from those established for internal baffle-to-baffle bolts. Therefore, there is no need to differentiate external baffle-to-baffle bolt types from internal baffle-to-baffle bolt types in the “RP-243” and “RP-244” line Items.
IV.B4.RP-240a IV.B4.RP-241a	The locking devices (including locking welds) for baffle-to-former bolts and internal baffle-to-baffle bolts cited in the edited or modified versions of the “RP-240a” and “RP-241a” Items apply to all B&W-designed PWRs. The locking devices are the subject of the “RP-241a” Item for cracking effect and mechanism combinations and the “RP-240a” Item for non-cracking effect and mechanism combinations. The cited locking devices are identified as “Primary” category components for the B&W-design RVI management programs per Item B11 in Table 4-1 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222]. In the “B11” item, the EPRI MRP screened the locking devices in for IASCC and neutron IE aging mechanisms. The edited version of the “RP-241a” Item is consistent with the cited IASCC mechanism and the edited version of the “RP-240a” Item is consistent with the cited IE mechanism.
IV.B4.RP-243a	The locking devices (including locking welds) for external baffle-to-baffle bolts and core barrel-to-former bolts cited in the edited/modified versions of the “RP-243a” Item apply to all B&W-designed PWRs. The locking devices are the subject of the “RP-243a” Item for non-cracking effect and mechanism combinations. The cited locking devices are identified as “Expansion” category components for the B&W-design RVI management programs per Item B11.1 in Table 4-4 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222]. In the “B11.1” Item, the EPRI MRP screened the locking devices in for the neutron IE aging mechanism. The modifications of the “RP-243a”

Table 2-21 Changes to GALL-SLR Report, Revision 0, Chapter IV Aging Management Review Items and Technical Bases (Continued)

Aging Management Review (AMR) Item No.	Technical Bases for Changes
	line make the GALL-SLR item consistent with Item B11.1 in Table 4-4 of MRP-227, Revision 1-A.
IV.B4.RP-248	The UCB bolts cited in the “RP-248” Item and the associated bolt locking devices cited in the “RP-248a” and “RP-248b” Items apply to all B&W-designed PWRs. The UCB bolts are the subject of the “RP-248” Item for cracking effect and mechanism combinations. The UCB bolt locking devices are the subject of the “RP-248a” Item for cracking effect and mechanism combinations and the “RP-248b” Item for non-cracking effect and mechanism combinations. The UCB bolts and UCB bolt locking devices remain as “Primary” category components for the B&W-design RVI management programs per Item B7 in Table 4-1 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222]. In the “B7” Item, the EPRI MRP screened the UCB bolts in for SCC and additionally for fatigue if the bolts had yet to be replaced at the plants. The EPRI MRP screened the corresponding UCB bolt locking devices in for fatigue and wear mechanisms. For simplicity, the modified version of the “RP-248” Item assumes that SCC and fatigue apply generically, regardless of whether the UCB bolts have been replaced at the facility. The staff deleted “UCB bolt locking devices” from the scope of the “RP-248” because they are already within the scope of the AMRs in the “RP-248a” and “RP-248b” Items. The existing versions of the “RP-248a” and “RP-248b” Items for the UCB bolt locking devices are consistent with the identification of fatigue and wear as applicable mechanisms for the components.
IV.B4.RP-252	The vent valve assembly top and bottom retaining rings cited in the “RP-252” Item applies to all Babcock and Wilcox (B&W)-designed PWRs. The vent valve assembly top and bottom retaining rings are identified as “Primary” category components for B&W-design RVI management programs per Items B3.a and B3.b in Table 4-1 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222]. In the “B3.a” and “B3.b” Items, the EPRI MRP screened the retaining rings in for TE as the applicable aging mechanism. The existing version of the “RP-252” Item is consistent with the component nomenclature and citing of TE as an applicable non-cracking mechanism in Items B3.a and B3.b of Table 4-1, MRP-227, Revision 1-A.
IV.B4.RP-256 IV.B4.RP-256a IV.B4.RP-256b	The flow distributor (FD) bolts cited in the “RP-256” Item and the associated bolt locking devices cited in the “RP-256a” and “RP-256b” Items apply to all B&W-designed PWRs. The FD bolts are the subject of the “RP-256” Item for cracking effect and mechanism combinations. The FD bolt locking devices are the subject of the “RP-256a” Item for cracking effect and mechanism combinations and the “RP-256b” Item for non-cracking effect and mechanism combinations. The FD bolts and FD bolt locking devices remain as “Primary” category components for the B&W-design RVI management programs per Item B12 in Table 4-1 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222]. In

Table 2-21 Changes to GALL-SLR Report, Revision 0, Chapter IV Aging Management Review Items and Technical Bases (Continued)

Aging Management Review (AMR) Item No.	Technical Bases for Changes
	the "B12" Item, the EPRI MRP screened the FD bolts in for SCC and fatigue cracking mechanisms and the corresponding FD bolt locking devices in for fatigue and wear mechanisms. The staff edits of the "RP-256" Item make it consistent with the SCC and fatigue mechanisms attributed to the FD bolts. The existing versions of the "RP-256a" and "RP-256b" Items for the FD bolt locking devices are consistent with the identification of fatigue and wear as applicable mechanisms for the components.
IV.B4.RP-259	The incore monitoring (IMI) guide tube spider-to-lower grid rib section welds cited in the "RP-259" Item apply to all B&W-designed PWRs. These welds are the subject of the "RP-259" Item for non-cracking effect and mechanism combinations. The IMI guide tube spider-to-lower grid rib section welds were identified as "Primary" category components for B&W-design RVI management programs per Item B15 in Table 4-1 of the MRP-227, Revision 1-A [NRC 2019-TN9222]. In the "B15" Item, the EPRI MPR screened the welds in for neutron IE aging mechanisms. However, in Table 3-1 of MRP-227, Revision 1-A, the EPRI MRP identifies that the applicable spider-to-lower grid rib sections welds are made from Type 308L stainless steel weld filler metals. Therefore, the staff deleted nickel alloy welds as a listed weld filler metal type for the IMI guide tube spider-to-lower grid rib section welds. The staff also deleted TE as a listed embrittlement mechanism in order to make the aging mechanisms consistent with those listed in Item B15 of Table 4-1 in MRP-227, Revision 1-A.
IV.B4.RP-262	As cited in Item B13.2 in Table 4-4 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222], the dowel-to-lower grid fuel assembly support pad welds cited in the "RP-262" Item applies to all B&W-designed PWRs, except for the PWR at the Davis-Besse Nuclear Plant. The support pad welds are the subject of the "RP-262" Item for cracking effect and mechanism combinations. The dowel-to-lower grid fuel assembly support pad welds were identified as "Expansion" category components for the B&W-design RVI management programs at these plants per Item B13.2 in Table 4-4 of the MRP-227, Revision 1-A. In the "B13.2" Item, the EPRI MPR screened the support pad welds in for the stress corrosion cracking aging mechanism. The edited version of the "RP-262" Item is consistent with the cited aging mechanism basis. If the owner of the Davis-Besse Nuclear Plant opts to submit a SLRA for its facility, the owner may use GALL-SLR Item IV.B4.R-423 as the alternate AMR line item for aligning to the alternate, unit-specific dowel-to-lower grid fuel assembly support pad configuration basis called out by MRP-227, Revision 1-A, Table 4-4, Note 2.

Table 2-21 Changes to GALL-SLR Report, Revision 0, Chapter IV Aging Management Review Items and Technical Bases (Continued)

Aging Management Review (AMR) Item No.	Technical Bases for Changes
IV.B4.RP-261	The dowel-to-guide block welds cited in the modified version of the “RP-261” item applies to all B&W-designed PWRs, except for the PWR at the Davis-Besse Nuclear Plant. The support pad welds are the subject of the “RP-261” Item for cracking effect and mechanism combinations. The dowel-to-guide block welds were identified as “Primary” category components for the B&W-design RVI management programs at these plants per Item B13 in Table 4-1 of the MRP-227, Revision 1-A [NRC 2019-TN9222]. In the “B13” item, the EPRI MPR screened the support pad welds in for the stress corrosion cracking aging mechanism. The modified version of the “RP-261” Item is consistent with the cited aging mechanism basis. If the owner of the Davis-Besse Nuclear Plant opts to submit a SLRA for its facility, the owner may use GALL-SLR Item IV.B4.R-423 as the alternate AMR line item for aligning to the alternate, unit-specific dowel-to-guide block configuration basis called out by MRP-227, Revision 1-A, Table 4-1, Note 9.
IV.B4.RP-246 IV.B4.RP-246a IV.B4.RP-246b	In the MRP-227, Revision 1-A Report [NRC 2019-TN9222], the EPRI MRP established the UTS bolts are located in the core barrel assemblies of B&W-designed PWRs and that the LTS bolts are located in the lower grid assembly of B&W-designed. This required the staff to delete the UTS bolts from the scope of the “RP-246” Item and to delete the associated UTS bolt locking devices from the scope of the “RP-246a” and “RP-246b” Items. The UTS bolts are now covered by the new GALL-SLR IV.B4.RP-246c Item, and the associated UTS bolt locking devices are now covered by the new GALL-SLR IV.B4.RP-246d and IV.B4.RP-246e Items. This leaves the LTS bolts as the cited components in the modified “RP-246” Item and the associated LTS bolt locking devices as the cited components in the modified “RP-246a” and “RP-246b” Items. The LTS bolts are the subject of the “RP-246” Item for cracking effect and mechanism combinations. The LTS bolt locking devices are the subject of the “RP-246a” Item for cracking effect and mechanism combinations and the “RP-246b” Item for non-cracking effect and mechanism combinations. For simplicity of the modified version of “RP-246,” the staff considers the term “studs/nuts” to be synonymous with the term “bolts,” so “studs/nuts” are not referenced in the “RP-246” Item. The LTS bolts and LTS bolt locking devices remain as “Expansion” category components for the B&W-design RVI management programs per Item B8.1 in Table 4-4 of the MRP-227, Revision 1-A Report. In the “B8.1” Item, the EPRI MRP screened the LTS bolts in for the SCC aging mechanism, and the associated locking devices in for fatigue and wear mechanisms. The modified version of the “RP-246” Item is consistent cited cracking mechanism of SCC. The existing versions of the “RP-246a” and “RP-246b” Items for the LTS bolt locking devices are consistent with the identification of fatigue and wear as applicable mechanisms for the components.

Table 2-21 Changes to GALL-SLR Report, Revision 0, Chapter IV Aging Management Review Items and Technical Bases (Continued)

Aging Management Review (AMR) Item No.	Technical Bases for Changes
IV.B4.RP-260 IV.B4.RP-260a	The lower grid assembly pads, pad-to-rib section welds, dowels, cap screws and associated locking devices cited in the "RP-260" and "RP-260a" Items apply to all B&W-designed PWRs. The "RP-260a" Items addresses cracking effect mechanism combinations in the components and the "RP-260" Item addresses non-cracking effect and mechanism combinations in the components. The lower grid assembly pads, pad-to-rib section welds, dowels, cap screws and associated locking devices are identified as "Expansion" category components for B&W-design RVI management programs per Item B15.1 in Table 4-4 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222]. In the "B15.1" Item, the EPRI MRP screened the components in for cracking and for neutron IE. The edited version of the RP-260" Item is consistent with the designation of IE as a listed non-cracking mechanism. The "B15.1" Item in the MRP-227, Revision 1-A Report did not specify any specific mechanisms for inducing cracking of the components. The staff assumes that SCC and fatigue are the mechanisms that may induce potential cracking of the components, as referenced in the "RP-260a" Item. The material columns in the "RP-260" and "RP-260a" Items already acknowledge that the components could be fabricated using nickel-based alloy materials, so there is no reason to reference X-750 as a potential nickel alloy material in the component descriptions of the line items.
IV.B4.RP-251a	The plenum cover weldment rib pads, plenum cover support flanges, and plenum cover support rings cited in the "RP-251a" Item apply to all B&W-designed PWRs. The "RP-251a" items addresses non-cracking effect and mechanism combinations in the components. The plenum cover weldment rib pads, plenum cover support flanges, and plenum cover support rings are identified as "Primary" category components for B&W-design RVI management programs per Items B1.a, B1.b, and B1.c in Table 4-1 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222]. In the "B1.a." "B1.b," and B1.c" Items, the EPRI MRP screened the components in for loss or material due to wear and loss of preload due to wear as the applicable non-cracking aging effect and mechanism combinations for the components. The modified version of the RP-251a is consistent with the bases in the "B1.a." "B1.b," and B1.c" Items.
IV.B4.RP-352	The dowel-to-upper grid fuel assembly support pad welds cited in the edited version of the "RP-352" Item applies to all B&W-designed PWRs, except for the PWR at the Davis-Besse Nuclear Plant. The support pad welds are the subject of the "RP-352" Item for cracking effect and mechanism combinations. The dowel-to-upper grid fuel assembly support pad welds are identified as "Expansion" category components for the B&W-design RVI management programs at these plants per Item B13.1 in Table 4-4 of the MRP-227,

Table 2-21 Changes to GALL-SLR Report, Revision 0, Chapter IV Aging Management Review Items and Technical Bases (Continued)

Aging Management Review (AMR) Item No.	Technical Bases for Changes
	Revision 1-A [NRC 2019-TN9222]. In the “B13.1” item, the EPRI MPR screened the support pad welds in for the SCC mechanism. The edited version of the “RP-352” Item is consistent with the cited aging mechanism basis. If the owner of the Davis-Besse Nuclear Plant opts to submit a subsequent license renewal application for its facility, the owner may use GALL-SLR Item IV.B4.R-423 as the alternate AMR line item for aligning to the alternate, unit-specific dowel-to-upper grid fuel assembly support pad configuration basis called out by MRP-227, Revision 1-A, Table 4-4, Note 2.
IV.B2.R-423 IV.B2.R-424 IV.B3.R-423 IV.B3.R-424 IV.B4.R-423 IV.B4.R-424	The previous versions of the “R-423” and “R-424” Items were extremely restrictive in that they could only be applied for cases where a SLR applicant was applying a plant-specific aging management program for its PWR RVI components. The modifications of the “R-423” and “R-424” Items now allow the line items to be applied for additional cases, and specifically for cases where the applicant is using its GALL-SLR XI.M16A-based AMP as its program, but where the referenced MRP-227, Revision 1-A [NRC 2019-TN9222] protocols for a specified component are being adjusted based on site-specific or component-specific considerations. This will broaden the scope of the “R-423” and “R-424” Items so that they can be more readily applied and used in applicable subsequent license renewal applications. For more information, refer to the technical basis statement in Appendix B.3 of SLR-ISG-2021-01-PWRVI [NRC 2021-TN9958] for the staff’s analogous changes proposed to SRP-SLR Table 3.1-1, Items 118 and 119.
IV.B4.RP-258	The incore monitoring instrument (IMI) guide tube spiders cited in the “RP-258” Item apply to all Babcock and Wilcox (B&W)-designed PWRs. The IMI guide tube spiders are the subject of the “RP-258” Item for non-cracking effect and mechanism combinations. The IMI guide tube spiders were identified as “Primary” category components for B&W-design RVI management programs per Item B15 in Table 4-1 of the MRP-227, Revision 1-A [NRC 2019-TN9222]. In the “B15” Item, the EPRI MPR screened the IMI guide tube spiders in for cracking and for neutron irradiation embrittlement (IE) and thermal aging embrittlement (TE) aging mechanisms. The existing version of the “RP-258” Item is consistent with the referencing of IE and TE as the applicable non-cracking mechanisms for the IMI guide tube spider components.
IV.A2.RP-154	Change for stainless steel (SS) BMI guide tubes exposed to reactor coolant, IV.A2.RP154, was to remove the plant-specific AMP. This line item is just the SS portion of the BMI guide tubes external to the bottom head. For other SS materials in the primary circuit with the concern for cracking due to primary water SCC, the application of AMP XI.M1 “ASME Section XI Inservice Inspection, Subsections IWB, IWC and IWD,” along with XI.M2 “Water Chemistry” has been shown to be adequate to address

Table 2-21 Changes to GALL-SLR Report, Revision 0, Chapter IV Aging Management Review Items and Technical Bases (Continued)

Aging Management Review (AMR) Item No.	Technical Bases for Changes
	this aging mechanism, primary water SCC, for this material, SS. Therefore, the update to reference these AMP's is now recommended.
IV.C2.R-05	The staff re-evaluated the guidance provided in Section 3.1.2.2.6, Item 2 which states "Further evaluation is recommended of a plant-specific program for these components to ensure that this aging effect is adequately managed" and Section 3.1.3.2.6, Item 2 which states that "A plant-specific AMP should be evaluated to manage cracking due to SCC in CASS PWR Class 1 reactor coolant system piping and piping components exposed to reactor coolant that do not meet the carbon and ferrite content guidelines of NUREG–0313." The guidance in NUREG-0313, "Technical Report on Material Selection and Process Guidelines for BWR Coolant Pressure Boundary," Revision 2, was published on January 1988 [NRC 1988-TN8039]. As the title suggests it was intended to provide guidance concerning intergranular stress corrosion cracking susceptibility of BWR piping and included guidelines on CASS components. Specifically, it highlighted the potential of SCC for certain CASS components if they did not meet the recommended ferrite and carbon content. While the recommendations in NUREG-0313 are still very relevant to BWRs, current operating experience of CASS components in PWRs does not merit to elevate this AMR item to a "Further Evaluation." There is no current operating experience that indicates that this is a problem for CASS components in PWRs that requires further evaluation. Section 3.1.2.2.6, Item 2 is deleted as referenced NUREG–0313 is applicable to BWRs.
IV.D1.RP-367 IV.D1.RP-358 IV.D2.RP-185	The staff changed the reference to a plant-specific AMP to the One-Time Inspection AMP because the GALL-SLR Report states that a plant-specific AMP, "may include a One-Time Inspection that is capable of detecting cracking to verify the effectiveness of the water chemistry and steam generator programs and the absence of primary water stress corrosion cracking (PWSCC) in the divider plate assemblies." The One-Time Inspection AMP fulfills this recommendation from the GALL-SLR and eliminates the need for a plant-specific AMP to be evaluated.
IV.E.R-444	Added reactor interior attachments to list of examples to be consistent with PWR reactor internal components that are defined as ASMES Section XI Class 1 interior attachments to the reactor vessel.
IV.C1.RP-158 IV.C2.RP-383 IV.C2.RP-41 IV.C2.RP-40 IV.D1.RP-372 IV.D2.RP-153 IV.A1.RP-50 IV.A1.RP-157	Removed XI.M32, "One-Time Inspection" from the "Aging Management Program(AMP)/Time Limited Aging Analyses (TLAA)" column. Changes result from the elimination of mandatory one-time inspections in the XI.M2 "Water Chemistry," XI.M30 "Fuel Oil Chemistry," and XI.M39 "Lubricating Oil Analysis" AMPs, which are called out in the XI.M32 "One-Time Inspection" AMP, using risk insights gained from industry operating experience. None of these four AMPs are being eliminated and the One-Time Inspection AMP is still available for use by any other AMP when needed.

Table 2-22 Changes to GALL-SLR Report, Revision 0, Chapter V Aging Management Review Items and Technical Bases

Aging Management Review Item No.	Technical Bases for Changes
V.A.E-20 V.D1.E-20 V.D2.EP-74	The staff noted that for other material and environment combinations in the GALL-SLR Report, reduction of heat transfer due to fouling is the only aging effect associated with an intended function of “heat transfer.” The Water Chemistry Aging Management Program (AMP) can be used to minimize the potential for deposits that can lead to fouling through the control of primary side water chemistry. The GALL-SLR recommends the use of the Water Chemistry and Steam Generator AMPs (Aging Management Review [AMR] Table 1 Item 3.1-1, 111) to manage the reduction of heat transfer due to fouling in nickel alloy tubes. The use of the Water Chemistry AMP provide an analogous approach (i.e., water chemistry control and an inspection to verify effectiveness) to managing the reduction of heat transfer on primary side nickel alloy heat exchanger tubes. The NRC staff’s review of the Turkey Point subsequent license renewal application (SLRA) demonstrates that stainless steel (SS) and nickel alloy have similar aging effects when exposed to treated borated water. The GALL-SLR recommends the use of the Water Chemistry AMP to manage the reduction of heat transfer in stainless steel heat exchanger tubes. Because SS and nickel alloy experience similar aging effects it is reasonable to use the same AMPs to manage the aging effects in nickel alloy materials.
V.A.E-475 V.D1.E-475 V.D2.E-475	Subsequent to issuance of the GALL-SLR Report, the staff recognized that to be consistent with other GALL-SLR Report items associated with heat exchanger tubes, E-475 should have also cited reduction of heat transfer due to fouling. This is consistent with GALL Report Revision 2 item SP-41 where a material (i.e., stainless steel) that is not susceptible to loss of material (a potential source of fouling products), is susceptible to reduction of heat transfer due to fouling. Titanium components are subject to flow blockage due to fouling due to potential debris in the raw water environment.
V.A.E-415 V.B.EP-54 V.B.E-415 V.C.E-415 V.D1.EP-52 V.D1.EP-54 V.D1.E-415 V.D2.EP-54 V.D2.E-415	During its review of recent SLRA plant-specific operating experience, in response to the staff’s observation regarding dark corrosion product layers indicative of graphitic corrosion on the internal surfaces of malleable iron fittings exposed to a closed-cycle cooling water environment (ADAMS Accession No. ML22010A129), the NRC staff has revised the guidance documents (i.e., GALL-SLR Report and SRP-SLR) to include malleable iron as a material susceptible to selective leaching.

Table 2-22 Changes to GALL-SLR Report, Revision 0, Chapter V Aging Management Review Items and Technical Bases (Continued)

Aging Management Review Item No.	Technical Bases for Changes
V.A.E-434	The NRC staff modified the AMR Item V.A.E-434 and added AMR Item VII.E2.A-798, to note that the aging effects of loss of material, and long-term loss of material due to general corrosion on steel exposed to an environment of treated water and sodium pentaborate can be managed by the "Water Chemistry" and "One-Time Inspection" AMPs. No item was added to manage stress corrosion cracking of steel in this environment as the GALL-SLR already states that steel components typically are not susceptible to stress corrosion cracking and are mainly susceptible to loss of material. The staff determined that this material, environment, aging effect program (MEAP) may be managed with the AMPs cited above because the Water Chemistry AMP can monitor and control the concentration of deleterious species in the water storage tanks that provide water to the Standby Liquid Control (SLC) system which contains the sodium pentaborate solution. Additionally, the One-Time Inspection AMP can verify the corrosion rate of the steel components is low enough that loss of material is unlikely to cause a loss of intended function. Several reports were reviewed by the staff to make this determination ([NUREG/CR-6001; NRC 1992-TN8346] [EPRI Report 1010639; EPRI 2006-TN8195] [Metals Handbook Desk Edition, 2nd Edition] [EPRI Report 1000975; EPRI 2001-TN8200]). These reports concluded that even though the pH of the SLC system varies with temperature, it is generally greater than pH 6.8 which is close to neutral [NUREG/CR-6001; NRC 1992-TN8346].
V.A.E-401 V.B.E-401 V.D1.E-401 V.D1.E-414 V.D2.E-401 V.D2.E-414	The staff has accepted opportunistic inspections, in lieu of periodic inspections, as an acceptable alternative for buried internally coated/lined fire water system piping provided: (a) flow tests and internal piping inspections will occur at intervals specified in National Fire Protection Association (NFPA 25), or as modified by AMP XI.M27, Table XI.M27-1; and (b) through-wall flaws in the piping can be detected through continuous system pressure monitoring. Examples of the staff's acceptance of this alternative approach are documented in the Safety Evaluation Report Related to the License Renewal of Fermi 2 Nuclear Power Plant (ADAMS Accession No. ML16190A241) and the Safety Evaluation Report Related to the Subsequent License Renewal of Peach Bottom Atomic Power Station, Units 2 and 3 (ADAMS Accession No. ML20044D902). Based on recent OE involving ruptures in the buried fire water system piping system due to age-related degradation (ADAMS Accession No. ML19294A044), the staff added a third condition for using this alternative approach related to plant-specific operating experience (OE). The staff notes that the subject OE involved degradation of the external surfaces of the piping; however, degradation of internal coatings/linings could also result in significant degradation of buried fire water system piping. The GALL-SLR Report discusses the reason for citing specific AMPs to manage recurring internal corrosion rather than a plant-specific AMP in the section titled "Explanation of the Use of Multiple Aging Management

Table 2-22 Changes to GALL-SLR Report, Revision 0, Chapter V Aging Management Review Items and Technical Bases (Continued)

Aging Management Review Item No.	Technical Bases for Changes
	Programs in Aging Management Review Items." For the associated AMR item in the SRP-SLR (Item 3.3-1-127), the listed environments still include closed-cycle cooling water even though NUREG-2221, "Technical Bases for Changes in the Subsequent License Renewal Guidance Documents NUREG-2191 and NUREG-2192," Table 2-13, notes that the associated item in Table C2, "Closed-Cycle Cooling Water System," was deleted because recurring internal corrosion is not anticipated in this system. These changes corrects this error in conjunction with the adjustments above for the use of multiple AMPs.
V.C.EP-62 V.D2.EP-60 V.D1.EP-71 V.D2.EP-71 V.D2.EP-74 V.A.E-20 V.D1.E-20 V.A.E-12 V.D1.E-12 V.C.EP-63 V.A.E-428 V.D1.E-428 V.D2.E-428 V.D2.EP-73 V.A.EP-41 V.D1.EP-41 V.B.E-457 V.C.E-457 V.D2.E-457 V.A.E-458 V.D1.E-458 V.D2.E-458 V.A.E-473 V.A.EP-78 V.A.EP-79 V.A.EP-75 V.A.EP-76 V.A.EP-77 V.D1.E-473 V.D1.EP-78 V.D1.EP-79 V.D1.EP-75 V.D1.EP-76 V.D1.EP-80 V.D1.EP-77 V.D2.E-473 V.D2.EP-78	Removed XI.M32, "One-Time Inspection" from the "Aging Management Program(AMP)/Time Limited Aging Analyses (TLAA)" column. Changes result from the elimination of mandatory one-time inspections in the XI.M2 "Water Chemistry," XI.M30 "Fuel Oil Chemistry," and XI.M39 "Lubricating Oil Analysis" AMPs, which are called out in the XI.M32 "One-Time Inspection" AMP, using risk insights gained from industry operating experience. None of these four AMPs are being eliminated and the One-Time Inspection AMP is still available for use by any other AMP when needed.

Table 2-22 Changes to GALL-SLR Report, Revision 0, Chapter V Aging Management Review Items and Technical Bases (Continued)

Aging Management Review Item No.	Technical Bases for Changes
V.D2.EP-79 V.D2.EP-75 V.D2.EP-76 V.D2.EP-77	

Table 2-23 Changes to GALL-SLR Report, Revision 0, Chapter VI Aging Management Review Items and Technical Bases

Aging Management Review (AMR) Item No.	Technical Bases for Changes
VI.A.LP-28	The AMR item is modified to incorporate industry operating experience to enhance aging management of high voltage insulators to include additional susceptible materials (toughened glass; polymers silicone rubber; fiberglass, aluminum alloy) and aging effects (peeling of silicone rubber sleeves for polymer insulators; or glazing degradation for porcelain insulators).
VI.A.LP-32	The AMR item is modified to incorporate industry operating experience to enhance aging management of high voltage insulators to include additional susceptible materials (toughened glass; polymers silicone rubber; fiberglass, aluminum alloy).

Table 2-24 Changes to GALL-SLR Report, Revision 0, Chapter VII Aging Management Review Items Technical Bases

Aging Management Review Item No.	Technical Bases for Changes
VII.G.A-789	The structure and/or component was changed from "fire damper assemblies" to "fire damper housing" because the housing is the passive component of the fire damper assembly that is subject to aging management. The applicable material was revised to "metallic" because fire damper housings are typically constructed of steel or stainless steel (SS). The applicable aging effects were revised to loss of material due to general, pitting, and crevice corrosion, and cracking due to stress corrosion cracking (SCC) (Stainless steel only) because the elastomer aging effects of hardening, loss of strength, and shrinkage do not apply to metallic components, and steel materials would not be subject to SCC; however, SS materials would be subject to SCC. The periodic inspections recommended by GALL-SLR Aging Management Program (AMP) Report XI.M26 are capable of detecting these aging effects.

Table 2-24 Changes to GALL-SLR Report, Revision 0, Chapter VII Aging Management Review Items Technical Bases (Continued)

Aging Management Review Item No.	Technical Bases for Changes
VII.C1.A-787a VII.C1.A-787c VII.G.A-787b VII.E5.A-787d	Based on a review of current subsequent license renewal applications (SLRAs), the staff noted that an applicant had cited a polyvinyl chloride (PVC) piping component (chemical addition tank) in its essential service water system. The tank is internally exposed to treated water. In Revision 0 of the GALL-SLR Report, Item A 787b is the only AMR item citing PVC piping components exposed to treated water. This item cites AMP XI.M27, “Fire Water System,” to manage loss of material due to wear and flow blockage due to fouling (raw water only). Given that the applicant’s tank was not located in the fire water system, AMP XI.M38, “Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components,” was cited as the applicable AMP in lieu of AMP XI.M27. To eliminate the potential for future generic note E items (different AMP than that cited in the GALL-SLR Report), Items A 787a and A 787c were revised to include treated water as an applicable environment. The staff concluded that the addition of treated water to these two AMR items is acceptable because the treated water environment is less aggressive than the existing raw water environment. As a result, the cited AMPs will be adequate to manage loss of material. Items A 787a and A 787c were further revised to state that flow blockage due to fouling is only applicable to the raw water environment as stated in SRP-SLR Item 3.3.1 253. In the process of incorporating this change, the staff noted an error in SRP-SLR Item 3.3.1 253. Based on the potential for accumulation of potential particles in the wastewater flow stream, PVC piping and piping components are susceptible to flow blockage due to fouling in the wastewater environment. This is consistent with Table 2-20, “Changes to Existing GALL Report Revision 2 Chapter VII AMR Items Technical Bases,” Item AP 269. The staff further noted that the bases for AP 269 states that based on The PVC Pipe – Design and Installation – Manual of Water Supply Practices, M23, American Water Works Association, 2nd Edition, 2002 [AWWA 2002-TN11525], “PVC pipe is well suited to applications where abrasive conditions are anticipated.” The staff concluded that it is reasonable to conclude that loss of material due to wear would not occur due to abrasive particle impingement or flow perturbations in low flow applications. The aging effects requiring management for A 787a, A 787b, A 787c, and A 787d were changed accordingly.
VII.A4.AP-139 VII.A3.A-101 VII.E1.A-101 VII.E1.AP-114 VII.E2.AP-181 VII.E3.AP-120 VII.E3.AP-112 VII.E1.AP-118 VII.E3.AP-106 VII.E4.AP-106 VII.A4.AP-140 VII.E3.AP-140	Removed XI.M32, "One-Time Inspection" from the “Aging Management Program(AMP)/Time Limited Aging Analyses (TLAA)” column. Changes result from the elimination of mandatory one-time inspections in the XI.M2 “Water Chemistry,” XI.M30 “Fuel Oil Chemistry,” and XI.M39 “Lubricating Oil Analysis” AMPs, which are called out in the XI.M32 “One-Time Inspection” AMP, using risk insights gained from industry operating experience. None of these four AMPs are being eliminated and the One-Time Inspection AMP is still available for use by any other AMP when needed.

Table 2-24 Changes to GALL-SLR Report, Revision 0, Chapter VII Aging Management Review Items Technical Bases (Continued)

Aging Management Review Item No.	Technical Bases for Changes
VII.E4.AP-140 VII.C2.AP-130 VII.A4.AP-130 VII.E3.AP-130 VII.E4.AP-130 VII.H2.AP-130 VII.A4.AP-108 VII.E3.AP-139 VII.E1.AP-82 VII.A2.A-96 VII.E1.A-103 VII.A3.A-56 VII.A2.A-97 VII.A2.A-98 VII.A2.AP-79 VII.A3.AP-79 VII.E1.AP-79 VII.A2.A-99 VII.F2.A-566 VII.F3.A-566 VII.F4.A-566 VII.F1.A-566 VII.F1.A-567 VII.F2.A-567 VII.F3.A-567 VII.F4.A-567 VII.A4.AP-111 VII.A4.AP-110 VII.E3.AP-110 VII.E4.AP-110 VII.E2.AP-141 VII.F1.A-748 VII.F2.A-748 VII.F3.A-748 VII.F4.A-748 VII.A3.A-765 VII.A4.A-765 VII.C1.A-765 VII.C3.A-765 VII.E1.A-765 VII.E3.A-765 VII.G.A-765 VII.H2.A-765 VII.E3.A-773 VII.E4.A-773 VII.C1.A-791 VII.C1.AP-133 VII.C1.AP-138 VII.C1.AP-127 VII.C2.A-791	

Table 2-24 Changes to GALL-SLR Report, Revision 0, Chapter VII Aging Management Review Items Technical Bases (Continued)

Aging Management Review Item No.	Technical Bases for Changes
VII.C2.AP-133 VII.C2.AP-138 VII.C2.AP-127 VII.C3.A-791 VII.E1.A-791 VII.E1.AP-133 VII.E1.AP-138 VII.E1.AP-127 VII.E4.A-791 VII.E4.AP-133 VII.E4.AP-138 VII.E4.AP-127 VII.F1.A-791 VII.F1.AP-127 VII.F2.A-791 VII.F2.AP-127 VII.F3.A-791 VII.F3.AP-127 VII.F4.A-791 VII.F4.AP-127 VII.G.A-791 VII.G.AP-162 VII.G.AP-133 VII.G.AP-138 VII.G.AP-127 VII.H2.AP-131 VII.H2.AP-154 VII.H2.A-791 VII.H2.AP-162 VII.H2.AP-133 VII.H2.AP-138 VII.H2.AP-127 VII.G.AP-129 VII.G.AP-132 VII.G.AP-136 VII.G.AP-234 VII.H1.AP-129 VII.H1.AP-132 VII.H1.AP-136 VII.H1.AP-105 VII.H2.AP-129 VII.H2.AP-132 VII.H2.AP-136 VII.H2.AP-105 VII.H2.A-799 VII.H2.A-801	

Table 2-25 Changes to GALL-SLR Report, Revision 0, Chapter VIII Aging Management Review Items and Technical Bases

Aging Management Review Item No.	Technical Bases for Changes
VIII.A.SP-28 VIII.A.SP-27 VIII.E.SP-26 VIII.E.SP-27 VIII.E.S-415 VIII.F.SP-27 VIII.F.S-415 VIII.G.SP-28 VIII.G.SP-26 VIII.G.SP-27 VIII.G.S-415 VIII.D1.S-482 VIII.D2.S-482 VIII.E.S-482 VIII.F.S-482 VIII.F.SP-85 VIII.B1.SP-88 VIII.C.SP-88 VIII.D1.SP-88 VIII.E.SP-88 VIII.F.SP-88 VIII.G.SP-88 VIII.E.SP-97 VIII.A.SP-98 VIII.B1.SP-98 VIII.B2.SP-98 VIII.E.SP-75 VIII.G.SP-75 VIII.B1.SP-74 VIII.B2.SP-73 VIII.C.SP-73 VIII.D1.SP-74 VIII.D2.SP-73 VIII.E.SP-73 VIII.F.SP-74 VIII.G.SP-74 VIII.A.SP-71 VIII.B1.SP-71 VIII.B2.SP-160 VIII.C.SP-71 VIII.E.SP-77 VIII.D1.SP-90 VIII.E.SP-90 VIII.F.SP-90	During its review of recent subsequent license renewal application (SLRA) plant-specific operating experience (OE), in response to the staff's observation regarding dark corrosion product layers indicative of graphitic corrosion on the internal surfaces of malleable iron fittings exposed to a closed-cycle cooling water environment (ADAMS Accession No. ML22010A129), the staff has revised guidance documents (i.e., GALL-SLR and Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants [SRP-SLR] Report) to include malleable iron as a material susceptible to selective leaching. Subsequent to issuance of the GALL-SLR Report, the staff recognized that to be consistent with other GALL-SLR Report items associated with heat exchanger tubes, E-475 should have also cited reduction of heat transfer due to fouling. This is consistent with GALL Report Revision 2 Item SP-41 where a material (i.e., stainless steel [SS]) that is not susceptible to loss of material (a potential source of fouling products), is susceptible to reduction of heat transfer due to fouling. Titanium components are subject to flow blockage due to fouling due to potential debris in the raw water environment. Removed XI.M32, "One-Time Inspection" from the "Aging Management Program(AMP)/Time Limited Aging Analyses (TLAA)" column. Changes result from the elimination of mandatory one-time inspections in the XI.M2 "Water Chemistry," XI.M30 "Fuel Oil Chemistry," and XI.M39 "Lubricating Oil Analysis" AMPs, which are called out in the XI.M32 "One-Time Inspection" AMP, using risk insights gained from industry operating experience. None of these four AMPs are being eliminated and the One-Time Inspection AMP is still available for use by any other AMP when needed.

Table 2-25 Changes to GALL-SLR Report, Revision 0, Chapter VIII Aging Management Review Items and Technical Bases (Continued)

Aging Management Review Item No.	Technical Bases for Changes
VIII.G.SP-90 VIII.D2.SP-90 VIII.A.SP-101 VIII.F.SP-101 VIII.E.SP-100 VIII.F.SP-100 VIII.G.SP-100 VIII.E.SP-96 VIII.F.SP-96 VIII.E.SP-162 VIII.G.SP-162 VIII.B1.SP-157 VIII.A.SP-155 VIII.B1.SP-155 VIII.B2.SP-155 VIII.E.SP-80 VIII.B1.SP-87 VIII.C.SP-87 VIII.D1.SP-87 VIII.D2.SP-87 VIII.E.SP-87 VIII.F.SP-87 VIII.G.SP-87 VIII.F.SP-80 VIII.E.S-462 VIII.F.S-462 VIII.G.S-462 VIII.A.SP-92 VIII.A.SP-95 VIII.A.SP-91 VIII.D1.SP-92 VIII.D1.SP-95 VIII.D1.SP-91 VIII.D2.SP-92 VIII.D2.SP-95 VIII.D2.SP-91 VIII.E.SP-113 VIII.E.SP-92 VIII.E.SP-95 VIII.E.SP-91 VIII.G.SP-79 VIII.G.SP-76 VIII.G.SP-113 VIII.G.SP-99 VIII.G.SP-102 VIII.G.SP-103 VIII.G.SP-114 VIII.G.SP-92 VIII.G.SP-95 VIII.G.SP-91	

Table 2-26 Chapter IX.B – Structures and Components, Differences From Chapter IX GALL-SLR Report, Revision 0, and Their Technical Bases

Defined Term	Summary of Significant Changes	Technical Basis for Change
Electrical insulation	Added examples of organic polymers for clarity.	Added examples of organic polymers: ethylene propylene rubber, silicone rubber, ethylene propylene diene monomer (EPDM), and cross-linked polyethylene.
“Existing programs” components “Expansion” components “No Additional Measures” components “Primary” components	Updated the referenced EPRI Report from EPRI Report No. 1022863 (MRP-227-A [EPRI 2011-TN8163]) to EPRI Report No. 3002017168 (MRP-227, Revision 1-A [NRC 2019-TN9222]).	Updated the referenced EPRI report to reflect the most recent revision that has been approved by NRC staff.

Table 2-27 Chapter IX.C – Materials, Differences From Chapter IX GALL-SLR Report, Revision 0, and Their Technical Bases

Defined Term	Summary of Significant Changes	Technical Basis for Change
Carbon fiber reinforced polymer (CFRP)	Added the new term.	The new term was added to support the new AMP, “GALL-SLR Report AMP XI.M43, High Density Polyethylene (HDPE) Piping and Carbon Fiber Reinforced Polymer (CFRP) Repaired Piping.” The technical basis for this new AMP can be found in Table 2-29, XI.M43 of this report.
Malleable Iron	Revised term: (a) to clarify the material properties of malleable iron; and (b) based on its inclusion to GALL-SLR Report AMP XI.M33, “Selective Leaching.”	The material properties description for this material was expanded to be similar to the existing definition of ductile iron. The staff’s basis for the inclusion of malleable iron as a material susceptible to selective leaching is documented in Table 2-29, “GALL-SLR Differences from Chapter XI, Mechanical Aging Management Programs, GALL Report Revision 2 and Their Technical Bases.”

Table 2-27 Chapter IX.C – Materials, Differences From Chapter IX GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Defined Term	Summary of Significant Changes	Technical Basis for Change
Stellite	Added the new “Material” terminology to GALL-SLR Table IX.C in SLR-ISG-2021-01-PWRVI [NRC 2021-TN9958] due to reference of stellite in the aging management review line items for specific types of pressurized water reactor (PWR) reactor vessel internal (RVI) components.	In the subsequent license renewal application (SLRA) for Surry Nuclear Station, Units 1 and 2, the applicant identified that certain reactor vessel (RV) components made from stainless steel or nickel alloy materials (e.g., clevis inserts or fuel alignment pins) were fabricated with stellite surface layers to make the components more resistant to wear. Reference of stellite was not previously included in Table IX.C of the GALL-SLR Report, but the material is referenced as a cited material in MRP-227, Revision 1-A Report [NRC 2019-TN9222]. The addition of “stellite” makes the contents of GALL-SLR Table IX.C up-to-date with materials referenced for PWR RVI components in the MRP-227, Revision 1-A Report [NRC 2019-TN9222]. The staff has adopted a definition for stellite by ASTM International.
Various polymeric materials	Included carbon fiber reinforced polymer in the list of examples of polymers used in mechanical applications that are addressed as specific material types.	The change was added to support the new AMP, “GALL-SLR Report AMP XI.M43, High Density Polyethylene (HDPE) Piping and Carbon Fiber Reinforced Polymer (CFRP) Repaired Piping.” The technical basis for this new AMP can be found in Table 2-29, XI.M43 of this report.

Table 2-28 Chapter IX.D – Environments, Differences From Chapter IX GALL-SLR, Report, Revision 0, and Their Technical Bases

Defined Term	Summary of Significant Changes	Technical Basis for Change
No differences from Chapter IX.D of GALL-SLR Report, Revision 0.		

Table 2-29 Chapter IX.E – Aging Effects, Differences From Chapter IX GALL-SLR Report, Revision 0, and Their Technical Bases

Defined Term	Summary of Significant Changes	Technical Basis for Change
Crack growth	Added that increase in crack size can be attributed to static loading.	Clarification that crack size can also increase to static loading in addition to cyclic loading.

Table 2-29 Chapter IX.E – Aging Effects, Differences From Chapter IX GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Defined Term	Summary of Significant Changes	Technical Basis for Change
Cracking	Added additional context to the use of the term as it relates to polymeric materials and carbon fiber reinforced polymer (CFRP) piping.	These changes were added to support the new AMP, “GALL-SLR Report AMP XI.M43, High Density Polyethylene (HDPE) Piping and Carbon Fiber Reinforced Polymer (CFRP) Repaired Piping.” The technical basis for this new AMP can be found in Table 2-33, XI.M43 of this report.
Flow Blockage	Added clarification that accumulations of particulate fouling, biofouling, or macro fouling also includes delamination/disbanding of CFRP repaired piping.	These changes were added to support the new AMP, “GALL-SLR Report AMP XI.M43, High Density Polyethylene (HDPE) Piping and Carbon Fiber Reinforced Polymer (CFRP) Repaired Piping.” The technical basis for this new AMP can be found in Table 2-33, XI.M43 of this report.
Loss of Material	Added additional context to the use of the term as it relates to polymeric materials.	These changes were added to support the new AMP, “GALL-SLR Report AMP XI.M43, High Density Polyethylene (HDPE) Piping and Carbon Fiber Reinforced Polymer (CFRP) Repaired Piping.” The technical basis for this new AMP can be found in Table 2-33, XI.M43 of this report.

Table 2-30 Chapter IX.F – Aging Mechanisms, Differences from Chapter IX GALL-SLR Report, Revision 0, and Their Technical Bases

Defined Term	Summary of Significant Changes	Technical Basis for Change
Crevice Corrosion	Clarified that crevice corrosion can result from situations beyond those with dissimilar materials or designed crevices.	The previous discussion did not sufficiently explain the variety of circumstances where crevice corrosion could occur. Clarification includes reference to a new term “differential aeration corrosion.”
Differential Aeration Corrosion	Added this new term as an overarching corrosion mechanism that applies to crevice corrosion and configurations where varying oxygen concentrations across a component can lead to accelerated corrosion.	The staff’s reviews of previous operating experience identified this mechanism as being associated with corrosion in various air-to-water and soil-to-air interfaces.
Wear	Added additional context to the use of the term as it relates to carbon fiber reinforced polymer (CFRP).	These changes were added to support the new AMP, “GALL-SLR Report AMP XI.M43, High Density Polyethylene (HDPE) Piping and Carbon Fiber Reinforced Polymer (CFRP) Repaired Piping.” The technical basis for this new AMP can be found in Table 2-29, XI.M43 of this report.
No differences from Chapter IX of GALL-SLR Report, Revision 0.		

Table 2-31 Chapter IX.G – References, Differences From Chapter IX GALL-SLR Report, Revision 0, and Their Technical Bases

Defined Term	Summary of Significant Changes	Technical Basis for Change
N/A	Added Reference 43: EPRI Technical Report No. 3002017168, "Materials Reliability Program: Pressurized Water Reactor Internals Inspection and Evaluation Guidelines (MRP-227, Revision 1-A [NRC 2019-TN9222])."	Reference added to support changes to terms: "Existing programs" components; "Expansion" components; "No Additional Measures" components; "Primary" components in Table 2-22 of this document.

Table 2-32 GALL-SLR Report, Revision 1, Chapter X, Time-Limited Aging Analyses, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases

Location of Change	Summary of Significant Changes	Technical Basis for Change
X.M1: Fatigue Monitoring		
Program Description Scope of Program References	NUREG/CR-6909, Revision 1 provides technical bases for RG 1.207, Revision 1. Both NUREG/CR-6909, Revision 1 and RG 1.207, Revision 1 were published after the publication of SRP-SLR, Revision 0. Accordingly, the outdated footnotes that state, "If and when published as RG 1.207, Revision 1 Final" will be removed in SRP-SLR, Revision 1. NUREG/CR-6909, Revision 1 will be also referenced as the latest guidance for EAF analyses in SRP-SLR, Revision 1. Consistent changes will be also made in GALL-SLR AMP X.M1, "Fatigue Monitoring," in GALL-SLR, Revision 1.	NUREG/CR-6909, Revision 1 describes the fatigue design curves and environmental fatigue correction factor (Fen) equations for the calculation of environmentally adjusted cumulative usage factor (CUFen) based on the recent fatigue test data. This report also serves as a technical basis document for RG 1.207, Revision 1 that provides the latest guidance for evaluating the environmental effects on the metal fatigue in nuclear power plant components. Therefore, NUREG/CR-6909, Revision 1 and RG 1.207, Revision 1 will be referenced as the latest guidance for EAF analyses in SRP-SLR, Revision 1 and GALL-SLR Revision 1.
X.M2: Neutron Fluence Monitoring		
Monitoring and Trending Acceptance Criteria	Aging management program (AMP) X.M2 is revised to reference approaches that have been found to be acceptable in recent staff reviews of extended beltline and reactor vessel internals fluence calculations, as RG 1.190 is not applicable, and the U.S. Nuclear Regulatory Commission (NRC) staff continues to develop regulatory guidance for such calculations.	The added references to this AMP provide examples of acceptable approaches from recent reviews. These examples provided acceptable justification to apply the methods used for fluence calculations in the traditional reactor vessel beltline, to the extended beltline and to reactor vessel internal components.

Table 2-32 GALL-SLR Report, Revision 1, Chapter X, Time-Limited Aging Analyses, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of Significant Changes	Technical Basis for Change
X.E1: Environmental Qualification of Electric Components		
Program Description	The AMP program description is revised to clarify that mechanical components associated with electrical equipment, such as gaskets, seals, O-rings, etc. may be within the scope of X.E1.	The Program Description is revised in order to provide further guidance and clarification on the qualification, scope, and maintenance of components under § 50.49 [TN249]. This qualification includes not just electrical components, but also mechanical components that are relied upon to ensure the functional capability of the equipment being qualified under the postulated design basis conditions. These include mechanical components such as gaskets, seals, or O-rings that are subject to aging.
Scope of Program	The AMP Scope of Program is revised to clarify that certain mechanical components associated with in-scope electrical equipment (e.g., gaskets, seals, O-rings, etc.) may be within the scope of X.E1.	The Scope of Program is revised in order to provide further guidance and clarification on the qualification, scope, and maintenance of components under § 50.49 [TN249]. Qualification under 10 CFR 50.49 addresses the electrical and mechanical components that are relied upon to ensure the functional capability of the equipment being qualified under the postulated design basis conditions. The mechanical components can include age-sensitive items such as gaskets, seals, or O-rings.

Table 2-33 GALL-SLR Report, Revision 1, Differences from Chapter XI, Mechanical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases

Location of Change	Summary of Significant Changes	Technical Basis for Change
Table XI-01: Final Safety Analysis Report Supplement Summaries		
Table XI-01, “Implementation Schedule” Column	For aging management programs (AMPs) XI.M27, XI.M29, XI.M30, XI.M32, XI.M33, XI.M41, and XI.M42, clarify that the inspections only begin <u>within</u> the specified time period (e.g., 10-years) prior to the subsequent period of extended operation and not <u>at</u> the specified time.	Although the implementation schedules for the associated programs stated that the activities begin a specific number of years prior to the subsequent period of extended operation, the staff had only intended that the activities would be conducted within the specified time period and not necessarily begin at that time.

Table 2-33 GALL-SLR Report, Revision 1, Differences from Chapter XI, Mechanical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of Significant Changes	Technical Basis for Change
X.M1: Fatigue Monitoring		
Table XI-01, XI.M32, “Implementation Schedule” Column	“Implementation Schedule” is revised to state, “The program is implemented and inspections begin within the 10 year period before the subsequent period of extended operation.”	“10 year” was accidentally dropped in editing between Revision 0 and Revision 1 and it will be corrected.
Program Description Scope of Program References	Remove outdated footnotes that state, “If and when published as RG 1.207, Revision 1 Final” and update references to NUREG/CR-6909 to Revision 1.	NUREG/CR-6909, Revision 1 describes the fatigue design curves and environmental fatigue correction factor (Fen) equations for the calculation of environmentally adjusted cumulative usage factor (CUFen) based on the recent fatigue test data. This report also serves as a technical basis document for RG 1.207, Revision 1 that provides the latest guidance for evaluating the environmental effects on the metal fatigue in nuclear power plant components. Therefore, NUREG/CR-6909, Revision 1 and RG 1.207, Revision 1 is referenced as the latest guidance for environmentally assisted fatigue (EAF) analyses in SRP-SLR, Revision 1 and GALL-SLR Revision 1.
XI.M2: Water Chemistry		
Program Description References	AMP XI.M2, “Water Chemistry,” was revised to include the latest revision of Electric Power Research Institute (EPRI) guidelines for boiling water reactor (BWR) and pressurized water reactor (PWR).	EPRI issued 3002010645, “Pressurized Water Reactor Secondary Water Chemistry Guidelines,” Revision 8, in 2017 [EPRI 2017-TN8112] from the previous version (1016555). According to EPRI, a committee of industry experts collaborated in reviewing data and generating water-chemistry guidelines, which should be used at all nuclear plants, that has been endorsed by the utility chemistry community. Approved precedent for use of the more recent version of the above guideline is documented in the NRC staff’s safety evaluation report for subsequent license renewal of Surry Units 1 and 2 (Agencywide Documents Access Management System [ADAMS] Accession No. ML20052F523) EPRI has issued BWRVIP-190, “BWR Water Chemistry Guidelines — Mandatory, Needed, and Good Practice

Table 2-33 GALL-SLR Report, Revision 1, Differences from Chapter XI, Mechanical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of Significant Changes	Technical Basis for Change
		Guidance." Revision 1. Consistent with the staff's evaluation of an exception documented in NUREG–2205, "Safety Evaluation Report Related to the License Renewal of LaSalle County Station, Units 1 and 2," September 2016, Section 3.0.3.2.1, "Water Chemistry," the staff finds the use of BWRVIP-190, Revision 1, "BWR Vessel and Internals Project, Volume 1, BWR Water Chemistry Guidelines — Mandatory, Needed, and Good Practice Guidance," EPRI 3002002623, dated April 24, 2014, acceptable to cite.
Program Description	Removed the vast majority of one-time inspection called out in this program element. The one-time inspection of item VII.E2.A-798, which is steel piping, piping components, and tanks exposed to treated water/sodium pentaborate solution for long-term loss of material due to general corrosion has been retained.	The water chemistry programs for boiling water reactors and pressurized water reactors are published as EPRI reports and developed, respectively, by the Boiling Water Reactor Vessel and Internals Project and Steam Generator Management Program. The guidance is widely implemented and has been in continuous use (under various names) since the 1980s. Although the NRC does not review and approve the PWR or BWR water chemistry guidelines referenced in AMP XI.M2, the NRC maintains an awareness of changes to the guidelines through periodic meetings with industry and review activities. The NRC has observed that changes to the guidance generally reflect factors such as operating experience and best practices. Also, given the insights that licensees gain with the one-time inspection recommendations for the initial period of extended operation (NUREG-1800), the staff does not consider it necessary to repeat the one-time inspections for the subsequent period of extended operation.
XI.M3: Reactor Head Closure Stud Bolting		
Preventive Actions Corrective Actions Table XI-01	Item (d) of the "Preventive Actions" program element of GALL-SLR AMP XI.M3 is changed to allow either yield-strength criterion (<150 ksi) or ultimate-tensile-strength criterion (≤170 ksi) for use of low alloy steels resistant to stress	Item (d) of the "Preventive Actions" program element describes the material strength criteria to prevent the susceptibility of reactor head closure stud materials to SCC (including intergranular stress corrosion cracking).

Table 2-33 GALL-SLR Report, Revision 1, Differences from Chapter XI, Mechanical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of Significant Changes	Technical Basis for Change
	corrosion cracking (SCC). Either of the material strength criteria may be used regardless of whether existing reactor head closure studs or newly installed studs are addressed in the preventive actions. Corresponding changes were made to the "Corrective Actions" program element and FSAR Supplement summarized in Table XI-01.	These criteria are defined in terms of material strength thresholds, below which the low alloy steels are resistant to SCC. Specifically, the program element uses the 170-ksi ultimate-tensile-strength criterion (≤170 ksi) for existing studs and the 150 ksi yield-strength criterion (<150 ksi) for newly installed studs to provide SCC resistance. These slightly different criteria are described in the guidance in Regulatory Guide (RG) 1.65, "Materials and Inspections for Reactor Vessel Closure Studs," Revision 0 [NRC 1973-TN11529] and 1 [NRC 2010-TN8358], respectively. The initial version of the Regulatory Guide (Revision 0) used the ultimate-tensile-strength criterion. This criterion was typically used to select the materials of the original studs installed at the start of the plant operation. In recent years, yield-strength-based criteria have been widely used to select alloy steels or other materials resistant to SCC. The approach using a yield-strength criterion for closure studs is described in the more recent revision of RG 1.65 (Revision 1 [NRC 2010-TN8358]). As discussed above, Item (d) of the "Preventive Actions" program element reflects the evolution in guidance development over time (i.e., the ultimate-tensile-strength criterion for the existing studs and yield-strength criterion for newly installed studs). The U.S. Nuclear Regulatory Commission (NRC) staff notes that either the yield-strength criterion or ultimate-tensile-strength criterion is sufficient to select SSC-resistant low alloy steels for the aging management. Therefore, changes are made to Item (d) to allow either of the criteria for the selection of SCC-resistant stud materials. Accordingly, the "Corrective Actions" program element and Final Safety Analysis Report (FSAR)

Table 2-33 GALL-SLR Report, Revision 1, Differences from Chapter XI, Mechanical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of Significant Changes	Technical Basis for Change
		Supplement (GALL-SLR Table XI-01) are revised. The NRC staff expect these changes will reduce the issuance of unnecessary request for additional information (RAIs).
Preventive Actions Corrective Actions Table XI-01	Item (d) of the “Preventive Actions” program element of GALL-SLR AMP XI.M3 is changed to allow either yield-strength criterion (<150 ksi) or ultimate-tensile-strength criterion (≤170 ksi) for use of low alloy steels resistant to stress corrosion cracking (SCC). Either of the material strength criteria may be used regardless of whether existing reactor head closure studs or newly installed studs are addressed in the preventive actions. This preventive action is not necessary if cracking is managed by volumetric examination per ASME Code, Section XI [ASME 2017-TN9258], Table IWB-2500-1, Examination Category B-G-1. Corresponding changes were made to the “Corrective Actions” program element and FSAR Supplement summarized in Table XI-01.	Item (d) of the “Preventive Actions” program element describes the material strength criteria to prevent the susceptibility of reactor head closure stud materials to SCC (including intergranular stress corrosion cracking). These criteria are defined in terms of material strength thresholds, below which the low alloy steels are resistant to SCC. Specifically, the program element uses the 170-ksi ultimate-tensile-strength criterion (≤170 ksi) for existing studs and the 150 ksi yield-strength criterion (<150 ksi) for newly installed studs to provide SCC resistance. These slightly different criteria are described in the guidance in Regulatory Guide (RG) 1.65, “Materials and Inspections for Reactor Vessel Closure Studs,” Revision 0 [NRC 1973-TN11529] and 1 [NRC 2010-TN8358], respectively. The initial version of the Regulatory Guide (Revision 0) used the ultimate-tensile-strength criterion. This criterion was typically used to select the materials of the original studs installed at the start of the plant operation. In recent years, yield-strength-based criteria have been widely used to select alloy steels or other materials resistant to SCC. The approach using a yield-strength criterion for closure studs is described in the more recent revision of RG 1.65 (Revision 1 [NRC 2010-TN8358]). As discussed above, Item (d) of the “Preventive Actions” program element reflects the evolution in guidance development over time (i.e., the ultimate-tensile-strength criterion for the existing studs and yield-strength criterion for newly installed studs). The U.S. Nuclear

Table 2-33 GALL-SLR Report, Revision 1, Differences from Chapter XI, Mechanical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of Significant Changes	Technical Basis for Change
		Regulatory Commission (NRC) staff notes that either the yield-strength criterion or ultimate-tensile-strength criterion is sufficient to select SSC-resistant low alloy steels for the aging management. Therefore, changes are made to Item (d) to allow either of the criteria for the selection of SCC-resistant stud materials. Accordingly, the “Corrective Actions” program element and Final Safety Analysis Report (FSAR) Supplement (GALL-SLR Table XI-01) are revised. The NRC staff expect these changes will reduce the issuance of unnecessary request for additional information (RAIs). As noted in the change summary, Item (d) of the program element is not necessary if cracking is managed by volumetric examination per ASME Code, Section XI [ASME 2017-TN9258], Table IWB-2500-1, Examination Category B-G-1. The NRC staff notes that volumetric examination is effective in monitoring and detecting degradation due to stress corrosion cracking or intergranular stress corrosion cracking. The examinations in ASME Code, Section XI, Table IWB-2500-1, are specified in program elements 3, 4, and 5 of the XI.M3 AMP.
XI.M4: BWR Vessel ID Attachment Welds		
Monitoring & Trending **References**	AMP XI.M4: Item 5, “Monitoring and Trending,” the reference to “BWRVIP-60-A” is changed to “Code Case N-896.” In addition, in the “References” section, the reference to “BWRVIP-60-A” is changed to “Code Case N-896.”	The NRC is updating aging management program XI.M4, “BWR Vessel ID Attachment Welds,” to reference the latest crack growth correlations for stress corrosion cracking of low alloy steels in BWR water environment. The crack growth correlations in Code Case N-896 represent updated data and analysis relative to the older crack growth correlations in BWRVIP-60-A. In a final rulemaking [89 FR 58039], the NRC proposed to approve Code Case N-896 without conditions. Therefore, the NRC has reviewed the technical basis of the code case as part of the rulemaking process and has no objections to the

Table 2-33 GALL-SLR Report, Revision 1, Differences from Chapter XI, Mechanical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of Significant Changes	Technical Basis for Change
		use of the updated crack growth correlations.
XI.M7: BWR Stress Corrosion Cracking		
Monitoring & Trending References	AMP XI.M7: item 5, "Monitoring and Trending," the reference to "BWRVIP-60-A" is changed to "Code Case N-896." In addition, in the "References" section, the reference to "BWRVIP-60-A" is changed to "Code Case N-896."	The NRC is updating aging management program XI.M7, "BWR Stress Corrosion Cracking," to reference the latest crack growth correlations for stress corrosion cracking of low alloy steels in BWR water environment. The crack growth correlations in Code Case N-896 represent updated data and analysis relative to the older crack growth correlations in BWRVIP-60-A. In a final rulemaking [89 FR 58039], the NRC approved Code Case N-896 without conditions. Therefore, the NRC has reviewed the technical basis of the code case as part of the rulemaking process and has no objections to the use of the updated crack growth correlations.
XI.M8: BWR Penetrations		
Monitoring & Trending References	AMP XI.M8, Item 5, "Monitoring and Trending," reference "BWRVIP-60-A" is changed to "ASME Code Case N-896." In addition, in the "References" section, the reference to "BWRVIP-60-A" is changed to "Code Case N-896.".	The NRC is updating AMP XI.M8, "BWR Penetrations" to reference the latest crack growth correlations for stress corrosion cracking of low alloy steels in BWR water environment. The crack growth correlations in Code Case N-896 represent updated data and analysis relative to the older crack growth correlations in BWRVIP-60-A. In a final rulemaking [89 FR 58039], the NRC approved Code Case N-896 without conditions. Therefore, the NRC has reviewed the technical basis of the code case as part of the rulemaking process and has no objections to the use of the updated crack growth correlations. The NRC approved BWRVIP-58-A for the first period of extended operation, and the BWRVIP analyzed existing programs (including aging management guidance for control rod guide tubes and control rod drive housings) for the subsequent period of operation in BWRVIP-315. The NRC issued the safety evaluation for BWRVIP-315 on October 31, 2023 (ML23251A266) with

Table 2-33 GALL-SLR Report, Revision 1, Differences from Chapter XI, Mechanical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of Significant Changes	Technical Basis for Change
		BWRVIP-315-NP-A subsequently issued on April 30.2024 (ML24191A266). Given the documented review history, the staff finds that it is appropriate to reference BWRVIP-58-A in GALL-SLR XI.M9.
XI.M9: BWR Vessel Internals		
Scope of Program Monitoring & Trending Operating Experience References	The AMP XI.M9 was updated to standardize cited Boiling Water Reactor Vessel and Internals Project (BWRVIP) references and reflect recent developments in the BWRVIP guidance. The AMP XI.M9 was updated to include Code Case N-889 [ASME 2018-TN10976] for calculating irradiation-assisted crack growth rates. The references were updated to replace BWRVIP-100-A [EPRI 2006-TN9997] with BWRVIP-100, Revision 1-A. The staff added ML21147A008 to provide additional context on toughness recommendations for irradiated stainless steel welds.	The AMP XI.M9 describes an AMP acceptable to the staff for BWR reactor vessel internals (RVIs). BWR RVIs are currently age managed through a series of BWRVIP guidance documents, many of which have been reviewed and approved by the NRC. This revision to AMP XI.M9 corrects, updates, and standardizes BWRVIP document references in the text. This update also reflects two recent developments in BWRVIP guidance. First, the fracture toughness and flaw evaluation guidance in BWRVIP-100, Revision 1-A [NRC 2021-TN9111] is currently being updated due to recent data collected in material harvesting programs. Therefore, the NRC staff added a description of the potential changes to BWRVIP guidance and how subsequent license renewal applicants should respond. Second, the BWRVIP-315 [EPRI 2019-TN8343] topical report was in an advanced stage of NRC review at the time of this proposed GALL-SLR update. The NRC staff added a reference to BWRVIP-315 [EPRI 2019-TN8343] under Scope of the Program and provided instructions to SLRAs concerning limitations and applicant action items. The staff removed reference to low alloy steels in Section 5 of XI.M9, since there are no low alloy steel BWR RVI components. Also in Section 5, the NRC staff added a reference to Code Case N-889 [ASME 2018-TN10976] and provided guidance to SLRAs for its use. Finally, the staff added a brief description of recent top guide cracking operating experience (OE) in Section 10 of XI.M9.

Table 2-33 GALL-SLR Report, Revision 1, Differences from Chapter XI, Mechanical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of Significant Changes	Technical Basis for Change
Operating Experience References	AMP XI.M9 in Item 10, "Operating Experience," and in the "References," the reference to BWRVIP-18, Revision 1-A is changed to Revision 2-A.	BWRVIP-18, Revision 2-A was reviewed and approved by the NRC through the topical report process. In addition, BWRVIP-18, Revision 2-A is the referenced revision elsewhere in XI.M9. Therefore, it is appropriate for the NRC to update the outdated reference to BWRVIP-18, Revision 1-A on page XI.M9-2.
References	AMP XI.M9, References, update the reference to BWRVIP 190 to reflect Revision 1.	The NRC is updating AMP XI.M9, "BWR Vessel Internals," to reference BWRVIP-190, Revision 1. Consistent with the section Guidance on Use of Later Editions/Revisions of Various Industry Documents, found in Volume 1 of GALL-SLR, the staff has previously evaluated BWRVIP-190, Revision 1 for two plant-specific license renewal applications. First, when reviewing an exception documented in NUREG-2205, "Safety Evaluation Report Related to the License Renewal of LaSalle County Station, Units 1 and 2," September 2016, Section 3.0.3.2.1, "Water Chemistry." The staff found that BWRVIP-190, Revision 1, "BWR Vessel and Internals Project: BWR Water Chemistry Guidelines," EPRI 3002002623, dated April 24, 2014, acceptable to cite without exception. Similarly, the staff reviewed use of BWRVIP-190, Revision 1 in the Fermi 2 license renewal application and found it to be acceptable (ADAMS Accession No. ML16190A241). During those previous reviews, the staff found that BWRVIP-190, Revision 1 "incorporates the latest industry operating experience" and that it "does not…relax any of the relevant guidelines from the previous revision." The staff does not formally review or issue a Safety Evaluation on the various EPRI water chemistry guidelines (including BWRVIP-190, Revision 1). However, these guidelines are recognized as representing the industry's best practices in water chemistry control. Extensive experience in operating reactors has demonstrated

Table 2-33 GALL-SLR Report, Revision 1, Differences from Chapter XI, Mechanical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of Significant Changes	Technical Basis for Change
		that following EPRI chemistry guidelines minimizes the occurrence of corrosion-related failures. Further, EPRI guidelines are periodically revised to reflect evolving knowledge with respect to best practices in chemistry control. Therefore, the staff accepts the use of the latest version of the EPRI Guidelines as the basis for the water chemistry program and has updated the relevant reference to reflect the latest version.
XI.M12: Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)		
Program Description Scope of Program Acceptance Criteria	The program description and the "Scope of Program" and "Acceptance Criteria" program elements in GALL-SLR AMP XI.M12 are changed to reference the screening criteria and fracture toughness estimation methods in NUREG/CR-4513, Revision 2 [NRC 2016-TN9178] with errata (March 2021). The references section and FSAR Supplement (GALL-SLR XI-01) were also updated.	The NUREG/CR-4513, Revision 2 [NRC 2016-TN9178] was published in 2016 to provide the updated screening criteria and fracture toughness (FT) estimation methods for CASS materials that are susceptible to thermal aging embrittlement [1]. Subsequently, typographical errors in NUREG/CR-4513, Revision 2 [NRC 2016-TN9178] were corrected in the errata dated March 15, 2021 [2]. The screening criteria and FT estimation methods in NUREG/CR-4513, Revision 2 [NRC 2016-TN9178] with errata are consistent with those in NUREG/CR-4513, Revision 2 published in 2016 [NRC 2016-TN9178]. The updated criteria and methods are based on the evaluation of additional CASS materials with a ferrite content up to 40 percent. The maximum ferrite content of 40 percent evaluated in NUREG/CR-4513, Revision 2 [NRC 2016-TN9178] is an extension from the maximum ferrite content of 25 percent evaluated in Revision 1 of the NUREG report. Therefore, changes are made to GALL-SLR AMP XI.M12 to reference and use the updated screening criteria and FT estimation methods for CASS materials.

Table 2-33 GALL-SLR Report, Revision 1, Differences from Chapter XI, Mechanical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of Significant Changes	Technical Basis for Change
Scope of Program	For the "Scope of Program," fifth paragraph, the sentence referencing surface examination of valve bodies less than 4 inches will be deleted. Specifically, the following sentence will be deleted, "ASME Code, Section XI, Subsection IWB requires only surface examination of valve bodies less than 4 inches NPS."	The editorial changes improve clarity and align better with current ASME Code, Section XI ISI requirements.
Acceptance Criteria:	In the acceptance criteria, in the phrase "Nonmandatory Appendix C to the 2019 ASME Code, Section XI, provides flaw evaluation procedures for CASS with ferrite content ≥ 20 percent," remove "with ferrite content ≥ 20 percent."	Nonmandatory Appendix C to the 2019 ASME Code, Section XI [ASME 2017-TN9258] provides flaw evaluation guidelines that cover a broad category of piping materials including for those of CASS with ferrite content ≥ 20 percent. Adding the "ferrite content ≥ 20 percent," specificity is unnecessary and potentially causes confusion.
XI.M16A: PWR Vessel Internals		
Program Description	The staff modified the program description to indicate that PWR vessel internals programs will be based on the updated inspection and evaluation (I&E) guidelines in EPRI Report No. 3002017168 (MRP-227, Revision 1-A [NRC 2019-TN9222]). Because MRP-227, Revision 1-A [NRC 2019-TN9222], represents aging management for 60 years of plant operation, the staff clarified that a gap analysis of the reactor internals is needed if the AMP is based on MRP-227, Revision 1-A [NRC 2019-TN9222] as a starting point for the AMP that will be applied during the subsequent period of extended operation. The staff amended the program description to clarify that programs for Westinghouse and CE-designed PWRs group the RVI components group the components into either "Primary," "Expansion," "Existing Program," and "No Additional Measures" inspection categories and that the associated programs for B&W-designed PWRs only group the RVI components into "Primary," "Expansion" or "No Additional Measures"	The change in the program description is consistent with the staff's assumption that, by the time a PWR-designed nuclear plant will have entered into the subsequent period of extended operation for plant, the licensee will have converted its PWR vessel internals program over to the updated program defined in the MRP-227, Revision 1-A Report [NRC 2019-TN9222]. In Section 7 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222], the EPRI MRP calls for the AMPs to be converted over to the I&E guidelines in MRP-227, Revision 1-A [NRC 2019-TN9222] by January 1, 2022. Thus, for those licensees that decide to submit SLRAs of their PWRs, the licensees will have converted their PWR vessel internals programs over to MRP-227, Revision 1-A [NRC 2019-TN9222] before the plants enter into the subsequent period of extended operation. Like the preceding guidelines in EPRI Report No. 1022863 (i.e., MRP-227-A [EPRI 2011-TN8163]), the EPRI MRP's I&E guidelines in MRP-227, Revision 1-A [NRC 2019-TN9222] only assessed

Table 2-33 GALL-SLR Report, Revision 1, Differences from Chapter XI, Mechanical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of Significant Changes	Technical Basis for Change
	categories. The staff also amended the program description to include a sentence that describes the types of analyses that are used for the EPRI MRP's integrated sample-based selection process. The staff defined that, in the updated version of AMP XI.M16A, "MRP-227 (as supplemented)" refers to MRP-227, Revision 1-A [NRC 2019-TN9222] criteria as supplemented by a gap analysis. This definition applies through the revised AMP.	the PWR RVI components for Westinghouse, CE and B&W-designed plants for operating cycles and neutron fluence exposures over a cumulative 60-year service life. The methods in MRP-227, Revision 1-A [NRC 2019-TN9222] do not account for the potential impact that additional cycles and fluence imparted during a subsequent period of extended operation would have on the I&E protocols defined for the components in the MRP-227, Revision 1-A Report [NRC 2019-TN9222]. Although reports like MRP-2018-022 [EPRI 2018-TN9890] may be used to assess those impacts, the reports have yet to be docketed with the NRC or endorsed for use by the staff. Thus, gap analyses will still be needed if the applicant's program is based on MRP-227, Revision 1-A [NRC 2019-TN9222] as a starting point for the AMP. PWR vessel internals AMPs for B&W-designed PWRs do not include "Existing Program" inspection categories.
Scope of Program	The staff updated the "Scope of Program" program element to clarify that the program is based on "MRP-227 (as supplemented)," or on a staff-approved generic report that assesses aging over an 80-year service life. The staff updated the program element to include applicable supplemental guidance or reports (e.g., WCAPs, B&W report, alert letters) as being within the scope of the program.	The first significant change to the "Scope of Program" element is consistent with changes made to the program description that specify a gap analysis will be needed if MRP-227, Revision 1-A [NRC 2019-TN9222] is used as the starting point for the version of the AMP that will be applied during the subsequent period of extended operation. The technical basis for coordinating the MRP-227, Revision 1-A [NRC 2019-TN9222] methods with a gap analysis has been given in the previous technical basis statement for the program description of the AMP. As previously clarified in the GALL-SLR version of the AMP, the "Scope of Program" element covers the possibility that the industry may develop a generic 80-year report for PWR RVI components that is endorsed by the staff and that it would be perfectly acceptable for the applicant to adopt that report as the

Table 2-33 GALL-SLR Report, Revision 1, Differences from Chapter XI, Mechanical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of Significant Changes	Technical Basis for Change
		basis for the AMP without the need for performing a gap analysis of the components. The second significant change is designed to eliminate unnecessary enhancements. Although these PWR vessel internals programs are based on the latest staff-endorsed version of MRP-227 I&E guidelines (currently Revision 1-A [NRC 2019-TN9222]), the programs may include supplemental guidelines or reports that are endorsed by the NRC. The staff cannot preclude an applicant from including these types of supplemental methods in the scope of its AMP. The staff would anticipate that the applicant would define any supplemental guidelines (i.e., beyond those in MRP-227, Revision 1-A [NRC 2019-TN9222]) in the "Scope of Program" element discussion in the technical basis document for the AMP and provide file copies of the documents containing the methods in its in-house audit portal site directory for the PWR vessel internals AMP. The current SLRA review process would allow the staff to review the supplemental methods as part of the staff's in-office audit review of the AMP.
Parameters Monitored or Inspected	The staff made a minor edit of the last paragraph in the "Parameters Monitored or Inspected" program element to indicate that parameters monitored or inspected by the program are based on those defined and established in "MRP-227 (as supplemented)."	The program description for the AMP was amended to clarify that if MRP-227, Revision 1-A [NRC 2019-TN9222] is used as the starting point for the AMP that will be applied during the subsequent period of extended operation, the gap analysis being applied to the components may include methods in supplemental guidance or reports. The "Scope of Program" was also amended to allow use of supplemental guidelines. Thus, the change to the "Parameters Monitored or Inspected" element will allow the parameters monitored or inspected by the AMP to be based those in the MRP-227, Revision 1-A Report

Table 2-33 GALL-SLR Report, Revision 1, Differences from Chapter XI, Mechanical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of Significant Changes	Technical Basis for Change
		[NRC 2019-TN9222], or as established in supplemental guidelines, including those referenced in the gap analysis section of the SLRA. For the current status of PWRVI programs proposed in PWR SLRAs, those defined in the staff-endorsed MRP-227, Revision 1-A Report [NRC 2019-TN9222] should be sufficient, unless the results of the gap analysis demonstrate a need for adjusting the EPRI MRP's I&E criteria for a specified RVI component evaluated in the MRP-227, Revision 1-A Report [NRC 2019-TN9222].
Detection of Aging Effects	The staff amended the first paragraph of the "Detection of Aging Effects" program element to indicate that RVI component-specific inspections are as established in Section 4 of "MRP-227 (as supplemented)." The staff amended the second to last paragraph in the program element to indicate that component-specific inspection coverages are established in the MRP-227, Revision 1-A Report [NRC 2019-TN9222], or as amended in the gap analysis for the components. The staff amended the last paragraph of the program element to indicate that justifications of the appropriateness of component-specific inspection methods should be based on those in the MRP-22, Revision 1-A Report (and not those that previously defined in the MRP-227-A Report). Otherwise, the criteria in the "Detection of Aging Effects" element remain as previously written and issued in the corresponding program element in AMP XI.M16A of the GALL-SLR Report.	The changes to the specific criteria in the "Detection of Aging Effects" program element update the RVI component-specific bases to be consistent with those defined MRP-227, Revision 1-A Report [NRC 2019-TN9222] or as modified by the results of the applicant's gap analysis for a specified RVI component.
Monitoring and Trending	The staff amended the first paragraph of the "Monitoring and Trending" program element to specify the methods for monitoring, recording, evaluating and trending data resulting from the	The changes to the specific criteria in the "Monitoring and Trending" program element update the RVI component-specific bases to be consistent with those defined MRP-227, Revision 1-A

Table 2-33 GALL-SLR Report, Revision 1, Differences from Chapter XI, Mechanical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of Significant Changes	Technical Basis for Change
	program's inspections are given in "MRP-227 (as supplemented)" and that the inspection frequencies are established in Section 4 of "MRP-227 (as supplemented)." Otherwise, the criteria in the "Detection of Aging effects" element remain as previously written and issued in the corresponding program element in AMP XI.M16A of the GALL-SLR Report.	Report [NRC 2019-TN9222] or as modified by the results of the applicant's gap analysis for a specified RVI component.
Acceptance Criteria	The staff amended the "Acceptance Criteria" program element in GALL-SLR AMP XI.M16A to indicate that the component-specific acceptance criteria are in Table 5-1, 5-2, or 5-3 of Section 5 of MRP-227, Revision 1-A [NRC 2019-TN9222] or else in MRP-227 (as supplemented). The staff also amended the "Acceptance Criteria" program element to establish that the acceptance criteria for some Expansion category components may be established through performance of a component-specific analysis, particularly if the component type is inaccessible to inspection or the industry has yet to establish an adequate inspection for the component.	The changes account for the fact that the current component-specific I&E criteria in MRP-227, Revision 1-A [NRC 2019-TN9222] are based on an assessment of aging over a cumulative 60-year licensed service life and that the acceptance criteria established in Table 5-1, 5-2, or 5-3 of MRP-227, Revision 1-A [NRC 2019-TN9222] may be superseded (on a component-specific basis) by the results of an 80-year RVI gap analysis or by the corresponding tables in a version of MRP-227 that covers an 80-year cumulative licensed service life. Additionally, the staff has already approved disposition by component-specific analysis in the staff's April 25, 2019 safety evaluation for MRP-227, Revision 1-A [NRC 2019-TN9222]; however, the prior version of the "Acceptance Criterion" program element did not account for this possibility. For example, in Items B10.1 and B10.2 of Table 4-4 in MRP-227, Revision 1-A, the EPRI MRP established the Expansion category B&W core barrel welds and former plates (as linked to the Primary category baffle plates) would be dispositioned by component-specific analysis if the results of primary inspections performed on the baffle plates triggered sample-expansion to the core barrel welds and former plates. Similarly, for Westinghouse baffle-former bolts, the EPRI MRP identifies in Item W6 of Table 5-1, MRP-227, Revision 1-A, that the acceptance criteria for the ultrasonic bolt inspections is to be

Table 2-33 GALL-SLR Report, Revision 1, Differences from Chapter XI, Mechanical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of Significant Changes	Technical Basis for Change
		established by performance of licensee technical justification for the bolt type. Thus, the staff's amendment of the "Acceptance Criteria" program accounts for acceptance criteria that are defined and established in a component-specific analysis technical justification.
Corrective Actions	The staff amended the "Corrective Actions" program element to reference "MRP-227 (as supplemented)." Otherwise the "Corrective Actions" program element remains as previously established and written in the analogous program element of AMP XI.16A in the GALL-SLR Report.	Similar to analogous changes to other program elements in the AMP, the corrective actions will be established by either those defined in the MRP-227, Revision 1-A Report [NRC 2019-TN9222] or as modified by the applicant's gap analysis, which may include and establish supplemental methods and alternative corrective action bases for the components.
Confirmation Process	The staff amended the "Confirmation Process" program element to indicate that the implementation criteria for these programs are established in Section 7 in MRP-227 Revision 1 or else as defined in Nuclear Energy Institute (NEI) 03-08 or other guidance documents, reports, or guidelines that are referenced for the AMP. Otherwise the "Conformation Process" program element remains as previously established and written in the analogous program element of AMP XI.16A in the GALL-SLR Report.	The EPRI MRP's latest criteria for implementing these types of programs in accordance with the guidance in NEI 03-08 are given in Section 7 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222]. But since MRP-227, Revision 1-A was based on an assessment of aging over a 60-year service life, the minor adjustment of the "Confirmation Process" program elements now allows additional implementation and confirmation activity criteria to be used as part of the confirmation and implementation activities of the program, particularly if they are defined and called as part of the gap analysis methodology for the AMP (or even a version of MRP-227 that covers an 80-year licensed service life). As an example of this, the use of the additional criteria in EPRI's MRP-2018-022 [EPRI 2018-TN9890] guidance may provide additional criteria for adjusting the MRP-227, Revision 1-A criteria for CE or Westinghouse components over a cumulative 80-year licensed service life.
Administrative Controls	The staff amended the second paragraph of the "Administrative Controls" program element to clarify that Section 7 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222] establishes the basis for	The staff confirmed that the EPRI MRP's bases for implementing MRP-based PWRVI programs in accordance with NEI-03-08 is given in Section 7 of the MRP-227, Revision 1-A Report [NRC

Table 2-33 GALL-SLR Report, Revision 1, Differences from Chapter XI, Mechanical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of Significant Changes	Technical Basis for Change
	implementing the PWRVI program in accordance with the industry guidelines set in NEI-03-08. The staff also added a sentence to clarify that administrative needs for updating the AMP implementation procedures consist with updated industry guidelines within the scope of the AMP fall within the "Administrative Controls" program element of the AMP and do not need to be subject to individual programmatic enhancements. The staff deleted the previous sentence that established a 45 day window for reporting programmatic MRP-227-based deviations to the NRC.	2019-TN9222]. The MRP-227, Revision 1-A Report no longer includes any criteria to report deviations from the MRP-established I&E criteria to the NRC within 45 days of their discovery. The additional clarification on program enhancements that solely involve needs for procedural updates is included to reduce unnecessary burden. Both the industry and staff agree that these types of PWRVI programs (i.e., MRP-based programs) are living programs that are periodically updated as new guidelines develop for the inspection or evaluation of PWR RVI components. Thus, the staff would expect licensee to keep their programs and related procedures up-to-date as new guidance develops and is issued by the industry relative to aging management needs of PWR RVI components. Applicants have already demonstrated to the staff that they are already performing the appropriate updates of the programs and related procedures on an "as needed" basis. Since these types of activities fully fall within the scope of the "Administrative Controls" program element of the AMP, there is no need for applicants to include additional AMP programmatic enhancements for procedural update needs that would already fall within the scope of the "Administrative Controls" program element of GALL-SLR AMP XI.M16A.
Operating Experience	The staff updated the "Operating Experience" program element to change any reference of the applicable report from "MRP-227-A" to "MRP-227, Revision 1-A."	The changes are administrative and are analogous to those made to the referencing of MRP-227, Revision 1-A [NRC 2019-TN9222] in the other program elements of the AMP.
References	Staff added references for the MRP-227, Revision 1-A Report (EPRI Topical Report No. 3002017168) and the staff's April 25, 2019 safety evaluation for the MRP-227, Revision 1-A. The staff also added a reference for the staff's	The staff's changes in the references in the AMP are considered to be administrative edits of the AMP. The updated reference list is intended to keep the references in the AMP up-to-date with changes made to GALL AMP XI.M16, "PWR Vessel Internals," in SLR-

Table 2-33 GALL-SLR Report, Revision 1, Differences from Chapter XI, Mechanical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of Significant Changes	Technical Basis for Change
	correspondence letter to the EPRI MRP that endorsed MRP-227.	ISG-2021-01-PWRVI [NRC 2021-TN9958].
GALL-SLR Table XI-01	The staff amended the FSAR Supplement summary description example for GALL-SLR AMP XI.M16A, “PWR Vessel Internals,” to reference MRP-227, Revision 1-A as the applicable report for the AMP.	The changes to the FSAR Supplement summary description example are considered to be administrative and are analogous to those made for the referencing of MRP-227, Revision 1-A [NRC 2019-TN9222] in the staff’s update of GALL-SLR AMP XI.M16A, “PWR Vessel Internals,” in SLR-ISG-2021-01-PWRVI [NRC 2021-TN9958].
XI.M17: Flow-Accelerated Corrosion		
Program Description	Clarify that commitments made in response to NRC Generic Letter 89-08 [NRC 1989-TN8046] were for an ongoing flow-accelerated corrosion (FAC) monitoring program.	Previous staff audits noted that some commitments for a “long-term” FAC monitoring program delineated in GL 89-08 [NRC 1989-TN8046] had been considered one-time commitments and not ongoing commitments. For license renewal, the staff views the commitments in response to GL 89-08 [NRC 1989-TN8046] to be ongoing commitments, remaining in effect, and part of the current licensing basis.
Program Description	Add information that software quality assurance (QA) activities should continue even though these activities are not required by the FAC program software QA classification.	The NSAC-202L notes that the CHECWORKS™ code was developed in accordance with QA policies requiring a formal software plan, detailed program documentation, and a list of program bugs. However, the staff has found that, in most cases, the software QA classification for FAC software does not require any of the QA activities currently being performed on the FAC software. The staff has determined that the currently performed QA activities should continue in order to provide reasonable assurance that the effects of aging will be adequately managed.
Program Description	Add that the guidance in EPRI 3002005530 [EPRI 2015-TN9225] can be used to manage loss of material due to erosion mechanisms.	During its review of the Surry SLRA (ML20052F523), the staff determined that the guidance in EPRI 3002005530 [EPRI 2015-TN9225], “Recommendations for an Effective Program Against Erosive Attack,” can be used as the basis for a program to manage erosion mechanisms.

Table 2-33 GALL-SLR Report, Revision 1, Differences from Chapter XI, Mechanical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of Significant Changes	Technical Basis for Change
Parameters Monitored or Inspected Detection of Aging Effects	Eliminated opportunistic inspections	Minimum sample size requirements for each population establish reasonable assurance and obviate the need for further opportunistic inspections.
Detection of Aging Effects	Clarify by adding specific recommendations from EPRI guidance NSAC202L for scope expansion due to unexpected or inconsistent inspection results.	The staff added the specificity regarding scope expansions based on previous SLRAs which did not appear to document plant requirements for expanding inspection results, and because of previous operating experience noting the importance of inspection scope expansions (Licensee Event Report [LER] 286/2018-003 [Entergy 2018-TN9232] and IN 2019-08 [NRC 2019-TN9248]). As noted in LER 286/2018-003, a contributing cause to the FAC event was inadequate procedural guidance for inspection scope expansions. The GALL-SLR guidance was updated to highlight the importance of not only inspecting two diameters downstream from the affected component, but also to inspect the next two most susceptible components in the line as predicted by CHECWORKS™ and to inspect corresponding components on other trains with a similar configuration to the one displaying wear.
Detection of Aging Effects	Include clarification that erosion susceptibility screening provided in EPRI 3002005530 [EPRI 2015-TN9225] can be used to augment erosion location identification, except that system exclusion should be based on 100 hours per year instead of the 2 percent of operating time.	The EPRI TR-112657 [EPRI 2000-TN9226], “Revised Risk-Informed Inservice Inspection Evaluation Procedure,” includes specific guidance regarding exclusion of erosion-cavitation consideration if flow occurs less than 100 hours per year. This is in contrast to the 2 percent operational time (approximately 275 hours) specified in EPRI 3002005530 [EPRI 2015-TN9225]. In addition, the severity of cavitation and OE should be used to validate screening results based on previous reviews where severe cavitation was only occurring during opening and closing of valves caused very high wear rates.

Table 2-33 GALL-SLR Report, Revision 1, Differences from Chapter XI, Mechanical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of Significant Changes	Technical Basis for Change
Acceptance Criteria	Add a safety factor of 2.0 from EPRI 3002005530 [EPRI 2015-TN9225] for erosion mechanism re-inspection interval determinations.	The EPRI 3002005530 [EPRI 2015-TN9225], Section 6.10 discusses Safety Factor determination and states that the minimum should never be less than 2.0. Cases where a safety factor greater than 2.0 are also discussed in that section.
Corrective Actions	Clarify that periodic monitoring of components replaced with a material that is more resistant to erosion mechanism can be discontinued, if sufficient inspections establish that the new material adequately mitigates the associated loss of material through the end of the period of extended operation.	In response to public comment 32-15, (NEI-13, ML23291A071) the staff agreed that a clarification was needed because the existing verbiage did not provide for ending periodic monitoring if there was an adequate basis for discontinuing the periodic inspections.
Administrative Controls	Add information that software QA activities should continue even though these activities are not required by the FAC program software QA classification.	The staff has found that, in most cases, the software QA classification for FAC software does not require any of the QA activities that are currently being performed on the FAC software. The staff has determined that the currently performed QA activities should continue in order to provide reasonable assurance that the effects of aging will be adequately managed.
Operating Experience	Add recently issued Information Notice (IN) 2019-08 [NRC 2019-TN9248] and associated LERs.	Issues identified at Indian Point and Davis-Besse were discussed in IN 2019-08 [NRC 2019-TN9248] where legacy issues from initial modeling resulted in loss of pressure boundary integrity.
References	Add EPRI 3002005530 [EPRI 2015-TN9225], “Recommendations for an Effective Program Against Erosive Attack.” In addition, add IN 2019-08, “Flow-Accelerated Corrosion Events [NRC 2019-TN9248],” and the associated LER from Indian Point, (286/2018-003; Entergy 2018-TN9232) and Davis-Besse (346/2015-002; FENOC 2015-TN9233).	During its review of the Surry SLRA (ML20052F523), the staff determined that the guidance in EPRI 3002005530 [EPRI 2015-TN9225], can be used as the basis for a program to manage erosion mechanisms IN 2019-08 [NRC 2019-TN9248], along with the associated LERs from Indian Point and Davis-Besse, were added to highlight legacy issues from initial FAC model development that resulted in several events.
XI.M18: Bolting Integrity		
Detection of Aging Effects	Eliminated opportunistic inspections	Minimum sample size requirements for each population establish reasonable assurance and alternate monitoring

Table 2-33 GALL-SLR Report, Revision 1, Differences from Chapter XI, Mechanical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of Significant Changes	Technical Basis for Change
		methods are provided when the minimum sample size cannot be obtained, thus obviating the need for further opportunistic inspections.
Corrective Actions	Reduced the minimum size of the expanded scope inspections from the lesser of 5 additional or 20 percent of the population, to the lesser of 2 additional or 10 percent if an initial inspection does not meet acceptance criteria.	The initial minimum sample size established a 90 percent confidence that 90 percent of the population did not contain an attribute. Reducing the minimum size of the expanded scope inspection to 2 samples or 10 percent continues to provide reasonable assurance that the systemic or localized nature of the issue can be determined and that the appropriate corrective actions can be taken.
XI.M19: Steam Generators		
Program Description References	Update the references to NUREG-1430, “Standard Technical Specifications – Babcock and Wilcox Plants,” NUREG-1431, “Standard Technical Specifications – Westinghouse Plants,” and NUREG-1432 [NRC 2021-TN9322], “Standard Technical Specifications – Combustion Engineering Plants,” to Revision 5.	In September 2021, the NRC published Revision 5 of NUREG-1430, “Standard Technical Specifications – Babcock and Wilcox Plants” (ML21272A363 [Volume 1; NRC 2021-TN9320]); NUREG-1431, “Standard Technical Specifications – Westinghouse Plants” (ML21259A155 [Volume 1; NRC 2021-TN9321]); and NUREG-1432, “Standard Technical Specifications – Combustion Engineering Plants” (ML21258A421 [Volume 1; NRC 2021-TN9322]). Therefore, the Program Description and the References were updated to reference Revision 5 of the Standard Technical Specifications.
Preventive Actions	Add clarification regarding the type of corrosion that SG tube plugs may experience and add clarification that extensive deposit buildup on the secondary side of SGs could affect tube integrity.	Other than SCC, the staff is unaware of OE of SG tube plugs experiencing other types of corrosion in the US. Therefore, the clarification was made to reflect the type of corrosion SG tube plugs may experience, which is stress corrosion cracking. The clarification regarding extensive buildup of deposits on the secondary side of SGs was made to clearly state where extensive deposit buildup is expected in the SG.

Table 2-33 GALL-SLR Report, Revision 1, Differences from Chapter XI, Mechanical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of Significant Changes	Technical Basis for Change
Parameters Monitored or Inspected	Add clarification that the Steam Generators and Water Chemistry programs are used to manage cracking due to primary water stress corrosion cracking (PWSCC) of divider plate assemblies and tube-to-tubesheet welds, even if it is determined that use of the One-Time Inspection program is not needed to confirm the effectiveness of the Steam Generators and Water Chemistry programs at mitigating PWSCC. In addition, references to Sections 3.1.2.2.11 and 3.1.3.2.11 in NUREG-2192, Revision 1, were added. These sections contain the review procedures for determining whether a One-Time Inspection AMP is applicable.	Based on a review of current SLRAs, the staff noted that applicants' may omit AMR items for managing cracking due to PWSCC if, after further evaluation, a One-Time Inspection AMP is determined not to be required for the divider plate assemblies or the tube-to-tubesheet welds. However, because the divider plate assemblies and tube-to-tubesheet welds, are susceptible to PWSCC, the intent is that cracking due to PWSCC for the divider plate assemblies and the tube-to-tubesheet welds be managed by the Steam Generators and Water Chemistry programs. Use of the One-Time Inspection AMP (beyond the Steam Generators and Water Chemistry programs) to confirm the effectiveness of the Steam Generators and Water Chemistry programs at mitigating cracking due to PWSCC may be applicable depending, in part, on the materials of construction of the divider plate assemblies and the tube-to-tubesheet welds. Reference to Sections 3.1.2.2.11 and 3.1.3.2.11 in NUREG-2192 were added because they provide the review procedures for determining whether use the applicability of the One-Time Inspection AMP.
Parameters Monitored or Inspected	Changes were made to the inspection frequency of divider plate assemblies, tube-to-tubesheet welds, heads (channel or lower/upper heads), and tubesheets to be consistent with the maximum inspection interval in the standard technical specifications.	NRC-approved Technical Specification Specifications Task Force (TSTF), TSTF-577 [NRC 2020-TN8034], Revision 1, "Revised Frequencies for Steam Generator Tube Inspections" (ADAMS Package Accession No. ML21099A086), increased the maximum inspection interval for thermally treated Alloy 690 (Alloy 690TT) SG tubing. Specifically, the maximum inspection interval for Alloy 690TT is 96 Effective Full Power Months (EFPM), which is longer than the current 72 EFPM inspection frequency of the divider plate assemblies, tube-to-tubesheet welds, heads (channel or lower/upper heads), and tubesheets in the GALL. Therefore, the inspection frequency of divider plate assemblies, tube-to-tubesheet welds,

Table 2-33 GALL-SLR Report, Revision 1, Differences from Chapter XI, Mechanical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of Significant Changes	Technical Basis for Change
		heads (channel or lower/upper heads), and tubesheets was updated to reflect the maximum inspection interval for units with Alloy 690TT SG tubing.
Parameters Monitored or Inspected	Update references to address recent EPRI guidelines for SGs.	In December 2020, EPRI published EPRI 3002018267, "PWR Primary-to-Secondary Leak Guidelines," Revision 5 [EPRI 2020-TN9259]. Therefore, EPRI 3002018267 replaces EPRI 1022832. In December 2021, EPRI published EPRI 3002020909, "Steam Generator Integrity Assessment Guidelines," Revision 5 [EPRI 2021-TN9262]. Therefore, EPRI 3002020909 replaces EPRI 3002007571.
Acceptance Criteria	Update references to address recent EPRI guidelines for SGs.	In November 2016, EPRI published EPRI 3002007856, "Steam Generator In Situ Pressure Test Guidelines," Revision 5 [EPRI 2016-TN9260]. Therefore, EPRI 3002007856 replaces EPRI 1025132.
References	Several references were updated to cite the latest revision and to correct titles and report numbers. In addition, TSTF-577 [NRC 2020-TN8034], Revision 1, and NUREG-2192, "Standard Review Plant for Review of Subsequent License Renewal Applications for Nuclear Power Plants," were added as references.	Since the last publication of Volume 2 of NUREG-2191, "Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report" (ADAMS Accession No. ML17187A204 [NRC 2017-TN9902]), new revisions of previously cited references have been issued, which, in some instances, resulted in a new report number. The NRC staff also identified minor errors in the titles of previously cited references. Therefore, the references were updated to cite the latest revisions and new report numbers, and those references with errors in the title were corrected. A reference to NRC-approved TSTF-577 [NRC 2020-TN8034], Revision 1, "Revised Frequencies for Steam Generator Tube Inspections" (ADAMS Package Accession No. ML21099A086), was added. Revision 5 of the standard technical specifications incorporate TSTF-577 [NRC 2020-TN8034]. A reference to NUREG-2192, "Standard Review Plan for Review of Subsequent

Table 2-33 GALL-SLR Report, Revision 1, Differences from Chapter XI, Mechanical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of Significant Changes	Technical Basis for Change
		License Renewal Applications for Nuclear Power Plants," dated July 2017 (ADAMS Accession No. ML17188A158 [NRC 2017-TN9323]), was added because it is referenced in the Parameters Monitored or Inspection section of AMP XI.M19.
XI.M21A: Closed Water Treated System		
Detection of Aging Effects	Clarify that 1-ft pipe samples should be taken from multiple locations to ensure that the samples are representative of the entire population.	During the staff's review of the North Anna SLRA, the applicant proposed taking all 1-ft piping samples from a single excavation location without any technical justification for this position. SRP-SLR Section A.1.2.3.4 notes that "when sampling is used to represent a larger population of [components], applicants provide the basis for the inspection population and sample size." The staff added additional guidance to alleviate future questions.
Detection of Aging Effects	Eliminated opportunistic inspections.	Minimum sample size requirements for each population establish reasonable assurance and obviate the need for further opportunistic inspections.
Corrective Actions	Reduced the minimum size of the expanded scope inspections from the lesser of 5 additional or 20 percent of the population, to the lesser of 2 additional or 10 percent if an initial inspection does not meet acceptance criteria.	The initial minimum sample size established a 90 percent confidence that 90 percent of the population did not contain an attribute. Reducing the minimum size of the expanded scope inspection to 2 samples or 10 percent continues to provide reasonable assurance that the systemic or localized nature of the issue can be determined and that the appropriate corrective actions can be taken.
XI.M24: Compressed Air Monitoring		
Program Description Parameters Monitored or Inspected Detection of Aging Effects Table XI-01	Eliminated opportunistic inspections.	Minimum sample size requirements for each population establish reasonable assurance and obviate the need for further opportunistic inspections.

Table 2-33 GALL-SLR Report, Revision 1, Differences from Chapter XI, Mechanical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of Significant Changes	Technical Basis for Change
XI.M26: Fire Protection		
Program Description Scope of Program Parameters Monitored or Inspected Detection of Aging Effects Monitoring and Trending Acceptance Criteria	Change “fire damper assembly” to “fire damper housing” to clarify that the fire damper housing is the passive component of a fire damper assembly that is subject to aging management.	Based on a review of current SLRAs, the staff noted that AMR items have been included for fire damper assemblies or fire damper housings. Fire damper assembly suggests the entire component (e.g., housing, damper) is subject to aging management while fire damper housing suggests only a portion of the component is subject to aging management. Therefore, clarification is needed regarding which components of a fire damper assembly are passive components and are subject to aging management. NUREG-2192 defines passive structures and components “as those that perform their intended functions without moving parts or change in configuration or properties in accordance with 10 CFR 54.21(a)(1)(i).” The fire damper housing does not perform its intended function with moving parts; however, the other fire damper assembly components, including the damper, do perform their intended function with moving parts. Treating the fire damper itself as an active component not subject to aging management is consistent with the treatment of other dampers. Specifically, 10 CFR 54.21(a)(1)(i) [TN4878] states that ventilation dampers are excluded from aging management, and SRP-SLR Table 2.1-6 states that only the housings of dampers, louvers, and gravity dampers associated with valves are subject to aging management. GALL-SLR Item VII.G.A-789, SRP Item 3.3-1, 255 in Volume 1 of NUREG-2191 is revised to address cracking and loss of material for metallic fire damper housings exposed to air by the Fire Protection program.

Table 2-33 GALL-SLR Report, Revision 1, Differences from Chapter XI, Mechanical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of Significant Changes	Technical Basis for Change
		SRP-SLR Table 2.1-6 is revised to state that the fire damper housing is subject to aging management.
Program Description	Add statement that the GALL-SLR Report AMP XI.M26 is complemented by GALL-SLR Report AMP XI.S5. In addition, add a statement that the Structures Monitoring and Fire Protection program would together manage applicable aging effects for structural fire barriers, and that the Masonry Walls and Fire Protection programs would together manage applicable aging effects for masonry walls that are considered fire barriers. Add clarification about why both the Structures Monitoring and Fire Protection programs are necessary to manage the effects of aging for structural fire barriers, and why both the Masonry Walls and Fire Protection programs are necessary to manage the effects of aging for masonry walls that are considered fire barriers. Add statement that the applicable procedures for the Structures Monitoring and Fire Protection programs should document their coordination with regards to managing the effects of aging for structural fire barriers, and the applicable procedures for the Masonry Walls and Fire Protection programs should document their coordination with regards to managing the effects of aging for masonry walls that are considered fire barriers. Add a statement that if an applicant does not credit both the Structures Monitoring and Fire Protection programs to manage applicable aging effects for structural fire barriers, or both the Masonry Walls and Fire Protection programs to manage applicable aging effects for masonry walls that are considered fire barriers, then sufficient information should be included in the application and the credited program's appliable procedures to demonstrate that the credited program's inspections, frequency of inspections,	Based on a review of current SLRAs, the staff noted instances where only the Masonry Walls program or the Fire Protection program is cited to monitor applicable aging effects for masonry walls that are considered fire barriers. However, GALL-SLR Report AMP XI.S5 states, "The aging effects on masonry walls that are considered fire barriers are also managed by the GALL-SLR Report AMP XI.M26, Fire Protection, as well as being managed by this program." This statement is consistent with GALL-SLR AMR Item VII.G.A-626, SRP item 3.3-1, 179 in Volume 1 of NUREG-2191, which cites both programs for managing applicable aging effects for masonry walls that are considered fire barriers. Therefore, the statement that the Fire Protection program is complemented by the Masonry Walls program is added to be consistent with GALL-SLR Report AMP XI.S5 and GALL-SLR AMR Item VII.G.A-626, SRP item 3.3-1, 179. This addition is consistent with the existing statement that the Fire Protection program is complemented by the Structures Monitoring program. The Structures Monitoring and Fire Protection program would together manage applicable aging effects for structural fire barriers, and that the Masonry Walls and Fire Protection programs would together manage applicable aging effects for masonry walls that are considered fire barriers because these components have both a structural and fire protection intended function. To ensure proper coordination between the programs, applicable procedures for the Structures Monitoring and Fire Protection programs should document their coordination with regards to

Table 2-33 GALL-SLR Report, Revision 1, Differences from Chapter XI, Mechanical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of Significant Changes	Technical Basis for Change
	and acceptance criteria are capable (equivalent to the Fire Protection, Structures Monitoring, or Masonry Walls programs not credited) of ensuring the intended functions for these components will be maintained.	managing the effects of aging for structural fire barriers, and the applicable procedures for the Masonry Walls and Fire Protection programs should document their coordination with regards to managing the effects of aging for masonry walls that are considered fire barriers. In addition, if an applicant does not credit both the Structures Monitoring and Fire Protection programs to manage applicable aging effects for structural fire barriers, or both the Masonry Walls and Fire Protection programs to manage applicable aging effects for masonry walls that are considered fire barriers, then sufficient information should be included in the application and the credited program's applicable procedures to demonstrate that the credited program's inspections, frequency of inspections, and acceptance criteria are capable (equivalent to the Fire Protection, Structures Monitoring, or Masonry Walls programs not credited) of ensuring the intended functions for these components will be maintained. Based on a review of current SLRAs, the staff also noted instances where only the Structures Monitoring program or the Fire Protection program is cited to monitor applicable aging effects for structural fire barriers. However, GALL-SLR AMR Item VII.G.A-90, SRP Item 3.3-1, 060 cites both the Structures Monitoring and Fire Protection programs for managing applicable aging effects for structural fire barriers (walls, ceilings, and floors). Changes are not required to GALL-SLR AMP Report XI.M26 because it already states that the Fire Protection program is complemented by the Structures Monitoring program.
Scope of Program	Add that materials used to secure fire wraps are subject to aging management by the Fire Protection program.	Based on a review of current SLRAs, the staff noted that either it was unclear whether AMR items were included, or no

Table 2-33 GALL-SLR Report, Revision 1, Differences from Chapter XI, Mechanical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of Significant Changes	Technical Basis for Change
		AMR items were included for materials used to secure fire wraps. The clarification is being made because EPRI 3002013084, "Long-Term Operations: Subsequent License Renewal Aging Effects for Structures and Structural Components (Structural Tools)," dated November 2018 [EPRI 2018-TN9412], states that materials used to secure the fire wrap are considered part of the fire wrap. Therefore, since the fire wrap is subject to aging management so is the material that is used to secure fire wrap.
Monitoring and Trending	Add clarification that the results of inspections for all aging effects, not just cracking and loss of material, are trended to provide for timely detection of aging effects. In addition, add clarification that fire barriers include walls, ceilings, floors, and other fire barrier materials and that the results of inspections of fire barrier walls, ceilings, and floors and other fire barrier materials are trended to provide for timely detection of aging effects. Add statement that to properly trend inspection results, enough detail to identify changes or trends in condition when comparing results to previous results should be documented. In addition, add clarification that comparing inspection results only to the immediately prior inspection results (unless inspection results are only available for an immediately prior inspection) may not identify changes or trends in conditions occurring over time.	The clarification is needed because fire barrier penetration seals and materials used as fireproofing/fire barriers may have aging effects, other than cracking and loss of material, therefore, inspection results of all aging effects, not just cracking and loss of material, are to be trended to provide for timely detection of aging effects. Clarification is needed to indicate that fire barriers include walls, ceilings, and floors and other fire barrier materials and that the results of inspections of that fire barriers include walls, ceilings, and floors and other fire barrier materials are trended to provide for timely detection of aging effects. Inspection results should be documented in sufficient detail and compared to prior inspection results to identify changes or trends in the condition of fire barriers. Comparing inspection results only to the immediately prior inspection results (unless inspection results are only available for an immediately prior inspection), may not identify changes or trends in condition occurring over time.

Table 2-33 GALL-SLR Report, Revision 1, Differences from Chapter XI, Mechanical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of Significant Changes	Technical Basis for Change
Acceptance Criteria	Add clarification that loss of fire protection capability can be from degradation other than loss of material; and separation of seals can also be from ceilings and floors, not just from walls and components.	Clarification is needed because the loss of fire protection capability can be from degradation other than loss of material (e.g., cracks that could allow fire or smoke to pass through). Clarification is needed because fire barrier penetration seals can be used with ceilings and floors, not just with walls and components. Therefore, separation of fire barrier penetration seals can also be from ceilings and floors.
References	Several references to cite the latest revision and to make formatting changes for consistency. In addition, EPRI 3002013084, “Long-Term Operations: Subsequent License Renewal Aging Effects for Structures and Structural Components (Structural Tools) [EPRI 2018-TN9412],” and NRC IN-89-52 [NRC 1989-TN9414], “Potential Fire Damper Operational Problems,” were added as references.	Since the last publication of Volume 2 of NUREG-2191, “Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report” (ADAMS Accession No. ML17187A204 [NRC 2017-TN9902]), new revisions of several of the previously cited references have been issued. The staff also made minor formatting changes for consistency. A reference to EPRI 3002013084, “Long-Term Operations: Subsequent License Renewal Aging Effects for Structures and Structural Components (Structural Tools) [EPRI 2018-TN9412],” was added because it is now referenced in the Scope of Program section of GALL-SLR AMP Report XI.M26. A reference to NRC IN-89-52, “Potential Fire Damper Operational Problems [NRC 1989-TN9414],” was added because it provides relevant operating history for fire dampers.
XI.M27: Fire Water System		
Program Description	Clarified that the requirements for replacing or testing sprinklers is in Section 5.3.1 of the 2011 Edition of NFPA 25, which includes sub-sections for standard, fast response, and dry sprinklers.	Reference to Section 5.3.1 of the 2011 Edition of NFPA 25 for the requirements for replacing or testing sprinklers was added because it includes sub-sections related to standard, fast response, and dry sprinklers. Changes were made to include information regarding replacing or testing dry sprinklers and fast response sprinklers because these type sprinklers may exist in nuclear power

Table 2-33 GALL-SLR Report, Revision 1, Differences from Chapter XI, Mechanical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of Significant Changes	Technical Basis for Change
		plants, and it is consistent with NFPA 25. The AMP XI.M27 in Revision 0 of NUREG-2191, Vol. 2 only refers to standard sprinklers.
Detection of Aging Effects	Deleted reference to fire hydrant hose hydrostatic tests and gasket inspections.	The tests and inspections were deleted because fire hydrant hoses and gaskets are typically excluded from aging management review based on SRP-SLR Table 2.1-3, “Specific Staff Guidance on Screening,” “Consumables,” Items (1) and (4).
Detection of Aging Effects	The recommended extent of standpipe and hose system flow tests is reduced if the tests conducted no earlier than 5 years prior to the subsequent period of extended operation meet pressure and flow criteria. New footnote (f) to Table XI.M27-1.	The staff has revised the recommendations for this testing for two reasons. The purpose of this testing is to detect potential flow blockage due to fouling and loss of material. The fire water system for plants entering the subsequent period of extended operation will have been in service for at least 60 years; with the program change allowing testing results to be monitored as early as 5 years prior to the subsequent period of extended operation. Based on its review of many fire water system AMPs, the staff has concluded that the internal environment for the fire water system (i.e., water supply) has either been the same or, at some plants, water supplies have been modified to take its source from a less adverse environment (e.g., modifying the system to take suction from city water or well water in lieu of a river). Given that the environment has been the same or less adverse and the acceptance criteria has been met, the design pressure at the required flow, it is reasonable to assume that a reduced sample size would be adequate to provide continued confirmation that the fire water system will meet its intended function in relation to these tests.
Detection of Aging Effects	The recommended drain down level for hydrant barrels was revised based on the plant-specific frost line and operating experience. New footnote (h) was added to Table XI.M27-1.	The staff has concluded that it is reasonable to assume that: (a) water that is in a hydrant barrel below the frost line will not freeze because of heat provided by the Earth below the frost line, which is supported by national

Table 2-33 GALL-SLR Report, Revision 1, Differences from Chapter XI, Mechanical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of Significant Changes	Technical Basis for Change
		standards for the installation of fire service mains and their appurtenances including fire hydrants and (b) national consensus standards for fire piping, such as Section 10.4.2.1 of NFPA 24 and Section 3.3.9.1 of NFPA 25, only require that the hydrant isolation valve be installed below the frost line. The staff reviewed the following: • NFPA 24, “Standard for the Installation of Private Fire Service Mains and Their Appurtenances,” Section 10.4.2.1, “Protection for Piping,” states that the top of the pipe shall be buried not less than 12 inches (in) below the frost line for the locality. • Section 3.3.9.1 of NFPA 25 and Section 3.4.1.1 of NFPA 24 state that the control valve for a dry barrel hydrant is located below the frost line. • The Manual of Water Supply Practices, M17, “Fire Hydrants: Installation, Field Testing, and Maintenance [AWWA 2016-TN11524],” Fifth Edition, states in the Chapter 2 section titled “Types of Dry Barrel Hydrants” that the main valve is located below the normal frost line to protect the hydrant from freezing.
Detection of Aging Effects	Clarification was added that the fire pump intake suction screen inspections are for flow blockage and loss of material and include the fire pump suction strainer when present. In addition, the recommended periodic fire pump suction strainer inspections were specified based on plant-specific operating experience and monitoring of upstream, fire pump intake suction screens and/or upstream	Fire pump intake suction screens have a filtration intended function which is associated with two aging effects: flow blockage and loss of material. The 2011 Edition of NFPA 25 Section 8.3.3.7 requires fire pump intake suction screens to be inspected and cleared of debris or obstructions after the waterflow portions of the annual test or after system activations. Although the inspections prescribed by the 2011 Edition of NFPA 25 Section 8.3.3.7 are

Table 2-33 GALL-SLR Report, Revision 1, Differences from Chapter XI, Mechanical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of Significant Changes	Technical Basis for Change
	traveling water screens, if present. New footnote (i) was added to Table XI.M27-1.	for clearing the fire pump intake suction screens of any debris or obstructions, these periodic inspections could reasonably be expected to identify loss of material leading to a loss of intended function of the fire pump intake suction screens. Therefore, clarification was added that inspections are for evaluating flow blockage and loss of material. In addition to the fire pump intake suction screens, a fire pump suction strainer may be present on the pump bowl. For example, the Wet Pit Suction Screen Installation shown in Figure A.8.2.2 in Annex A of the 2011 Edition of NFPA 25 includes a fire pump suction strainer on the pump bowl. Like fire pump intake suction screens, fire pump suction strainers are passive, long-lived in-scope components in the fire protection system having a filtration intended function associated with the aging effects of flow blockage and loss of material. Because the fire pump suction strainers may become blocked, damaged, or corrode over time, which could impact their ability to perform their intended function, it is appropriate for AMP XI.M27 to include a recommendation to manage loss of material and flow blockage of the fire pump suction strainers. The NRC staff determined that the inspection frequency for the fire pump suction strainer can be extended to 10 years if a site has no operating experience related to flow blockage and loss of material of the fire pump suction strainer, and either the site monitors the differential pressure across the fire pump suction strainer or the site conducts activities to verify the capability of the upstream fire pump intake suction screens and/or upstream traveling water screens prevent pass-through of debris that could reach the fire pump suction strainer. Past examination results (no

Table 2-33 GALL-SLR Report, Revision 1, Differences from Chapter XI, Mechanical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of Significant Changes	Technical Basis for Change
		plant-specific operating experience related to flow blockage or loss of material) for the fire pump suction strainer should predict future performance, monitoring differential pressure across the fire pump suction strainer should identify flow blockage, and monitoring the ability of the upstream fire pump intake suction screens and/or upstream traveling water screens, if present, to prevent pass-through of debris should limit the debris that could buildup on the fire pump suction strainer. The inspections performed every 10 years would verify flow blockage is being adequately managed for the fire pump suction strainer and the fire pump suction screen is not damaged or corroding. Clarification was also included that the application describes the activities to verify the capability of the upstream fire pump intake suction screens and/or upstream traveling water screens, if present, to prevent pass-through of debris.
Detection of Aging Effects	The recommended sample size and periodicity of conducting main drain tests was revised based on test results and plant-specific operating experience. New footnote (l) was added to Table XI.M27-1.	Like the basis for the inclusion of the new footnote (f) to Table XI.M27-1, it is reasonable to assume that the amount of internally generated debris (i.e., loss of material) from the piping system would not vary after 55 years of operating the fire water system with exposure to the same environment. Accordingly, the test results and plant-specific OE can provide effective enough insights such that the extent of testing and periodicity changes can still provide reasonable assurance that the system will meet its intended function. In addition, the reduced sampling size is consistent with the number of recommended tests or inspections (i.e., 20 percent) in several sampling based AMPs (e.g., XI.M38, “Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components”).

Table 2-33 GALL-SLR Report, Revision 1, Differences from Chapter XI, Mechanical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of Significant Changes	Technical Basis for Change
Detection of Aging Effects	The recommendation for inspecting the exterior surfaces of insulated fire water storage tanks was revised to allow insulation removal and inspection consistent with AMP XI.M29, "Outdoor and Large Atmospheric and Metallic Storage Tanks." In addition, the reference to footnote no. (10) to Table XI.M27-1 in Revision 0 was deleted and the inspections are recommended as occurring on a refueling outage interval in lieu of annually. New footnote (j) was added to Table XI.M27-1.	Although NFPA 25 states that exterior visual examinations should be conducted on an annual basis, conducting inspections consistent with GALL-SLR Report AMP XI.M29, provides reasonable assurance that loss of material and cracking (e.g., aluminum tanks) will be adequately managed for these tanks. Refueling outage interval inspections of the external surfaces of the tank are consistent with GALL-SLR Report AMP XI.M29.
Detection of Aging Effects	A "Periodicity" column was added to Table XI.M27-1. The "NFPA 25 Section" column was retained. Footnote no. (2) from Revision 0 was retained. Footnotes were revised accordingly.	Some parentheticals included the periodicity in the "Description" column of Table XI.M27-1 in Revision 0 of NUREG-2191, Volume 2; therefore, for simplicity and completeness, the periodicities from the 2011 Edition of NFPA 25, "Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems," were added in a new "Periodicity" column. Existing and new footnotes were assigned as appropriate. It was determined to retain the "NFPA 25 Section" column since the inspections, tests, and periodicities are based on the 2011 Edition of NFPA 25. Footnote no. (2) from Revision 0 was retained and redesignated as new Footnote (q) and assigned to the "NFPA 25 Section" column header.
Detection of Aging Effects	The recommendation for performing main drain tests was revised to include that full flow pressures should not be compared only to the immediately prior test result. New footnote (m) was added to Table XI.M27-1.	Although Section 13.2.5 of NFPA 25 states, "When there is a 10 percent reduction in full flow pressure when compared to the original acceptance test or previously performed tests, the cause of the reduction shall be identified and corrected if necessary." The staff notes that if the test-to-test pressure monitoring only uses the immediately prior test result, significant degradation of the fire water system supply over several years may not be identified while still being less than a 10 percent reduction from the previous test.

Table 2-33 GALL-SLR Report, Revision 1, Differences from Chapter XI, Mechanical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of Significant Changes	Technical Basis for Change
Detection of Aging Effects	A recommendation to visually inspect and clean the mainline strainers of the private fire service main was added. New footnote (g) was added to Table XI.M27-1.	Mainline strainers may become blocked or corrode over time, therefore, consistent with NFPA 25 Section 7.2.2.3, a recommendation was added to visually inspect and clean the mainline strainers annually and after each significant flow. NFPA 25 Sections 7.2.2.3 and A.7.2.2.3 provide additional information on significant flow.
Detection of Aging Effects	AMP XI.M27, Table XI.M27-1, “Fire Water System Inspection and Testing Recommendations (a, b, c),” added new footnote (p) to, Foam Water Sprinkler Systems, Operational Test Discharge Patterns as follows: Where the nature of the protected property is such that foam cannot be discharged, the nozzles or open sprinklers are inspected for correct orientation and the system tested with air to ensure that the nozzles are not obstructed.	Section 11.3.2.6 of NFPA 25, 2011 Edition, requires observing discharge patterns of foam water sprinkler systems to ensure the nozzles or sprinklers are positioned correctly and the nozzles or sprinklers are not obstructed. A new footnote (p) is added to allow the option to inspect the nozzles or sprinklers for correct orientation and to test with air when the nature of the protected property is such that foam cannot be discharged for testing purposes. Consistent with Section 11.3.2.6 of NFPA 25, 2011 Edition, inspecting the nozzles or sprinklers for correct orientation and testing them with air will ensure they are not obstructed, and the discharge patterns are not impeded.
Acceptance Criteria	The third Acceptance Criteria is revised to include foreign organic or inorganic material consistent with Chapter 14 of NFPA 25.	Language regarding foreign organic or inorganic material to obstruct pipes or sprinklers was moved from the Corrective Actions program element for AMP XI.M27. In addition to no loose fouling products in the Acceptance Criteria program element, it is appropriate to include no sufficient foreign organic or inorganic material to obstruct pipes, sprinklers, or deluge nozzles because if the pipe or sprinklers are obstructed, then they may not be able to perform their intended function.
Corrective Actions	The first and second sentences of the third paragraph are revised to acknowledge that depending on the site’s testing regime, performing additional tests may not be necessary to determine whether the issue is localized or widespread. The second sentence is deleted because Table XI.M27-1	Depending on the site’s testing regime, performing additional tests may not be necessary to determine whether the issue is localized or widespread. Therefore, deleted the specific number of additional tests and added recommendation to conduct additional tests in locations that could be

Table 2-33 GALL-SLR Report, Revision 1, Differences from Chapter XI, Mechanical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of Significant Changes	Technical Basis for Change
	recommends an obstruction investigation and internal inspection of piping consistent with NFPA Section 14.3. In addition, the fourth paragraph is deleted because the Monitoring and Trending program element for AMP XI.M27 includes guidance related to confirming the timing of subsequent inspections will maintain the component's intended function throughout the subsequent period of extended operation.	susceptible to the same obstructing material and were not in the scope of the initial tests. Deleted the corrective action related to conducting a flush if loose fouling products detected because Table XI.M27-1 recommends an obstruction investigation and internal inspection of piping consistent with NFPA Section 14.3, which recommends a complete flushing program. In addition, removed the corrective action regarding adjusting inspection frequencies because the Monitoring and Trending program element for AMP XI.M27 includes guidance related to confirming the timing of subsequent inspections will maintain the component's intended function throughout the subsequent period of extended operation.
XI.M29: Outdoor and Large Atmospheric Metallic Storage Tanks		
Detection of Aging Effects	Clarify that the 1 square-foot (ft^2) sections of insulation should be taken from multiple locations to ensure that the samples are representative of the entire exterior of the tank.	During its review of a recent SLRA, an applicant proposed taking all 1 ft piping samples from a single excavation location without any technical justification for this position. SRP-SLR Section A.1.2.3.4 notes that "when sampling is used to represent a larger population of [components], applicants provide the basis for the inspection population and sample size." The staff added additional guidance to alleviate future questions.
Corrective Actions	Reduced the minimum size of the expanded scope inspections from the lesser of 5 additional or 20 percent of the population, to the lesser of 2 additional or 10 percent if an initial inspection does not meet acceptance criteria.	The initial minimum sample size established a 90 percent confidence that 90 percent of the population did not contain an attribute. Reducing the minimum size of the expanded scope inspection to 2 samples or 10 percent continues to provide reasonable assurance that the systemic or localized nature of the issue can be determined and that the appropriate corrective actions can be taken.
XI.M30: Fuel Oil Chemistry		
Detection of Aging Effects	Removed the one-time inspection called out in this program element and allowed	Because element 4, Detection of Aging Effects, already requires inspections at least once during the 10-year period

Table 2-33 GALL-SLR Report, Revision 1, Differences from Chapter XI, Mechanical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of Significant Changes	Technical Basis for Change
	an exception to multi-level sampling for tanks with frequent turnover.	prior to the subsequent period of extended operation, and at least once every 10 years during the subsequent period of extended operation, and because the operating experience reviews have not identified significant aging issues in systems and components covered by the Fuel Oil Chemistry AMP, and because the corrective action program has been used effectively to address issues found during inspections and maintenance covered by this AMP, the staff agreed to remove the one-time inspection noted in the Fuel Oil Chemistry AMP. The staff has previously reviewed and accepted exceptions to multi-level sampling of tanks with frequent inventory turnover because the frequent turnover negates the need for multi-level sampling.
Corrective Actions	Revised wording to allow other options besides adding a biocide upon finding MIC during tank inspections.	The staff agreed that the current guidance is overly prescriptive, since other options, such as replacing the fuel oil, might be more appropriate in certain situations.
XI.M32: One-Time Inspection		
Parameters Monitored or Inspected	As revised by Revision 1 to the SLR AMP XI.M32, footnote no. (3), which stated, “Visual inspections conducted to detect potential loss of material or cracking of SS and aluminum alloy support members; welds; bolted connections; support anchorage to building structure exposed to air or condensation (see SRP-SLR Section 3.5.2.2.2.4) may be conducted consistent with those for the GALL-SLR Report AMP XI.S6, ‘Structures Monitoring’” was deleted.	The staff deleted footnote no. (3) because it has concluded that the more rigorous examination techniques cited in AMP XI.M32 should be conducted when periodic inspections will not be conducted during the subsequent period of extended operation. These techniques can detect minor indications of loss of material and cracking. If the One-Time Inspections and plant-specific OE do not reveal loss of material or cracking, periodic inspections will not be conducted during the subsequent period of extended operation. As a result, it is important to demonstrate that the environment conditions will not promote loss of material or cracking by more rigorous examination techniques during the One-Time Inspection.

Table 2-33 GALL-SLR Report, Revision 1, Differences from Chapter XI, Mechanical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of Significant Changes	Technical Basis for Change
		For a support, minor loss of material or cracking that might not be detectable during a one-time walkdown inspection will likely not impact the intended function of the support; however, the staff has concluded that growth of loss of material or cracking will become more evident during periodic inspections of supports.
Program Description Detection of Aging Effects	Incorporation of an incubation period into AMP XI.M32 for repairs or replacements that are used to correct a condition adverse to quality that is related to plant-specific operating experience.	Since the One-Time Inspection program is based on a 50- to 60-year incubation period, inspections on recently installed repairs or replacements do not provide objective evidence that adverse aging effects are not occurring at a rate that would cause a loss of intended function during the subsequent period of extended operation. This scenario occurred during the review of a carbon fiber wrap for the Indian Point LRA, when it was found that a One-Time Inspection was proposed for a repair that was only in service for about 5 years. The review resulted in several management discussions and RAIs.
Program Description	XI.M32, Program Description, is revised to state, "A one-time inspection of selected components is conducted 6 months prior to the subsequent period of extended operation or no later than the last refueling outage prior to the beginning of a subsequent period of extended operation …"	The Program Description will be revised to more clearly reflect the inspection timing requirements.
Scope of Program	XI.M32, Scope of Program, is revised to remove the names of the three AMPs that were recommended for deletion in a public comment (i.e., Water Chemistry, Fuel Oil Chemistry, and Lubricating Oil Analysis).	The staff performed a review of the operating experience for the Water Chemistry, Fuel Oil Chemistry, and Lubricating Oil Analysis AMPs for seven subsequent license renewal applications. This review confirmed that operating experience reviews have not identified significant aging issues in systems and components covered by the Water Chemistry, Fuel Oil Chemistry, and Lubricating Oil Analysis AMPs, and on those occasions when the corrective action program has been used, it has been effective in addressing

Table 2-33 GALL-SLR Report, Revision 1, Differences from Chapter XI, Mechanical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of Significant Changes	Technical Basis for Change
		issues found during inspections and maintenance. In addition, per SRP-SLR Section A.4.2, plants are required to implement programs for the ongoing review of operating experience, and plants should also periodically assess the effectiveness of aging management programs. These activities can provide objective evidence to support the conclusion that the effects of aging are managed adequately so that the intended functions of structures and components will be maintained during the subsequent period of extended operation. The staff therefore eliminated one-time inspections associated with Water Chemistry, Fuel Oil Chemistry, and Lubricating Oil Analysis.
Detection of Aging Effects	Removed the one-time inspection of the Water Chemistry, Fuel Oil Chemistry, and Lube Oil Analysis AMPs.	The Water Chemistry AMP is a mitigation program that regularly monitors the water chemistry in accordance with the EPRI water chemistry guidelines and based on plant operating conditions. In the Fuel Oil Chemistry AMP, Element 4, Detection of Aging Effects, already requires inspections at least once during the 10-year period prior to the subsequent period of extended operation, and at least once every 10 years during the subsequent period of extended operation. The Lubricating Oil Analysis AMP performs periodic sampling and testing of lubricating oil for moisture and corrosion particles in accordance with equipment manufacturers recommendations or industry standards (e.g., American Society of Testing Materials [ASTM] D 6224-02). Operating experience reviews did not identify significant aging issues in systems and components covered by the Water Chemistry, Fuel Oil Chemistry, or Lubricating Oil Analysis AMPs, and the corrective action program has been used

Table 2-33 GALL-SLR Report, Revision 1, Differences from Chapter XI, Mechanical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of Significant Changes	Technical Basis for Change
		effectively to address issues found during inspections and maintenance covered by these AMPs. Also, the implementation of the One-Time Inspection Program for initial renewal per NUREG-1800 will continue to provide data to verify the lack of significance of aging effects at plants as they enter their period of extended operation (i.e., year 40).
Corrective Actions	Clarified that if the cause of degradation is found to be systemic, periodic inspections will commence, but if the degradation is found to be from an assignable non systemic cause, periodic inspections will not be required.	If an inspection result does not meet the acceptance criteria (whether based on the current inspection result or projected degradation), it is appropriate to transition to a periodic program given the potential adverse impact to the SC’s ability to meet its intended function; however, if the cause can be shown to be non-systemic, then other options, such as an additional one-time inspection, can be implemented.
XI.M33: Selective Leaching		
Scope of Program and Detection of Aging Effects	Eliminate the conditional exclusion of buried components with external coatings from inspection.	LR-ISG-2011-03, “Changes to the Generic Aging Lessons Learned (GALL) Report, Revision 2 AMP XI.M41, “Buried and Underground Piping and Tanks,” introduced the recommendation regarding reducing the number of selective leaching inspections for buried piping based on the presence of external coatings. The basis provided in LR-ISG-2011-03 for this reduction is coatings can prevent or mitigate selective leaching in buried components. These recommendations were subsequently moved from AMP XI.M41 to AMP XI.M33 with the issuance of LR-ISG-201501, “Changes to Buried and Underground Piping and Tank Recommendations.” These recommendations, which were later incorporated into GALL-SLR Report AMP XI.M33, provided conditions where externally coated buried piping may be excluded from the scope of the Selective Leaching program and provided conditions where the inspection sample size may be reduced by 50 percent.

Table 2-33 GALL-SLR Report, Revision 1, Differences from Chapter XI, Mechanical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of Significant Changes	Technical Basis for Change
		During the staff's review of the Surry SLRA, two ruptures occurred in buried gray cast iron piping associated with the fire protection system due to selective leaching (ADAMS Accession No. ML19310E716). Prior to the ruptures occurring, the applicant had responded to a staff's request to clarify if all buried fire protection piping is externally coated by stating "specifications require buried cast iron fire protection piping to be coated with bituminous coating" (ADAMS Accession No. ML19183A386). The staff notes that in this instance, external coatings were ineffective in preventing or mitigating selective leaching of the buried fire protection piping. Although external coatings were ineffective in this OE example, the staff recognizes that external coatings can be effective in preventing or mitigating selective leaching of buried piping based on site-specific parameters such as coating types utilized, results of inspections of these coatings, soil corrosivity as determined by soil testing in the vicinity of buried piping susceptible to selective leaching, etc. Based on the need for site-specific information, the staff is removing the current generic recommendations in the AMP with respect to reducing or eliminating selective leaching inspections of buried piping based on the presence of external coatings. An applicant still has the option to take an exception with technical justification to inspect a reduced sample size of buried components.
Scope of Program, Detection of Aging Effects, and Acceptance Criteria	Inclusion of malleable iron as a material susceptible to selective leaching.	During its review of recent SLRA plant-specific OE, in response to the staff's observation regarding dark corrosion product layers indicative of graphitic corrosion on the internal surfaces of malleable iron fittings exposed to a closed cycle cooling water environment, an applicant revised its SLRA to reflect that malleable iron components exposed

Table 2-33 GALL-SLR Report, Revision 1, Differences from Chapter XI, Mechanical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of Significant Changes	Technical Basis for Change
		to environments where selective leaching could occur will be managed for loss of material due to selective leaching. Based on this new OE, the staff has revised guidance documents (i.e., GALL-SLR and SRP-SLR Report) to include malleable iron as a material susceptible to selective leaching. The staff's revisions to guidance documents are similar to those incorporated when ductile iron was added as a susceptible material in 2016. In addition, due to similarities in microstructure between malleable iron and ductile iron, the staff revised GALL-SLR Report AMP XI.M33 to reflect that these two materials may be grouped together in sample populations. The staff notes ductile iron and malleable iron consist of spherical graphite nodules and irregularly shaped graphite nodules, respectively, embedded in iron (whereas gray cast iron has a semicontinuous network of graphite flakes embedded in iron).
Detection of Aging Effects	Clarify that a technical justification for using the extent of inspections in the AMP should be provided for gray cast iron piping exposed to soil.	NUREG-2222 [NRC 2017-TN9926], "Disposition of Public Comments on the Draft Subsequent License Renewal Guidance Documents NUREG–2191 and NUREG–2192," provides the basis for reducing the extent of inspections for selective leaching during the subsequent period of extended operation (i.e., 3 percent with a maximum of 10 components per GALL-SLR guidance) when compared to the extent of inspections for selective leaching during the initial period of extended operation (i.e., 20 percent with a maximum of 25 components per GALL Report, Revision 2 guidance). Part of the basis for reducing the extent of inspections is that industry OE had not identified instances of loss of material due to selective leaching which had resulted in a loss of intended function for the component.

Table 2-33 GALL-SLR Report, Revision 1, Differences from Chapter XI, Mechanical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of Significant Changes	Technical Basis for Change
		The NRC issued IN 202004, "Operating Experience Regarding Failure of Buried Fire Protection Main Yard Piping," to inform the industry of OE involving the loss of function of buried gray cast iron fire water main yard piping due to multiple factors, including graphitic corrosion (i.e., selective leaching), overpressurization, low cycle fatigue, and surface loads. As noted in the IN, a contributing cause to the failures of buried gray cast iron piping at Surry Power Station was the external reduction in wall thickness at several locations due to graphitic corrosion. Based on recent industry OE, the staff revised GALL-SLR Report AMP XI.M33 to reflect that a technical justification is provided in the SLRA when using the sample size recommend in the AMP for gray cast iron piping exposed to soil. Alternatively, an applicant may elect to use the sample size recommended in Revision 2 of the GALL Report (i.e., 20 percent with a maximum of 25 components) for this population.
Detection of Aging Effects	Clarify that 1-ft pipe samples should be taken from multiple locations to ensure that the sample is representative of the entire population.	During the staff's review of the North Anna SLRA, the applicant proposed taking all 1-ft piping samples from a single excavation location without any technical justification for this position. SRP-SLR Section A.1.2.3.4 notes that "when sampling is used to represent a larger population of [components], applicants provide the basis for the inspection population and sample size." The staff added additional guidance to alleviate future questions.
Detection of Aging Effects	Include soil parameter consistency when providing a basis for reducing the total number of inspections at multiunit sites for buried components.	The current factors to consider when reducing the number of inspections at multiunit sites focus on aqueous environments; however, components susceptible to selective leaching are also commonly exposed to a soil environment (e.g., buried cast iron fire water system piping).

Table 2-33 GALL-SLR Report, Revision 1, Differences from Chapter XI, Mechanical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of Significant Changes	Technical Basis for Change
Acceptance Criteria	Revise the pointer related to not crediting material properties of dealloyed portions from criterion (c) to criterion (d).	Due to an editorial error, the discussion related to not crediting the material properties of the dealloyed portion of a component in any evaluations inadvertently referred to criterion (c) instead of criterion (d). Criterion (c) refers to a superficial dealloyed layer which would not involve an evaluation, whereas criterion (d) would involve an evaluation to show that system design requirements would be met.
Acceptance Criteria	State that in the last sentence of Element 6, reference to criterion (3) should be changed to criterion (4).	This revision is to correct an editorial error which was documented in NUREG-2221, Supplement 1, page 2-93.
Corrective Actions	State that in all cases, the additional inspections (required when acceptance criteria are not met), if identified during the latter half of the current inspection interval, must be completed within 4 years after the end of the 10-year interval.	This change is consistent with requirements in other AMPs, such as XI.M41, and allows for these additional inspections to be completed within 10 years of the acceptance criteria not being met.
Operating Experience	Include recent OE.	The cited OE contributed to the program changes associated with: (a) inspection reductions that credit external coatings and common soil environments and (b) the addition of malleable iron as a material susceptible to selective leaching.
Detection of Aging Effects and Acceptance Criteria	Include “white/grey meringue deposit” to the list of visual indicators of selective leaching for copper alloys.	The staff added “white/grey meringue deposit” to the list of visual indicators of selective leaching for copper alloys based on its review of EPRI Report 3002020822, “Accelerated Testing and Evaluation of Factors Affecting Selective Leaching Susceptibility,” and *Corrosion of Copper and its Alloys - A Practical Guide for Engineers* during its audit of the NEI proposed revision to GALL-SLR Report AMP XI.M33 (ML22353A608).
References	Revise the “references” section of GALL-SLR Report AMP XI.M33, “Selective Leaching,” to add four EPRI references: EPRI. EPRI 3002020832, “Electromagnetic NDE Techniques for Detection of Selective Leaching in Gray Cast Iron Piping.” Palo Alto, California:	Referenced EPRI reports provide technical basis related to selective leaching degradation mechanisms and viable non-destructive examination techniques.

Table 2-33 GALL-SLR Report, Revision 1, Differences from Chapter XI, Mechanical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of Significant Changes	Technical Basis for Change
	Electric Power Research Institute. September 15, 2021. EPRI. EPRI 3002020830, "Ultrasonic NDE Techniques for Detection of Selective Leaching in Complex Shaped Gray Cast Iron Components." Palo Alto, California: Electric Power Research Institute. July 2, 2021. EPRI. EPRI 3002020822, "Accelerated Testing and Evaluation of Factors Affecting Selective Leaching Susceptibility." Palo Alto, California: Electric Power Research Institute. September 15, 2021. EPRI. EPRI 3002016057, "Selective Leaching: State-of-the-Art Technical Update." Palo Alto, California: Electric Power Research Institute. December 20, 2019.	
XI.M36: External Surfaces Monitoring of Mechanical Components		
Detection of Aging Effects	Revised program to clarify that VT-1 inspections are optional for non-ASME Code components.	Based on a public comment received related to the GALL-SLR Report Revision 1 update, the staff revised the "detection of aging effects" program element to clarify that VT-1 inspections are optional for non-ASME Code components.
Detection of Aging Effects	Clarify that 1-ft pipe samples should be taken from multiple locations to ensure that the samples are representative of the entire population.	During the staff's review of the North Anna SLRA, the applicant proposed taking all 1-ft piping samples from a single excavation location without any technical justification for this position. SRP-SLR Section A.1.2.3.4 notes that "when sampling is used to represent a larger population of [components], applicants provide the basis for the inspection population and sample size." The staff added additional guidance to alleviate future questions.
Corrective Actions	Reduced the minimum size of the expanded scope inspections from the lesser of 5 additional or 20 percent of the population, to the lesser of 2 additional or 10 percent if an initial inspection does not meet acceptance criteria.	The initial minimum sample size established a 90 percent confidence that 90 percent of the population did not contain an attribute. Reducing the minimum size of the expanded scope inspection to 2 samples or 10 percent

Table 2-33 GALL-SLR Report, Revision 1, Differences from Chapter XI, Mechanical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of Significant Changes	Technical Basis for Change
		continues to provide reasonable assurance that the systemic or localized nature of the issue can be determined and that the appropriate corrective actions can be taken.
XI.M38: Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components		
Detection of Aging Effects	Revised program to clarify that VT-1 inspections are optional for non-ASME Code components.	Based on a public comment received related to the GALL-SLR Report Revision 1 update, the staff revised the “detection of aging effects” program element to clarify that VT-1 inspections are optional for non-ASME Code components.
Detection of Aging Effects	Clarify that 1-ft pipe samples should be taken from multiple locations to ensure that the samples are representative of the entire population.	During the staff’s review of the North Anna SLRA, the applicant proposed taking all 1-ft piping samples from a single excavation location without any technical justification for this position. The SRP-SLR Section A.1.2.3.4 notes that “when sampling is used to represent a larger population of [components], applicants provide the basis for the inspection population and sample size.” The staff added additional guidance to alleviate future questions.
Corrective Actions	Reduced the minimum size of the expanded scope inspections from the lesser of 5 additional or 20 percent of the population, to the lesser of 2 additional or 10 percent if an initial inspection does not meet acceptance criteria.	The initial minimum sample size established a 90 percent confidence that 90 percent of the population did not contain an attribute. Reducing the minimum size of the expanded scope inspection to 2 samples or 10 percent continues to provide reasonable assurance that the systemic or localized nature of the issue can be determined and that the appropriate corrective actions can be taken.
Corrective Actions Detection of Aging Effects Table XI-01	Eliminated opportunistic inspections.	Minimum sample size requirements for each population establish reasonable assurance and obviate the need for further opportunistic inspections.

Table 2-33 GALL-SLR Report, Revision 1, Differences from Chapter XI, Mechanical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of Significant Changes	Technical Basis for Change
XI.M39: Lube Oil Analysis		
Detection of Aging Effects	Removed the one-time inspection called out in this program element.	The Lubricating Oil Analysis AMP performs periodic sampling and testing of lubricating oil for moisture and corrosion particles in accordance with equipment manufacturers recommendations or industry standards (e.g., American Society of Testing Materials [ASTM] D 6224-02). Operating experience reviews did not identify significant aging issues in systems and components covered by the Lubricating Oil Analysis AMP, and the corrective action program has been used effectively to address issues found during inspections and maintenance covered by this AMP.
XI.M41: Buried and Underground Piping and Tanks		
Acceptance Criteria	Revise AMP XI.M41, “Buried and Underground Piping and Tanks,” to clarify that when the 100 millivolt (mV) criterion is utilized to protect copper alloy or aluminum alloy components, applicants must explain in the application why the effects of mixed potentials are minimal and why the most anodic metal in the system is adequately protected.	The LR-ISG-2011-03, “Changes to the Generic Aging Lessons Learned (GALL) Report Revision 2 Aging Management Program (AMP) XI.M41, “Buried and Underground Piping and Tanks,” provides the following recommendation: “[w]hen the 100 mV criterion is utilized in lieu of the -850 mV CSE [copper/copper sulfate reference electrode] criterion for steel piping, or where copper or aluminum components are protected, applicants must explain in the application why the effects of mixed potentials are minimal and why the most anodic metal in the system is adequately protected.” This recommendation was removed when LR-ISG-2015-01, “Changes to Buried and Underground Piping and Tank Recommendations,” was issued. LR-ISG-2015-01 addressed the issue of mixed potentials for steel components by introducing the concept of confirmatory testing (i.e., verifying external loss of material rate through the use installed electrical resistance [ER] corrosion rate probes). However, LR-ISG-2015-01 did not address the issue of mixed potentials for copper alloy and aluminum alloy

Table 2-33 GALL-SLR Report, Revision 1, Differences from Chapter XI, Mechanical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of Significant Changes	Technical Basis for Change
		components, which was an oversight by the staff. The staff considered including confirmatory testing for aluminum alloy components; however, ER probes are intended to indicate metal loss by general corrosion (i.e., not suited for aluminum where pitting and crevice corrosion are the aging mechanisms in a soil environment). Specifically, the staff reviewed the following: *Corrosion Tests and Standards: Application and Interpretation* [ASTM 2005-TN9865] states "[i]n the same way as mass loss on corrosion test specimens, resistance measurements on electrical resistance probes indicate metal loss by general corrosion. Pitting is generally not noticeable until near the end of probe life, where the effect of pitting becomes "runaway" on the resistance measurement." "*Corrosion Rate Probes for Soil Environments*," American Society for Metals (ASM) Handbook Volume 13C [Covino and Bullard 2006-TN9864], states "[t]he ER technique does not function well in pitting environments because corrosion pits could be interpreted as thinning of the sensor cross-sectional area and thus as a uniform corrosion rate." Regarding copper alloy components, ER probes for buried environments predominately contain corrosion rate elements constructed from carbon steel; therefore, it is unclear if proposing the use of ER probes with copper corrosion rate elements is practical. In addition, based on its review of the first three subsequent license renewal applications, which did not cite this component, material, and environment combination (i.e., copper alloy piping exposed to soil), the staff did not identify a need to provide a specific

Table 2-33 GALL-SLR Report, Revision 1, Differences from Chapter XI, Mechanical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of Significant Changes	Technical Basis for Change
		recommendation in the AMP to address the issue of mixed potentials for copper alloy components. To address the issue of mixed potentials for copper alloy and aluminum alloy components, the staff reinserted the recommendation from LR-ISG-201103 regarding the use of the 100 mV criterion in a mixed metal environment. Recommendations regarding validating the use of the 100 mV criterion (through the use of ER probes) for steel piping were not revised.
Acceptance Criteria	Clarify that either NACE or AMPP qualifications are valid for coating inspectors and cathodic protection specialists.	This is a strictly administrative change that recognizes the restructuring of the organization responsible for the coating inspector qualifications and the cathodic protection specialist qualification. These qualifications are relevant to, and will continue to be relevant to, the Buried and Underground Piping and Tanks AMP. This change recognizes the validity of current Coating Inspector Level 2 or 3 and Cathodic Protection CP4 qualifications that may be certified as NACE. This change also recognizes the validity of current and future Coating Inspector Level 2 or 3 and Cathodic Protection CP4 qualifications that may be certified as AMPP.
Detection of Aging Effects Operating Experience	Revise GALL-SLR AMP XI.M41 to clarify that evaluation of plant-specific OE includes out of scope buried components if they are representative of in-scope buried components (e.g., similar material composition, degradation mechanisms, coatings, soil conditions, history of cathodic protection).	An applicant inadequately addressed an RAI regarding several through-wall leaks in buried piping by stating that the components were not within the scope of license renewal. During a clarification call for the RAI, the staff stated that in-scope buried components might have the same material composition, degradation mechanisms, coatings, soil conditions, and history of cathodic protection. Therefore, it was unclear to the staff why aging experienced on the out of scope components would not be equally applicable to in-scope buried components. The staff requested that the applicant provide a basis for why the out of scope components (where self-

Table 2-33 GALL-SLR Report, Revision 1, Differences from Chapter XI, Mechanical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of Significant Changes	Technical Basis for Change
		revealing issues had been identified) were not representative of in-scope components or provide a basis for why additional inspections, beyond those recommended in AMP XI.M41, were not appropriate.
Detection of Aging Effects	Revise GALL-SLR AMP XI.M41 Preventive Action Category F inspection recommendations to clarify that this inspection category is based on a cathodic protection system being installed; however, it is not meeting performance criteria.	GALL-SLR AMP XI.M41 Preventive Action Category F states, "[i]nspection criteria provided for Category F piping is used for those portions of in-scope buried piping which cannot be classified as Category C, D, or E." It was not the staff's intent that Preventive Action Category F would be used where cathodic protection was not installed. In this case, the applicant would develop plant-specific inspection quantities.
Preventive Actions	Revise the "Preventive Actions" program element of GALL-SLR AMP XI.M41 to recommend external coatings for underground cementitious piping.	Recent OE at a station with a renewed license revealed a significant failure of prestressed concrete cylindrical piping in an underground environment. This piping was not in-scope; however, it was exposed to the same environment as in-scope piping. Physical deterioration of the cement and corrosion of the internal prestressed wire reduced the pipe's strength and led to a local rupture. External coatings could have helped prevent this failure. In addition, *Concrete Pressure Pipe - Manual of Water Supply Practices* [AWWA 2008-TN9869] recommends barrier coatings for atmospheric exposure of concrete pressure pipe where the exposed line may be subjected to large temperature fluctuations, wetting and drying cycles, freezing and thawing cycles, and atmospheric carbonation.
Preventive Actions	In AMP XI.M41 Element 2 paragraph (a) a clarifying footnote "NACE International and the Society for Protective Coatings (SSPC) merged in 2021 and created the Association for Materials Protection and Performance (AMPP)," is added.	This is a strictly administrative change that recognizes the restructuring of the organization responsible for the coating inspector qualifications and the cathodic protection specialist qualification. These qualifications are relevant to, and will continue to be relevant to, the Buried and Underground Piping and Tanks AMP. This

Table 2-33 GALL-SLR Report, Revision 1, Differences from Chapter XI, Mechanical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of Significant Changes	Technical Basis for Change
		change recognizes the validity of current Coating Inspector Level 2 or 3 and Cathodic Protection CP4 qualifications that may be certified as NACE. This change also recognizes the validity of current and future Coating Inspector Level 2 or 3 and Cathodic Protection CP4 qualifications that may be certified as AMPP. This change also recognizes the validity of legacy NACE procedures such as NACE SP0169-2007 and NACE RP0285-2002.
Detection of Aging Effects	Revise GALL-SLR AMP XI.M41 to include EPRI Report 3002005294 [EPRI 2015-TN9469], "Soil Sampling and Testing Methods to Evaluate the Corrosivity of the Environment for Buried Piping and Tanks at Nuclear Power Plants," Table 9-4, "Soil Corrosivity Index from BPWORKS," as an additional approach to determine soil corrosivity.	Preventive Action Category E of GALL-SLR Table XI.M41, "Inspection of Buried and Underground Piping and Tanks," currently references American Water Works Association (AWWA) C105 [AWWA 2010-TN9870], "Polyethylene Encasement for Ductile-Iron Pipe Systems," and Table A.1, "Soil Test Evaluation," to determine soil corrosivity. Nine points or less indicates noncorrosive soil using AWWA C105 [AWWA 2010-TN9870], Table A.1. As an alternative to using this AWWA standard, the staff finds that a threshold of ten points or less using the "carbon steel" column in Table 9-4 of EPRI Report 3002005294 [EPRI 2015-TN9469] to be acceptable for determining noncorrosive soil for carbon steel. The staff's basis is documented in the Safety Evaluation Report Related to the Subsequent License Renewal of Surry Power Station, Units 1 and 2 (ADAMS Accession No. ML ML20052F520 [NRC 2020-TN9945]), Section 3.0.3.2.20, "Buried and Underground Piping and Tanks." The staff notes that Preventive Action Category E of GALL-SLR Table XI.M412 also applies to aluminum and copper alloys (i.e., not just carbon steel). Based on its review of the columns in Table 9-4 of EPRI Report 3002005294 [EPRI 2015-TN9469] associated with aluminum and copper alloys, the staff finds a

Table 2-33 GALL-SLR Report, Revision 1, Differences from Chapter XI, Mechanical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of Significant Changes	Technical Basis for Change
		threshold of ten points or less to also be acceptable for these two material types.
Detection of Aging Effects	Revise the extent of inspections for internal volumetric examinations of piping in AMP XI.M41.	The extent of inspections for internal volumetric examinations of piping in AMP XI.M41 was revised from 25 percent to “the smaller of 10 percent or 60 feet.” Inspecting 25 percent of the piping is not consistent with the staff’s sampling approach in other GALL-SLR Report programs (i.e., in addition to citing percentages, the extent of inspections are typically capped at a specific number of components to prevent oversampling). The new sample size is based on engineering judgement and aligns with the maximum number of inspections in GALL-SLR Report Table XI.M41-2, “Inspection of Buried and Underground Piping and Tanks,” for piping.
Parameters Monitored or Inspected	Revised GALL SLR Report AMP XI.M41 to clarify that the AMP does not manage the effects of aging for HDPE piping.	GALL SLR Report AMP XI.M43, “High Density Polyethylene (HDPE) and Carbon Fiber Reinforced Polymer (CFRP) Repaired Piping,” was created with the issuance of Revision 1 to the GALL-SLR Report, which manages the effect of aging for HDPE piping. Therefore, referring to HDPE piping in GALL SLR Report AMP XI.M41 is no longer warranted.
XI.M42: Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks		
Detection of Aging Effects	Clarify that 1-ft pipe samples should be taken from multiple locations to ensure that the samples are representative of the entire population.	During the staff’s review of the North Anna SLRA, the applicant proposed taking all 1-ft piping samples from a single excavation location without any technical justification for this position. The SRP-SLR Section A.1.2.3.4 notes that “when sampling is used to represent a larger population of [components], applicants provide the basis for the inspection population and sample size.” The staff added additional guidance to alleviate future questions.
Detection of Aging Effects	Clarify that piping components can be considered as piping with respect to	From the initiation of the XI.M42 as a new AMP, established in LR-ISG-2013-01, it has been the intent of NRC staff

Table 2-33 GALL-SLR Report, Revision 1, Differences from Chapter XI, Mechanical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of Significant Changes	Technical Basis for Change
	extent of inspection guidance in this program element.	that piping components be included in the scope of the AMP, as discussed in Appendix E “Resolution of Public Comments” of LR-ISG-2013-01. However, although AMP XI.M42 explicitly defines the scope to include piping components, AMP XI.M42 does not explicitly describe the extent of inspection guidance for piping components. The commenter recommends the addition of another bullet under program element 4 to correct this oversight. Instead, the NRC staff has concluded that it is more efficient to include piping components with the guidance for piping systems and this approach appropriately covers piping components. Therefore, the GALL-SLR is revised to consider piping components as piping for purposes of inspection guidance for piping systems. In practice, with this change, the “representative sample”, described in GALL-SLR Chapter XI-XI.M42 MECHANICAL, Program Element 4, “Detection of Aging Effects,” Page XI-271, Line 26, could be taken from the piping, piping components, or combination of piping and piping components within a piping system with a common coating/lining material and environment combination. NRC staff cautions though that the statement “focusing on components that are most susceptible to the applicable aging effect” described in GALL-SLR Chapter XI-XI.M42 MECHANICAL, Program Element 4, “Detection of Aging Effects,” Page XI-271, Line 30, still applies and that this must be factored into the decisions on including piping components in the inspection sample.
Corrective Actions	Reduced the minimum size of the expanded scope inspections from the lesser of 5 additional or 20 percent of the	The initial minimum sample size established a 90 percent confidence that 90 percent of the population did not

Table 2-33 GALL-SLR Report, Revision 1, Differences from Chapter XI, Mechanical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of Significant Changes	Technical Basis for Change
	population, to the lesser of 2 additional or 10 percent if an initial inspection does not meet acceptance criteria.	contain an attribute. Reducing the minimum size of the expanded scope inspection to 2 samples or 10 percent continues to provide reasonable assurance that the systemic or localized nature of the issue can be determined and that the appropriate corrective actions can be taken.
XI.M43: High Density Polyethylene (HDPE) Piping and Carbon Fiber Reinforced Polymer (CFRP) Repaired Piping* (*XI.M43 is a new AMP; revisions discussed below refer to changes from NUREG-2191, Revision 1, Volume 2, Draft Report for Comment (ML23180A188) to the current version issued for use)		
GALL-SLR Report, Chapter XI	The AMP XI.M43 is a new AMP. This AMP manages the aging of buried and underground HDPE piping and CFRP-repaired piping. This program manages aging through preventive, mitigative, inspection and in some cases, performance monitoring activities. This AMP manages aging effects such as loss of material, cracking, delamination, debonding, and/or blistering. Aging effects can lead to loss of leak tightness, loss of strength, loss of modulus, debris, reduction in flow, and/or flow blockage. Preventive actions and inspection intervals are defined, depending on the environment and the type of material.	The technical basis for the new AMP is to manage the effects of age-related degradation mechanisms that are applicable to HDPE piping and CFRP-repaired piping. This new AMP reflects the recent introduction and increasing use of HDPE and CFRP for repair and replacement of a buried or underground piping at reactor facilities. The unique aging issues and aging management approaches for CFRP-repaired piping and HDPE piping were considered to be most effectively addressed with a dedicated AMP. A CFRP-repaired piping by design constitutes a CFRP laminate and metal substrate of CFRP terminal ends where the laminate is adhesively bonded to metal host pipe. The design of CFRP-repaired piping requires that the metal substrate of CFRP terminal ends always meet the minimum design wall thickness. The new AMP XI.M43 is established to manage the aging of the CFRP laminate and the metal substrate of CFRP terminal ends. Quality of backfill, external coatings, and/or cathodic protection for the metal substrate of CFRP terminal ends can be addressed by the method of AMP XI.M41. However, the wall thickness for the metal substrate of CFRP terminal ends is addressed by AMP XI.M43

Table 2-33 GALL-SLR Report, Revision 1, Differences from Chapter XI, Mechanical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of Significant Changes	Technical Basis for Change
		because of the CFRP design requirement. A CFRP repair can be performed on the full length/run of a metal pipe or on the partial length/run of a metal pipe. For cases where a CFRP repair is performed on the partial length/run of a metal pipe, the aging of the unrepaired partial length/run of the metal host pipe is managed by AMP XI.M41.
Program Description	AMP XI.M43, Program Description is revised to state, "This aging management program (AMP) manages the aging of the internal and external surfaces of buried, underground, safety-related, and in-scope non-safety-related high-density polyethylene (HDPE) piping and carbon fiber-reinforced polymer (CFRP)-repaired piping. The CFRP-repaired piping is defined in this AMP as application of CFRP on the internal surface of metal pipe as structural lining. This program manages aging through preventive, mitigative, inspection, and performance monitoring activities. It manages aging effects such as loss of material, cracking, delamination, debonding, and/or blistering. Aging effects can lead to loss of leak tightness, loss of strength, loss of modulus, debris, reduction in flow, and/or flow blockage."	AMP XI.M43, Program Description is revised to clarify any potential or perceived contradiction in terms of scope of the program between AMP XI.M41 and AMP XI.43.
Program Description	AMP XI.M43 Program Description is rephrased to clarify the applicability of cathodic protection, backfill, and coating to HDPE piping and CFRP-repaired piping.	XI.M43 Program Description is revised to provide a clear and concise overall description of the program in terms of preventive and mitigative techniques for the HDPE piping and CFRP-repaired piping (i.e., backfill and inspection activities), and metal substrate of CFRP terminal ends (i.e., cathodic protection, coatings, backfills, and inspection activities).
Program Description	AMP XI.M43 Program Description is revised to include the aging issues related to the HDPE and CFRP-repaired piping such as loss of material, cracking, delamination, debonding, and/or blistering. Aging effects can lead to loss	XI.M43 Program Description is revised to clarify and provides examples of the aging effects associated with HDPE and CFRP-repaired piping. Monitoring of these aging effects will ensure that degradation is detected before there is

Table 2-33 GALL-SLR Report, Revision 1, Differences from Chapter XI, Mechanical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of Significant Changes	Technical Basis for Change
	of leak tightness, loss of strength, loss of modulus, debris, reduction in flow, and/or flow blockage.	loss of any intended function during the period of extended operation..
Scope of Program	AMP XI.M43 Element 1 is revised to state that AMP XI.M43 is applicable for safety-related and in-scope non-safety-related buried and underground HDPE piping and CFRP-repaired piping,	Element 1, Scope of Program is revised to clarify any potential or perceived contradiction in terms of scope of the program between AMP XI.M41 and AMP XI.43. Therefore, the scope of AMP XI.M43 will cover safety-related and in-scope non-safety-related buried and underground HDPE piping and CFRP-repaired piping.
Scope of Program	AMP XI.M43 Element 1 is revised to add that the methods described in AMP XI.M41 may be used for quality of backfill, external coatings, and/or cathodic protection of the metal substrate of terminal ends, but the metal wall thickness at the terminal ends is addressed by AMP XI.M43.	A CFRP-repaired piping by design constitutes a CFRP laminate and metal substrate of CFRP terminal ends where the laminate is adhesively bonded to metal host pipe. The scope of XI.M43 for the CFRP-repaired piping includes the management of aging of the CFRP laminate and the metal substrate of CFRP terminal ends. Preventive and mitigative techniques for the metal substrate of the CFRP terminal ends include the quality backfill to prevent damage to the metal substrate of terminal ends, cathodic protection and/or external coatings to prevent corrosion of the metal substrate of terminal ends. Therefore, the scope of program in XI.M43 is changed to allow the methods described in AMP XI.M41 to be used for quality of backfill, external coatings, and/or cathodic protection of the metal substrate of CFRP terminal ends. However, the wall thickness of the metal substrate at CFRP terminal ends is addressed by XI.M43 because the design requires that the minimum design wall thickness is met during plant operation.
Scope of Program	AMP XI.M43 Element 1 is revised to state that when HDPE is referenced for non-safety related piping that is in the scope of this AMP, the HDPE should continue to meet the original construction and fabrication codes.	Element 1, Scope of Program is revised to clarify the scope of the program that is applicable to HDPE piping. As such, AMP XI.M43 will cover HDPE piping that replaces non-safety related piping system. That HDPE piping that is in the scope of this AMP needs to satisfy the

Table 2-33 GALL-SLR Report, Revision 1, Differences from Chapter XI, Mechanical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of Significant Changes	Technical Basis for Change
	Furthermore, a statement is added to Scope of Program to state that when CFRP is referenced, it applies to installation or application of the CFRP repair on the interior surface of a pipe as a structural liner.	original construction and fabrication codes. Addition of a statement defining CFRP repair eliminates any misperception about type of repair such as internal, external, structural, or nonstructural repair.
Preventive Actions	AMP XI.M43 Element 2 Table XI.M43-1 footnotes (a) and (b) are rephrased. Coatings are added to Table XI.M43-1 for the buried and underground CFRP-repaired piping because they were left out.	XI.M43 Preventive Actions Table XI.M43-1 footnotes (a) and (b) are revised to provide clear description of applicability of cathodic protection and backfills to each material type (i.e., HDPE, CFRP, and metal substrate of CFRP terminal ends). Coatings are added since the exterior of metal substrate of CFRP terminal ends may require coatings as a corrosion protection.
Preventive Actions	AMP XI.M43 Element 2 paragraph (a) is revised to read: "The methods of GALL-SLR Report AMP XI.M41 are used for cathodic protection, external coatings, and/or quality of backfill of the metal substrate of terminal ends of the CFRP-repaired piping, but the wall thickness at the terminal ends is addressed by AMP XI.M43."	This revision clarifies that the CFRP laminate replaces the metal host pipe except at the CFRP terminal ends. Therefore, no guidance is needed to manage the aging of the metal host pipe between terminal ends, however the metal substrate of CFRP terminal ends requires aging management. Revision to paragraph (a) clarifies that the applicant may use the methods of GALL-SLR Report AMP XI.M41 for the preventive actions listed in Table XI.M43-1 (i.e., backfill, coatings, cathodic protection) for the metal substrate of terminal ends of CFRP-repaired piping. However, the wall thickness for the metal substrate of CFRP terminal ends is addressed by AMP XI.M43 because of the CFRP design requirement (ASME Code, Section III Subsection ND) to meet minimum wall thickness to support the CFRP repair.
Preventive Actions	In AMP XI.M43 Element 2 paragraph (b) a clarifying footnote "NACE International and the Society for Protective Coatings (SSPC) merged in 2021 and created the	This is a strictly administrative change that recognizes the restructuring of the organization responsible for the coating inspector qualifications and the cathodic protection specialist qualification. These

Table 2-33 GALL-SLR Report, Revision 1, Differences from Chapter XI, Mechanical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of Significant Changes	Technical Basis for Change
	Association for Materials Protection and Performance (AMPP)," is added.	qualifications are relevant to, and will continue to be relevant to, the Buried and Underground Piping and Tanks AMP. This change recognizes the validity of current Coating Inspector Level 2 or 3 and Cathodic Protection CP4 qualifications that may be certified as NACE. This change also recognizes the validity of current and future Coating Inspector Level 2 or 3 and Cathodic Protection CP4 qualifications that may be certified as AMPP.
Detection of Aging Effects	Table XI.M43-3 was revised to replace "Steel (Metallic substrate of CFRP)" with "Metal Substrate of CFRP-Repaired Piping at Terminal Ends" and categories/footnotes "A, B, C, and D" with "The methods described in GALL-SLR Report AMP XI.M41 may be used for quality of backfill, external coatings, and/or cathodic protection, but the metal wall thickness at the terminal ends is addressed by AMP XI.M43."	The changes in Table XI.M43-3 are due to the following: (1) the CFRP laminate replaces the metal host pipe except at the CFRP terminal ends, therefore, no guidance is needed to manage the aging of the metal host pipe between terminal ends, (2) the metal substrate of CFRP terminal ends requires aging management, therefore the preventive and mitigative techniques of XI.M41 may be used for the quality of backfill, external coatings, and/or cathodic protection of the metal substrate at CFRP terminal ends, and (3) the wall thickness of the metal substrate of the CFRP terminal ends is addressed by XI.M43 to ensure the metal substrate wall thickness meets the minimum design requirement.
Preventive Actions	AMP XI.M43 Element 2 paragraph (b) is revised to identify (1) the merge of NACE International and the Society for Protective Coatings (SSPC) and (2) the impact of the backfill to the CFRP laminate between terminal ends after repair. of CFRP-repaired piping.	Preventive Actions, paragraph (b) is revised to clarify that NACE International and the Society for Protective Coatings (SSPC) merged in 2021 and created the Association for Materials Protection and Performance (AMPP). However, the AMPP website still identifies NACE as their designator. In addition, Preventive Actions, paragraph (b) is revised to clarify that the impact of backfill is applicable to the CFRP laminate between terminal ends. The basis is that the CFRP laminate replaces the metal pipe between terminal ends after the repair. The aging of the metal pipe between terminal ends is no longer managed after CFRP repair. If metal pipe between terminal ends

Table 2-33 GALL-SLR Report, Revision 1, Differences from Chapter XI, Mechanical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of Significant Changes	Technical Basis for Change
		degrades completely over time, the CFRP laminate between terminal ends will be exposed to backfill.
Preventive Actions	AMP XI.M43 Element 2 paragraph (c) is deleted.	Preventive Actions, paragraph (c) provides alternative to the preventive actions in Table XI.M43-1. Table XI.M43-1 and associated footnotes and paragraph (a) have been revised. As a result, paragraph (c) is not needed.
Parameters Monitored or Inspected	AMP XI.M43 Element 3 paragraphs (a)(i) and (b)(i) are revised to specify that visual inspections of the external and internal surface condition of the in-scope non-safety-related HDPE piping are conducted per the requirements of construction code, or plant procedures.	AMP XI.M43 Parameters Monitored or Inspected Element paragraphs3(a)(i) and (b)(i) is revised to clarify how visual inspections of the external and internal surface condition of the in-scope non-safety-related HDPE are to be conducted.
Parameters Monitored or Inspected	AMP XI.M43 Element 3 paragraphs (a)(i)(1) and (b)(i)(1) specify that "…loss of HDPE material due to wear, radiation, temperature, and/or moisture…". The wording "radiation" is removed from paragraph (a)(i)(1) and (b)(i)(1).	AMP XI.M43 Element 3 paragraphs (a)(i)(1) and (b)(i)(1) are revised to remove radiation from loss of material because loss of material due to radiation is not a concern for the HDPE and CFRP-repaired piping..
Parameters Monitored or Inspected	AMP XI.M43 Element 3 paragraphs (a)(i)(1) and (b)(i)(1) are revised to include aging mechanisms, "loss of HDPE material due to wear, temperature, and/or moisture" and "loss of CFRP material due to wear, temperature, and/or moisture."	For CFRP, exposure to environmental effects such as temperature and/or moisture can cause degradation of the epoxy resin matrix and the bond between CFRP laminate and metal substrate. Degradation of matrix can result in debonding/cracking of fiber-matrix interfacial bond, debonding/delamination/cracking of laminate layers, lowering matrix glass transition temperature, swelling of matrix, microcracking of matrix, loss watertightness, and loss of maintaining design load. Degradation of the bond between laminate and metal substrate can result in loss of material, watertightness, and maintaining design loads. HDPE fabrication can also introduce moisture in the resin/hydrocarbon mixture which can cause degradation in the future. At high temperature, HDPE will deform which could lead to the loss of material and strength. Loss of material due to degradation and/or environmental

Table 2-33 GALL-SLR Report, Revision 1, Differences from Chapter XI, Mechanical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of Significant Changes	Technical Basis for Change
		effects can occur in HDPE piping if the incorrect material is selected or an improper fusion butt joint such as electrofused joint is performed.
Parameters Monitored or Inspected	AMP XI.M43 Element 3 paragraphs (a)(ii) and (b)(iii) revised to specify that "For in-scope non-safety-related piping, a system leakage test is performed to detect leakage in accordance with the original construction code, or in accordance with ASME Code, Section XI if no system leakage test is specified in the original construction code."	Adding this statement clarifies how system leakage of in-scope non-safety-related piping to be performed.
Parameters Monitored or Inspected	In AMP XI.M43 Element 3 paragraph (b)(ii), the description of acoustic tap test technique is moved to footnote. In addition, this paragraph is modified to clarify that volumetric examination of the terminal end regions of the CFRP repaired piping is performed using a nondestructive examination technique of the CFRP repaired piping at the terminal end regions to detect delamination of the layers and debonding of the laminate, and to verify the thickness of the metal substrate at the CFRP terminal ends meets the design requirements. .	Moving the description of acoustic tap test technique to footnote simplifies paragraph (b)(ii). Paragraph (b)(ii) is clarified to ensure that the CFRP repaired piping at the terminal end regions are managed for specific degradation (delamination and debonding) and continue to meet design requirements.
Parameters Monitored or Inspected	AMP XI.M43 Element 3 paragraphs (a)(iii) and (b)(iv) revised to specify that "The visual examination performed under GL 89-13 [NRC 1989-TN9367] or under other requirements such as vendor required inspection can be credited for the visual inspection specified in this AMP."	Adding this statement provides option for the visual inspection specified in this AMP.
Parameters Monitored or Inspected	AMP XI.M43 Element 3 Parameters monitored or inspected, paragraph b, staff will change the numbering of 3.b.iii and 3.b.iv to be sub-bullets of paragraph 3.b.ii.	This is an editorial change in the numbering format
Parameters Monitored or Inspected	AMP XI.M43 Element 3 Parameters monitored or inspected, paragraph c and d, staff will change the numbering of 3.c and 3.d to indicate that they are sub-bullets iii. and iv. of paragraph 3.b respectively	This is an editorial change in the numbering format

Table 2-33 GALL-SLR Report, Revision 1, Differences from Chapter XI, Mechanical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of Significant Changes	Technical Basis for Change
Detection of Aging Effects	Element 4, paragraph (c) (originally paragraph (d)) is revised to delete coating type, coating condition, cathodic protection efficiency, soil resistivity, pipe contents, and pipe function. The limitation on the use guided wave ultrasonic examination is removed. Element 4, paragraph (d) becomes Element 4, paragraph (c).	Element 4, paragraph (c) (originally paragraph (d)) is revised because coating type, coating condition, cathodic protection efficiency, soil resistivity, pipe contents, and pipe function may not be applicable to HDPE piping and CFRP-repaired piping. . The limitation on the use of guided wave ultrasonic examination is removed because guided wave ultrasonic examination may improve in the future such that the use of it to monitor the subject piping may be a viable inspection technique.
Detection of Aging Effects	The existing Element 4, Table XI.M43-2, "Internal Surface Inspection of Buried and Underground HDPE Piping and CFRP Repaired Piping," is re-named Table XI.M43-3, " External Surface Inspection of Buried and Underground HDPE Piping and CFRP Repaired Piping." Table XI.M43-3 is revised to include inspections as stated in the table's title.	XI.M43 Element 4, Tables XI.M43-2 and Table XI.M43-3 are revised for better organization and clarity such that: Table XI.M43-2 lists the recommended examinations for the interior surface of HDPE and CFRP-repaired piping, Table XI.M43-3 lists the recommended external surface inspections for buried HDPE piping and CFRP-repaired piping, and underground HDPE piping and CFRP repaired piping.
Detection of Aging Effects	Element 4 Table XI.M43-2 is re-named as Table XI.M43-3, "External Surface Inspection of Buried and Underground HDPE Piping and CFRP Repaired Piping." Revisions to Table XI.M43-3 include: • replacing the row entry "Steel (Metallic Substrate of CFRP)" with "Metal Substrate of CFRP-Repaired Piping at Terminal Ends" • in the same row, second column, deleting table Categories A, B, C, and D and replacing them with "The methods described of in GALL-SLR Report AMP XI.M41 may be used for quality of backfill, external coatings, and/or cathodic protection, but the metal wall thickness at the terminal ends is addressed by AMP XI.M43"	The subject revisions to XI.M43, Detection of Aging Effects, Table XI.M43-3 (formerly Table XI.M43-2) clarify that preventive action is necessary for the metal substrate of CFRP terminal ends and not for metal pipe between CFRP terminal ends. Further, the revisions clarify that the CFRP laminate replaces the metal host pipe except at the CFRP terminal ends. Preventive action for protecting external surface of the metal substrate of CFRP terminal ends from damage due to backfill and from corrosion includes assurance of quality of backfill, external coatings, and/or cathodic protection that the guidance in GALL-SLR Report AMP XI.M41 may be used. However, for inspections and measurement of metal

Table 2-33 GALL-SLR Report, Revision 1, Differences from Chapter XI, Mechanical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of Significant Changes	Technical Basis for Change
	• in the same row, third column adding, "The metal substrate at CFRP terminal ends is inspected by ultrasonic examination (or any reliable NDE technique capable of measuring metal wall thickness) from the pipe's internal surface during each inspection interval to ensure the metal substrate wall thickness meets the minimum design requirement" and • deleting the table's footnotes A, B, C, and D	wall thickness of the CFRP terminal ends, the guidance in GALL-SLR Report AMP XI.M43 (ultrasonic examination, or any reliable NDE technique capable of measuring metal wall thickness) is used to assure that the metal wall thickness of CFRP terminal ends meets the CFRP-repaired piping design requirement during the period of extended operating license. Table XI.M43-3 Categories A, B, C, and D including the associated footnotes A, B, C, and D, are deleted because they are related to the metal pipe that is replaced by CFRP laminate.
Detection of Aging Effects	AMP XI.M43 Element 4 Detection of Aging Effects paragraph (a) is deleted.	XI.M43-3 (formerly XI.M43-2) and all these categories are deleted. The basis for deletion of categories of A, B, C, and D in Table XI.M43-3 is provided in the preceding row of this table
Detection of Aging Effects	AMP XI.M43 Detection of Aging Effects paragraph 4(d) (now renumbered to paragraph 4(c)) is rephrased to eliminate the following: cathodic protection, coating, soil resistivity, pipe contents, pipe function, and the use of guided wave ultrasonic examination since these are specific to corrosion of the metal pipe between the terminal ends.	XI.M43 Detection of Aging Effects paragraph 4(d) is revised to clarify that for HDPE piping and CFRP-repaired piping between terminal ends, only characteristics of backfill's type and material need to be considered.
Detection of Aging Effects	Element 4, paragraph (c)(iii) was deleted and paragraph (e) is added to specify that the metal substrate at CFRP terminal ends is inspected by ultrasonic examination (or any reliable NDE technique capable of measuring metal wall thickness) from the pipe's internal surface during each inspection interval to ensure the metal substrate wall thickness meets the minimum design requirement.	Element 4, paragraph (c)(iii) was deleted and paragraph (e) was added to clarify that any reliable NDE method is used to verify minimum wall thickness of the metal substrate at the terminal ends to ensure its structural integrity in order to support the CFRP repair. Degradation such as wall thinning due to loss of material of wall thickness at metal substrate terminal ends may affect the CFRP laminate. As such, the wall thickness at terminal ends must meet the minimum design requirement.
Monitoring and Trending	XI.M43 Monitoring and Trending Element 5 is revised to remove cathodic protection and coatings since cathodic protection and coatings are not applicable to HDPE and CFRP materials except metal substrate of terminal ends. Element 5 is	Deletion of cathodic protection and coatings of metal substrate of terminal ends from XI.M43 Element 5 is consistent with XI.M43 Program Description since the method of GALL-SLR Report AMP XI.M41 may be used

Table 2-33 GALL-SLR Report, Revision 1, Differences from Chapter XI, Mechanical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of Significant Changes	Technical Basis for Change
	also rephased to clarify that a leak rate testing is conducted for the HDPE piping and CFRP-repaired piping. In addition, the wall thickness measurement is conducted only for the metal substrate of CFRP-repaired piping terminal ends regions.	for external coatings and cathodic protection of the metal substrate of the CFRP-required piping at terminal ends. This revision also clarifies that the leak rate testing is intended for the HDPE piping and CFRP-repaired piping and the wall thickness measurement is intended for metal substrate of CFRP terminal ends regions.
Acceptance Criteria	XI.M43 Acceptance Criteria Table XI.M43-3 and paragraphs 6.b.ix and 6.b.x are deleted since they are related to cathodic protection of metals, and to remove the materials copper alloy and aluminum alloy, which are covered by XI.M41.	This deletion is consistent with XI.M43 Program Description that states: “The method of GALL-SLR Report AMP XI.M41…may be used for quality of backfill, external coatings, and/or cathodic protection of the metal substrate of the CFRP-repaired piping at the terminal ends but the wall thickness at the terminal ends are addressed by AMP XI.M43.” For clarification, if CFRP repair is performed on the full length of a metal pipe or on the partial length of a metal pipe, the method of GALL-SLR Report AMP XI.M41 may be used for quality of backfill, external coatings, and/or cathodic protection of the metal substrate of the CFRP-repaired piping at the terminal ends. Furthermore, if CFRP repair is performed on the partial length of a metal pipe, the unrepaired partial length is managed by GALL-SLR Report AMP XI.M41.
Acceptance Criteria	XI.M43 Element 6 paragraph (a)(ii) specifies that “Backfill is acceptable if the inspections do not reveal evidence that the backfill caused damage to the piping’s coatings or the surface of the piping” Replace “piping’s coatings or the surface” with “external surface”.	XI.M43 Element 6 paragraph (a)(ii) is revised to remove coatings from the acceptance criteria for HDPE piping because potential damage to the external surface of HDPE piping by backfill is a sufficient acceptance criterion.
Acceptance Criteria	The staff deleted paragraph (b)(i) of Element 6.	The staff deleted paragraph (b)(i) of Element 6 because the statements in this paragraph are not relevant for the acceptance criteria.

Table 2-33 GALL-SLR Report, Revision 1, Differences from Chapter XI, Mechanical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of Significant Changes	Technical Basis for Change
Acceptance Criteria	The staff relabeled Element 6 paragraph (b)(iii) to Element 6 paragraph (b)(ii), and revised it to state, “The measured wall thickness of the metal substrate at terminal ends of the CFRP-repaired piping that is extrapolated to degrade with a loss of material to the end of the next 10-year inservice inspection interval shall meet the minimum design wall thickness requirements.” Replace “to the end of the period of extended operation or subsequent period of extended operation” with “to the end of the next 10-year inservice inspection interval,” and replace “wall thickness” with “wall thickness of the metal substrate at terminal ends of the CFRP-repaired piping.”	This revision clarifies that only the wall thickness of metal substrate of terminal ends of the CFRP-repaired piping is to be measured, and its loss of material due to corrosion to be projected to the end of the next 10-year inservice inspection interval. This change is appropriate because the CFRP terminal ends are inspected every 10-year ISI interval to ensure the minimum wall thickness of the metal substrate of terminal ends as required by CFRP design is met.
Corrective Actions	XI.M43 Corrective Actions paragraph 7.b is deleted since it is related to cathodic protection.	The metal substrate of CFRP terminal ends is managed by AMP XI.M41.
Corrective Actions	The staff revised Element 7 paragraph (a) by replacing the wording “the period of extended operations” with “the end of the next 10-year inservice inspection.”	This change is appropriate because the CFRP terminal ends are inspected every 10-year ISI interval to ensure the minimum wall thickness of the metal substrate of terminal ends as required by CFRP design is met.
Corrective Actions	The staff revised Element 7 paragraph (a) by deleting the phrase “of the base metal” and revised paragraphs (a) and (c) by replacing the phrases “loss of material” and “cracking,” respectively, with “degradation (e.g., loss of material cracking, delamination debonding, and/or blistering).	With regard to deleting “of the base metal,” this was deleted because it relates to XI.M41 and not XI.M43. With regard to replacing “loss of material” and “cracking” with the word degradation and a list of types of degradation, this change was made to capture all the relevant types of degradation.

Table 2-34 GALL-SLR Report, Revision 1, Chapter XI, Structural Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases

Location of Change	Summary of Significant Changes	Technical Basis for Change
XI.S1: ASME Section XI, Subsection IWE		
Preventive Action	Added wording to add ASTM International (ASTM) F3125 bolts to the list of bolts that require preventive actions.	ASTM F3125/F3125M-21 specification consolidates and replaces six ASTM standards that include: A325, A325M, A490, A490M, F1852, and F2280.
XI.S3: ASME Section XI, Subsection IWF		
Preventive Action	Added wording to add ASTM F3125 bolts to the list of bolts that require preventive actions.	ASTM F3125/F3125M-21 specification consolidates and replaces six ASTM standards that include: A325, A325M, A490, A490M, F1852 and F2280.
XI.S6: Structures Monitoring		
Scope of Program Detection of Aging Effects	Added reference to AMP XI.M26, “Fire Protection,” to clarify that together the Structures Monitoring program and the Fire Protection program manage the applicable aging effects for reinforced concrete structural fire barriers (walls, ceilings, and floors).	Based on a review of current subsequent license renewal applications (SLRAs), the staff noted instances where only the Structures Monitoring program or the Fire Protection program is cited to manage applicable aging effects for reinforced concrete structural fire barriers. However, GALL-SLR AMR Item VII.G.A-90, SRP item 3.3-1, 060 cites both the Structures Monitoring program and the Fire Protection program for managing applicable aging effects for reinforced concrete structural fire barriers (walls, ceilings, and floors). Adding reference to AMP XI.M26 to AMP XI.S6 is consistent with GALL-SLR AMR Item VII.G.A-90, SRP item 3.3-1, 060 in Volume 1 of NUREG-2191, which cites both programs for managing applicable aging effects for reinforced concrete structural fire barriers (walls, ceilings, and floors), and clarifies in the AMP XI.S6 description that both programs manage the applicable aging effects.
Preventive Action	Added wording to add ASTM F3125 bolts to the list of bolts that require preventive actions.	ASTM F3125/F3125M-21 specification consolidates and replaces six ASTM standards that include: A325, A325M, A490, A490M, F1852 and F2280.

Table 2-34 GALL-SLR Report, Revision 1, Chapter XI, Structural Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of Significant Changes	Technical Basis for Change
Detection of Aging Effects	Clarify ambiguities when applying the term “groundwater/soil” in the GALL-SLR AMP. Revised to “groundwater and/or soil.”	The forward slash from the “groundwater/soil” term is replaced and spelled-out to clearly communicate its usage within the XI.S6, “Structures Monitoring,” and the XI.S7, “Inspection of Water Control Structures Associated with Nuclear Power Plants” programs. For example, when the guidance document refers to an “aggressive groundwater and/or soil” it is intended to be used as “aggressive groundwater or aggressive soil, or both”; and when the guidance document refers to a “nonaggressive groundwater and/or soil” it is intended to be used as “nonaggressive groundwater or nonaggressive soil, or both.”
XI.S7: Inspection of Water-Control Structures Associated with Nuclear Power Plants		
Preventive Action	Added wording to add ASTM F3125 bolts to the list of bolts that require preventive actions.	ASTM F3125/F3125M-21 specification consolidates and replaces six ASTM standards that include: A325, A325M, A490, A490M, F1852 and F2280.
Detection of Aging Effects	Clarify ambiguities when applying the term “groundwater/soil” in the GALL-SLR AMP. Revised to “groundwater and/or soil.”	The forward slash from the “groundwater/soil” term is replaced and spelled-out to clearly communicate its usage within the XI.S6, “Structures Monitoring,” and the XI.S7, “Inspection of Water Control Structures Associated with Nuclear Power Plants” programs. For example, when the guidance document refers to an “aggressive groundwater and/or soil” it is intended to be used as “aggressive groundwater or aggressive soil, or both”; and when the guidance document refers to a “nonaggressive groundwater and/or soil” it is intended to be used as “nonaggressive groundwater or nonaggressive soil, or both.”
XI.S8: Protective Coating Monitoring and Maintenance		
Program Description Detection of Aging Effects	Revisions made to the frequency of inservice coating inspection monitoring to allow the inspection of coatings meeting GALL-SLR AMP XI.S8 Element 6, “Acceptance Criteria,” to be performed on a frequency not to exceed 6 years,	ASTM International Specification D5163-08, “Standard Guide for Establishing a Program for Condition Assessment of Coating Service Level I Coating Systems in Nuclear Power Plants.” West Conshohocken, Pennsylvania. ASTM International, 2008, paragraph 6, notes

Table 2-34 GALL-SLR Report, Revision 1, Chapter XI, Structural Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of Significant Changes	Technical Basis for Change
Monitoring and Trending Operating Experience References	based on trending of the total amount of permitted degraded coatings.	that the licensee shall determine the frequency of inservice coating inspections. ASTM D5163-08, paragraph 6, also notes that it is a good practice to perform inspections during each refueling outage at an interval of <6 years based on station OE if coatings meet the acceptance criteria (AMP XI.S8 Element 6) and trending activities for the total amount of degraded coatings in containment indicate that a margin will be maintained (AMP XI.S8 Element 5). A qualified nuclear coating specialist performs a coating condition assessment report to determine the priority of repairs to be conducted during the current outage and repairs that can be postponed to a future date (ASTM D5163-08, paragraph 11.1.2). Trending of the total amount of degraded coatings allowed in containment will also performed.
Program Description Detection of Aging Effects Monitoring and Trending Operating Experience References	Updates GALL-SLR Report AMP XI.S8 to reference Regulatory Guide (RG) 1.54, “Service Level I, II, III, and In-Scope License Renewal Protective Coatings Applied to Nuclear Power Plants,” Revision 3, issued April 2017, as it is the most current revision at the time of this change.	RG 1.54, Revision 3, contains the most up-to-date NRC guidance on the selection, application, qualification, inspection, and maintenance of protective coatings applicable under GALL-SLR Report AMP XI.S8. For an applicant to extend the inspection interval stated in the GALL-SLR Report (each refueling outage), an applicant must demonstrate that margin to the ECCS suction strainer operability limits for coating debris will be maintained during the subsequent period of extended operation based on operating experience and trending of degraded/unqualified coatings. If plant-specific OE identifies coating degradation mechanisms that indicate the potential to exceed the ECCS suction strainer debris margin, an applicant may not be able to extend the inspection intervals beyond each refueling outage. Applicants that extend the inspection interval to longer than each refueling

Table 2-34 GALL-SLR Report, Revision 1, Chapter XI, Structural Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of Significant Changes	Technical Basis for Change
		outage may need to provide trending of degraded and unqualified coatings and review operating experience for more than the previous two coating monitoring reports. This is because an extension of the inspection interval may result in periods of time without inspections that are longer than the time period covered by the previous two refueling outages. Additionally, an applicant may need to consider covering a time period greater than the proposed interval to provide margin for trending of coatings and to account for variations in degraded coatings recorded during a typical inspection. RG 1.54, Revision 3, contains the most up-to-date NRC guidance on the selection, application, qualification, inspection, and maintenance of protective coatings applicable under GALL-SLR Report AMP XI.S8. For an applicant to demonstrate that an inspection interval of longer than every refueling outage is appropriate, it is necessary to identify aging effects such as blistering, cracking, flaking, peeling, rusting, and physical damage and to demonstrate acceptable historical coating performance. This is because coating degradation mechanisms can cause large amounts of coatings to become degraded/unqualified in time periods of less than 6 years (the maximum interval). The applicant will need to account for aging effects such as blistering, cracking, flaking, peeling, rusting, and physical damage for the containment coatings to demonstrate that the coating will be able to perform its safety function during all inspection intervals through the subsequent period of extended operation.

Table 2-35 GALL-SLR Report, Revision 1, Chapter XI, Electrical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases

Changed Program Elements	Summary of Significant Changes	Technical Basis for Change
XI.E1: Electrical Insulation for Electrical Cables and Connections Not Subject to 10 CFR 50.49 [TN249] Environmental Qualification Requirements		
Program Description	XI.E1 Program Description, the adverse localized environment definition is revised.	The localized environment definition is revised as follows "An adverse localized environment is an environment that exceeds the most limiting environment (e.g., temperature, radiation, or moisture) for the electrical insulation of cables and connectors, including those that are coated with fire-retardant material," for clarity and to avoid unintentionally limiting the AMP scope.
Detection of Aging Effects	XI.E1 Detection of Aging Effects, the phrase "coated with fire-retardant material" is removed from the guidance on cables and electrical connections inspections.	In the Detection of Aging Effects discussion the phrase "coated with fire-retardant material" is deleted to be in accordance with Program Description clarification changes to the adverse localized environment definition.
Program Description Detection of Aging Effects	Aging management program (AMP) is clarified with an improved definition of an adverse localized environment. An adverse localized environment is an environment that exceeds the most limiting environment (e.g., temperature, radiation, or moisture) for the electrical insulation of cables that are coated with fire retardant material and connectors. The Detection of Aging Effects program adds, "Cable and connection electrical insulation are inspected to identify cable and connection insulation coated with fire retardant material installed in an adverse localized environment."	AMP is based on a visual inspection of accessible cables and connections. Past reviews and operating experience (OE) indicated the management of cables specifically those that are coated with fire retardant material need to be visually inspected. The staff concluded that this change should clarify the intent of the program and provide additional guidance on the cable and electrical insulation material coated with fire retardant material type subject to aging.
Detection of Aging Effects	XI.E1 Detection of Aging Effects is revised to clarify when maintenance, calibration, or surveillance program may be credited in lieu of testing.	The Detection of Aging Effects is revised to clarify and acknowledge that testing as part of an existing maintenance, calibration, or surveillance program may be credited in lieu of testing recommended in this AMP provided they can be shown to adequately assess the aged condition or health of the electrical insulation of in-scope cables and connections.

Table 2-35 GALL-SLR Report, Revision 1, Chapter XI, Electrical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Changed Program Elements	Summary of Significant Changes	Technical Basis for Change
Detection of Aging Effects	XI.E1, Detection of Aging Effects, is revised to remove reference to ‘coated with fire-retardant material’ as a result of the revised definition of adverse localized environment for this AMP.	The Detection of Aging Effects is revised to clarify that cables and electrical connections are to be inspected to identify cables and connections insulation installed in an adverse localized environment.
XI.E2: Electrical Insulation for Electrical Cables and Connections Not Subject to 10 CFR 50.49 [TN249] Environmental Qualification Requirements Used in Instrumentation Circuits		
Program Description	XI.E2 Program Description is revised to clarify when maintenance, calibration, or surveillance program may be credited in lieu of testing.	The Program Description is revised to clarify and acknowledge that calibration results or findings of surveillance testing programs that can be shown to adequately assess the aged condition or health of the electrical insulation of in-scope cables and connections used in instrumentation circuits, may be credited to identify the existence of electrical cable and connection insulation aging degradation.
Detection of Aging Effects	XI.E2 Detection of Aging Effects, is revised to clarify when maintenance, calibration, or surveillance program may be credited in lieu of testing.	The XI.E2 Detection of Aging Effects is revised to clarify and acknowledge that calibration results or findings of surveillance programs that can be shown to adequately assess the aged condition or health of the electrical insulation of in-scope cables and connections used in instrumentation circuits, can provide an indication of the existence of aging effects based on acceptance criteria related to instrumentation circuit performance, and therefore, can be credited.
Detection of Aging Effects	XI.E2 Detection of Aging Effects, is revised to clarify that insulation resistance should not be used solely for detecting deterioration of electrical insulation systems.	The XI.E2 Detection of Aging Effects is revised to clarify that cable system testing should be conducted when the calibration or surveillance program does not include the cabling system in the testing circuit, or as an alternative to the review of calibration results. The changes add that a cable system test for detecting deterioration of the electrical insulation system is performed and several examples of how test can be performed, or other testing judged to be effective in determining cable system

Table 2-35 GALL-SLR Report, Revision 1, Chapter XI, Electrical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Changed Program Elements	Summary of Significant Changes	Technical Basis for Change
		insulation physical, mechanical, and chemical properties, as applicable. The changes clarify that insulation resistance should not be used solely for detecting deterioration of electrical insulation systems since it is a pass/fail test that is not particularly sensitive to aging degradation of insulation materials. Clarification is added that the test frequency of the cable system is determined by the applicant based on engineering evaluation, but the test frequency is at least once every 10 years. Finally, the changes clarify that the first test is to be completed prior to the subsequent period of extended operation.
XI.E3A: Electrical Insulation for Inaccessible Medium-Voltage Power Cables Not Subject to 10 CFR 50.49 [TN249] Environmental Qualification Requirements		
Program Description	XI.E3A Program Description, revise the test related to the level monitoring devices by deleting the word "continuous" to read as follows, "Credit for water level monitoring equipment can be taken if such devices have self-monitoring features and generate failure alarms in a location that is easily identifiable and observable to ensure that the cause of the alarm is appropriately and expeditiously identified and addressed (e.g., a central location, control room, etc.).... The reliability and methods of ensuring operation of level monitoring devices are justified and documented."	The word "continuous" is deleted from the level monitoring device description, as use of this word could imply that any temporary interruption of level detection systems would negate their use in justifying less frequent inspections.
Program Description	XI.E3A Program Description, is clarified to provide general guidance on acceptable level control alarms, including locations, to ensure that the cause of level alarms is appropriately and expeditiously identified and addressed.	The Program Description is revised to clarify and acknowledge that credit for water level monitoring equipment can be taken if such devices have self-monitoring features and generate failure alarms in a location that is easily identifiable and observable to ensure that the cause of the alarm is appropriately and expeditiously identified and addressed. The revision provides an

Table 2-35 GALL-SLR Report, Revision 1, Chapter XI, Electrical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Changed Program Elements	Summary of Significant Changes	Technical Basis for Change
		alternative that an alarm that is automatically generated and distributed by way of electronic message (i.e., email, phone call, or text) may be acceptable provided the applicant has demonstrated the method functions as expected and the electronic message is sent to multiple personnel that have a clear understanding of their expected response and the ability to respond to correct the condition in an expeditious manner.
Program Description	XI.E3A Program Description, the word "potentially" is clarified.	The word "potentially" is clarified as follows: The word "potentially" is necessary to capture environmental unknowns associated with inaccessible cables. If cables could be exposed to significant moisture (based on location and geology) they should be included in the program and therefore subject to increased monitoring (i.e., a cable is assumed to be wet if it cannot be verified that it is dry in inaccessible locations; and therefore, aging management actions must be performed on those cables). This ensures that inaccessible cables are conservatively scoped into the AMP and adequately monitored to provide reasonable assurance that cables potentially exposed to wetting or submergence (i.e., significant moisture) can perform their intended function.
Preventive Actions	XI.E3A Preventive Actions, revise the test related to the level monitoring devices by deleting the word "continuous" to read as follows, "Credit for water level monitoring equipment can be taken if such devices have self-monitoring features and generate failure alarms in a location that is easily identifiable and observable to ensure that the cause of the alarm is appropriately and expeditiously identified and addressed (e.g., a central location, control room, etc.).... The reliability and methods of ensuring operation of level	The word "continuous" is deleted from the level monitoring device description, as use of this word could imply that any temporary interruption of level detection systems would negate their use in justifying less frequent inspections.

Table 2-35 GALL-SLR Report, Revision 1, Chapter XI, Electrical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Changed Program Elements	Summary of Significant Changes	Technical Basis for Change
	monitoring devices are justified and documented."	
Program Description Scope of Program Preventative Actions Parameters Monitored or Inspected Acceptance Criteria Table XI-01	The proposed revisions add inspection of manholes with water level monitoring and alarms that result in consistent, subsequent pump out of accumulated water prior to wetting or submergence of cable at least once every 5 years. Also, the proposed revisions add inspection of manholes following event-driven occurrences such as heavy rain, rapid thawing of ice and snow, or flooding, only when water level monitoring indicates water is accumulating. Based on the review of a previous SLRA, manholes with water level monitoring and alarms are self-monitoring, and therefore do not require annual inspection for water accumulation.	The staff finds that there is no need to perform annual inspections for manholes that have an installed water level monitoring and alarm system if there are provisions for a timely response to level alarms. Manholes with water level monitoring and alarms, and timely pump out, prevent water accumulation from wetting or submerging cables. There is no adverse industry OE for the level monitoring equipment. Therefore, the staff finds that inspecting manholes with installed water level monitoring and alarms every 5 years is acceptable. Additionally, because of the level transmitters' continuous monitoring and alarms, there is no need for event-driven inspections if there is no water accumulation. Therefore, the staff finds acceptable a practice of inspecting manholes with water level monitoring and alarms following event-driven occurrences, only when the water level monitoring indicates water is accumulating. These water level monitoring systems are widely used in the industry, are very reliable, and can cope with a variety of operating conditions encountered in manholes at nuclear power plants. The water level monitoring system is self-monitoring. If it fails, indication will be shown in the control room. This proposed change provides continuous monitoring of water level in manholes rather than annual inspection of water level in manholes.
Program Description	XI.E3A Program Description, the word "potentially" is clarified.	The word "potentially" is clarified as follows: The word "potentially" is necessary to capture environmental unknowns with inaccessible cables. If cables could be exposed to significant moisture (based on location and geology) they should be included in the program and therefore subject to

Table 2-35 GALL-SLR Report, Revision 1, Chapter XI, Electrical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Changed Program Elements	Summary of Significant Changes	Technical Basis for Change
		increased monitoring (i.e., a cable is assumed to be wet if it cannot be verified that it is dry in inaccessible locations; and therefore, aging management actions must be performed on those cables). This ensures that inaccessible cables are conservatively scoped into the AMP and adequately monitored to provide reasonable assurance that cables potentially exposed to wetting or submergence (i.e., significant moisture) can perform their intended function.
Preventive Actions:	XI.E3A Preventive Actions is clarified to provide general guidance on acceptable level control alarms, including locations, to ensure that the cause of level alarms is appropriately and expeditiously identified and addressed.	The Preventive Actions is revised to clarify and acknowledge that credit for water level monitoring equipment can be taken if such devices have self-monitoring features and generate failure alarms in a location that is easily identifiable and observable to ensure that the cause of the alarm is appropriately and expeditiously identified and addressed. The revision provides an alternative that an alarm that is automatically generated and distributed by way of electronic message (i.e., email, phone call, or text) may be acceptable provided the applicant has demonstrated the method functions as expected and the electronic message is sent to multiple personnel that have a clear understanding of their expected response and the ability to respond to correct the condition in an expeditious manner.

Table 2-35 GALL-SLR Report, Revision 1, Chapter XI, Electrical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Changed Program Elements	Summary of Significant Changes	Technical Basis for Change
XI.E3B: Electrical Insulation for Inaccessible Instrument and Control Cables Not Subject to 10 CFR 50.49 [TN249] Environmental Qualification Requirements		
Program Description	XI.E3B Program Description, revise the test related to the level monitoring devices by deleting the word “continuous” to read as follows, “Credit for water level monitoring equipment can be taken if such devices have self-monitoring features and generate failure alarms in a location that is easily identifiable and observable to ensure that the cause of the alarm is appropriately and expeditiously identified and addressed (e.g., a central location, control room, etc.).... The reliability and methods of ensuring operation of level monitoring devices are justified and documented.”	The word “continuous” is deleted from the level monitoring device description to avoid misinterpretation that any temporary interruption of level detection systems negates their use in justifying less frequent inspections.
Program Description	XI.E3B Program Description, is clarified to provide general guidance on acceptable level control alarms, including locations, to ensure that the cause of level alarms is appropriately and expeditiously identified and addressed.	The Program Description is revised to clarify and acknowledge that credit for water level monitoring equipment can be taken if such devices have self-monitoring features and generate failure alarms in a location that is easily identifiable and observable to ensure that the cause of the alarm is appropriately and expeditiously identified and addressed. The revision provides an alternative that an alarm that is automatically generated and distributed by way of electronic message (i.e., email, phone call, or text) may be acceptable provided the applicant has demonstrated the method functions as expected and the electronic message is sent to multiple personnel that have a clear understanding of their expected response and the ability to respond to correct the condition in an expeditious manner.
Preventive Actions	XI.E3B Evaluation and Technical Basis, Preventive Actions is clarified to provide general guidance on acceptable level control alarms, including locations, to ensure that the cause of level alarms is	The Preventive Actions is revised to clarify and acknowledge that credit for water level monitoring equipment can be taken if such devices have self-monitoring features and generate failure

Table 2-35 GALL-SLR Report, Revision 1, Chapter XI, Electrical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Changed Program Elements	Summary of Significant Changes	Technical Basis for Change
	appropriately and expeditiously identified and addressed.	alarms in a location that is easily identifiable and observable to ensure that the cause of the alarm is appropriately and expeditiously identified and addressed. The revision provides an alternative that an alarm that is automatically generated and distributed by way of electronic message (i.e., email, phone call, or text) may be acceptable provided the applicant has demonstrated the method functions as expected and the electronic message is sent to multiple personnel that have a clear understanding of their expected response and the ability to respond to correct the condition in an expeditious manner.
Preventive Actions	XI.E3B Preventive Actions, revise the test related to the level monitoring devices by deleting the word "continuous" to read as follows, "Credit for water level monitoring equipment can be taken if such devices have self-monitoring features and generate failure alarms in a location that is easily identifiable and observable to ensure that the cause of the alarm is appropriately and expeditiously identified and addressed (e.g., a central location, control room, etc.).... The reliability and methods of ensuring operation of level monitoring devices are justified and documented."	The word "continuous" is deleted from the level monitoring device description to avoid misinterpretation that any temporary interruption of level detection systems negates their use in justifying less frequent inspections.
Program Description Scope of Program Preventative Actions Parameters Monitored or Inspected	The proposed revisions add inspection of manholes with water level monitoring and alarms that result in consistent, subsequent pump out of accumulated water prior to wetting or submergence of cable at least once every 5 years. Also, the proposed revisions add inspection of manholes following event-driven occurrences such as heavy rain, rapid thawing of ice and snow, or flooding only when water level monitoring indicates water is accumulating. Based on the review of a previous SLRA, manholes	The staff finds that there is no need to perform annual inspections for manholes that have an installed water level monitoring and alarm system if there are provisions for a timely response to level alarms. Manholes with water level monitoring and alarms, and timely pump out, prevent water accumulation from wetting or submerging cables. There is no adverse industry OE for the water level monitoring equipment. Therefore, the staff finds that inspecting manholes with installed water level monitoring and

Table 2-35 GALL-SLR Report, Revision 1, Chapter XI, Electrical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Changed Program Elements	Summary of Significant Changes	Technical Basis for Change
Acceptance Criteria Table XI-01	with water level monitoring and alarms are self-monitoring, and therefore do not require annual inspection for water accumulation.	alarms every 5 years is acceptable. Additionally, because of the level transmitters' continuous monitoring and alarms, there is no need for event-driven inspections if there is no water accumulation. Therefore, the staff finds acceptable a practice of inspecting manholes with water level monitoring and alarms following event-driven occurrences, only when the water level monitoring indicates water is accumulating. These water level monitoring systems are widely used in the industry, are very reliable and can cope with a variety of operating conditions encountered in nuclear power plant manholes. The water level monitoring system is self-monitoring. If it fails, indication will be shown in the control room. This proposed change provides continuous monitoring of water level in manholes rather than annual inspection of water level in manholes.
Program Description	XI.E3B Program Description, the word 'potentially' is clarified.	The word 'potentially' is clarified as follows: The word 'potentially' is necessary to capture environmental unknowns associated with inaccessible cables. If cables could be exposed to significant moisture (based on location and geology) they should be included in the program and therefore subject to increased monitoring (i.e., a cable is assumed to be wet if it cannot be verified that it is dry in inaccessible locations; and therefore, aging management actions must be performed on those cables). This ensures that inaccessible cables are conservatively scoped into the AMP and adequately monitored to provide reasonable assurance that cables potentially exposed to wetting or submergence (i.e., significant moisture) can perform their intended function.
Program Description	XI.E3B Program Description, is revised to clarify when maintenance, calibration,	The Program Description is revised to clarify and acknowledge that: (1) testing of installed inservice inaccessible and

Table 2-35 GALL-SLR Report, Revision 1, Chapter XI, Electrical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Changed Program Elements	Summary of Significant Changes	Technical Basis for Change
	or surveillance program may be credited in lieu of testing.	underground instrumentation and control cables as part of an existing maintenance, calibration or surveillance program (that can be shown to adequately assess the aged condition or health of the electrical insulation of in-scope inaccessible instrument and control cables), and (2) testing of coupons, abandoned or removed cables, or inaccessible medium- or low-voltage power cables (subjected to the same or bounding environment, inservice application, cable routing, construction manufacturing and insulation material) may be credited in lieu of or in combination with testing of installed inservice inaccessible instrumentation and control cables when testing is recommended in this AMP.
Detection of Aging Effects	XI.E3B Detection of Aging Effects, is revised to clarify when maintenance, calibration, or surveillance program may be credited in lieu of testing.	The Program Description is revised to clarify and acknowledge that: (1) testing of installed inservice inaccessible and underground instrumentation and control cables as part of an existing maintenance, calibration or surveillance program (that can be shown to adequately assess the aged condition or health of the electrical insulation of in-scope inaccessible instrument and control cables), and (2) testing of coupons, abandoned or removed cables, or inaccessible medium- or low-voltage power cables (subjected to the same or bounding environment, inservice application, cable routing, construction manufacturing and insulation material) may be credited in lieu of or in combination with testing of installed inservice inaccessible instrumentation and control cables when testing is recommended in this AMP.

Table 2-35 GALL-SLR Report, Revision 1, Chapter XI, Electrical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Changed Program Elements	Summary of Significant Changes	Technical Basis for Change
XI.E3C: Electrical Insulation for Inaccessible Low-Voltage Power Cables Not Subject to 10 CFR 50.49 [TN249] Environmental Qualification Requirements		
Program Description	XI.E3C Program Description, revise the test related to the level monitoring devices by deleting the word "continuous" to read as follows, "Credit for water level monitoring equipment can be taken if such devices have self-monitoring features and generate failure alarms in a location that is easily identifiable and observable to ensure that the cause of the alarm is appropriately and expeditiously identified and addressed (e.g., a central location, control room, etc.).... The reliability and methods of ensuring operation of level monitoring devices are justified and documented."	The word "continuous" is deleted from the level monitoring device description to avoid misinterpretation that any temporary interruption of level detection systems negates their use in justifying less frequent inspections.
Program Description	XI.E3C Program Description, is clarified to provide guidance on acceptable level control alarms, including locations, to ensure that the cause of level alarms is appropriately and expeditiously identified and addressed.	The Program Description is revised to clarify and acknowledge that credit for water level monitoring equipment can be taken if such devices have self-monitoring features and generate failure alarms in a location that is easily identifiable and observable to ensure that the cause of the alarm is appropriately and expeditiously identified and addressed. The revision provides an alternative that an alarm that is automatically generated and distributed by way of electronic message (i.e., email, phone call, or text) may be acceptable provided the applicant has demonstrated the method functions as expected and the electronic message is sent to multiple personnel that have a clear understanding of their expected response and the ability to respond to correct the condition in an expeditious manner.
Preventive Actions	XI.E3C Preventive Actions is clarified to provide guidance on acceptable level control alarms, including locations, to ensure that the cause of level alarms is	The Preventive Actions is revised to clarify and acknowledge that credit for water level monitoring equipment can be taken if such devices have self-monitoring features and generate failure

Table 2-35 GALL-SLR Report, Revision 1, Chapter XI, Electrical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Changed Program Elements	Summary of Significant Changes	Technical Basis for Change
	appropriately and expeditiously identified and addressed.	alarms in a location that is easily identifiable and observable to ensure that the cause of the alarm is appropriately and expeditiously identified and addressed. The revision provides an alternative that an alarm that is automatically generated and distributed by way of electronic message (i.e., email, phone call, or text) may be acceptable provided the applicant has demonstrated the method functions as expected and the electronic message is sent to multiple personnel that have a clear understanding of their expected response and the ability to respond to correct the condition in an expeditious manner.
Preventive Actions	XI.E3C Preventive Actions, revise the test related to the level monitoring devices by deleting the word "continuous" to read as follows, "Credit for water level monitoring equipment can be taken if such devices have self-monitoring features and generate failure alarms in a location that is easily identifiable and observable to ensure that the cause of the alarm is appropriately and expeditiously identified and addressed (e.g., a central location, control room, etc.).... The reliability and methods of ensuring operation of level monitoring devices are justified and documented."	The word "continuous" is deleted from the level monitoring device description to avoid misinterpretation that any temporary interruption of level detection systems negates their use in justifying less frequent inspections
Program Description Scope of Program Preventative Actions Parameters Monitored or Inspected	The proposed revisions add inspection of manholes with water level monitoring and alarms that result in consistent, subsequent pump out of accumulated water prior to wetting or submergence of cable at least once every 5 years. Also, the proposed revisions add inspection of manholes following event-driven occurrences such as heavy rain, rapid thawing of ice and snow, or flooding, only when water level monitoring indicates water is accumulating. Based on the review of a previous SLRA, manholes	The staff finds that there is no need to perform annual inspections for manholes that have an installed water level monitoring and alarm system if there are provisions for a timely response to level alarms. Manholes with water level monitoring and alarms, and timely pump out, prevent water accumulation from wetting or submerging cables. There is no adverse industry OE for the level monitoring equipment. Therefore, the staff finds that inspecting manholes with

Table 2-35 GALL-SLR Report, Revision 1, Chapter XI, Electrical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Changed Program Elements	Summary of Significant Changes	Technical Basis for Change
Detection of Aging Effects Acceptance Criteria Corrective Actions Table XI-01	with water level monitoring and alarms are self-monitoring, and therefore do not require annual inspection for water accumulation.	installed water level monitoring and alarms every 5 years is acceptable. Additionally, because of the level transmitters' continuous monitoring and alarms, there is no need for event-driven inspections if there is no water accumulation. Therefore, the staff finds an acceptable level of inspecting manholes with water level monitoring and alarms following event driven occurrences, only when the water level monitoring indicates water is accumulating. These water level monitoring systems are widely used in the industry, are very reliable, and can cope with a variety of operating conditions encountered in nuclear power plant manholes. The water level monitoring system is self-monitoring. If it fails, indication will be shown in the control room. This proposed change provides continuous monitoring of water level in manholes rather than annual inspection of water level in manholes.
Program Description	XI.E3C Program Description, the word "potentially" is clarified.	The word "potentially" is clarified as follows: The word "potentially" is necessary to capture environmental unknowns associated with inaccessible cables. If cables could be exposed to significant moisture (based on location and geology) they should be included in the program and therefore subject to increased monitoring (i.e., a cable is assumed to be wet if it cannot be verified that it is dry in inaccessible locations; and therefore, aging management actions are performed on those cables). This ensures that inaccessible cables are conservatively scoped into the AMP and adequately monitored to provide reasonable assurance that cables potentially exposed to wetting or submergence (i.e., significant moisture) can perform their intended function.

Table 2-35 GALL-SLR Report, Revision 1, Chapter XI, Electrical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Changed Program Elements	Summary of Significant Changes	Technical Basis for Change
Program Description	XI.E3C Program Description, is revised to remove the term “multiple random.”	The Program Description is revised to clarify that a common environmental aging stressor such as submergence represents an aging mechanism that, if not anticipated in the design or mitigated in service, could have an adverse effect on operability, may lead to failures of the cable insulation system, and compromise system defense-in-depth.
Program Description	XI.E3C Program Description, is revised to clarify when maintenance, calibration, or surveillance program may be credited in lieu of testing.	The Program Description is revised to clarify and acknowledge that: (1) testing of installed inservice inaccessible and underground instrumentation and control cables as part of an existing maintenance, calibration or surveillance program (that can be shown to adequately assess the aged condition or health of the electrical insulation of in-scope inaccessible instrument and control cables), and (2) testing of coupons, abandoned or removed cables, or inaccessible medium- or low-voltage power cables (subjected to the same or bounding environment, inservice application, cable routing, construction manufacturing and insulation material) may be credited in lieu of or in combination with testing of installed inservice inaccessible instrumentation and control cables when testing is recommended in this AMP.
Detection of Aging Effects	XI.E3C Detection of Aging Effects, is revised to clarify when maintenance, calibration, or surveillance program may be credited in lieu of testing	The Program Description is revised to clarify and acknowledge that: (1) testing of installed inservice inaccessible and underground instrumentation and control cables as part of an existing maintenance, calibration or surveillance program (that can be shown to adequately assess the aged condition or health of the electrical insulation of in-scope inaccessible instrument and control cables), and (2) testing of coupons, abandoned or removed cables, or inaccessible medium- or low-voltage power cables (subjected to the same or bounding environment, inservice

Table 2-35 GALL-SLR Report, Revision 1, Chapter XI, Electrical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Changed Program Elements	Summary of Significant Changes	Technical Basis for Change
		application, cable routing, construction manufacturing and insulation material) may be credited in lieu of or in combination with testing of installed inservice inaccessible instrumentation and control cables when testing is recommended in this AMP.
XI.E7: High-Voltage Insulators		
Program Description Scope of Program Parameters Monitored or Inspected Detection of Aging Effects Acceptance Criteria Table XI-01	The proposed revisions add polymer high-voltage (HV) insulators to the scope and program elements of GALL-SLR AMP XI.E7. The current AMP addresses porcelain insulators, however, polymer insulators have been utilized in some nuclear plant sites and should be addressed accordingly. Polymer high voltage (HV) insulators include different material/environment and aging effects not previously considered in GALL-SLR and GALL-SRP. This also clarifies the scope of the insulators included under this program. Although the term “high-voltage” is used throughout AMP XI.E7, this program includes all insulators used in power systems operating at nominal system voltages greater than 1 kV and equal to or less than 765 kV, and installed on in-scope portions of switchyards, transmission lines, and power systems.	The staff added polymer and toughened glass HV insulators to the scope and program elements of GALL-SLR AMP XI.E7. Polymer and toughened glass HV insulators are being used in some nuclear plant sites and are not currently discussed in GALL-SLR. Polymer HV insulators include different material/environment and aging effects not previously considered in GALL-SLR and SRP-SLR. Adding polymer insulators to this AMP enables its use to manage aging of porcelain as well as polymer HV insulators. Polymer HV insulators are typically composed of material such as fiberglass, silicone rubber (SIR), ethylene propylene rubber (EPR), epoxy, silicone gel, sealants, ductile iron, aluminum, aluminum alloys, steel, steel alloys, malleable iron, and galvanized metals. Exposure to air-outdoor can cause degradation and aging effects that can result in reduced insulation resistance due to deposits and surface contamination, reduced insulation resistance due to polymer degradation as well as loss of material caused by wind blowing on transmission conductors, all of which may require aging management. This component material/environment combination has not previously been evaluated in GALL-SLR and is considered a site-specific condition to be evaluated by the applicant. Polymer HV insulators have been shown to have unique failure modes with little

Table 2-35 GALL-SLR Report, Revision 1, Chapter XI, Electrical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Changed Program Elements	Summary of Significant Changes	Technical Basis for Change
		advance indications. Surface buildup of contamination can be worse for SIR (compared to porcelain insulators) due to absorption by silicone oil, especially in late stages of service life. Typical aging degradation and mechanisms for polymer HV insulators include (but are not limited to) the following: • Deposits and buildup of surface contamination causing reduced insulation resistance, arcing and flashover • Polymer degradation caused by thermal degradation of organic material, radiolysis and photolysis of ultra-violet (UV)sensitive material, oxidation, and moisture intrusion • Stress corrosion cracking of glass fibers due to sheath degradation • Swelling of SIR layer due to chemical contamination • Sheath wetting caused by chemicals absorbed by oil from SIR compound • Brittle fracture of rods resulting from discharge activity, flash under, and flashover • Chalking and crazing of insulator surfaces resulting in contamination, arcing, and flashover • Water penetration through the sheath followed by electrical failure • Bonding failure at rod and sheathing interface • Water ingress through end fittings causing flash under, corrosion, and fracture of glass fibers Additionally, aggressive environment due to presence of excrement from birds and rodents containing chemicals such as uric acid, phosphates, and ammonia can accelerate degradation.

Table 2-35 GALL-SLR Report, Revision 1, Chapter XI, Electrical Aging Management Programs, Differences From GALL-SLR Report, Revision 0, and Their Technical Bases (Continued)

Changed Program Elements	Summary of Significant Changes	Technical Basis for Change
		This focus of this program is on certain classes of insulators commonly used in nuclear power plant applications, not on a particular voltage range definition. The term "high-voltage insulator" is recognized in the industry to apply to types of power conductor insulators used across a wide range of conductor voltages. Given that there are multiple standards that define voltage ranges (low, medium, high, extra high) differently, this AMP does not use any one definition but instead clarifies the specific voltage rating range that within the scope of this program.
Detection of Aging Effects	XI.E7 Detection of Aging Effects, is revised to clarify that insulation resistance should not be used solely for detecting deterioration of electrical insulation systems.	The Detection of Aging Effects is revised to clarify that visual inspection can be used to detect the following two aging degradations: (1) loss of material in the metallic parts due to corrosion and/or frequent movement, and (2) reduced insulation resistance. The revision describes the cause of the loss of material in the metallic parts and the reduced insulation resistance. The revision adds that visual inspections may be supplemented with other test methods that have been demonstrated to be effective in determining the aged condition of insulators, that corona cameras may also be employed to detect early signs of corona emissions, and that the first inspection for SLR is to be completed prior to the subsequent period of extended operation.

3 CHANGES TO STANDARD REVIEW PLAN FOR REVIEW OF SUBSEQUENT LICENSE RENEWAL APPLICATIONS FOR NUCLEAR POWER PLANTS, REVISION 0 AND THEIR TECHNICAL BASES

Many changes have been made to NUREG–2192, the Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants (SRP-SLR), Revision 0. Some changes are the result of lessons learned and experience from the staff's reviews of subsequent license renewal applications (SLRAs), including those from NRC Interim Staff Guidance (ISG) documents. Revision 1 of NUREG–2192 has consolidated these changes. This section provides a summary of notable technical changes that were made in Revision 1 to the SRP-SLR and provides the technical basis for each change. The specific changes to each SRP-SLR chapter are discussed in Sections 3.1 through 3.5 of this document. A summary of the changes to each chapter and their technical bases are presented in Table 3-1 through Table 3-17.

3.1 <u>SRP-SLR Chapter 1 – Administrative Information</u>

There are no major technical changes in Chapter 1 of the SRP-SLR, Revision 0; however, revisions to the staff's review approach related to AMP enhancements and the depth of the review are described in Table 3-1.

3.2 <u>SRP-SLR Chapter 2 – Scoping and Screening</u>

There are no major technical changes to SRP-LR Chapter 2 of SRP-SLR, Revision 0, with the exception of clarifications for applicant references to the results of its first renewal, complex assemblies and to the requirements of the Station Blackout Rule. The changes and technical bases for these changes are shown in Table 3-2.

3.3 <u>SRP-SLR Chapter 3 – Aging Management Review</u>

There are six subchapters to the SRP-SLR Chapter 3 on aging management review (AMR). Subchapter 3.1 discusses aging management of reactor vessel (RV), internal, and reactor coolant system. Subchapter 3.2 deals with aging management of engineered safety features; Subchapter 3.3 covers auxiliary systems; Subchapter 3.4 discuses steam and power conversion system; Subchapter 3.5 discusses containments, structures, and component supports; and Subchapter 3.6 discusses electrical and instrumentation and controls. The changes and technical bases for these changes are shown in Table 3-3 through Table 3-8, respectively.

3.4 <u>SRP-SLR Appendices A.1, A.2, A.3, and A.4</u>

There were no major technical changes to the appendices in the SRP-SLR, Revision 0; however, clarifying guidance for the review of AMP acceptance criteria is described in Table 3-17.

Table 3-1 SRP-SLR, Revision 1, Chapter 1, Section 1.1, Administrative Information, and Section 1.2, Integrated Plants Assessments and Aging Management Reviews Differences from SRP-SLR, Revision 0, and Their Technical Bases

Location of Change	Summary of Significant Changes	Technical Bases for Changes
Section 1.1 Administrative Information		
No changes from SRP-SLR, Revision 0, to SRP-SLR, Revision 1.		
Section 1.2 Integrated Plant Assessments and Aging Management Reviews		
Section 1.2.1 – Background on the Types of Reviews	Revised the discussion on the staff's AMP review to focus on verifying the GALL-consistency of the proposed AMPs, as enhanced, rather than directing the staff to explicitly review and document the acceptability of each enhancement in the safety evaluation. Revised the discussion on the staff's AMP review to consider risk insights and other factors when assessing the appropriate depth of the staff review.	The revisions to the staff's review approach continue to adequately support a GALL-consistency conclusion for each AMP, but in a manner that removes unnecessarily prescriptive staff direction. In addition, insights from plant program operating history, consistency with NRC guidance, and risk significance are to be applied when considered the appropriate depth of staff review, consistent with Office Instruction LIC-206, Revision 1, "Integrated Risk-Informed Decision-Making for Licensing Reviews." These revisions enhance the review approach initially approved by the Commission in SRM-SECY-99-148, "Credit for Existing Programs for License Renewal" (ML003751930) with the more recent Commission direction in SRM-COMCTH-24-0003, "License Renewal and Subsequent License Renewal Review Expectations" (ML24221A319) to implement review efficiencies. The basis for the staff's position is also described in response to comment no. 21 in the GALL-SLR Report, Revision 1.

Table 3-2 SRP-SLR, Revision 1, Chapter 2, Scoping and Screening, Differences from SRP-SLR, Revision 0, and Their Technical Bases

Location of Change	Summary of the Change	Technical Basis for Change
Section 2.1.1, “Areas for Review”	The staff review guidance was revised to note the option of focusing the scoping and screening review on changes from the first renewal application.	A public comment requested the allowance of an option for an SLR applicant to present only changes in scope from the first renewal application. The staff notes that the SRP-SLR does not preclude an applicant from doing so. Nevertheless, the SRP-SLR was revised to clarify the allowance of this option. The staff also notes that the effective use of this approach is predicated on the applicant documenting the process for identifying changes and adequately describing plant modifications and other factors leading to results that differ from the first renewal. For more details, refer to the staff response to comment no. 20 in the GALL-SLR Report, Revision 1.
Table 2.1-2, Issue “Complex Assemblies”	The guidance for the “Complex Assemblies,” issue in SRP-SLR, Table 2.1-2, “Specific Staff Guidance on Scoping,” was modified to clarify the evaluation of complex assemblies, performed to identify the structures and components (SCs) within the scope of subsequent license renewal and subject to aging management review (AMR).	In associated discussions about screening complex assemblies, recent SLRAs have stated that complex assemblies are predominantly “active assemblies” that can be excluded from an AMR. The term “active assembly” is not a term recognized within license renewal guidance documents, and the need for an AMR of SCs that make up a complex assembly is dependent on whether the SCs perform a passive function. As noted in SRP-SLR Table 2.3-2, diesel engine jacket water heat exchangers and other passive components supplied by a vendor on a diesel generator skid are “passive,” “long-lived” components that are subject to an AMR even though the diesel generator may broadly be described as “active.” The Statements of Consideration for Title 10 *Code of Federal Regulations* (10 CFR) Part 54 [TN4878] published in the *Federal Register* Notice of May 8, 1995, “Nuclear Power Plant License Renewal; Revisions,” 60 FR 22461, states, in part, “Passive parts of structures and components that only perform active functions do not require an

Table 3-2 SRP-SLR, Revision 1, Chapter 2, Scoping and Screening, Differences from SRP-SLR, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of the Change	Technical Basis for Change
		aging management review. The SCs that perform both passive and active functions require an AMR for their intended passive function[s] only.” Accordingly, Table 2.1-2 was changed to indicate that if complex assemblies performed passive intended functions (which meet the criteria of 10 CFR 54.4(a) [TN4878] to be included within the scope of license renewal), either solely or in addition to active intended functions, the passive intended functions should be evaluated to identity any SCs subject to AMR.
Table 2.1-6, Item 128	New item in SRP-SLR Table 2.1-6 to state that the fire damper housing is subject to aging management.	Based on a review of current subsequent license renewal applications, the staff noted that AMR items have been included for fire damper assemblies or fire damper housings. Fire damper assembly suggests the entire component (e.g., housing, damper) is subject to aging management while fire damper housing suggests only a portion of the component is subject to aging management. Therefore, clarification is needed regarding which components of a fire damper assembly are passive components and are subject to aging management. NUREG-2192 defines passive structures and components “as those that perform their intended functions without moving parts or change in configuration or properties in accordance with 10 CFR 54.21(a)(1)(i)” [TN4878]. The fire damper housing does not perform its intended function with moving parts; however, the other fire damper assembly components, including the damper, do perform their intended function with moving parts. Treating the fire damper itself as an active component not subject to aging management is consistent with the treatment of other dampers. Specifically, 10 CFR 54.21(a)(1)(i) states that ventilation dampers are excluded from aging management, and SRP-SLR Table 2.1-6 states that only the housings of dampers, louvers, and gravity dampers associated

Table 3-2 SRP-SLR, Revision 1, Chapter 2, Scoping and Screening, Differences from SRP-SLR, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of the Change	Technical Basis for Change
		with valves are subject to aging management.
Section 2.5.2.1.1	Added clarifying language to the requirements of the Station Blackout (SBO) Rule. Specifically, to address components within the scope of the SBO.	Updated to conform with the requirements of the SBO rule.

Table 3-3 SRP-SLR, Revision 1, Chapter 3.1, Reactor Vessels, Internals, Coolant System, Differences from SRP-SLR, Revision 0, and Their Technical Bases

Location of Change	Summary of the Change	Technical Basis for Change
Table 3.1-1, Item 028	The staff made the following changes to SRP-SLR Table 3.1-1, Item 028 in SLR-ISG-2021-01-PWRVI [NRC 2021-TN9958]: 1) Deleted reference of Combustion Engineering (CE)-design components (i.e., thermal shield repositioning pins and incore instrumentation [ICI] thimble tubes) from the scope of the Item 028a and realigned the aging management review (AMR) line items for the components as described in the “Technical Basis for Changes” column entry for this line item. 2) Edited the component description to clarify it only applies to Westinghouse-design CRGT support pins (split pins). 3) Added parenthetical statements to the GALL-SLR Item references in the GALL-SLR column entry of Item 028 that clarify when the GALL-SLR items may be applied for use in an incoming SLRA. 4) Administratively edited the item to cite the irradiation-assisted stress corrosion cracking mechanism as “IASCC.”	The Electric Power Research Institute (EPRI) MRP revised its aging management criteria for Westinghouse-design control rod guide tube (CRGT) split pins and CE-design thermal shield positioning pins and incore monitoring instrument (IMI) thimble tube in the MRP-227, Revision 1-A Report [NRC 2019-TN9222]. Therefore, the staff modified its AMR criteria for Westinghouse-design CRGT split pins in AMR Item 028 and deleted reference of CE-design reactor vessel internal (RVI) thermal shield positioning pins and ICI thimble tubes components from the scope of AMR Item 028. For the AMR criteria that apply to the Westinghouse-design CRGT support pins (split pins), the staff modified Item 028 to allow application and use of GALL-SLR Item IV.B2.RP-355 if the CRGT split pins in the plant design have yet to be replaced and are made from X-750 nickel alloy materials. Otherwise, the modified version of SRP-SLR Table 3.1-1, Item 028 allows use of GALL-SLR Item IV.B2.RP-265 (i.e., No Additional Measures) if the CRGT split pins have been replaced and are made from austenitic SS materials, and can be placed in the “No Additional Measures” category of components. The modified version Item 028 also allows use of GALL-SLR Item IV.E.R-444 if the CRGT split pins are defined in the CLB as ASME Section XI [ASME 2017-TN9258] Code Class components and

Table 3-3 SRP-SLR, Revision 1, Chapter 3.1, Reactor Vessels, Internals, Coolant System, Differences from SRP-SLR, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of the Change	Technical Basis for Change
	5) Deleted GALL-SLR Items IV.B2.RP-356, IV.B3.RP-357, and IV.B3.RP-400 as referenced GALL-SLR Items in Item 028.	the ISI program is credited for aging management of the pins. The changes to Item 28 for Westinghouse-design CRGT spilt pins should make the AMR criteria consistent with those in MRP-227, Revision 1-A. The EPRI MRP changed the inspection categories for the referenced CE-design thermal shield positioning pins and ICI thimble tubes in the MRP-227, Revision 1-A Report. Specifically, the EPRI MRP downgraded the CE-design thermal shield repositioning pins to “No Additional Measures” components in the updated report. Therefore, based on that change, the staff realigned its AMR criteria for the thermal shield positioning pins to the AMR line items for CE-design “No Additional Measures” components, which are given in SRP-SLR Table 3.1-1, Item 055b and in GALL-SLR Item IV.B2.RP-306. Additionally, EPRI MRP has identified that CE-design ICI thimble tubes are “Existing Program” category components per the line item entry for these components in Table 3-2 (page 3-26) of the MRP-227, Revision 1-A Report. In this table, EPRI MRP identifies that the ICI thimble tubes are susceptible to the aging mechanism of wear. The existing item in GALL-SLR IV.B3.RP-357 is consistent with this basis, with the exception that it is now appropriate to the reference of the “RP-357” item as being aligned to SRP-SLR Item 056c (the item for CE-design Existing Program components that are subject to non-cracking aging effect and mechanism combinations), and not Item 028. IASCC was included in Item 028 based on lessons learned from the Surry SLRA gap analysis, which referenced inclusion of IASCC as an applicable mechanism for the CRGT split pins per criteria in the MRP-2018-022 Report.

Table 3-3 SRP-SLR, Revision 1, Chapter 3.1, Reactor Vessels, Internals, Coolant System, Differences from SRP-SLR, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of the Change	Technical Basis for Change
Table 3.1-1, Item 032	The staff deleted SRP-SLR Table 3.1-1, Item 032 in SLR-ISG-2021-01-PWRVI [NRC 2021-TN9958].	In the SRP-SLR and GALL-SLR reports, SRP-SLR Table 3.1-1, Item 032, and the linked items in GALL-SLR Items IV.B2.RP-382, IV.B3.RP-382 and IV.B4.RP-382 provided the SRP-SLR and GALL-SLR AMR line items for Westinghouse-designed, CE-designed, and Babcock and Wilcox (B&W)-designed reactor internals that are categorized as ASME Section XI [ASME 2017-TN9258] Code Class components. During the staff ISG review, the staff determined that Item 032 is bounded by and redundant with the scope of the AMR in SRP-SLR Table 3.1-1, Item 114, as updated in SLR-ISG-2021-01-PWRVI [NRC 2021-TN9958]. Similarly, the staff determined that the scope of GALL-SLR Items IV.B2.RP-382, IV.B3.RP-382 and IV.B4.RP-382 are bounded by and redundant with the scope of the AMR in GALL-SLR Item IV.E.R-444, as updated in SLR-ISG-2021-01-PWRVI [NRC 2021-TN9958]. Therefore, SRP-SLR Table 3.1-1, Item 032 and the corresponding GALL-SLR "RP-382" items were deleted in SLR-ISG-2021-01-PWRVI [NRC 2021-TN9958]. For more details, refer to the comment and technical basis for changes being made to SRP-SLR Table 3.1-1, Item 114 in this table.
Table 3.1-1, Item 051a	The staff made the following changes to SRP-SLR Table 3.1-1, Item 051a in SLR-ISG-2021-01-PWRVI [NRC 2021-TN9958]: 1) Added GALL-SLR Item IV.B4.RP-252c as a new referenced GALL-SLR item in Item 051a. 2) Deleted GALL-SLR Items IV.B4.RP-249a, IV.B4.RP-252a, IV.B4.RP-258a, IV.B4.RP-259a, and IV.B4.RP-400 as referenced GALL-SLR items in Item 051a. 3) Administratively edited Item 051a to cite the irradiation-assisted	SRP-SLR Table 3.1-1, Item 051a remains as AMR line item for B&W "Primary" category RVI components subject to cracking. 1) In the staff-approved basis in the MRP-227, Revision 1-A Report [NRC 2019-TN9222], the EPRI MRP designated specific B&W-design vent valve original locking devices and modified locking devices as new "Primary" category component per Items B5 and B6 in Table 4-1 of the report. Since the staff has developed new GALL-SLR Item IV.B4.RP-252c to address cracking of these "Primary" category locking devices, this required addition of the new GALL-SLR Item as an additional referenced item for SRP-SLR Table 3.1-1, Item 051a.

Table 3-3 SRP-SLR, Revision 1, Chapter 3.1, Reactor Vessels, Internals, Coolant System, Differences from SRP-SLR, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of the Change	Technical Basis for Change
	stress corrosion cracking mechanism as "IASCC."	2) Based on acceptance of EPRI MRP Comments #29 and #32, the staff confirmed that the B&W-design RVI components that were previously within the scope of GALL-SLR Items IV.B4.RP-249a, IV.B4.RP-252a, IV.B4.RP-258a, and IV.B4.RP-259a did not screen in for any cracking mechanisms in MRP-227, Revision 1-A [NRC 2019-TN9222]. Therefore those "RP" line items were deleted or completely revised as non-cracking items in Appendix B.3 of the ISG and the referencing of these GALL-SLR item was either deleted from Item 051a or deleted from 051a and moved as a referenced item to one of non-cracking SRP-SLR items for B&W-design components (i.e., either SRP-SLR Table 3.1-1 Item 058a or 058b) in Appendix A of the ISG. For example in the ISG, the staff modified the existing IV.B4.RP-252a item to address loss of fracture toughness due to thermal aging embrittlement in B&W-design vent valve bodies instead of cracking in B&W-design core support shield (CSS) vent valve top and bottom retaining rings, which was the topic of the previous version of the "RP-252a" item. However, the vent valve bodies are B&W-design Expansion category components per item B2.1 in Table 4-4 of MRP-227, Revision 1-A. Therefore, the staff deleted the IV.B4.RP-252a item as a referenced item in SRP-SLR Table 3.1-1, Item 051a and instead added it as a new reference item for SRP-SLR Table 3.1-1, Item 058b, as updated in Appendix A of the ISG (i.e., Item 058b is the proper item in SRP-SLR Table 3.1-1 for B&W-design Expansion category components in MRP-227, Revision 1-A that are subject to non-cracking effect and mechanism combinations, including the vent valve bodies). The previous inclusion of GALL-SLR Item IV.B4.RP-400 in the GALL-SLR Report only applied to cracking of specific B&W-designed RVI components that were included in the design of the Three Mile

Table 3-3 SRP-SLR, Revision 1, Chapter 3.1, Reactor Vessels, Internals, Coolant System, Differences from SRP-SLR, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of the Change	Technical Basis for Change
		Island Unit 1 (TMI-1) reactor. The owner of TMI-1 has made the decision to decommission the reactor. Therefore, GALL-SLR Item IV.B4.RP-400 is no longer needed for the objectives of the updates in SLR-ISG-2021-01-PWRVI [NRC 2021-TN9958] and has been deleted. The staff adjusted AMR Item 051a accordingly to delete Item IV.B4.RP-400 as a referenced GALL-SLR item for the line item. 3) The change to cite the "irradiation-assisted stress corrosion cracking mechanism" as IASCC is an administrative edit for consistency with other AMR line items that cite IASCC as an aging mechanism.
Table 3.1-1, Item 051b	The staff made the following changes to SRP-SLR Table 3.1-1, Item 051b in SLR-ISG-2021-01-PWRVI [NRC 2021-TN9958]: 1) Added GALL-SLR Items IV.B4.RP-246c and IV.B4.RP-246d as new referenced GALL-SLR items in Item 051b. Per the staff's acceptance of Nuclear Energy Institute (NEI) Comment #3, and similar generic comment bases in EPRI MRP Comments #29 and #32, and the staff's bases for resolving these comments, the Final version of the ISG no longer includes a new GALL-SLR IV.B4.RP-375 item on the subject of cracking in B&W-design lower grid rib sections. 2) Deleted GALL-SLR Items IV.B4.RP-244a, IV.B4.RP-250a, IV.B4.RP-254 and IV.B4.RP-254a as referenced GALL-SLR items in Item 051b. 3) Administratively edit the line item to cite the irradiation-assisted stress corrosion cracking mechanism as "IASCC."	The SRP-SLR Table 3.1-1, Item 051b remains as the AM line item for B&W "Expansion" category RVI components subject to cracking. 1) In Item B7.1 in Table 4-4 of the MRP-227, Revision 1-A Report [NRC 2019-TN9222], the EPRI MRP identifies that the upper thermal shield (UTS) bolts and their locking devices are "Expansion" category components that are located in the core barrel assemblies of B&W-designed PWRs. The prior GALL-SLR IV.IV.B4-RP-246 and IV.B4.RP-246a items covering cracking in both the lower thermal shield (LTS) bolt and bolt locking devices and UTS bolt and bolt locking devices indicated that all of the components are located in the lower grid assembly of the plants. As a result of these MRP-227, Revision 1-A changes, the staff deleted reference of the UTS bolt and bolt locking devices from the scope of existing Item IV.B4.RP-246 and IV.B4.RP-246a items, and instead, developed new GALL-SLR Items IV.B4.RP-246c and IV.B4.RP-246d to address cracking of UTS bolts and UTS bolt locking devices, as located in the proper core barrel assembly containing the components. The staff adjusted SRP-SLR Table 3.1-1, Item 051b

Table 3-3 SRP-SLR, Revision 1, Chapter 3.1, Reactor Vessels, Internals, Coolant System, Differences from SRP-SLR, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of the Change	Technical Basis for Change
		accordingly to include Items IV.B4.RP-246c and IV.B4.RP-246d as new GALL-SLR Item references for the line item. Based on the staff's partial acceptance of NEI #3, and similar generic comments made in EPRI MRP Comments #29 and #32, the staff confirmed that the MRP-227, Revision 1-A Report did not screen B&W-design lower grid rib sections in for any cracking mechanisms. Thus, the IV.B4.RP-375 Item, as previously proposed in the ISG for cracking in the lower grid rib sections, is not being included as a new item for the final version of the ISG and is not referenced as a GALL-SLR item reference for the revision of SRP-SLR Table 3.1-1, Item 051b in the ISG. 2) Based on the staff's partial acceptance of NEI #3, and similar generic comments made in EPRI MRP Comments #29 and #32, the staff confirmed that the MRP-227, Revision 1-A Report did not screen B&W-design external baffle-to-baffle bolts, core barrel-to-former bolts, core barrel cylinders, or former plates in for any cracking mechanisms. Therefore, the staff deleted GALL-SLR Items IV.B4.RP-244a and IV.B4.RP-250a in Appendix B.3 of SLR-ISG-2021-01-PWRVI [NRC 2021-TN9958] and as referenced GALL-SLR items for the update of AMR Item 051b in the ISG. The previous inclusion of GALL-SLR Items IV.B4.RP-254 and IV.B4.RP-254a in the GALL-SLR Report only applied to cracking of specific B&W-designed lower grid assembly bolts and bolt locking devices that were included in the design of the TMI-1 reactor. The owner of TMI-1 has made the decision to decommission the reactor. Therefore, the staff deleted GALL-SLR Items IV.B4.RP-254 and IV.B4.RP-254a in Appendix B.3 of SLR-ISG-2021-01-PWRVI [NRC 2021-

Table 3-3 SRP-SLR, Revision 1, Chapter 3.1, Reactor Vessels, Internals, Coolant System, Differences from SRP-SLR, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of the Change	Technical Basis for Change
		TN9958] and as referenced GALL-SLR items for the update of AMR Item 051b in in the ISG. 3) The change to cite the "irradiation-assisted stress corrosion cracking" mechanism as IASCC is an administrative edit for consistency with other AMR line items that cite IASCC as an aging mechanism.
Table 3.1-1, Item 052a Table 3.1-1, Item 052b	The staff made the following changes to SRP-SLR Table 3.1-1, Items 052a and 052b in SLR-ISG-2021-01-PWRVI [NRC 2021-TN9958]: 1) Moved the reference of GALL-SLR Item IV.B3.RP-363 from SRP-SLR Table 3.1-1, Item 052a to SRP-SLR Table 3.1-1, Item 052b. 2) Deleted Item IV.B3.RP-326a as a referenced GALL-SLR item for Item 052a. 3) Administratively edited the 052a and 052b line items to cite the irradiation-assisted stress corrosion cracking mechanism as "IASCC."	The SRP-SLR Table 3.1-1, Items 052a and 052b remain as the AMR line items for Combustion Engineering (CE) "Primary" and "Expansion" category RVI components that may be subject to cracking. 1) In the staff-approved basis in the MRP-227, Revision 1 report, the EPRI MRP amended the inspection category for CE-design lower support structure core support columns from "Primary" category components (as designated in Table 4-2 of the MRP-227-A report) to "Expansion" category components, as indicated in Item C6.3 of Table 4-5 in the MRP-227, Revision 1-A Report. As a result of this component category designation change, the staff amended GALL-SLR Item IV.B3.RP-363 to link its SRP-SLR item reference to that in SRP-SLR Table 3.1-1, Item 052b (and not to Item 052a) and adjusted the references of GALL-SLR Item IV.B3.RP-363 in SRP-SLR Table 3.1-1, Items 052a and 052b accordingly by moving the reference of the "RP-363" item from Item 052a to Item 052b. 2) Based on the staff's partial acceptance of NEI Comment #3, the staff confirmed that the MRP-227, Revision 1-A Report did not screen CE-design core shroud assembly components (for CE plant designs with core shrouds that are assembled in two vertical sections) in for any cracking mechanisms. Thus, IV.B3.RP-326a Item, as previously as previously included in the GALL-SLR

Table 3-3 SRP-SLR, Revision 1, Chapter 3.1, Reactor Vessels, Internals, Coolant System, Differences from SRP-SLR, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of the Change	Technical Basis for Change
		Report for cracking in these shroud components, is being deleted in Appendix B.2 of the final version of the ISG. 3) The change to cite the “irradiation-assisted stress corrosion cracking” mechanism as IASCC is an administrative edit for consistency with other AMR line items that cite IASCC as an aging mechanism.
Table 3.1-1, Item 052c	The staff made the following changes to SRP-SLR Table 3.1-1, Item 052c in SLR-ISG-2021-01-PWRVI [NRC 2021-TN9958]: 1) Added GALL-SLR Item IV.B3.RP-320a as a new GALL-SLR item reference in SRP-SLR Table 3.1-1, Item 052c 2) Administratively edited the line item to cite the “irradiation-assisted stress corrosion cracking” mechanism as “IASCC.”	SRP-SLR Table 3.1-1, Item 052c remains as the AMR line item for CE “Existing Program” category RVI components subject to cracking. In Item C17 of Table 4-8 in the MRP-227, Revision 1-A Report, the EPRI MRP added the core stabilizing lugs and shims (and their associated bolts) as “Existing Program” components for plants with CE-designed reactor internals, with the applicable aging effect being cited as cracking due to stress corrosion cracking (SCC). The staff developed new GALL-SLR Item IV.B3.RP-320a to be consistent with this basis. The staff adjusted SRP-SLR Table 3.1-1, Item 052c to include Item IV.B3.RP-320a as a new GALL-SLR item reference for the line item. Other designated CE-design “Existing Program” components (e.g., the fuel alignment pins per Item C15a in MRP-227, Revision 1-A, Table 4-8 and GALL-SLR Item IV.B3.RP-334) have been identified as being susceptible to the cracking mechanisms of SCC, IASCC, or fatigue. The 052c line item cites all of these cracking mechanisms, which is appropriate for the generic basis of the line item. The change to cite the irradiation-assisted stress corrosion cracking mechanism as IASCC is an administrative edit for consistency with other AMR line items that cite IASCC as an aging mechanism.

Table 3-3 SRP-SLR, Revision 1, Chapter 3.1, Reactor Vessels, Internals, Coolant System, Differences from SRP-SLR, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of the Change	Technical Basis for Change
Table 3.1-1, Item 053a	The staff made the following changes to SRP-SLR Table 3.1-1, Item 053a in SLR-ISG-2021-01-PWRVI [NRC 2021-TN9958]: 1) Moved the reference of GALL-SLR Item IV.B2.RP-280 from SRP-SLR Table 3.1-1, out of Item 053a and into Item 053b. 2) Added GALL-SLR Item IV.B2.RP-296a as a new GALL-SLR item reference in SRP-SLR Table 3.1-1, Item 053a. 3) Administratively edited the line item to cite the "irradiation-assisted stress corrosion cracking" mechanism as "IASCC."	The SRP-SLR Table 3.1-1, Item 053a remains as the AMR line item for Westinghouse "Primary" category RVI components subject to cracking. 1) Per the criteria in Items W3.1, W3.2, and W3.3 of Table 4-6 in MRP-227, Revision 1-A, the EPRI MRP designated Westinghouse-design core barrel lower flanges welds (LFWs), upper circumferential (girth) welds (UGWs), and upper vertical (axial) welds (UAWs) as "Expansion" category components for the programs. As a result, the staff amended GALL-SLR Item IV.B2.RP-280 to be consistent with the EPRI MRP's "Expansion" category criteria for the LFWs, UGWs and UAWs in MRP-227, Revision p 1-A and realigned the GALL-SLR item from SRP-SLR Table 3.1-1, Item 053a to Item 053b. The staff adjusted the reference of GALL-SLR Item IV.B2.RP-280 in SRP-SLR Table 3.1-1 from Item 053a to Item 053b accordingly. 2) The staff developed new GALL-SLR Item IV.B2.RP-296a to address potential cracking that may occur in CRGT assembly guide plates (guide cards). Although the guide cards were not identified as being susceptible to cracking in Table 4-3 of MRP-227, Revision 1-A, the components were screened in for fatigue as part of the Surry SLRA , as referenced to EPRI's 80-year Expert Panel assessment for the components in MRP-2018-022 report. As a result, the staff adjusted SRP-SLR Table 3.1-1, Item 053a accordingly to include Item IV.B2.RP-296a as a new GALL-SLR item reference for the line item. Based on the lessons learned from the Surry SLRA, the staff did not accept EPRI MRP Comments #1 and #8 that fatigue should not be screened in as a cracking mechanism for CRGT guide cards, as

Table 3-3 SRP-SLR, Revision 1, Chapter 3.1, Reactor Vessels, Internals, Coolant System, Differences from SRP-SLR, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of the Change	Technical Basis for Change
		cited in the new “RP-296a” item for the guide cards. 3) The change to cite the “irradiation-assisted stress corrosion cracking” mechanism as “IASCC” is an administrative edit for consistency with other AMR line items that cite IASCC as an aging mechanism.
Table 3.1-1, Item 053b	The staff made the following changes to SRP-SLR Table 3.1-1, Item 053b in SLR-ISG-2021-01-PWRVI [NRC 2021-TN9958]: 1) Moved reference of GALL-SLR Item IV.B2.RP-280 into Item 053b from its previous referenced location in Item 053a. 2) Added GALL-SLR Item IV.B2.RP-298a as a new GALL-SLR item reference in SRP-SLR Table 3.1-1, Item 053b. 3) Deleted GALL-SLR Item IV.B2.RP-278 as a referenced GALL-SLR item in SRP-SLR Table 3.1-1, Item 053b. 4) Administratively edited the line item to cite the “irradiation-assisted stress corrosion cracking” mechanism as “IASCC.”	SRP-SLR Table 3.1-1, Item 053b remains as the AMR line item for Westinghouse “Expansion” category RVI components subject to cracking. 1) In Items W3.1, W3.2, and W3.3 of Table 4-6 in the MRP-227, Revision 1-A Report, the EPRI MRP designated Westinghouse-design core barrel LFWs, UGWs, and UAWs as “Expansion” category components for the programs. Based on these changes, the staff amended GALL-SLR Item IV.B2.RP-280 to be consistent with the EPRI MRP’s “Expansion” category criteria for the LFWs, UGWs and UAWs in MRP-227, Revision 1-A and adjusted the reference of GALL-SLR Item IV.B2.RP-280 in SRP-SLR Table 3.1-1 from Item 053a to Item 053b accordingly. 2) In Item W2 of Table 4-3 of the MRP-227, Revision 1-A Report, the EPRI MRP only assigned the LFWs in peripheral (outer) CRGT assemblies of Westinghouse-designed PWRs as “Primary” category components, with the inspections expanding to the LFWs in the non-peripheral (remaining) assemblies (as the designated “Expansion” components) per Item W2.1 in Table 4-6 of MRP-227, Revision 1-A) if unacceptable degradation was detected in the peripheral CRGT assembly LFWs. The previous version of the GALL-SLR Report did not include a line item for cracking of the non-peripheral CRGT LFWs. Therefore, the staff developed new GALL-SLR Item IV.B2.RP-298a to

Table 3-3 SRP-SLR, Revision 1, Chapter 3.1, Reactor Vessels, Internals, Coolant System, Differences from SRP-SLR, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of the Change	Technical Basis for Change
		address cracking in the non-peripheral CRGT assembly LFWs and adjusted SRP-SLR Table 3.1-1, Item 053b accordingly to cite new GALL-SLR Item IV.B2.RP-298a as a new GALL-SLR item reference for Item 053b. 3) In MRP-227-A, the core barrel outlet nozzle welds (ONWs) covered by GALL-SLR Item IV.B2.RP-278 were designated as the “Expansion” components for Primary inspections performed on the core barrel UFW. However, in MRP-227, Revision 1-A, the EPRI MRP deleted the ONWs as Expansion components and replaced them with the core barrel assembly UGW, LFW, UAWs, and lower support forging or casting as the applicable new Expansion components for Primary UFW inspections. Therefore, the staff deleted GALL-SLR Item IV.B2.RP-278 in SLR-ISG-2021-01-PWRVI [NRC 2021-TN9958] and the reference of the GALL-SLR Item IV.B2.RP-278 from Item 053b. 4) The change to cite the “irradiation-assisted stress corrosion cracking” mechanism as “IASCC” is an administrative edit for consistency with other AMR line items that cite IASCC as an aging mechanism.
Table 3.1-1, Item 053c Table 3.1-1, Item 059c	The staff made the following changes to SRP-SLR Table 3.1-1, Items 053c and 059c in SLR-ISG-2021-01-PWRVI [NRC 2021-TN9958]: 1) Added stellite as an additional potential material of fabrication for Westinghouse-design “Existing Program” components in SRP-SLR Table 3.1-1, Item 059c. 2) Added GALL-SLR Item IV.B2.RP-345a as a new GALL-SLR reference for SRP-SLR Table 3.1-1, Item 053c.	The SRP-SLR Table 3.1-1, Items 053c and 059c remain as the AMR line items for Westinghouse “Existing Program” category RVI components subject to cracking or non-cracking effects. 1) Stellite has been added as an additional material for SRP-SLR Table 3.1-1, Item 059c in order to account for the possibility that the materials used in the design of some reactor internals may have an outside, wear resistant surface layer made from stellite. For example, in Dominion Energy Company’s subsequent license renewal application for Surry Nuclear Plant, Units 1 and 2,

Table 3-3 SRP-SLR, Revision 1, Chapter 3.1, Reactor Vessels, Internals, Coolant System, Differences from SRP-SLR, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of the Change	Technical Basis for Change
	3) Deleted Item IV.B2.RP-355 as a GALL-SLR item reference in SRP-SLR Table 3.1-1, Item 053c. 4) Administratively edited the 053c line item to cite the "irradiation-assisted stress corrosion cracking" mechanism as "IASCC."	the licensee identified that clevis inserts and fuel alignment pins in the units included an outside, wear resistant stellite layer on the nickel alloy or SS materials used to fabricate the components. As a result, the staff adjusted SRP-SLR Table 3.1-1, Items 053c and 059c to include stellite as a potential material of fabrication for the line item. 2) The staff developed new GALL-SLR Item IV.B2.RP.345a as part of the ISG update efforts to address potential cracking in the Westinghouse-design core barrel flanges similar to the manner that GALL-SLR Item IV.B2.RP-345 is used to address loss of material due to wear on the flanges. In the Appendix C gap analysis results for the Surry subsequent license renewal application (SLRA), Dominion identified that SCC and fatigue were applicable cracking mechanisms for the flanges based on the Expert Panel basis in the MRP-2018-022 report. As a result of these criteria, the staff determined it was prudent to develop the new GALL-SLR Item IV.B2.RP-345a to address cracking in the core barrel flange components. The staff adjusted SRP-SLR Table 3.1-1, Item 053c accordingly to include Item IV.B2.RP-345a as a new GALL-SLR item reference for the line item. Based on the Surry SLRA lessons learned, the staff did not accept EPRI's basis in EPRI MRP Comments #2 and #10 that the new "RP-345a" item on cracking of Westinghouse core bare flanges is not appropriate for the ISG. 3) The staff deleted GALL-SLR Item IV.B2.RP-355 as a referenced item for SRP-SLR Table 3.1-1, Item 053c because it was redundant with the existing referencing of GALL-SLR Item IV.B2.RP-355 in SRP-SLR Table 3.1-1, Item 028. As modified in the ISG, SRP-

Table 3-3 SRP-SLR, Revision 1, Chapter 3.1, Reactor Vessels, Internals, Coolant System, Differences from SRP-SLR, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of the Change	Technical Basis for Change
		SLR Table 3.1-1, Item 028 remains as the applicable SRP-SLR line item for addressing cracking and loss of material due to wear in Westinghouse-designed CRGT pins (split pins), which in turn links to use of the GALL-SLR "RP-355" item if the split pins made from X-750 nickel alloy materials. Refer to the technical basis statement in this table for Item 028 for additional information. 4) The change to cite the "irradiation-assisted stress corrosion cracking" mechanism as "IASCC" in Item 053c is an administrative edit for consistency with other AMR line items that cite IASCC as aging mechanism.
Table 3.1-1, Item 054	The staff only made a minor administrative edit of SRP-SLR Table 3.1-1, Item 054 in SLR-ISG-2021-01-PWRVI [NRC 2021-TN9958] to clarify that the line item and GALL-SLR Item IV.B2.RP-284 are only applicable to the bottom mounted instrumentation (BMI) flux thimble tubes in Westinghouse-designed PWRs.	The staff's change is strictly administrative. The technical bases for managing loss of material due to wear in Westinghouse-design BMI flux thimble tubes, as defined in GALL-SLR Table 3.1-1, Item 054 and GALL-SLR Item IV.B2.RP-284, remain the same as defined in the NUREG-2191 and NUREG-2192 reports and explained in NUREG-2221.
Table 3.1-1, Item 056a Table 3.1-1, Item 056b	The staff made the following changes to SRP-SLR Table 3.1-1, Items 056a and 056b in SLR-ISG-2021-01-PWRVI [NRC 2021-TN9958]: 1) Moved the reference of GALL-SLR Item IV.B3.RP-364 from SRP-SLR Table 3.1-1, Item 056a to Item 056b. 2) Added GALL-SLR Item IV.B3.RP-338a as a new referenced GALL-SLR item for SRP-SLR Table 3.1-1, Item 056a. 3) Added GALL-SLR Item IV.B3.RP-333a as a new referenced GALL-SLR items for	The SRP-SLR Table 3.1-1, Items 056a and 056b remain as the AMR line items for CE "Primary" and "Expansion" category RVI components that are subject to non-cracking effect and mechanism combinations. 1) In the staff-approved basis in the MRP-227, Revision 1 report, the EPRI MRP amended the inspection category for CE-design lower support structure core support columns from "Primary" category (as designated in Table 4-2 of the MRP-227-A report) to "Expansion" category, as indicated in Item C6.3 of Table 4-5 in the MRP-227, Revision 1-A Report. As a result of this component category designation change, the staff has amended GALL-SLR Item IV.B3.RP-364 to link its SRP-SLR item reference to that in SRP-SLR Table 3.1-1, Item 056b.

Table 3-3 SRP-SLR, Revision 1, Chapter 3.1, Reactor Vessels, Internals, Coolant System, Differences from SRP-SLR, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of the Change	Technical Basis for Change
	SRP-SLR Table 3.1-1, Item 056b.	Similarly, staff adjusted the references of GALL-SLR Item IV.B3.RP-364 in SRP-SLR Table 3.1-1 accordingly by moving the reference of the "RP-364" item from Item 056a to Item 056b. 2) The staff developed new GALL-SLR Item IV.B3.RP-338a as part of the ISG update efforts. For CE plants with welded core shroud designs that utilize full height shroud plates, the "Primary" category fuel alignment plate in the upper internals assembly screened in for cracking (fatigue) and loss of fracture toughness (irradiation embrittlement [IE]) per Item C10 in Table 4-2 of the MRP-227, Revision 1-A Report. Management of cracking in the fuel alignment plate is addressed by the existing AMR in GALL-SLR Item IV.B3.RP-338. The staff added GALL-SLR Item IV.B3.RP-338a in ISG Appendix B.2 to address management of loss of fracture toughness due to neutron IE in the fuel alignment plate. The staff adjusted SRP-SLR Table 3.1-1, Item 056a accordingly to include Item IV.B.RP-338a as a new GALL-SLR item reference for the plates. 3) The staff developed new GALL-SLR Item IV.B3.RP-333a as part of the ISG update efforts. For CE core support barrel LGWs, the "Expansion" category LGWs screened in for cracking (SCC, IASCC, and fatigue) and loss of fracture toughness (IE) per Item C5.1 in Table 4-5 of the MRP-227, Revision 1-A Report. Management of cracking in the core support barrel LGWs is addressed by the modified AMR in GALL-SLR Item IV.B3.RP-333. The staff added GALL-SLR Item IV.B3.RP-338a in ISG Appendix B.2 to address management of loss of fracture toughness due to neutron IE in the LGWs. The staff adjusted SRP-SLR Table 3.1-1, Item 056b accordingly to include Item

Table 3-3 SRP-SLR, Revision 1, Chapter 3.1, Reactor Vessels, Internals, Coolant System, Differences from SRP-SLR, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of the Change	Technical Basis for Change
		IV.B.RP-333a as a new GALL-SLR item reference for the LGWs.
Table 3.1-1, Item 056c	The staff made the following changes to SRP-SLR Table 3.1-1, Item 056c in SLR-ISG-2021-01-PWRVI [NRC 2021-TN9958]: 1) Moved the reference of GALL-SLR Item IV.B3.RP-357 from SRP-SLR Table 3.1-1, Item 028 to Item 056c. 2) Deleted reference of GALL-SLR Item IV.B3.RP-334a from SRP-SLR Table 3.1-1, Item 056c.	The SRP-SLR Table 3.1-1, Item 056c remains as the AMR line item for CE “Existing Program” category RVI components that are subject to non-cracking effect and mechanism combinations. 1) The staff’s technical bases for moving the referencing of GALL-SLR Item IV.B3.RP-357 from SRP-SLR Table 3.1-1 Item 028 to Item 056c have been adequately addressed and discussed in the technical basis entry for changes made to SRP-SLR Table 3.1-1, Item 028 in this table. The criteria relate to the updated I&E criteria for CE-design ICI thimble tubes (lower) in the MRP-227, Revision 1-A Report, which screened in for the mechanism of wear in Table 3-2 of the report. 2) In SLR-ISG-2021-01-PWRVI [NRC 2021-TN9958], the staff deleted GALL-SLR Item IV.B3.RP-334a based on the staff’s decision to fold the CE plant design applicability statement in the “RP-334a” item (i.e., the prior line item applied to CE plants with welded full height shroud designs) into GALL-SLR Item IV.B3.RP-336 (which applied to CE plants with welded shrouds fabricated from two vertical shroud sections). The modification to the component description and the applicable shroud types in the “RP-336” item now accounts for the component description and applicable shroud types cited in the prior GALL-SLR Item IV.B3.RP-334a. These changes to the “RP-336” item permitted the staff to delete the “RP-334a” item due to its redundancy of the modified “RP-336 item.” The staff adjusted SRP-SLR Table 3.1-1, Item 056c accordingly to delete reference of the “RP-334a” item.
Table 3.1-1, Item 058a	The staff made the following changes to SRP-SLR Table 3.1-1, Item 058a	The SRP-SLR Table 3.1-1, Item 058a remains as the AMR line item for B&W

Table 3-3 SRP-SLR, Revision 1, Chapter 3.1, Reactor Vessels, Internals, Coolant System, Differences from SRP-SLR, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of the Change	Technical Basis for Change
	in SLR-ISG-2021-01-PWRVI [NRC 2021-TN9958]: 1) Added GALL-SLR Item IV.B4.RP-247c as a new referenced GALL-SLR item for Item 058a. 2) Added GALL-SLR Item IV.B4.RP-252b as a new referenced GALL-SLR item for Item 058a. 3) Deleted GALL-SLR Item IV.B4.RP-401 as a referenced GALL-SLR item for Item 058a	“Primary” category RVI components that are subject to non-cracking aging effect and mechanism combinations. 1) The staff developed new GALL-SLR Item IV.B4.RP-247c as part of the ISG update efforts in order to be consistent with Item B8 in Table 4-1 of the MRP-227, Revision 1-A Report for B&W-design, “Primary” category lower core barrel (LCB) bolts. In Item B8, EPRI screened the LCB bolts in for irradiation-enhanced creep/stress relaxation (ISR/IC), wear, SCC, and fatigue aging mechanisms. Cracking of the LCB bolts is being addressed in the ISG by the staff’s modification of the GALL-SLR Item IV.B4.RP-247 in the ISG. The staff developed the new GALL-SLR Item IV.B4.RP-247c to address loss of material due to wear and loss of preload due to ISR/IC in the LCB bolts. SRP-SLR Table 3.1-1, Item 058a was administratively edited to reference the new GALL-SLR Item IV.B4.RP-247c. 2) The staff developed new GALL-SLR Item IV.B4.RP-252b as part of the ISG update efforts in order to be consistent with Items B4 and B5 in Table 4-1 of the MRP-227, Revision 1-A Report for various types of “original” locking devices (Primary components) located in the vent valve assemblies of B&W-designed reactors. For the “original” pressure plate, spring retainer, spring, and U-cover components, EPRI screened the components in for wear; for the “original” key, ring, and pin components, EPRI screened the components in for thermal embrittlement (TE). Thus, the new GALL-SLR Item IV.B4.RP-252b item addresses loss of material due to wear in the “original” pressure plate, spring retainer, spring, and U-cover components and loss of fracture toughness due to TE in the “original” key, ring, and pin components. The staff adjusted SRP-SLR Table 3.1-1, Item 058a to reference the GALL-SLR

Table 3-3 SRP-SLR, Revision 1, Chapter 3.1, Reactor Vessels, Internals, Coolant System, Differences from SRP-SLR, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of the Change	Technical Basis for Change
		Item IV.B4.RP-252b as a new referenced GALL-SLR item for Item 058a. 3) The staff's previous inclusion of GALL-SLR Item IV.B4.RP-401 in the GALL-SLR Report only applied to the management of non-cracking effects in specific types of B&W-designed RVI components that were included in the design of the TMI-1 reactor and that were designated by the EPRI MRP as "Primary" category components for TMI-1. The owner of TMI-1 has made the decision to decommission the reactor. Therefore, the staff no longer needed GALL-SLR Item IV.B4.RP-401 item for the purposes of the updates in SLR-ISG-2021-01-PWRVI [NRC 2021-TN9958] and the staff has deleted the IV.B4.RP-401 item in Appendix B.3 of the ISG. The staff adjusted the SRP-SLR Table 3.1-1 058a item accordingly by deleting the reference of the GALL-SLR Item IV.B4.RP-401 from Item 058a.
Table 3.1-1, Item 058b	The staff made the following changes to SRP-SLR Table 3.1-1, Item 058b in SLR-ISG-2021-01-PWRVI [NRC 2021-TN9958]: 1) Added GALL-SLR Item IV.B4.RP-245c as a new referenced GALL-SLR item for Item 058b. 2) Added GALL-SLR Item IV.B4.RP-246e as a new referenced GALL-SLR item for Item 058b. 3) Added GALL-SLR Item IV.B4.RP-252a as a new referenced GALL-SLR item for Item 058b. 4) Added GALL-SLR Item IV.B4.RP-386 as a new	The SRP-SLR Table 3.1-1, Item 058b remains as the AMR line item for B&W "Expansion" category components that are subject to non-cracking effect and mechanism combinations. 1) The staff developed the new GALL-SLR Item IV.B4.RP-245c in the ISG in order to be consistent with Item B2.1 in Table 4-4 of the MRP-227, Revision 1-A Report for B&W "Expansion" category surveillance specimen holder tube bolts (surveillance specimen holder tube [SSHT] bolts, Davis-Besse only). In Item B2.1, EPRI screened the SSHT bolts in for the aging mechanisms of wear and irradiation-enhanced stress relaxation or creep (ISR/IC). Thus, the new "RP-245c" item accounts for loss of material due to wear and loss of preload due to thermal or irradiation-enhanced stress relaxation or creep in the SSHT bolts. The staff adjusted SRP-SLR Table 3.1-1, Item

Table 3-3 SRP-SLR, Revision 1, Chapter 3.1, Reactor Vessels, Internals, Coolant System, Differences from SRP-SLR, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of the Change	Technical Basis for Change
	referenced GALL-SLR item for Item 058b. 5) Deleted GALL-SLR Item IV.B4.RP-254b as a referenced GALL-SLR item for Item 058b.	058b accordingly to reference the GALL-SLR Item IV.B4.RP-245c. 2) The prior GALL-SLR line item covering loss of material due to wear and changes in dimension in B&W-design “Expansion” category LTS bolt locking devices and UTS bolt locking devices was GALL-SLR Item IV.B4.RP-246b, which identified that the locking devices were located in the lower grid assembly. However, in Item B7.1 of Table 4-4 in MRP-227, Revision 1-A, the EPRI MRP identified that the UTS bolt locking devices are located in the core barrel assembly and screened them in for the mechanisms of wear and distortion. Therefore, the staff needed to delete the UTS bolt locking devices from the “RP-346b” item and developed the new IV.B4.RP-246e item to address wear and distortion in the UTS bolt locking devices. The staff adjusted SRP-SLR Table 3.1-1, 058b item to reference GALL-SLR Item IV.B4.RP-246e. 3) The staff developed the new GALL-SLR Item IV.B4.RP-252a in the ISG in order to be consistent with Item B2.1 in Table 4-4 of the MRP-227, Revision 1-A Report for B&W “Expansion” category vent valve bodies, which screened in for the aging mechanism of TE. Thus, the new “RP-252a” item accounts for loss of fracture toughness due to TE in the valve bodies. The staff adjusted SRP-SLR Table 3.1-1, Item 058b accordingly to reference GALL-SLR Item IV.B4.RP-252a. 4) The staff developed the new GALL-SLR Item IV.B4.RP-386 in the ISG in order to be consistent with Item B2.1 in Table 4-4 of the MRP-227, Revision 1-A Report for B&W “Expansion” category lower grid rib sections, which screened in for the aging mechanism of IE. Thus, the new “RP-386” item accounts for loss fracture toughness due to IE in the rib sections.

Table 3-3 SRP-SLR, Revision 1, Chapter 3.1, Reactor Vessels, Internals, Coolant System, Differences from SRP-SLR, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of the Change	Technical Basis for Change
		The staff adjusted the SRP-SLR Table 3.1-1, Item 058b accordingly to reference the GALL-SLR Item IV.B4.RP-386. 5) The previous inclusion of GALL-SLR Item IV.B4.RP-254b in the GALL-SLR Report only applied to cracking of specific lower grid assembly bolt locking devices included in the design of the TMI-1 reactor. The owner of TMI-1 has made the decision to decommission the reactor. Therefore, GALL-SLR Item IV.B4.RP-254b is no longer needed for the purposes of the updates in the ISG and has been deleted. The staff adjusted Item 058b accordingly to delete Item IV.B4.RP-254b as a GALL-SLR item reference in the line item.
Table 3.1-1, Item 059b	The staff made the following changes to SRP-SLR Table 3.1-1, Item 059b in SLR-ISG-2021-01-PWRVI [NRC 2021-TN9958]: 1) Added GALL-SLR Item IV.B2.RP-280a as a new referenced GALL-SLR item for Item 059b. 2) Added GALL-SLR Item IV.B2.RP-297a as a new referenced GALL-SLR item for Item 059b. 3) Deleted GALL-SLR Item IV.B2.RP-278a as a referenced GALL-SLR item in Item 059b.	The SRP-SLR Table 3.1-1, Item 059b remains as the AMR line item for Westinghouse “Expansion” category RVI components that are subject to non-cracking aging effect and mechanism combinations. 1) The staff developed Item IV.B2.RP-280a as a new GALL-SLR item reference for in the ISG in order to be consistent with Item W3.3 in Table 4-6 of the MRP-227, Revision 1-A Report, as modified by the additional lessons learned bases for Westinghouse-design core barrel assembly LFWs from the staff’s past processing of the Surry SLRA. In Item W3.3, the EPRI MRP designated that these LFWs are “Expansion” category components for Westinghouse RVI management programs. In EPRI MRP Comment #12 on the ISG, EPRI MRP commented that GALL-SLR Item IV.B2.RP.280a should be omitted from the scope of the ISG due to the fact the core barrel LFW is not subject to IE and is located far from the reactor core region. However, in the gap analysis of the staff-approved Surry SLRA, the past applicant cited IE and void swelling (VS) as applicable aging mechanisms for the

Table 3-3 SRP-SLR, Revision 1, Chapter 3.1, Reactor Vessels, Internals, Coolant System, Differences from SRP-SLR, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of the Change	Technical Basis for Change
		Surry LFWs based on the information in contained in MRP-2018-022. Thus, the docketed SLRA information formed a sufficient basis for the establishment of the new GALL-SLR “RP-280a” item based on the reporting of IE and VS as being applicable to the Surry core barrel LFWs. The staff also adjusted SRP-SLR Table 3.1-1, Item 059b to include reference of the new GALL-SLR Item IV.B2.RP-280a, which remains valid for the objective of the ISG. 2) In Item W2 of Table 4-3 in the MRP-227, Revision 1-A Report, the EPRI MRP assigned only the LFWs in peripheral (outer) CRGT assemblies as “Primary” category components for Westinghouse-design RVI programs, with inspections expanding to the LFWs in the non-peripheral (remaining) CRGT assemblies (per Item W2.1 in Table 4-6 of the report) if an unacceptable level of degradation was detected in the peripheral CRGT LFWs. The EPRI MRP designated that these LFWs are susceptible to cracking (SCC, fatigue) and IE and TE aging mechanisms. The GALL-SLR Report did not include an AMR line item to address loss of fracture toughness due to IE or TE in the non-peripheral CRGT LFWs, which required the staff’s development of the new GALL-SLR Item IV.B2.RP-297a to address this gap. The staff adjusted SRP-SLR Table 3.1-1, Item 059b accordingly to reference Item IV.B4.RP-297a as a new GALL-SLR item reference in the line item. 3) In MRP-227-A, the core barrel ONWs were designated as the “Expansion” components for Primary inspections performed on the core barrel UFW. However, in MRP-227, Revision 1-A, the EPRI MRP deleted the ONWs as “Expansion” components and replaced them with the core barrel assembly

Table 3-3 SRP-SLR, Revision 1, Chapter 3.1, Reactor Vessels, Internals, Coolant System, Differences from SRP-SLR, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of the Change	Technical Basis for Change
		UGW, LFW, UAWs, and lower support forging or casting as the new applicable "Expansion" category components for the "Primary" category core barrel UFW inspections. Therefore, the staff deleted GALL-SLR Item IV.B2.RP-278a as part of the ISG update efforts and adjusted SRP-SLR Table 3.1-1, Item 059b accordingly to delete reference of GALL-SLR Item IV.B2.RP-278a. The core barrel ONWs are now covered by the staff's Items for B&W-design "No Additional Measures" components (e.g., SRP-SLR Table 3.1-1, Item 055a and GALL-SLR AMR Item IV.B4.RP-236).
Table 3.1-1, Item 059c	The staff made the following changes to SRP-SLR Table 3.1-1, Item 059c in SLR-ISG-2021-01-PWRVI [NRC 2021-TN9958]: 1) Modified the "Component" column entry of the item to include stellite as an additional (penitential) material of fabrication.	The inclusion of stellite in Item 059c, and in SRP-SLR Table 3.1-1, Item 119 as well, was requested by members of the U.S. nuclear power as part of their initial set of recommendations for development of the ISG. Based on lessons learned from the RVI gap analysis previously provided in the Surry SLRA, the staff confirmed that the previous applicant for the Surry SLRA identified that some of the RVI components (e.g., clevis inserts or fuel alignment pins) were designed with an outer, wear resistant stellite surface layer. Thus, the staff also found it would be appropriate to add stellite as a potentially applicable component material in the SRP-SLR Table 3.1-1 059c line item, as updated in Appendix A of the ISG.
Table 3.1-1, Item 114	The staff made the following changes to SRP-SLR Table 3.1-1, Item 114 in SLR-ISG-2021-01-PWRVI [NRC 2021-TN9958]: 1) Added ASME Code Class 1 reactor interior attachments to the list of components in the "Component" column entry for the line item. 2) Added primary water stress corrosion cracking (PWSCC), IASCC, and fatigue as additional listed mechanisms for all or some	The staff modified SRP-SLR Table 3.1-1, Item 114 to generically cover any reactor coolant system components that may be defined in the current licensing basis as ASME Code Class components and the aging effects and mechanisms that may apply to these types of components. This includes administrative adjustments of Item 114 to include ASME Code Class 1 reactor interior attachments and to incorporate the previous criteria for ASME Code Class-defined PWR reactor internals that were previously within the scope of SRP-SLR Table 3.1-1 Item 032, which is being deleted

Table 3-3 SRP-SLR, Revision 1, Chapter 3.1, Reactor Vessels, Internals, Coolant System, Differences from SRP-SLR, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of the Change	Technical Basis for Change
	of the components listed in the line item.	in SLR-ISG-2021-01-PWRVI [NRC 2021-TN9958]. Upon the staff's review of Items 032 and 114 in SRP-SLR Table 3.1-1, the staff found that the scope of components in Item 114 would bound those components that were previously include in Item 032. Thus, the AMR objective in SRP-SLR Table 3.1-1, Item 032 was determined to be redundant with that in SRP-SLR Table 3.1-1, Item 114, and therefore SRP-SLR Table 3.1-1, Item 032 was deleted from the scope of SRP-SLR Table 3.1-1, as updated in ISG Appendix A. The aging mechanism of IASCC was added to Item 114 in order to account for the possibility that a specified PWR RVI component may be a nickel alloy or SS reactor internal core support structure component located in the vicinity of the reactor core. For completeness, the mechanism of PWSCC was added to and included in Item 114 to account for cases where the component is defined as an ASME Code Class 1 steam generator component and PWSCC is a plausible cracking mechanism for the component. The mechanism of fatigue was added administratively to account for the possibility that a Code Class component may be susceptible to fatigue or cyclic loading mechanisms.
Table 3.1-1, Item 118 Table 3.1-1, Item 119	The staff made the following changes to SRP-SLR Table 3.1-1, Items 118 and 119 in SLR-ISG-2021-01-PWRVI [NRC 2021-TN9958]: 1) Based on receipt and acceptance of EPRI MRP Comments #15 and #17, modified the "Structure and/or Component" column entries of the SRP-SLR Table 3.1-1 #118 and #119 items to include the words "or LRA/SLRA-specified reactor vessel internal component".	The staff modified SRP-SLR Table 3.1-1, Items 118 and 119 to be consistent with changes to the referenced GALL-SLR items linked to the SRP-SLR items (i.e., GALL-SLR Items IV.B2.R-423, IV.B3.R-423 and IV.B4.R-423, as linked to SRP-SLR Table 3.1-1, Item 118 for cracking effect and mechanism combinations, and GALL-SLR Items IV.B2.R-424, IV.B3.R-424 and IV.B4.R-424, as linked to SRP-SLR Table 3.1-1, Item 119 for non-cracking effect and mechanism combinations). The staff changes to the SRP-SLR-Table 3.1-1 AMR Items 118 and 119 allow

Table 3-3 SRP-SLR, Revision 1, Chapter 3.1, Reactor Vessels, Internals, Coolant System, Differences from SRP-SLR, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of the Change	Technical Basis for Change
	2) Administratively edited Item 118 to cite "irradiation-assisted stress corrosion cracking" as "IASCC". 3) Based on receipt and acceptance of EPRI MRP Comments #15, the staff modified the "Aging Management Program (AMP)/TLAA" column entry of the SRP-SLR Table 3.1-1 #118 item to include the words "or AMP XI.M16A, "PWR Vessel Internals," and AMP XI.M2, "Water Chemistry" (SCC and IASCC only), with an adjusted site-specific or component-specific aging management basis for a specified reactor vessel internal component". 4) Based on receipt and acceptance of EPRI MRP Comment #17, the staff modified the "Aging Management Program (AMP)/TLAA" column entry of the SRP-SLR Table 3.1-1 #119 item to include the words "or AMP XI.M16A, "PWR Vessel Internals," with an adjusted site-specific or component-specific aging management basis for a specified reactor vessel internal component." 5) Added stellite as a new nickel-based alloy material for SRP-SLR Table 3.1-1, AMR Item 119.	more flexibility on when the #118 and #119 items, and the associated GALL-SLR "R-423" and "R-424" type items, can be adopted and used for development of AMR line items in an incoming PWR SLRA. Use of SRP-SLR Table 3.1-1, Items 118 and 119 (and the applicable referenced GALL-SLR items) may now be used for GALL-SLR XI.M16A-based programs where the referenced MRP-227, Revision 1-A protocols for a specified PWR RVI component are adjusted based on site-specific or component-specific considerations. This will broaden the scope of SRP-SLR Table 3.1-1, Items 118 and 119 (and the associated GALL-SLR "R-423" items referenced by Item 118 and GALL-SLR "R-424" items referenced by Item 119) so that they can be more readily applied and used in applicable subsequent license renewal applications. Based on the staff acceptance of EPRI MRP Comments #15 and #17 on SLR-ISG-PWRVI-2021-PWRVI, the staff implemented the changes recommended by EPRI for the "Structure and/or Component" and "Aging Management Program (AMP)/TLAA" column entries of Items #118 and #119, as specified in the previous column entry of this line item. In MRP 2018-022, the EPRI MRP added stellite as a type of wear resistant nickel-based alloy for specified stainless steel RVI components that were designed with an outer stellite surface layer for wear-resistance objective. The staff amended AMR Item 119 consistent with this change in MRP-2018-022.
Table 3.1-1, Item 029 Table 3.1-1, Item 041 Table 3.1-1, Item 103	The staff administratively edited the SRP-SLR Table 3.1-1 029, 041, and 103 to cite the mechanism of "irradiation-assisted stress corrosion cracking" (or irradiation-assisted SCC) as "IASCC."	The SRP-SLR Table 3.1-1 029, 041, and 103 items involve specified types of BWR RVI components. Although the line items do not involve PWR RVI components, the changes involve administrative edits in order to make the referencing of IASCC in the 029, 041, and 103 items consistent with the manner it is referenced in the corresponding SRP-SLR line items on cracking that were updated in Appendix A of SLR-ISG-2021-01-

Table 3-3 SRP-SLR, Revision 1, Chapter 3.1, Reactor Vessels, Internals, Coolant System, Differences from SRP-SLR, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of the Change	Technical Basis for Change
		PWRVI [NRC 2021-TN9958] and apply to PWR RVI components in SRP-SLR Table 3.1-1.
Section 3.1.2.2.6 Section 3.1.3.2.6 Table 3.1-1, Item 019	Item 1 was deleted. The recommendation was to remove this item from the FE guidance. Removal of this item from FE would allow for more efficient and consistent review of an SLRA.	In the current GALL-SLR and SRP-SLR, the item was edited or modified from the previous documents. Previously in the September 2005 GALL report, it was listed with the reactor vessel closure head flange leak detection line, and it was recommended to have a plant-specific program. When split up and transferred to the latest versions the nickel alloy version and SS version were separated for bottom-mounted instrument guide tubes. The recommendation for a plant-specific aging management program migrated as well. However, this line item covers just the SS portion of the bottom mounted instrument guide tubes external to the bottom head. For other SS materials in the primary circuit with the concern for cracking due to primary water stress corrosion cracking (SCC), the application of AMP XI.M1 “ASME Section XI Inservice Inspection, Subsections IWB, IWC and IWD,” along with XI.M2 “Water Chemistry” has been shown to be adequate to address this aging mechanism, primary water SCC, for this material, SS, as noted in Item 033 (shown below.)
Section 3.1.2.2.6 Section 3.1.3.2.6 Table 3.1-1, Item 020	Item 2 is deleted. The recommendation is to remove this item from the FE guidance. Removal of this item from FE would allow for more efficient and consistent review of an SLRA.	The staff re-evaluated the guidance provided in Section 3.1.2.2.6, Item 2 which states “Further evaluation is recommended of a plant-specific program for these components to ensure that this aging effect is adequately managed” and Section 3.1.3.2.6, Item 2 which states that “A plant-specific AMP should be evaluated to manage cracking due to SCC in cast austenitic stainless steel (CASS) PWR Class 1 reactor coolant system piping and piping components exposed to reactor coolant that do not meet the carbon and ferrite content guidelines of NUREG–0313.” The guidance in NUREG-0313, “Technical Report on Material Selection and Process Guidelines for BWR Coolant Pressure Boundary,” Revision 2,

Table 3-3 SRP-SLR, Revision 1, Chapter 3.1, Reactor Vessels, Internals, Coolant System, Differences from SRP-SLR, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of the Change	Technical Basis for Change
		was published on January 1988. As the title suggests it was intended to provide guidance concerning intergranular stress corrosion cracking susceptibility of BWR piping and included guidelines on CASS components. Specifically, it highlighted the potential of SCC for certain CASS components if they did not meet the recommended ferrite and carbon content. While the recommendations in NUREG-0313 are still very relevant to BWRs, current operating experience of CASS components in PWRs does not merit to elevate this AMR item to a "Further Evaluation." There is no current OE that indicates that this is a problem for CASS components in PWRs that requires FE.
Section 3.1.2.2.9	The staff updated the AMR further acceptance criteria to base them on the updated EPRI MRP I&E guidelines in EPRI Technical Report 3002017168 (MRP-227, Revision 1-A): 1) Clarified if GALL AMP XI.M16A and EPRI MRP-based program is used for aging management, the program for the period of extended operation will be based on MRP-227, Revision 1-A Report. 2) Clarified that, if MRP-227, Revision 1-A is used for the program, the assessments of the RVI components will still need to be subject to a gap analysis. 3) Eliminated the discussion related to SLRA responses to the applicant/licensee action items (A/LAIs) on the previous methodology in MRP-227-A. 4) Clarified that a SLR applicant of a PWR may address the A/LAI on the MRP-227, Revision 1-A Report as part of the "Operating	1) The updated acceptance criteria are based on staff's assumption that, if the "EPRI-defined living" AMP is based on GALL-SLR AMP XI.M16A, the program being applied to the subsequent period of extended operation will be based on the updated I&E guidelines in MRP-227, Revision 1-A. This is based on the EPRI-defined "Needed Requirement" in Section 7.3 of the MRP-227, Revision 1-A Report, that establishes the program will need to covert over and implement the updated guidelines in the MRP-227, Revision 1-A by January 1, 2022. Thus, for applicants that decide to submit SLRAs for their PWRs, the PWR vessel internals programs will have converted over to the MRP-227, Revision 1-A guidelines by the time the licensees will have entered into the subsequent period of extended operation for their PWR units. 2) If the AMP is based on MRP-227, Revision 1-A as a starting point, a gap analysis will still be necessary, as the Revision 1-A version of the report is still based on an assessment of aging in the RVI components over a 60-year service life. The staff's previous criteria in SPR-SLR Section 3.1.2.2.9 and in GALL-SLR

Table 3-3 SRP-SLR, Revision 1, Chapter 3.1, Reactor Vessels, Internals, Coolant System, Differences from SRP-SLR, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of the Change	Technical Basis for Change
	Experience" program element of its PWR vessel internals program and in the technical basis document for the AMP.	AMP XI.M16A, "PWR Vessel Internals," for requesting performance of a gap analysis still remain valid even if the program is updated to be based on the updated I&E guidelines in the MRP-227, Revision 1-A Report. 3) Responses to the A/LAIs on MRP-227-A are no longer necessary PWR SLRAs because they were adequately resolved by the EPRI MRP in the MRP-227, Revision 1-A Report and closed out by the staff in the April 25, 2019 safety evaluation for the report. 4) The sole A/LAI on the guidelines in the MRP-227, Revision 1-A Report was issued by the staff in relation to resolving operating experience associated with the cracking of baffle-to-former bolts or core shroud bolts. Thus, an applicant of a PWR unit may address the A/LAI on MRP-227, Revision 1-A as part of its "Operating Experience" program element discussion provided in its AMP or in the technical basis document for the AMP. A separate response to the A/LAI does not need to be included in Appendix C of the SLRA.
Section 3.1.2.2.10 Section 3.1.3.2.10	The SRP-SLR Sections 3.1.2.2.10.2 , Item 2 and 3.1.3.2.10, Item 2 are changed to add additional examples for the wear locations in control rod drive (CRD) thermal sleeves. The added examples address the wear degradation near the bottom of the thermal sleeve and at the thermal sleeve upper flange location.	The SRP-SLR Sections 3.1.2.2.10, Item 2 and 3.1.3.2.10, Item 2 describe a FE to manage loss of material due to wear in CRD thermal sleeves. As an example of the wear locations, the SRP-SLR sections refer to the location where the thermal sleeve exists from the CRD head penetration nozzle inside the reactor vessel (RV). The wear at this location results from the interactions between the thermal sleeve outer surface and the head penetration nozzle. This type of wear is called thermal sleeve OD wear. In addition, industry OE indicates that wear can occur in the following locations of the thermal sleeves: (1) near the bottom of the thermal sleeve (wear at this location is called thermal sleeve inner-diameter [ID] wear); and (2) thermal sleeve upper flange location (thermal sleeve flange wear). The thermal

Table 3-3 SRP-SLR, Revision 1, Chapter 3.1, Reactor Vessels, Internals, Coolant System, Differences from SRP-SLR, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of the Change	Technical Basis for Change
		sleeve ID wear is due to the interactions between the thermal sleeve inner surface and the drive rod passing through the thermal sleeve near the bottom of the thermal sleeve. The thermal sleeve flange wear is caused by the interactions between the bottom side of the flange and the CRD penetration housing near the top of the thermal sleeve. Changes are made to the SRP-SLR sections to add ID and flange wear locations. Related references are also added in the reference section (SRP-SLR Section 3.1.6).
Section 3.1.2.2.10 Section 3.1.3.2.10 Section 3.1.6 Table 3.1-1, Item 141	The SRP-SLR, NUREG-2192, July 2017 Section 3.1.2.2.10, “Loss of Material Due to Wear” currently has Items 1 and 2, which address loss of material due to wear for pressurized water reactor (PWR) control rod drive (CRD) head penetration nozzles and stainless steel (SS) thermal sleeves of PWR CRD head penetration nozzles, respectively. An additional item, Item 3, is needed to address new industry operating experience related to loss of material due to wear on the outside diameter (OD) of ASME Code Class 1 and Class 2 small-bore piping. Specifically, a reference is made to the NRC Information Notice (IN) 2007-21 [NRC 2020-TN8034], “Pipe Wear Due to Interaction of Flow-Induced Vibrations and Reflective Metal Insulation,” Supplement 1, issued on December 11, 2020. Its purpose was to alert licensees of nuclear power reactors on recent operating experience related to wear of nuclear power plant piping caused by flow-induced vibration and interaction of certain type of insulation.	Recent industry operating experience (OE) indicates that significant wear can occur on the OD of piping due to system vibrations and interactions with certain types of reflective metal insulation (RMI). Specifically, piping that uses RMI with an end cap of thin sheet metal has the potential for wear up to 360 degrees around its circumference. Repeated movement of the RMI end cap in contact with a pipe OD can cause loss of material on the OD of the subject pipe. Multiple instances of such wear are known to have occurred. An occurrence of this type of material loss due to RMI end cap wear was reported in 2006, and was the subject of IN 2007-21 [NRC 2020-TN8034], issued by the NRC on June 11, 2007. During outage activities in fall of 2006, the licensee at Catawba, Unit 1 removed RMI on small-bore ASME Code Class 2 piping for a planned valve replacement. The licensee identified multiple wear marks on the OD of stainless steel piping. It was determined that the wear marks were the result of interactions between the SS piping and the SS RMI end caps, caused by vibration. The licensee initially identified three locations with metal loss. During the extent of condition review, additional 81 discrete wear marks were identified over a 150-ft length of piping. All of the wear marks were located inside containment and at insulation end caps.

Table 3-3 SRP-SLR, Revision 1, Chapter 3.1, Reactor Vessels, Internals, Coolant System, Differences from SRP-SLR, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of the Change	Technical Basis for Change
		In December of 2020 IN 2007-21 [NRC 2020-TN8034] was revised due to more recent occurrences of metal loss on the OD of ASME Code Class 1 small-bore piping at two other nuclear power plants. The most recent known occurrence is summarized below. During an outage in the spring of 2020, workers at Arkansas Nuclear One, Unit 2 identified multiple wear marks on American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME) Code Class 1 pressurizer spray piping. The wear marks were identified as a result of piping inspections in response to vibration related failures of snubber connections to the pressurizer spray piping. The wear marks ranged from surface scratches to deeper groves that were nearly 360 around the OD circumference of the pipe. The licensee determined that the wear was caused by vibration-induced interactions of the RMI end caps and the OD surfaces of the subject piping. In the overview of the original IN 2007-21 [NRC 2020-TN8034] and its subsequent supplement of 2020, it is apparent that the observed OD pipe wear for both the ASME Code Class 1 and 2 small-bore piping was discovered as a result of unrelated inspections. There are currently no specific ASME Code requirements to remove insulation from piping and inspect the piping for degradation due to RMI wear. This type of wear, if present and undetected, could have a significant impact on the integrity of ASME Code Class 1 and 2 small-bore piping because: (1) small-bore piping has wall thickness values that are significantly less than those for large bore piping, (2) small-bore piping systems are more susceptible to vibration, and (3) there are no specific ASME Code requirements to inspect piping for RMI wear.

Table 3-3 SRP-SLR, Revision 1, Chapter 3.1, Reactor Vessels, Internals, Coolant System, Differences from SRP-SLR, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of the Change	Technical Basis for Change
		Based on the observed degradation, the licensees referenced in the updated IN 2007-21 [NRC 2020-TN8034] have performed engineering evaluations as well as completed extent of conditions and installed a modified RMI to eliminate the pipe wear. The modified insulation has an end cap as a piece of flat sheet metal that looks like a cuff, band or strip. The modified end cap touches the pipe as a flat piece of metal parallel to the pipe, not as a sharp edge; thereby eliminating the potential for excessive wear. Temporary modifications have also included installation of cuffs on the OD of the pipe where the end caps are located. More recently, an applicant in the process of applying for a subsequent license renewal (SLR) reviewed the OE in the updated IN 2007-21 [NRC 2020-TN8034], determined that the operating experience could be applicable at its units, and updated its aging management program to check for the RMI end cap wear on its ASME Code Class 1 small-bore piping (Ref. 40). Relevant SRP-SLR sections are being updated to add a FE to determine whether a plant seeking license renewal has evaluated the use of RMI in its integrated plant assessment and the potential of OD wear on its population of ASME Code Class 1 and 2 small-bore piping. Related references are also added in the reference section (SRP-SLR Section 3.1.6).
Section 3.1.2.2.11, Table 3.1-1, Item 025	The AMR FE subsections were revised, to clarify the plant-specific parameters to be evaluated against industry analyses to determine whether a given plant is bounded by industry analyses for steam generator (SG) divider plate cracking. Additionally, reference to a plant-specific AMP for plants that are not bounded is replaced with a reference to the One-Time Inspection AMP.	For the SRP-SLR Section 3.1.2.2.11, Item 1 guidelines that apply to PWR SG divider plates, the staff added additional guidance on the plant-specific parameters that should be compared to industry analyses that show the analyses are “applicable and bounding” for a given plant. Additionally, for the SRP-SLR Section 3.1.2.2.11, Items 1 and 2 guidelines, the reference to a plant-specific AMP was replaced with a reference to the One-Time Inspection AMP for applicants that would need to use the One-Time Inspection

Table 3-3 SRP-SLR, Revision 1, Chapter 3.1, Reactor Vessels, Internals, Coolant System, Differences from SRP-SLR, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of the Change	Technical Basis for Change
		AMP to verify the effectiveness of the Water Chemistry and Steam Generator AMP for managing cracking due to PWSCC in their SG divider plates tube-to-tubesheet welds.
Section 3.1.2.2.12 Table 3.1-1, Item 029 Table 3.1-1, Item 041 Table 3.1-1, Item 103	Section 3.1.2.2.12 was deleted.	Section 3.1.2.2.12 instructed SLRAs to perform FE on AMPs for IASCC. However, since publication of the SRP-SLR, the EPRI submitted the BWRVIP-315 topical report for NRC review. This topical report provided the industry's evaluation of AMPs for IASCC for operations beyond 60 years. At the time of this revision, the BWRVIP-315 topical report was in an advanced stage of NRC review. The NRC determined that FE for IASCC was no longer necessary, given the BWRVIP-315 topical report.
Section 3.1.2.2.13 Table 3.1-1, Item 099	Section 3.1.2.2.13 was deleted.	Section 3.1.2.2.13 instructed SLRAs to perform FE on AMPs for loss of fracture toughness. However, since publication of the SRP-SLR, the EPRI submitted the BWRVIP-315 topical report for NRC review. This topical report provided the industry's evaluation of AMPs for loss of fracture toughness for operations beyond 60 years. At the time of this revision, the BWRVIP-315 topical report was in an advanced stage of NRC review. The NRC determined that FE for loss of fracture toughness was no longer necessary, given the BWRVIP-315 topical report.
Sections 3.1.2.2.14 and 3.1.3.2.14	SRP-SLR Sections 3.1.2.2.14 and 3.1.3.2.14 are updated to reflect the issuance of BWRVIP-25, Revision 1-A [EPRI 2020-TN8303], which provides an NRC-approved methodology to justify elimination of core plate hold-down bolt inspections.	BWRVIP-25, Revision 1-A [EPRI 2020-TN8303] is an NRC-approved topical report. The purpose of BWRVIP-25, Revision 1-A is to provide inspection and evaluation (I&E) guidelines, information on potential failure locations in the BWR/2 through BWR/6 core plate assemblies, and a discussion of susceptibility considerations, which concludes that all core plate subcomponents may be subject to cracking. Additionally, Appendix I of BWRVIP-25, Revision 1-A documents a comprehensive evaluation that provides justification for the elimination of periodic core plate bolt inspections for many boiling water reactors so long as the application criteria of this report are met.

Table 3-3 SRP-SLR, Revision 1, Chapter 3.1, Reactor Vessels, Internals, Coolant System, Differences from SRP-SLR, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of the Change	Technical Basis for Change
		The results of this report can be used to demonstrate inspections of core plate bolts are no longer required because of the intergranular stress corrosion cracking (IGSCC) resistance of the bolts, excellent field experience, and a margin assessment on the number of bolts required to meet allowable limits.
Section 3.1.2.2.16	Revised the last paragraph to state that the applicant may mitigate or prevent loss of material using a barrier coating rather than saying the loss of material does not require management if a barrier coating is used. Added a statement that the applicant should identify loss of material as applicable for SLR and identify the AMP that will be used to manage the integrity of the coating.	The statement in Section 3.1.2.2.16 that loss of material does not require management contradicts the statement in SLR-SRP Section A.1.2.1, Item 5, which states that even with a prevention or mitigation program, including a coating, an aging effect should be identified as applicable for SLR, and the AMR should consider the adequacy of the AMP referencing the prevention or mitigation program (e.g., coating). Section A.1.2.1, Item 5, correctly states the need for an AMP to manage coating integrity.
Section 3.1.2.2.17 Section 3.1.3.2.17 Table 3.1-1 Item 140	The SRP-SLR Sections 3.1.2.2.16a and 3.1.3.2.16a are added to address a FE for aging management of thermal fatigue in the reactor coolant system. In the FE, the applicant evaluates the adequacy of a plant-specific program for the aging management (e.g., adequate selection of susceptible locations for inspections, timely detection of cracks and preventive action for valve in-leakage as needed).	As addressed in NRC Bulletin 88-08, non-isolable branch lines connected to the reactor coolant system may be subject to unacceptable thermal stress that can cause thermal fatigue cracking and leakage failure. The NRC Bulletin 88-08 states that, when such piping is identified, actions should be taken to ensure that the piping will not be subject to unacceptable thermal stress. Industry OE and evaluation indicate that, in some branch lines, thermal stratification or mixing cycles can occur due to the interaction between the hot swirl penetration from the reactor coolant system and the cold water in-leakage from a leaking valve. In other branch lines, thermal stratification or mixing cycles can result from the interaction of the hot swirl penetration and the cold water in the normally cool, stagnant branch lines without a leaking valve. In addition, cold or hot fluid injections can cause thermal fatigue in the reactor coolant system as indicated in ASME Code Case N-716-1 [ASME 2013-TN8107]. Therefore, cracking due to thermal fatigue can occur due to

Table 3-3 SRP-SLR, Revision 1, Chapter 3.1, Reactor Vessels, Internals, Coolant System, Differences from SRP-SLR, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of the Change	Technical Basis for Change
		cyclic stresses from the thermal stratification, mixing or injection cycles. The industry guidance to manage the thermal fatigue in the PWR branch lines is described in EPRI MRP-146, Revision 2. The guidance provides methods for screening and evaluating the susceptibility of non-isolable branch lines to thermal fatigue. MRP-146, Revision 2 also provides general guidance for monitoring valve in-leakage and thermal stress as needed and performing volumetric examinations on the susceptible locations (e.g., examination areas, volumes and frequencies). These guidelines continue to be enhanced based on the lessons learned from relevant operating experience and research activities. BWRVIP-155, Revision 1 also describes the evaluation of thermal fatigue susceptibility in the branch lines of BWR reactor coolant pressure boundary. In comparison, the inservice inspection (ISI) requirements in Table IWB-2500-1 of ASME Code, Section XI [ASME 2017-TN9258] do not include a specific examination item for thermal fatigue cracking in ASME Code Class 1 components (reactor coolant pressure boundary). However, alternative risk-informed ISIs typically include an examination item for thermal fatigue cracking (e.g., as specified in ASME Code Case N-716-1 [ASME 2013-TN8107] that has been approved in NRC Regulatory Guide [RG] 1.147, Revision 18 [NRC 2017-TN9957]). Therefore, the existing ISIs at plants may include the piping locations susceptible to thermal fatigue. Currently, the SRP-SLR does not include a FE section that addresses aging management for the piping locations susceptible to thermal fatigue. Therefore, new SRP-SLR Sections 3.1.2.2.16a and 3.1.3.2.16a are added to address the adequacy of a plant-specific AMP (e.g., adequate selection of susceptible locations

Table 3-3 SRP-SLR, Revision 1, Chapter 3.1, Reactor Vessels, Internals, Coolant System, Differences from SRP-SLR, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of the Change	Technical Basis for Change
		for inspections, timely detection of cracks and preventive action for valve in-leakage). Changes are also made to the SRP-SLR section for references (Section 3.1.6). In addition, relevant changes are made to the AMR tables in the SRP-SLR and GALL-SLR Report.
Section 3.1.3.2.9	Changes are analogous to those made to AMR acceptance criteria in SRP-SLR Section 3.1.2.2.9. Additionally, the staff clarified the AMR items in GALL-SLR Items IV.B2.R-423, IV.B3.R-423, or IV.B4.R-423 for cracking effects or mechanisms, or GALL-SLR Items IV.B4.R-424, IV.B3.R-424, or IV.B4.R-424 for non-cracking effects or mechanisms may be used if the MRP I&E protocols for a specified component in the MRP-227, Revision 1-A are being adjusted on a site-specific or component-specific basis.	The technical bases for changes being made to AMR acceptance criteria in SRP-SLR Section 3.1.2.2.9 also apply to the changes being made to the AMR review procedures of SRP-SLR Section 3.1.3.2.9. Since a gap analysis will be needed if MRP-227, Revision 1-A is used as the starting point AMP, the staff expanded the scope of the GALL-SLR “R-423” items and “R-424” items to allow use of the generic AMR line items, even if the program was being based on the program defined in GALL-SLR AMP XI.M16A, and the EPRI-defined protocols for a specified component in MRP-227, Revision 1-A were being adjusted on a site-specific or component-specific basis. The changes will provide a broader scope of the “R-423” and “R-424” items and will allow the amended GALL-SLR AMR items to be used even if the EPRI MRP I&E protocols for a given component in the MRP-227, Revision 1-A Report are being adjusted as a result of the gap analysis or operating experience considerations. The AMRs in the “R-423” and “R-424” type line items are no longer limited only to plant-specific RVI AMPs.
Section 3.1.3.2.16	Revised the wording in the last paragraph to delete the statement that loss of material (LOM) does not require aging management if a barrier coating is used. Deleted the statement that the reviewer verifies the barrier coating is impermeable.	The statement in Section 3.1.3.2.16 that barrier coatings make aging management unnecessary is inconsistent with Section A.1.2.1, Item 5, which correctly states that an AMP is needed to manage the integrity of the coating that prevents the aging effect. Because an AMP will be used to manage coating integrity, an evaluation of coating permeability is not necessary for this FE review.

Table 3-3 SRP-SLR, Revision 1, Chapter 3.1, Reactor Vessels, Internals, Coolant System, Differences from SRP-SLR, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of the Change	Technical Basis for Change
Section 3.1.3.5 Final Safety Analysis Report (FSAR) Supplement	Add reference to the FSAR Supplement information contained in GALL-SLR Table X-01 and Table XI-01. The scope of this section was expanded to include other types of cyclical loading analyses that may qualify as time-limited aging analyses (TLAAs) for these components, as defined in SRP-SLR Section 4.3. In addition, the further evaluation (FE) “Acceptance Criteria” and “Review Procedure” guidelines in SRP-SLR were amended to indicate that monitoring of cumulative usage factor analyses for Class 1 components may be based on stress-based monitoring methods.	This information was inadvertently omitted when the FSAR Supplement information was relocated from the SRP-SLR tables to the GALL-SLR tables.
Table 3.1-1 Items: IV.C1.RP-158(079) IV.C2.RP-383(080) IV.C2.RP-41(081) IV.C2.RP-40(082) IV.D1.RP-372(083) IV.D2.RP-153(083) IV.A1.RP-50(084) IV.A1.RP-157(085)	Removed XI.M32, “One-Time Inspection” from the “Aging Management Program(AMP)/Time Limited Aging Analyses (TLAA)” column.	Changes result from the elimination of mandatory one-time inspections in the XI.M2 “Water Chemistry,” XI.M30 “Fuel Oil Chemistry,” and XI.M39 “Lubricating Oil Analysis” AMPs, which are called out in the XI.M32 “One-Time Inspection” AMP, using risk insights gained from industry operating experience. None of these four AMPs are being eliminated and the One-Time Inspection AMP is still available for use by any other AMP when needed.
Section 3.1.2.4 Section 3.1.3.4 Aging Management Programs	Revised the discussion on the staff’s AMP review to focus on verifying the GALL-consistency of the proposed AMPs, as enhanced, rather than directing the staff to explicitly review and document the acceptability of each enhancement in the safety evaluation.	The revision to the staff’s review approach continues to adequately support a GALL-consistency conclusion for each AMP, but in a manner that removes unnecessarily prescriptive staff direction. These revisions enhance the approach initially approved by the Commission in SRM-SECY-99-148, “Credit for Existing Programs for License Renewal” (ML003751930) with the more recent Commission direction in SRM-COMCTH-24-0003, “License Renewal and Subsequent License Renewal Review Expectations” (ML24221A319) to implement review efficiencies. The basis for the staff’s position is also described in response to comment no. 21 in the GALL-SLR Report, Revision 1.

Table 3-4 SRP-SLR, Revision 1 Chapter 3.2, Engineered Safety Features, Differences from SRP-SLR, Revision 0, and Their Technical Bases

Location of Change	Summary of the Change	Technical Basis for Change
Section 3.2.3.5 Final Safety Analysis Report (FSAR) Supplement	Add reference to the FSAR Supplement information contained in GALL-SLR Table X-01 and Table XI-01.	This information was inadvertently omitted when the FSAR Supplement information was relocated from the SRP-SLR tables to the GALL-SLR tables.
Section 3.2.2.2.11 Section 3.2.3.2.11 Section 3.2.6 Table 3.2-1, Item 135	New further evaluation (FE) sections in SRP-SLR Section 3.2 is needed to address new industry operating experience related to loss of material due to wear on the outside diameter (OD) of American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code) Class 1 and Class 2 small-bore piping. Specifically, a reference is made to the NRC Information Notice (IN) 2007-21 [NRC 2020-TN8034], “Pipe Wear Due to Interaction of Flow-Induced Vibrations and Reflective Metal Insulation,” Supplement 1, issued on December 11, 2020. Its purpose was to alert licensees of nuclear power reactors on recent operating experience (OE) related to wear of nuclear power plant piping caused by flow-induced vibration and interaction of certain type of insulation.	Recent industry OE indicates that significant wear can occur on the OD of piping due to system vibrations and interactions with certain types of reflective metal insulation (RMI). Specifically, piping that uses RMI with an end cap of thin sheet metal has the potential for wear up to 360 around its circumference. Repeated movement of the RMI end cap in contact with a pipe OD can cause loss of material on the OD of the subject pipe. Multiple instances of such wear are known to have occurred. An occurrence of this type of material loss due to RMI end cap wear was reported in 2006, and was the subject of IN 2007-21 [NRC 2020-TN8034], issued by the NRC on June 11, 2007. During outage activities in fall of 2006, the licensee at Catawba, Unit 1 removed RMI on small-bore ASME Code Class 2 piping for a planned valve replacement. The licensee identified multiple wear marks on the OD of stainless steel (SS) piping. It was determined that the wear marks were the result of interactions between the SS piping and the SS RMI end caps, caused by vibration. The licensee initially identified three locations with metal loss. During the extent of condition review, additional 81 discrete wear marks were identified over a 150-ft length of piping. All of the wear marks were located inside containment and at insulation end caps. In December 2020, IN 2007-21 [NRC 2020-TN8034] was revised due to more recent occurrences of metal loss on the OD of ASME Code Class 1 small-bore piping at two other nuclear power plants. The most recent known occurrence is summarized below.

Table 3-4 SRP-SLR, Revision 1 Chapter 3.2, Engineered Safety Features, Differences from SRP-SLR, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of the Change	Technical Basis for Change
		During an outage in the spring of 2020, workers at Arkansas Nuclear One, Unit 2 identified multiple wear marks on ASME Code Class 1 pressurizer spray piping. The wear marks were identified as a result of piping inspections in response to vibration related failures of snubber connections to the pressurizer spray piping. The wear marks ranged from surface scratches to deeper groves that were nearly 360 degrees around the OD circumference of the pipe. The licensee determined that the wear was caused by vibration-induced interactions of the RMI end caps and the OD surfaces of the subject piping. In the overview of the original IN 2007-21 [NRC 2020-TN8034] and its subsequent supplement of 2020, it is apparent that the observed OD pipe wear for both the ASME Code Class 1 and 2 small-bore piping was discovered as a result of unrelated inspections. There are currently no specific ASME Code requirements to remove insulation from piping and inspect the piping for degradation due to RMI wear. This type of wear, if present and undetected, could have a significant impact on the integrity of ASME Code Class 1 and 2 small-bore piping because: (1) small-bore piping has wall thickness values that are significantly less than those for large bore piping, (2) small-bore piping systems are more susceptible to vibration, and (3) there are no specific ASME Code requirements to inspect piping for RMI wear. Based on the observed degradation, the licensees referenced in the updated IN 2007-21 [NRC 2020-TN8034] have performed engineering evaluations as well as completed extent of conditions and installed a modified RMI to eliminate the pipe wear. The modified insulation has an end cap as a piece of flat sheet metal that looks like a cuff, band or strip. The

Table 3-4 SRP-SLR, Revision 1 Chapter 3.2, Engineered Safety Features, Differences from SRP-SLR, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of the Change	Technical Basis for Change
		modified end cap touches the pipe as a flat piece of metal parallel to the pipe, not as a sharp edge; thereby eliminating the potential for excessive wear. Temporary modifications have also included installation of cuffs on the OD of the pipe where the end caps are located. More recently, an applicant in the process of applying for a subsequent license renewal (SLR) reviewed the OE in the updated IN 2007-21 [NRC 2020-TN8034], determined that the OE could be applicable at its units, and updated its aging management program (AMP) to check for the RMI end cap wear on its ASME Code Class 1 small-bore piping (Ref. 40). Relevant SRP-SLR sections are being updated to add a FE to determine whether a plant seeking license renewal has evaluated the use of RMI in its integrated plant assessment and the potential of OD wear on its population of ASME Code Class 1 and 2 small-bore piping. Related references are also added in the reference section (SRP-SLR Section 3.2.6).
Section 3.2.2.2.2	Revised the last paragraph to state that the applicant may mitigate or prevent loss of material using a barrier coating rather than saying the loss of material does not require management if a barrier coating is used. Added a statement that the applicant should identify loss of material as applicable for SLR and identify the AMP that will be used to manage the integrity of the coating.	The statement in Section 3.2.2.2.2 that loss of material does not require management contradicts the statement in SLR-SRP Section A.1.2.1, Item 5, which states that even with a prevention or mitigation program, including a coating, an aging effect should be identified as applicable for SLR, and the AMR should consider the adequacy of the AMP referencing the prevention or mitigation program (e.g., coating). Section A.1.2.1, Item 5, correctly states the need for an AMP to manage coating integrity.
Section 3.2.3.2.2	Revised the wording in the last paragraph to delete the statement that LOM does not require aging management if a barrier coating is used. Deleted the statement that the reviewer verifies the barrier coating is impermeable.	The statement in Section 3.2.3.2.2 that barrier coatings make aging management unnecessary is inconsistent with Section A.1.2.1, Item 5, which correctly states that an AMP is needed to manage the integrity of the coating that prevents the aging effect. Because an AMP will be used to manage coating integrity, an evaluation of

Table 3-4 SRP-SLR, Revision 1 Chapter 3.2, Engineered Safety Features, Differences from SRP-SLR, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of the Change	Technical Basis for Change
		coating permeability is not necessary for this FE review.
Section 3.2.2.2.4	Revised the last paragraph to state that the applicant may mitigate or prevent cracking due to stress corrosion cracking (SCC) using a barrier coating rather than saying cracking due to SCC does not require management if a barrier coating is used. Added a statement that the applicant should identify cracking due to SCC as applicable for SLR and identify the AMP that will be used to manage the integrity of the coating.	The statement in Section 3.2.2.2.4 that cracking due to SCC does not require management contradicts the statement in SLR-SRP Section A.1.2.1, Item 5, which states that even with a prevention or mitigation program, including a coating, an aging effect should be identified as applicable for SLR, and the AMR should consider the adequacy of the AMP referencing the prevention or mitigation program (e.g., coating). Section A.1.2.1, Item 5, correctly states the need for an AMP to manage coating integrity.
Section 3.2.2.4 Section 3.2.3.4 Aging Management Programs	Revised the discussion on the staff's AMP review to focus on verifying the GALL-consistency of the proposed AMPs, as enhanced, rather than directing the staff to explicitly review and document the acceptability of each enhancement in the safety evaluation.	The revision to the staff's review approach continues to adequately support a GALL-consistency conclusion for each AMP, but in a manner that removes unnecessarily prescriptive staff direction. This revision enhances the approach initially approved by the Commission in SRM-SECY-99-148, "Credit for Existing Programs for License Renewal" (ML003751930) with the more recent Commission direction in SRM-COMCTH-24-0003, "License Renewal and Subsequent License Renewal Review Expectations" (ML24221A319) to implement review efficiencies. The basis for the staff's position is also described in response to comment no. 21 in the GALL-SLR Report, Revision 1.
Section 3.2.3.2.4	Revised the wording in the last paragraph to delete the statement that cracking due to SCC does not require aging management if a barrier coating is used. Deleted the statement that the reviewer verifies the barrier coating is impermeable.	The statement in Section 3.2.3.2.4 that barrier coatings make aging management unnecessary is inconsistent with Section A.1.2.1, Item 5, which correctly states that an AMP is needed to manage the integrity of the coating that prevents the aging effect. Because an AMP will be used to manage coating integrity, an evaluation of coating permeability is not necessary for this FE review.
Section 3.2.2.2.8	Revised the wording in the last paragraph to clarify that the applicant may mitigate or prevent cracking due to SCC using a	The purpose of this change is to make the wording about barrier coatings consistent with that of other FE sections that required changes to the coatings discussion.

Table 3-4 SRP-SLR, Revision 1 Chapter 3.2, Engineered Safety Features, Differences from SRP-SLR, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of the Change	Technical Basis for Change
	barrier coating. Added a statement that the applicant should identify cracking due to SCC as applicable for SLR and identify the AMP that will be used to manage the integrity of the coating.	
Section 3.2.3.2.8	Revised the wording in the fourth paragraph to delete the statement that cracking due to SCC does not require aging management if a barrier coating is used. Deleted the statement that the reviewer verifies the barrier coating is impermeable.	The statement in Section 3.2.3.2.8 that barrier coatings make aging management unnecessary is inconsistent with Section A.1.2.1, Item 5, which correctly states that an AMP is needed to manage the integrity of the coating that prevents the aging effect. Because an AMP will be used to manage coating integrity, an evaluation of coating permeability is not necessary for this FE review.
Section 3.2.2.2.10	Revised the wording in the last paragraph to clarify that the applicant may mitigate or prevent LOM using a barrier coating. Added a statement that the applicant should identify LOM as applicable for SLR and identify the AMP that will be used to manage the integrity of the coating.	The purpose of this change is to make the wording about barrier coatings consistent with that of other FE sections that required changes to the coatings discussion.
Section 3.2.2.2.10	Revised the wording to indicate that LOM due to pitting and crevice corrosion need not be managed if the type of aluminum is not susceptible to cracking and plant-specific OE does not reveal any issues related to loss of material due to pitting or crevice corrosion.	During the first revision or interim staff guidance (ISG) to the SRP-SLR, the staff added a provision to the FE sections associated with loss of material due to pitting and crevice corrosion of aluminum components exposed to air or condensation. This change allowed an alternative to conducting a One-Time Inspection to detect loss of material. Loss of material need not be managed if: (a) the aluminum material is not susceptible to cracking; and (b) plant-specific OE does not reveal any issues related to loss of material due to pitting or crevice corrosion. The staff included this alternative because: (a) it is unlikely that pitting or crevice corrosion in aluminum components would lead to a loss of intended function and (b) if loss of material has not been identified as an issue after 40 years (the earliest point at which a subsequent license renewal application [SLRA] can be submitted, it is unlikely that

Table 3-4 SRP-SLR, Revision 1 Chapter 3.2, Engineered Safety Features, Differences from SRP-SLR, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of the Change	Technical Basis for Change
		it will lead to a loss of intended function during the subsequent period of extended operation. This alternative was not allowed for aluminum materials that are susceptible to SCC because pitting or crevice corrosion might, but not necessarily, be a precursor to cracking.
Section 3.2.3.2.10	Revised the wording in the last paragraph to delete the statement that LOM does not require aging management if a barrier coating is used. Deleted the statement that the reviewer verifies the barrier coating is impermeable.	The statement in Section 3.2.3.2.10 that barrier coatings make aging management unnecessary is inconsistent with Section A.1.2.1, Item 5, which correctly states that an AMP is needed to manage the integrity of the coating that prevents the aging effect. Because an AMP will be used to manage coating integrity, an evaluation of coating permeability is not necessary for this FE review.
Section 3.2.3.2.10	Revised the wording to indicate that LOM due to pitting and crevice corrosion need not be managed if the type of aluminum is not susceptible to cracking and plant-specific OE does not reveal any issues related to loss of material due to pitting or crevice corrosion.	During the first revision or ISG to the SRP-SLR, the staff added a provision to the FE sections associated with loss of material due to pitting and crevice corrosion of aluminum components exposed to air or condensation. This change allowed an alternative to conducting a One-Time Inspection to detect loss of material. Loss of material need not be managed if: (a) the aluminum material is not susceptible to cracking and (b) plant-specific OE does not reveal any issues related to loss of material due to pitting or crevice corrosion. The staff included this alternative because: (a) it is unlikely that pitting or crevice corrosion in aluminum components would lead to a loss of intended function and (b) if loss of material has not been identified as an issue after 40 years (the earliest point at which a SLRA can be submitted, it is unlikely that it will lead to a loss of intended function during the subsequent period of extended operation. This alternative was not allowed for aluminum materials that are susceptible to SCC because pitting or crevice corrosion might, but not necessarily, be a precursor to cracking.
Table 3.2-1 Item 19	Included reduction of heat transfer for nickel alloy internally exposed to treated borated water.	The staff noted that for other material and environment combinations in the GALL-SLR Report, reduction of heat transfer due to fouling is the only aging effect associated with an intended function of

Table 3-4 SRP-SLR, Revision 1 Chapter 3.2, Engineered Safety Features, Differences from SRP-SLR, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of the Change	Technical Basis for Change
		"heat transfer." The Water Chemistry AMP can be used to minimize the potential for deposits that can lead to fouling through the control of primary side water chemistry. The GALL-SLR recommends the use of the Water Chemistry and Steam Generator AMPs (AMR Table 1 Item 3.1-1, 111) to manage the reduction of heat transfer due to fouling in nickel alloy tubes. The use of the Water Chemistry AMP provides an analogous approach (i.e., Water Chemistry control and an inspection to verify effectiveness) to managing the reduction of heat transfer on primary side nickel alloy heat exchanger tubes. The staff's review of the Turkey Point SLRA demonstrates that SS and nickel alloy have similar aging effects when exposed to treated borated water. The GALL-SLR recommends the use of the Water Chemistry AMP to manage the reduction of heat transfer in SS heat exchanger tubes. Because SS and nickel alloy experience similar aging effects it is reasonable to use the same AMPs to manage the aging effects in nickel alloy materials.
Table 3.2-1, Item 036 Table 3.2-1, Item 037 Table 3.2-1, Item 074	Added malleable iron as an applicable material.	During its review of recent SLRA plant-specific OE, in response to the staff's observation regarding dark corrosion product layers indicative of graphitic corrosion on the internal surfaces of malleable iron fittings exposed to a closed-cycle cooling water environment (ADAMS Accession No. ML22010A129), the staff has revised guidance documents (i.e., GALL-SLR Report and SRP-SLR) to include malleable iron as a material susceptible to selective leaching.
Table 3.2-1, Item 072 Table 3.2-1, Item 073	Added lubricating oil and condensation as applicable environments.	The staff has accepted opportunistic inspections, in lieu of periodic inspections, as an acceptable alternative for buried internally coated or lined fire water system piping provided: (a) flow tests and internal piping inspections will occur at intervals specified in NFPA 25, or as modified by AMP XI.M27, Table XI.M27-1; and (b) through-wall flaws in the piping can be

Table 3-4 SRP-SLR, Revision 1 Chapter 3.2, Engineered Safety Features, Differences from SRP-SLR, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of the Change	Technical Basis for Change
		detected through continuous system pressure monitoring. Examples of the staff's acceptance of this alternative approach are documented in the Safety Evaluation Report Related to the License Renewal of Fermi 2 Nuclear Power Plant (ADAMS Accession No. ML16190A241) and the Safety Evaluation Report Related to the Subsequent License Renewal of Peach Bottom Atomic Power Station, Units 2 and 3 (ADAMS Accession No. ML20044D902). Based on recent OE involving ruptures of buried fire water system piping due to age-related degradation (ADAMS Accession No. ML19294A044), the staff added a third condition for using this alternative approach related to plant-specific OE. The staff notes that the subject OE involved degradation of the external surfaces of the piping; however, degradation of internal coatings or linings could also result in significant degradation of buried fire water system piping. The GALL-SLR Report discusses the reason for citing specific AMPs to manage recurring internal corrosion rather than a plant-specific AMP in the section titled "Explanation of the Use of Multiple Aging Management Programs in Aging Management Review Items." For the associated AMR item in the SRP-SLR (item 3.3-1-127), the listed environments still include closed-cycle cooling water even though NUREG-2221, "Technical Bases for Changes in the Subsequent License Renewal Guidance Documents NUREG-2191 and NUREG-2192," Table 2-13, notes that the associated item in Table C2, "Closed-Cycle Cooling Water System," was deleted because recurring internal corrosion is not anticipated in this system. These changes corrects this error in conjunction with the adjustments above for the use of multiple AMPs.

Table 3-4 SRP-SLR, Revision 1 Chapter 3.2, Engineered Safety Features, Differences from SRP-SLR, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of the Change	Technical Basis for Change
Table 3.2-1, Item 132	Added “Flow blockage due to fouling” as an applicable aging effect or mechanism.	Subsequent to issuance of the GALL-SLR Report, the staff recognized that to be consistent with other GALL-SLR Report items associated with heat exchanger tubes, E-475 should have also cited reduction of heat transfer due to fouling. This is consistent with GALL Report Revision 2 Item SP-41 where a material (i.e., SS) that is not susceptible to loss of material (a potential source of fouling products), is susceptible to reduction of heat transfer due to fouling. Titanium components are subject to flow blockage due to fouling due to potential debris in the raw water environment.
Table 3.2-1, Item 134	Added “Inspection of Internal Surfaces only” to flow blockage due to fouling.	Flow blockage due to fouling is not an applicable aging effect requiring management for the external environment of polymeric components.
Table 3.2-1 Items: 016 017 019 020 022 049 050 051 114 115 130	Removed XI.M32, “One-Time Inspection” from the “Aging Management Program(AMP)/Time Limited Aging Analyses (TLAA)” column.	Changes result from the elimination of mandatory one-time inspections in the XI.M2 “Water Chemistry,” XI.M30 “Fuel Oil Chemistry,” and XI.M39 “Lubricating Oil Analysis” AMPs, which are called out in the XI.M32 “One-Time Inspection” AMP, using risk insights gained from industry operating experience. None of these four AMPs are being eliminated and the One-Time Inspection AMP is still available for use by any other AMP when needed.

Table 3-5 SRP-SLR, Revision 1, Chapter 3.3, Auxiliary Systems, Differences from SRP-SLR, Revision 0, and Their Technical Bases

Location of Change	Summary of the Change	Technical Basis for Change
Section 3.3.2.4 Section 3.3.3.4 Aging Management Programs	Revised the discussion on the staff’s AMP review to focus on verifying the GALL-consistency of the proposed AMPs, as enhanced, rather than directing the staff to explicitly review and document the acceptability of each enhancement in the safety evaluation.	The revision to the staff’s review approach continues to adequately support a GALL-consistency conclusion for each AMP, but in a manner that removes unnecessarily prescriptive staff direction. This revision enhances the approach initially approved by the Commission in SRM-SECY-99-148,

Table 3-5 SRP-SLR, Revision 1, Chapter 3.3, Auxiliary Systems, Differences from SRP-SLR, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of the Change	Technical Basis for Change
		"Credit for Existing Programs for License Renewal" (ML003751930) with the more recent Commission direction in SRM-COMCTH-24-0003, "License Renewal and Subsequent License Renewal Review Expectations" (ML24221A319) to implement review efficiencies. The basis for the staff's position is also described in response to comment no. 21 in the GALL-SLR Report, Revision 1.
Section 3.3.3.5 Final Safety Analysis Report (FSAR) Supplement	Add reference to the FSAR Supplement information contained in GALL-SLR Table X-01 and Table XI-01.	This information was inadvertently omitted when the FSAR Supplement information was relocated from the SRP-SLR tables to the GALL-SLR tables.
Section 3.3.2.2.3	Revised the last paragraph to state that the applicant may mitigate or prevent cracking due to stress corrosion cracking (SCC) using a barrier coating rather than saying cracking due to SCC does not require management if a barrier coating is used. Added a statement that the applicant should identify cracking due to SCC as applicable for subsequent license renewal (SLR) and identify the aging management program (AMP) that will be used to manage the integrity of the coating.	The statement in Section 3.3.2.2.3 that cracking due to SCC does not require management contradicts the statement in SLR-SRP Section A.1.2.1, Item 5, which states that even with a prevention or mitigation program, including a coating, an aging effect should be identified as applicable for SLR, and the AMR should consider the adequacy of the AMP referencing the prevention or mitigation program (e.g., coating). Section A.1.2.1, Item 5, correctly states the need for an AMP to manage coating integrity.
Section 3.3.3.2.3	Revised the wording in the last paragraph to delete the statement that cracking due to SCC does not require aging management if a barrier coating is used. Deleted the statement that the reviewer verifies the barrier coating is impermeable.	The statement in Section 3.3.3.2.3 that barrier coatings make aging management unnecessary is inconsistent with Section A.1.2.1, Item 5, which correctly states that an AMP is needed to manage the integrity of the coating that prevents the aging effect. Because an AMP will be used to manage coating integrity, an evaluation of coating permeability is not necessary for this further evaluation (FE) review.

Table 3-5 SRP-SLR, Revision 1, Chapter 3.3, Auxiliary Systems, Differences from SRP-SLR, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of the Change	Technical Basis for Change
Section 3.3.2.2.4	Revised the last paragraph to state that the applicant may mitigate or prevent loss of material using a barrier coating rather than saying the loss of material does not require management if a barrier coating is used. Added a statement that the applicant should identify loss of material as applicable for SLR and identify the AMP that will be used to manage the integrity of the coating.	The statement in Section 3.3.2.2.4 that loss of material does not require management contradicts the statement in SLR-SRP Section A.1.2.1, Item 5, which states that even with a prevention or mitigation program, including a coating, an aging effect should be identified as applicable for SLR, and the AMR should consider the adequacy of the AMP referencing the prevention or mitigation program (e.g., coating). Section A.1.2.1, Item 5, correctly states the need for an AMP to manage coating integrity.
Section 3.3.3.2.4	Revised the wording in the last paragraph to delete the statement that LOM does not require aging management if a barrier coating is used. Deleted the statement that the reviewer verifies the barrier coating is impermeable.	The statement in Section 3.3.3.2.4 that barrier coatings make aging management unnecessary is inconsistent with Section A.1.2.1, Item 5, which correctly states that an AMP is needed to manage the integrity of the coating that prevents the aging effect. Because an AMP will be used to manage coating integrity, an evaluation of coating permeability is not necessary for this FE review.
Section 3.3.2.2.8	Revised the wording in the last paragraph to clarify that the applicant may mitigate or prevent cracking due to SCC using a barrier coating. Added a statement that the applicant should identify cracking due to SCC as applicable for SLR and identify the AMP that will be used to manage the integrity of the coating.	The purpose of this change is to make the wording about barrier coatings consistent with that of other FE sections that required changes to the coatings discussion.
Section 3.3.3.2.8	Revised the wording in the fourth paragraph to delete the statement that cracking due to SCC does not require aging management if a barrier coating is used. Deleted the statement that the reviewer verifies the barrier coating is impermeable.	The statement in Section 3.3.3.2.8 that barrier coatings make aging management unnecessary is inconsistent with Section A.1.2.1, Item 5, which correctly states that an AMP is needed to manage the integrity of the coating that prevents the aging effect. Because an AMP will be used to manage coating integrity, an evaluation of coating permeability is not necessary for this FE review.

Table 3-5 SRP-SLR, Revision 1, Chapter 3.3, Auxiliary Systems, Differences from SRP-SLR, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of the Change	Technical Basis for Change
Section 3.3.2.2.10	Revised the wording to indicate that loss of material due to pitting and crevice corrosion need not be managed if the type of aluminum used is not susceptible to cracking and plant-specific operating experience does not reveal any issues related to loss of material due to pitting or crevice corrosion.	During the first revision/ISG to the SRP-SLR, the staff added a provision to the further evaluation sections associated with loss of material due to pitting and crevice corrosion of aluminum components exposed to air or condensation. This change allowed an alternative to conducting a one-time inspection to detect loss of material. Loss of material need not be managed if: (a) the aluminum material used is not susceptible to cracking; and (b) plant-specific operating experience does not reveal any issues related to loss of material due to pitting or crevice corrosion. The staff included this alternative because: (a) it is unlikely that pitting or crevice corrosion in aluminum components would lead to a loss of intended function; and (b) if loss of material has not been identified as an issue after 40 years (the earliest point at which a SLRA can be submitted), it is unlikely that it will lead to a loss of intended function during the subsequent period of extended operation. This alternative was not allowed for aluminum materials that are susceptible to stress corrosion cracking because pitting or crevice corrosion might, but not necessarily, be a precursor to cracking.
Section 3.3.2.2.10	Revised the wording in the last paragraph to clarify that the applicant may mitigate or prevent LOM using a barrier coating. Added a statement that the applicant should identify LOM as applicable for SLR and identify the AMP that will be used to manage the integrity of the coating.	The purpose of this change is to make the wording about barrier coatings consistent with that of other FE sections that required changes to the coatings discussion.
Section 3.3.3.2.10	Revised the wording in the last paragraph to delete the statement that LOM does not require aging management if a barrier coating is used. Deleted the statement that the reviewer verifies the barrier coating is impermeable.	The statement in Section 3.3.3.2.10 that barrier coatings make aging management unnecessary is inconsistent with Section A.1.2.1, Item 5, which correctly states that an AMP is needed to manage the integrity of the coating that prevents

Table 3-5 SRP-SLR, Revision 1, Chapter 3.3, Auxiliary Systems, Differences from SRP-SLR, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of the Change	Technical Basis for Change
		the aging effect. Because an AMP will be used to manage coating integrity, an evaluation of coating permeability is not necessary for this FE review.
Table 3.3-1, Item 30a Table 3.3-1, Item 104 Table 3.3-1, Item 133 Table 3.3-1, Item 194 Table 3.3-1, Item 196 Table 3.3-1, Item 210 Table 3.3-1, Item 253	Revised the items to include High-density polyethylene (HDPE) and/or carbon fiber reinforced polymer (CFRP) repaired piping as components, as applicable, clarify the associated aging mechanisms and effects, and refer to the new AMP XI.M43, "High Density Polyethylene (HDPE) Piping and Carbon Fiber Reinforced Polymer (CFRP) Repaired Piping." Added GALL-SLR Item VII.I.AP-182 to item 104. Added GALL-SLR Item VII.I.A-420 to item 133. Added GALL-SLR Item VII.I.A-538 to item 194. Added GALL-SLR Item VII.C1.A-792 to item 253.	These items are revised to include components, aging effects/mechanism, and/or GALL-SLR item(s) for crediting new AMP XI.M43, "High Density Polyethylene (HDPE) Piping and Carbon Fiber Reinforced Polymer (CFRP) Repaired Piping, to manage the effects of age-related degradation mechanisms that are applicable to HDPE piping and CFRP repaired piping. This new AMP reflects the recent introduction and increasing use of CFRP repaired piping at reactor facilities. The unique aging issues and aging management approaches for CFRP repaired piping and HDPE piping (previously managed by AMP XI.M41) were considered to be most effectively addressed with a dedicated AMP.
Table 3.3-1, Items 104, 133, 194, 196.	Aging effect/mechanism includes loss of material due to exposure to temperature or moisture.	For CFRP, exposure to environmental effects such as temperature and/or moisture can cause degradation of the epoxy resin matrix and the bond between CFRP laminate and metal substrate. Degradation of matrix can result in debonding/cracking of fiber-matrix interfacial bond, debonding/delamination/cracking of laminate layers, lowering matrix glass transition temperature, swelling of matrix, microcracking of matrix, loss watertightness, and loss of maintaining design load. Degradation of the bond between laminate and metal substrate can result in loss of material, watertightness, and maintaining design loads. HDPE fabrication can also introduce moisture in the

Table 3-5 SRP-SLR, Revision 1, Chapter 3.3, Auxiliary Systems, Differences from SRP-SLR, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of the Change	Technical Basis for Change
		resin/hydrocarbon mixture which can cause degr dation in the future. At high temperature, HDPE will deform which could lead to the loss of material and strength. Loss of material due to degradation and/or environmental effects can occur in HDPE piping if the incorrect material is selected or an improper fusion butt joint such as electrofused joint is performed.
Table 3.3-1, Item 071	Added nickel alloy as an applicable material and updated applicable GALL-SLR Report items.	The staff noted that the GALL-SLR Report recommends the use of the Fuel Oil Chemistry AMP to manage loss of material of several different materials that are exposed to a fuel oil environment. These new AMR items credit the Fuel Oil Chemistry program to minimize contaminants which could lead to loss of material. The use of the Fuel Oil Chemistry program can minimize contaminants regardless of the material of the affected component. Therefore, the staff has reasonable assurance that it will be effective in managing loss of material for nickel alloy strainer elements exposed to fuel oil.
Table 3.3-1, Item 072 Table 3.3-1, Item 140	Added malleable iron as an applicable material.	During its review of recent SLRA plant-specific operating experience (OE), in response to the staff's observation regarding dark corrosion product layers indicative of graphitic corrosion on the internal surfaces of malleable iron fittings exposed to a closed-cycle cooling water environment (ADAMS Accession No. ML22010A129), the staff has revised guidance documents (i.e., GALL-SLR Report and SRP-SLR) to include malleable iron as a material susceptible to selective leaching.
Table 3.3-1, Item 114	Added heat exchanger components and tanks as applicable components.	GALL-SLR Table VII.J only addresses components with material/environment combinations

Table 3-5 SRP-SLR, Revision 1, Chapter 3.3, Auxiliary Systems, Differences from SRP-SLR, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of the Change	Technical Basis for Change
		that do not have aging effects expected to degrade their intended function. Because copper alloy heat exchanger tubes have aging effects requiring management, the component description for this item needs to include “other than tubes,” after heat exchanger components. The historical response to public comment 045-062 (ML17362A143 [NRC 2017-TN9926]), which stated that a change to this item will be made, never occurred. The comment response had stated that the basis for AP-144 was equally applicable to tanks and heat exchangers components in addition to piping and piping components. However, the response also noted that reduction of heat transfer due to fouling of copper alloy heat exchanger tubes is addressed separately in item A-565. Because copper alloy heat exchanger tubes exposed to air and condensation have an aging effect that could degrade their ability to perform their intended function, they are excluded from GALL-SLR Report Table VII.J for components with no aging effects requiring management. GALL-SLR Report Items A-419, A-565, and A-716 address reduction of heat transfer due to fouling of copper alloy heat exchanger tubes exposed to air and condensation environments.
Table 3.3-1, Item 127	Removed close cycle cooling water as a susceptible environment.	For the associated AMR item in SRP-SLR (Item 3.3.1-127), the listed environments erroneously include closed-cycle cooling water even though NUREG-2221, Table 2-13 notes that the associated item in Table C2, “Closed-Cycle Cooling Water System,” was deleted because recurring internal corrosion is not anticipated in this system. This oversight is being corrected in

Table 3-5 SRP-SLR, Revision 1, Chapter 3.3, Auxiliary Systems, Differences from SRP-SLR, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of the Change	Technical Basis for Change
		conjunction with the adjustments above for use of multiple AMPs.
Table 3.3-1, Item 138 Table 3.3-1, Item 139	Added air-dry, air, and condensation as applicable environments and updated applicable GALL-SLR Report items.	Air and condensation environments were added to the scope of the Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks program with the issuance of SLR-ISG-2021-02-MECHANICAL, "Updated Aging Management Criteria for Mechanical Portions of Subsequent License Renewal Guidance."
Table 3.3-1, Item 175	Removed ultraviolet light and ozone as applicable environments.	Modified to incorporate industry OE to update aging management of piping, piping components, and tanks made of fiberglass exposed to water and soil environments, by removing exposure to ultraviolet light and ozone as a cause of cracking, blistering, and loss of material.
Table 3.3-1, Item 175	Removed ultraviolet light and ozone as applicable environments.	Modified to incorporate industry operating experience to update aging management of piping, piping components, and tanks made of fiberglass exposed to water and soil environments, by removing exposure to ultraviolet light and ozone as a cause of cracking, blistering, and loss of material.
Table 3.3-1, Item 203	Added steel as an applicable material and updated applicable GALL-SLR Report items.	Modified to note that the aging effects of loss of material, and long-term loss of material due to general corrosion on steel exposed to an environment of treated water and sodium pentaborate can be managed by the Water Chemistry AMP. No item was added to manage stress corrosion cracking of steel in this environment as the GALL-SLR already states that steel components typically are not susceptible to stress corrosion cracking and are mainly susceptible to loss of material. The staff determined that this material, environment, aging effect

Table 3-5 SRP-SLR, Revision 1, Chapter 3.3, Auxiliary Systems, Differences from SRP-SLR, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of the Change	Technical Basis for Change
		program (MEAP) may be managed with the AMPs cited above because the Water Chemistry AMP can monitor and control the concentration of deleterious species in the water storage tanks that provide water to the Standby Liquid Control (SLC) system which contains the sodium pentaborate solution. Several reports were reviewed by the staff to make this determination [NUREG/CR-6001; NRC 1992-TN8346] [EPRI Report 1010639; EPRI 2006-TN8195] [Metals Handbook Desk Edition, 2nd Edition] [EPRI Report 1000975; EPRI 2001-TN8200]. These reports concluded that even though the pH of the SLC system varies with temperature, it is generally greater than 6.8 pH which is close to neutral [NUREG/CR-6001; NRC 1992-TN8346]. Additionally, these reports noted that the pH range in SLC systems tends to be between 6.8–8.5 [EPRI Report 1010639; EPRI 2006-TN8195]. This would result in less corrosion of the steel as the corrosion rate of steel tends to decrease with an increasing pH (i.e., more basic) and would need additional impurities (e.g., salts, oxygen) for appreciable corrosion to occur in this environment (Metals Handbook Desk Edition, 2nd Edition). Additionally, one report found that corrosion rates of carbon and low-alloy steel, when exposed to varying concentrations of boric acid, were relatively low (0.05–1.1 mm/year [0.002–0.045 inches/year]), when the temperature was below 60°C (140 °F) (EPRI Report 1000975 [EPRI 2001-TN8200]).
Table 3.3-1, Item 255	Clarified applicable materials as metallic, replaced the term, “assemblies,” with “housings”, and removed hardening, loss of strength, and shrinkage due to elastomer	The Structure and/or Component was changed from “fire damper assemblies” to “fire damper housing” because the housing is the passive component of the fire damper

Table 3-5 SRP-SLR, Revision 1, Chapter 3.3, Auxiliary Systems, Differences from SRP-SLR, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of the Change	Technical Basis for Change
	degradation as applicable aging effects/mechanisms.	assembly that is subject to aging management. The applicable material was revised to "metallic" because fire damper housings are typically constructed of steel or stainless steel. The applicable aging effects were revised to loss of material due to general, pitting, and crevice corrosion, and cracking due to SCC because the elastomer aging effects of hardening, loss of strength, and shrinkage do not apply to metallic components. The fire damper housing is potentially subject to the cited aging effects. For example, steel materials would not be subject to SCC; however, stainless steel materials would be. The periodic inspections recommended by GALL-SLR AMP Report XI.M26 are capable of detecting these aging effects.
Table 3.3-1, Item 261	Added "flow blockage due to fouling" as an applicable aging effect/mechanism.	Subsequent to issuance of the GALL-SLR Report, the staff recognized that to be consistent with other GALL-SLR Report items associated with heat exchanger tubes, E-475 should have also cited reduction of heat transfer due to fouling. This is consistent with GALL Report Revision 2 Item SP-41 where a material (i.e., stainless steel) that is not susceptible to loss of material (a potential source of fouling products), is susceptible to reduction of heat transfer due to fouling.
Table 3.3-1, Item 263	Added "(Inspection of Internal Surfaces only)" to flow blockage due to fouling.	Flow blockage due to fouling is not an applicable aging effect requiring management for the external environment of polymeric components.
Table 3.3-1, Item 264	New Table 3.3-1 Item.	New item to note that the aging effects of loss of material, and long-term loss of material due to general corrosion on steel exposed to an environment of treated water and sodium pentaborate can be managed by the Water Chemistry and One-

Table 3-5 SRP-SLR, Revision 1, Chapter 3.3, Auxiliary Systems, Differences from SRP-SLR, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of the Change	Technical Basis for Change
		Time Inspection AMPs. No item was added to manage stress corrosion cracking of steel in this environment as the GALL-SLR already states that steel components typically are not susceptible to stress corrosion cracking and are mainly susceptible to loss of material. The staff determined that this MEAP may be managed with the AMPs cited above because the Water Chemistry AMP can monitor and control the concentration of deleterious species in the water storage tanks that provide water to the Standby Liquid Control (SLC) system which contains the sodium pentaborate solution. Additionally, the One-Time Inspection AMP can verify the corrosion rate of the steel components is low enough that loss of material is unlikely to cause a loss of intended function. Several reports were reviewed by the staff to make this determination [NUREG/CR-6001; NRC 1992-TN8346] [EPRI Report 1010639; EPRI 2006-TN8195] [Metals Handbook Desk Edition, 2nd Edition] [EPRI Report 1000975; EPRI 2001-TN8200]. These reports concluded that even though the pH of the SLC system varies with temperature, it is generally greater than 6.8 pH which is close to neutral [NUREG/CR-6001; NRC 1992-TN8346]. Additionally, these reports noted that the pH range in SLC systems tends to be between 6.8–8.5 [EPRI Report 1010639; EPRI 2006-TN8195]. This would result in less corrosion of the steel as the corrosion rate of steel tends to decrease with an increasing pH (i.e., more basic) and would need additional impurities (e.g., salts, oxygen) for appreciable corrosion to occur in this environment (Metals

Table 3-5 SRP-SLR, Revision 1, Chapter 3.3, Auxiliary Systems, Differences from SRP-SLR, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of the Change	Technical Basis for Change
		Handbook Desk Edition, 2nd Edition). Additionally, one report found that corrosion rates of carbon and low-alloy steel, when exposed to varying concentrations of boric acid, were relatively low (0.05–1.1 mm/year [0.002–0.045 inches/year]), when the temperature was below 60 °C (140 °F)(EPRI Report 1000975 [EPRI 2001-TN8200]).
Table 3.3-1, Item 265 Table 3.3-1, Item 266	New Table 3.3-1 items.	Two new items on heat exchanger tubes are added to reflect that the Fuel Oil Chemistry program is capable of mitigating reduction of heat transfer for heat exchanger tubes by periodic sampling of fuel oil for contaminants that may cause the reduction of heat transfer due to fouling. The Fuel Oil Chemistry program can manage contaminants that would promote corrosion (e.g., water or microbial activity), particulate concentration, or other contaminants that tested for under ASTM D975 that could contribute to heat exchanger tube fouling. If OE, or plant specific configurations, indicate other fouling mechanisms for a fuel oil environment may be present or the Fuel Oil Chemistry program alone is not sufficient to manage aging, the staff may need to evaluate whether the Fuel Oil Chemistry program is appropriate to manage these aging effects and if a One-Time Inspection is needed for a given plant.
Table 3.3-1, Item 267	New Table 3.3-1 item.	A new item for subliming compounds used as fireproofing/fire barriers is being added because they are materials that are widely used throughout industry and are likely to be cited in future SLRAs. The aging effects and aging mechanisms for subliming compounds used as fireproofing/fire barriers exposed to air are based on the NRC staff's review and approval of applicants' programs for aging management of

Table 3-5 SRP-SLR, Revision 1, Chapter 3.3, Auxiliary Systems, Differences from SRP-SLR, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of the Change	Technical Basis for Change
		fire protection materials listed in previous SLRAs. In addition, the aging effects and aging mechanisms are consistent with Section 6, “Fire Barriers,” of EPRI Report 3002013084, “Long-Term Operations: Subsequent License Renewal Aging Affects for Structures and Structural Components (Structural Tools),” issued November 2018, and those cited by industry as part of SLRA lessons learned activities and public comments on the AMR item. The new item manages loss of material due to abrasion, flaking, and vibration; cracking/delamination due to chemical reaction and settlement; change in material properties due to gamma irradiation exposure; and separation for subliming compounds (Thermo-lag®, Darmatt™, 3M™ Interam™, and other similar materials) exposed to air. The periodic inspections recommended by AMP XI.M26, “Fire Protection,” are capable of detecting these aging effects for these materials.
Table 3.3-1, Item 268	New Table 3.3-1 item.	A new item for cementitious coatings used as fireproofing/fire barriers is being added because they are materials that are widely used throughout industry and are likely to be cited in future SLRAs. The aging effects and aging mechanisms for cementitious coatings used as fireproofing/fire barriers exposed to air are based on the NRC staff’s review and approval of applicants’ programs for aging management of fire protection materials listed in previous SLRAs. In addition, the aging effects and aging mechanisms are consistent with Section 5, “Structural Concrete Members,” and Section 6, “Fire Barriers,” of EPRI

Table 3-5 SRP-SLR, Revision 1, Chapter 3.3, Auxiliary Systems, Differences from SRP-SLR, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of the Change	Technical Basis for Change
		3002013084, and those cited by industry as part of SLRA lessons learned activities and public comments on the AMR item. This item manages loss of material due to abrasion, exfoliation, elevated temperature, flaking, and spalling; cracking/delamination; change in material properties; and separation for cementitious coatings (Pyrocrete, BIO™ K-10 Mortar, Cafecote, and other similar materials) exposed to air.
Table 3.3-1, Item 269	New Table 3.3-1 item.	A new item for silicates used as fireproofing/fire barriers is being added because they are materials that are widely used throughout industry and are likely to be cited in future SLRAs. The aging effects and aging mechanisms for silicates used as fireproofing/fire barriers exposed to air are based on the NRC staff's review and approval of applicants' programs for aging management of fire protection materials listed in previous SLRAs. In addition, the aging effects and aging mechanisms are consistent with Section 6 of EPRI Report 3002013084, and those cited by industry as part of SLRA lessons learned activities and public comments on the AMR item. The new item manages loss of material due to abrasion and flaking; cracking/delamination due to settlement; change in material properties due to gamma irradiation exposure; and separation for silicates (Marinite®, Kaowool™, Cerafiber®, Cera® blanket, or other similar materials) exposed to air. The periodic inspections recommended by AMP XI.M26 are capable of detecting these aging effects for these materials.

Table 3-5 SRP-SLR, Revision 1, Chapter 3.3, Auxiliary Systems, Differences from SRP-SLR, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of the Change	Technical Basis for Change
Table 3.3-1 Items: 017 018 019 020 021 022 025 026 027 028 069 070 071 097 098 099 100 101 124 125 169 170 203 219 236 244 257 265	Removed XI.M32, "One-Time Inspection" from the "Aging Management Program(AMP)/Time Limited Aging Analyses (TLAA)" column.	Changes result from the elimination of mandatory one-time inspections in the XI.M2 "Water Chemistry," XI.M30 "Fuel Oil Chemistry," and XI.M39 "Lubricating Oil Analysis" AMPs, which are called out in the XI.M32 "One-Time Inspection" AMP, using risk insights gained from industry operating experience. None of these four AMPs are being eliminated and the One-Time Inspection AMP is still available for use by any other AMP when needed.

Table 3-6 SRP-SLR, Revision 1, Chapter 3.4, Steam and Power Conversion Systems, Differences from SRP-SLR, Revision 0, and Their Technical Bases

Location of Change	Summary of the Change	Technical Basis for Change
Section 3.4.3.5 Final Safety Analysis Report (FSAR) Supplement	Add reference to the FSAR Supplement information contained in GALL-SLR Table X-01 and Table XI-01.	This information was inadvertently omitted when the FSAR Supplement information was relocated from the SRP-SLR tables to the GALL-SLR tables.
Section 3.4.2.2.2	Revised the last paragraph to state that the applicant may mitigate or prevent cracking due to stress corrosion cracking (SCC) using a barrier coating rather than saying cracking due to SCC does not require management if a barrier	The statement in Section 3.4.2.2.2 that cracking due to SCC does not require management contradicts the statement in SLR-SRP Section A.1.2.1, Item 5, which states that even with a prevention or mitigation program, including a coating, an aging effect should be identified as

Table 3-6 SRP-SLR, Revision 1, Chapter 3.4, Steam and Power Conversion Systems, Differences from SRP-SLR, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of the Change	Technical Basis for Change
	coating is used. Added a statement that the applicant should identify cracking due to SCC as applicable for subsequent license renewal (SLR) and identify the aging management program (AMP) that will be used to manage the integrity of the coating.	applicable for SLR, and the aging management review (AMR) should consider the adequacy of the AMP referencing the prevention or mitigation program (e.g., coating). Section A.1.2.1, Item 5, correctly states the need for an AMP to manage coating integrity.
Section 3.4.3.2.2	Revised the wording in the last paragraph to delete the statement that LOM does not require aging management if a barrier coating is used. Deleted the statement that the reviewer verifies the barrier coating is impermeable.	The statement in Section 3.4.3.2.2 that barrier coatings make aging management unnecessary is inconsistent with Section A.1.2.1, Item 5, which correctly states that an AMP is needed to manage the integrity of the coating that prevents the aging effect. Because an AMP will be used to manage coating integrity, an evaluation of coating permeability is not necessary for this further evaluation (FE) review.
Section 3.4.2.2.3	Revised the last paragraph to state that the applicant may mitigate or prevent loss of material using a barrier coating rather than saying the loss of material does not require management if a barrier coating is used. Added a statement that the applicant should identify loss of material as applicable for SLR and identify the AMP that will be used to manage the integrity of the coating.	The statement in Section 3.4.2.2.3 that loss of material does not require management contradicts the statement in SLR-SRP Section A.1.2.1, Item 5, which states that even with a prevention or mitigation program, including a coating, an aging effect should be identified as applicable for SLR, and the AMR should consider the adequacy of the AMP referencing the prevention or mitigation program (e.g., coating). Section A.1.2.1, Item 5, correctly states the need for an AMP to manage coating integrity.
Section 3.4.3.2.3	Revised the wording in the last paragraph to delete the statement that LOM does not require aging management if a barrier coating is used. Deleted the statement that the reviewer verifies the barrier coating is impermeable.	The statement in Section 3.4.3.2.3 that barrier coatings make aging management unnecessary is inconsistent with Section A.1.2.1, Item 5, which correctly states that an AMP is needed to manage the integrity of the coating that prevents the aging effect. Because an AMP will be used to manage coating integrity, an evaluation of coating permeability is not necessary for this FE review.
Section 3.4.2.2.7	Revised the wording in the last paragraph to clarify that the applicant may mitigate or prevent cracking due to SCC using a barrier coating. Added a statement that the	The purpose of this change is to make the wording about barrier coatings consistent with that of other FE sections that required changes to the coatings discussion.

Table 3-6 SRP-SLR, Revision 1, Chapter 3.4, Steam and Power Conversion Systems, Differences from SRP-SLR, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of the Change	Technical Basis for Change
	applicant should identify cracking due to SCC as applicable for SLR and identify the AMP that will be used to manage the integrity of the coating.	
Section 3.4.3.2.7	Revised the wording in the fourth paragraph to delete the statement that cracking due to SCC does not require aging management if a barrier coating is used. Deleted the statement that the reviewer verifies the barrier coating is impermeable.	The statement in Section 3.4.3.2.7 that barrier coatings make aging management unnecessary is inconsistent with Section A.1.2.1, Item 5, which correctly states that an AMP is needed to manage the integrity of the coating that prevents the aging effect. Because an AMP will be used to manage coating integrity, an evaluation of coating permeability is not necessary for this FE review.
Section 3.4.2.2.9	Revised the wording in the last paragraph to clarify that the applicant may mitigate or prevent LOM using a barrier coating. Added a statement that the applicant should identify LOM as applicable for SLR and identify the AMP that will be used to manage the integrity of the coating.	The purpose of this change is to make the wording about barrier coatings consistent with that of other FE sections that required changes to the coatings discussion.
Section 3.4.2.2.9	Revised the wording to indicate that LOM due to pitting and crevice corrosion need not be managed if the type of aluminum is not susceptible to cracking and plant-specific OE does not reveal any issues related to loss of material due to pitting or crevice corrosion.	During the first revision or ISG to the SRP-SLR, the staff added a provision to the FE sections associated with loss of material due to pitting and crevice corrosion of aluminum components exposed to air or condensation. This change allowed an alternative to conducting a One-Time Inspection to detect loss of material. Loss of material need not be managed if: (a) the aluminum material is not susceptible to cracking and (b) plant-specific OE does not reveal any issues related to loss of material due to pitting or crevice corrosion. The staff included this alternative because: (a) it is unlikely that pitting or crevice corrosion in aluminum components would lead to a loss of intended function and (b) if loss of material has not been identified as an issue after 40 years (the earliest point at which a SLRA can be submitted, it is unlikely that it will lead to a loss of intended function during the subsequent period of extended operation.

Table 3-6 SRP-SLR, Revision 1, Chapter 3.4, Steam and Power Conversion Systems, Differences from SRP-SLR, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of the Change	Technical Basis for Change
		This alternative was not allowed for aluminum materials that are susceptible to SCC because pitting or crevice corrosion might, but not necessarily, be a precursor to cracking.
Section 3.4.3.2.9	Revised the wording in the last paragraph to delete the statement that LOM does not require aging management if a barrier coating is used. Deleted the statement that the reviewer verifies the barrier coating is impermeable.	The statement in Section 3.4.3.2.9 that barrier coatings make aging management unnecessary is inconsistent with Section A.1.2.1, Item 5, which correctly states that an AMP is needed to manage the integrity of the coating that prevents the aging effect. Because an AMP will be used to manage coating integrity, an evaluation of coating permeability is not necessary for this FE review.
Section 3.4.2.2.9	Revised the wording to indicate that loss of material due to pitting and crevice corrosion need not be managed if the type of aluminum is not susceptible to cracking and plant-specific operating experience does not reveal any issues related to loss of material due to pitting or crevice corrosion.	During the first revision/ISG to the SRP-SLR, the staff added a provision to the further evaluation sections associated with loss of material due to pitting and crevice corrosion of aluminum components exposed to air or condensation. This change allowed an alternative to conducting a one-time inspection to detect loss of material. Loss of material need not be managed if: (a) the aluminum material is not susceptible to cracking; and (b) plant-specific operating experience does not reveal any issues related to loss of material due to pitting or crevice corrosion. The staff included this alternative because: (a) it is unlikely that pitting or crevice corrosion in aluminum components would lead to a loss of intended function; and (b) if loss of material has not been identified as an issue after 40 years (the earliest point at which a SLRA can be submitted), it is unlikely that it will lead to a loss of intended function during the subsequent period of extended operation. This alternative was not allowed for aluminum materials that are susceptible to stress corrosion cracking because pitting or crevice corrosion might, but not necessarily, be a precursor to cracking.
Section 3.4.2.4 Section 3.4.3.4	Revised the discussion on the staff's AMP review to focus on verifying the	The revision to the staff's review approach continues to adequately support a

Table 3-6 SRP-SLR, Revision 1, Chapter 3.4, Steam and Power Conversion Systems, Differences from SRP-SLR, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of the Change	Technical Basis for Change
Aging Management Programs	GALL-consistency of the proposed AMPs, as enhanced, rather than directing the staff to explicitly review and document the acceptability of each enhancement in the safety evaluation.	GALL-consistency conclusion for each AMP, but in a manner that removes unnecessarily prescriptive staff direction. This revision enhances the approach initially approved by the Commission in SRM-SECY-99-148, “Credit for Existing Programs for License Renewal” (ML003751930) with the more recent Commission direction in SRM-COMCTH-24-0003, “License Renewal and Subsequent License Renewal Review Expectations” (ML24221A319) to implement review efficiencies. The basis for the staff’s position is also described in response to comment no. 21 in the GALL-SLR Report, Revision 1.
Table 3.4-1, Item 032 Table 3.4-1, Item 033 Table 3.4-1, Item 068	Added malleable iron as an applicable material.	During its review of recent SLRA plant-specific OE, in response to the staff’s observation regarding dark corrosion product layers indicative of graphitic corrosion on the internal surfaces of malleable iron fittings exposed to a closed-cycle cooling water environment (ADAMS Accession No. ML22010A129), the staff has revised guidance documents (i.e., GALL-SLR Report and SRP-SLR) to include malleable iron as a material susceptible to selective leaching.
Table 3.4-1, Item 134	Added “flow blockage due to fouling” as an applicable aging effect/mechanism.	Subsequent to issuance of the GALL-SLR Report, the staff recognized that to be consistent with other GALL-SLR Report items associated with heat exchanger tubes, E-475 should have also cited reduction of heat transfer due to fouling. This is consistent with GALL Report Revision 2 item SP-41 where a material (i.e., stainless steel) that is not susceptible to loss of material (a potential source of fouling products), is susceptible to reduction of heat transfer due to fouling.
Table 3.4-1, Item 135	Added “(Inspection of Internal Surfaces only)” to flow blockage due to fouling.	Flow blockage due to fouling is not an applicable aging effect requiring management for the external environment of polymeric components.
Table 3.4-1, Item 125	Revised the item to include carbon fiber reinforced polymer (CFRP)	The item is revised to include CFRP repaired piping components and credit the

Table 3-6 SRP-SLR, Revision 1, Chapter 3.4, Steam and Power Conversion Systems, Differences from SRP-SLR, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of the Change	Technical Basis for Change
	repaired piping as applicable components and to refer to the new AMP XI.M43, "High Density Polyethylene (HDPE) Piping and Carbon Fiber Reinforced Polymer (CFRP) Repaired Piping.". Added GALL-SLR Item VIII.H.S-484 to item 125.	new AMP XI.M43, "High Density Polyethylene (HDPE) Piping and Carbon Fiber Reinforced Polymer (CFRP) Repaired Piping, to manage the effects of age-related degradation mechanisms that are applicable to HDPE piping and CFRP repaired piping. This new AMP reflects the recent introduction and increasing use of CFRP repaired piping at reactor facilities. The unique aging issues and aging management approaches for CFRP repaired piping and HDPE piping (previously managed by AMP XI.M41) were considered to be most effectively addressed with a dedicated AMP.
Table 3.4-1 Items: 011 012 014 015 016 018 040 041 042 043 044 045 046 083 084 085 114	Removed XI.M32, "One-Time Inspection" from the "Aging Management Program(AMP)/Time Limited Aging Analyses (TLAA)" column.	Changes result from the elimination of mandatory one-time inspections in the XI.M2 "Water Chemistry," XI.M30 "Fuel Oil Chemistry," and XI.M39 "Lubricating Oil Analysis" AMPs, which are called out in the XI.M32 "One-Time Inspection" AMP, using risk insights gained from industry operating experience. None of these four AMPs are being eliminated and the One-Time Inspection AMP is still available for use by any other AMP when needed.

Table 3-7 SRP-SLR, Revision 1, Chapter 3.5, Containments, Structures, and Component Supports, Differences from SRP-SLR, Revision 0, and Their Technical Bases

Location of Change	Summary of the Change	Technical Basis for Change
Section 3.5.2.2.1.2 Section 3.5.3.2.1.2 Section 3.5.2.2.1.7 Section 3.5.3.2.1.7 Section 3.5.2.2.1.8 Section 3.5.3.2.1.8 Section 3.5.2.2.1.9 Section 3.5.3.2.1.9 Section 3.5.2.2.2.1 Section 3.5.3.2.2.1 Section 3.5.2.2.2.2 Section 3.5.3.2.2.2 Section 3.5.2.2.2.3 Section 3.5.3.2.2.3 Section 3.5.2.2.2.6 Section 3.5.3.2.2.6	Modifies SRP-SLR Section 3.5 Further Evaluation sections to manage the effects of aging in concrete for the following: • Reduction of strength and modulus of elasticity due to elevated temperature (>66 degrees Celsius [C](150 degrees Fahrenheit [F]) general: greater than 93 C(200 F) local). •Loss of material (spalling, scaling) and cracking due to freeze-thaw. •Cracking due to expansion from reaction with aggregates. •Increase in porosity and permeability; loss of strength due to leaching of calcium hydroxide and carbonation. •Reduction of strength; loss of mechanical properties due to irradiation (i.e., radiation interactions with material and radiation-induced heating) for boiling-water reactor (BWR) and pressurized-water reactor (PWR) components in question, including those located in inaccessible areas.	Modifications to SRP-SLR Further Evaluation sections provide the option to use plant-specific enhancements to GALL-SLR Report AMP XI.S2, "ASME Section XI Subsection IWL," AMP XI.S6, "Structures Monitoring," or other AMPs in lieu of a plant-specific AMP. The option to use plant-specific enhancements to GALL-SLR Report AMPs increases the efficiency of subsequent license renewal application (SLRA) reviews by limiting the use of AMR "Note E" designations for plant-specific aging management activities when aging effects are managed by a plant-specific AMP.
Section 3.5.2.2.1.5 Section 3.5.3.2.1.5	Modifies SRP-SLR Further Evaluation sections to provide the option to perform a further evaluation based on ASME Code, Section III, Division 1, Subsection NE, fatigue waiver analysis for containment metallic pressure-retaining boundary components that are subject to cyclic loading but have no current licensing basis (CLB) fatigue analysis.	ASME Code, Section III, Division 1, includes provisions to analytically address cumulative fatigue damage (cracking due to cyclic loading) through detailed fatigue analysis or fatigue waiver analysis. If the code criteria for a fatigue waiver are satisfied, then a detailed fatigue analysis is not required. SRP-SLR Section 4.6.1, "Areas of Review," states that ASME Code fatigue analyses and fatigue waiver analyses that are in the CLB may be time-limited aging analyses (TLAAs).

Table 3-7 SRP-SLR, Revision 1, Chapter 3.5, Containments, Structures, and Component Supports, Differences from SRP-SLR, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of the Change	Technical Basis for Change
		The fatigue waiver analysis described in this change is a TLAA, except that it will not be in the CLB at the time of a subsequent license renewal application (SLRA) submittal. It therefore does not meet the sixth criterion of 10 CFR 54.3, “Definitions,” for TLAA, which states that the analysis “[is] contained or incorporated by reference in the CLB.” Nevertheless, as indicated above, performing a fatigue waiver analysis in accordance with the ASME Code is a technically acceptable approach to analytically address the effects of cyclic loading (fatigue aging effects) for containment metallic pressure-retaining boundary components. Therefore, satisfying the six conditions for fatigue waiver analysis in the ASME Code for applicable component materials provides an acceptable technical basis to demonstrate that a detailed fatigue analysis is not required, and cracking due to cyclic loading is not an aging effect requiring management. Therefore, the revised further evaluation section and modified AMR line items in this change provide one acceptable approach to address the aging effect of cracking due to cyclic loading for specific containment metallic pressure-retaining boundary components in lieu of supplemental surface examinations or performing or crediting an appropriate leak-rate test pursuant to Appendix J, “Primary Reactor Containment Leakage Testing for Water-Cooled Power Reactors,” to 10 CFR Part 50 [TN249], “Domestic licensing of production and utilization facilities,” as discussed in GALL-SLR Report AMP XI.S1, “ASME Section XI, Subsection IWE,” for which no CLB fatigue analysis exists at the time of SLRA submittal.
Section 3.5.2.2.2.4	The staff added aluminum Alloy 6063T6 to the list of materials that are not susceptible to SCC.	This is a wrought material alloyed primary with magnesium (Mg) and silicon (Si). It is a moderate strength precipitation hardened aluminum alloy in the peak-aged condition. The strengthening phase precipitated during the artificial aging of Alloy 6063 is Mg_2Si. Generally, 6xxx series alloys have

Table 3-7 SRP-SLR, Revision 1, Chapter 3.5, Containments, Structures, and Component Supports, Differences from SRP-SLR, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of the Change	Technical Basis for Change
		satisfactory SCC resistance and inservice performance. However, some 6xxx series alloys are known to be susceptible to SCC when exposed to certain atypical processing histories. The majority of 6xxx series SCC testing and characterization has been performed on Alloy 6061T6, which is known to be resistant to SCC. Much more limited SCC testing and characterization has been performed on Alloy 6063T6, although results have been consistent with those of Alloy 6061T6. Alloy 6063 is a compositionally leaner version of 6061 that has been optimized for extrusion. The two alloys have the same strengthening mechanism and their nominal Mg/Si ratios are also similar. Therefore, it is expected that the SCC performance is comparable. Additionally, the known inservice performance of aluminum alloy 6063T6 has shown satisfactory SCC resistance across multiple industries. Based on the metallurgical characteristics, available laboratory testing, and known service history, the staff has determined that Alloy 6063T6 is not susceptible to SCC.
Section 3.5.2.2.2.8 Section 3.5.3.2.2.8 Table 3.5-1, Item 102 Table 3.5-1, Item 103	Added new further evaluation (FE) acceptance criteria Section 3.5.2.2.2.8 (and corresponding review procedure Section 3.5.3.2.2.8) to address combined effects of aging associated with radiation exposure of the reactor vessel (RV) structural support assembly (e.g., reduction in fracture toughness of RV steel structural support components and potential loss of intended function for the support assembly as a whole, including nonconcrete, non-metallic, nonferrous components and/or materials). New aging management review (AMR) line items 102 and 103 (notwithstanding those considered additionally by an applicant as	To understand the serviceability of an aged structure, it is important to understand the applicable aging mechanisms, and more importantly, their effects on the ability of that structure to safely operate during the subsequent period of extended operation (SPEO). Reduction in fracture toughness due to irradiation embrittlement (IE) from accumulated neutron exposure through the SPEO could occur in BWR and PWR RV steel structural support components (e.g., RV steel girder and column supports, neutron shield tank, support skirt). Reduction in fracture toughness (and other potentially combined aging effects associated with irradiation such as loss of preload and distortion) could compromise the structural integrity of the above steel structural components and could also result in loss of intended function of the RV structural support assembly, including

Table 3-7 SRP-SLR, Revision 1, Chapter 3.5, Containments, Structures, and Component Supports, Differences from SRP-SLR, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of the Change	Technical Basis for Change
	plant-specific AMRs) associated with the new FE and corresponding references are also added to SRP-SLR Table 3.5-1. As a result of public comments, the staff clarifies the use of NUREG-1509 generic nil-ductility temperature values by adding specificity as to when the generic values may be used. As a result of public comments, the staff is changing the threshold value at which neutron damage could be a concern from a value of 2×10^{-5} dpa to a value of 1×10^{-4} dpa.	related nonconcrete, non-metallic, components or materials (e.g., Lubrite in sliding surfaces of the assembly) and nonconcrete, nonferrous components or materials (e.g., manganese bronze alloy). To address the above concerns, a new FE acceptance criteria, Section 3.5.2.2.2.8, and corresponding review procedures Section 3.5.3.2.2.8, are added to determine whether plant-specific AMP or plant-specific enhancements to selected GALL-SLR AMPs are needed to manage the effects of aging due to combined mechanisms that could lead to loss of intended function, for example those attributed to irradiation, corrosive media (boric acid), large temperature variations, cyclic loading, and stress, in steel and related nonconcrete, non-metallic, nonferrous components of the RV structural support assembly for the SPEO. New AMR line Items 102 and 103 (not withstanding those added by applicants as plant-specific AMRs) associated with the FE are also added to SRP-SLR Table 3.5-1. The criteria and technical evaluation procedures (with the exception of the structural consequence analysis in Section 4.5) in NUREG-1509 “Radiation Effects on Reactor Pressure Vessel Supports, May 1996” provide one acceptable methodology for performing a FE for IE of the RV steel structural support components. Alternatively, applicant proposed methodologies are acceptable on the basis that comprehensive inspections and examinations of the RV structural support assembly noted above precede and are included on an ongoing basis in the recommended FE analysis subject to GALL-SLR guidance and the ASME Code requirements. As a result of public comments, the staff clarifies that if the initial nil-ductility transition temperature (NDTT) values of the

Table 3-7 SRP-SLR, Revision 1, Chapter 3.5, Containments, Structures, and Component Supports, Differences from SRP-SLR, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of the Change	Technical Basis for Change
		plant-specific support materials are available, then the plant-specific values should be used. If plant-specific initial NDTT values are not available, and if the plant-specific support material is one of the types/grades of steels in Table 4-2 of NUREG-1509, the generic initial NDTT values in Table 4-1 of NUREG-1509 may be used with 1.3 times the standard deviation. If plant-specific initial NDTT values are not available, and if the plant-specific support material is not one of the types/grades of steels in Table 4-2 of NUREG-1509, the generic initial NDTT values in Table 4-1 of NUREG-1509 with 1.3 times the standard deviation may be used provided that justification is included (e.g., chemical composition, mechanical properties, manufacturing process, fracture toughness, initial NDTT values from published sources) that demonstrates the plant-specific support material is similar to the corresponding type/grade of steel in Table 4-2 of NUREG-1509. As a result of public comments, the staff is changing the threshold value at which neutron damage could be a concern from a value of 2×10^{-5} dpa to a value of 1×10^{-4} dpa because below 1×10^{-4} dpa, embrittlement shift due to neutron irradiation is insignificant for RV steel structural supports.
Table 3.5-, Item 027	Column, “Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Item,” revise to change the word from “and” to “or.”	The word “and” is changed to “or” to make the wording for the AMR line items consistent with the corresponding description in the “detection of aging effects” program element of GALL-SLR AMP XI.S1 with regard to managing the aging effect of cracking due to cyclic loading (CLB fatigue analysis does not exist) for each of the components specified in the AMR item.
Section 3.5.2.2.2.7 Section 3.5.3.2.2.7 Table 3.5-1, Item 101	Added new “Further Evaluation” Section to address loss of material, and/or changes in material properties of wooden poles due to	The staff added wooden poles as a new structural component requiring an AMR since current guidance does not provide recommendations to

Table 3-7 SRP-SLR, Revision 1, Chapter 3.5, Containments, Structures, and Component Supports, Differences from SRP-SLR, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of the Change	Technical Basis for Change
	weathering, chemical degradation, insect infestation, repeated wetting and drying, or fungal decay.	adequately manage aging effects for this component. During recent SLRAs, licensees identified standing wooden poles as a structural component within the scope of SLR that required AMR. However, the lack of a clear guidance has resulted in inefficiencies during the review process, in part, because industry's recommendations and guidelines for the inspections of wooden poles are different from those normally recommended by the GALL-SLR Report for other structural components. Wooden poles are generally used on site for power distribution and function as structural supports for utility line distribution, or for support of other essential electrical components (e.g., cables, power conductors, pole transformers) with a safety-related function or a function related to NRC regulations such as station blackout. These wooden poles, typically, are treated with wood preservatives that protect them from deterioration. Although, these preservatives typically have a limited life expectancy, it is possible to significantly increase the service life of wooden poles through inspections, remediations, and management of prevalent aging effects. For plants entering the subsequent period of extended operation, it is expected that these wooden poles will remain in service past the service life of the original preservative and therefore will be susceptible to deterioration. Thus, a plant-specific AMP or plant-specific enhancements to an existing AMP is recommended to adequately manage the aging effects in wooden poles for the loss of material, and/or changes in material properties due to weathering, chemical degradation, insect infestation, repeated wetting and

Table 3-7 SRP-SLR, Revision 1, Chapter 3.5, Containments, Structures, and Component Supports, Differences from SRP-SLR, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of the Change	Technical Basis for Change
		drying, or fungal decay during the subsequent period of extended operation. Decay of wooden poles is usually a gradual deterioration caused by fungi and other low forms of plant life. In most cases, the decay of wooden poles will be just below the groundline where the conditions of moisture, temperature and air are most favorable for the loss of material, and/or changes in material properties due to growth of fungi and other deteriorations due to the site-specific environmental conditions. Factors affecting the service life of wooden poles are the species of wood, type and thoroughness of treatment, geographical location, and soil conditions. Since these factors are considered site-specific, it is recommended to develop FE criteria to adequately address the site-specific conditions and establish criteria for a plant-specific AMP or plant-specific enhancements to an existing AMP required to manage the effects of aging for wooden poles during the subsequent period of extended operation. It is expected that the type and frequency of periodic inspections will vary by region and be determined based on site-specific conditions. Although visual inspection might be considered a good first step, visual inspection alone will not detect majority of defective wooden poles since most decay tends to occur underground and/or internally. Thus, the use of existing AMP, such as the Structures Monitoring program, needs to be enhanced with additional inspection methods, frequency, and acceptance criteria to adequately detect and manage the effects of aging for wooden poles before there is a loss of intended function.

Table 3-7 SRP-SLR, Revision 1, Chapter 3.5, Containments, Structures, and Component Supports, Differences from SRP-SLR, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of the Change	Technical Basis for Change
Section 3.5.2.4 Section 3.5.3.4 Aging Management Programs	Revised the discussion on the staff's AMP review to focus on verifying the GALL-consistency of the proposed AMPs, as enhanced, rather than directing the staff to explicitly review and document the acceptability of each enhancement in the safety evaluation.	The revision to the staff's review approach continues to adequately support a GALL-consistency conclusion for each AMP, but in a manner that removes unnecessarily prescriptive staff direction. This revision enhances the approach initially approved by the Commission in SRM-SECY-99-148, "Credit for Existing Programs for License Renewal" (ML003751930) with the more recent Commission direction in SRM-COMCTH-24-0003, "License Renewal and Subsequent License Renewal Review Expectations" (ML24221A319) to implement review efficiencies. The basis for the staff's position is also described in response to comment no. 21 in the GALL-SLR Report, Revision 1.
Section 3.5.3.5 Final Safety Analysis Report (FSAR) Supplement	Add reference to the FSAR Supplement information contained in GALL-SLR Table X-01 and Table XI-01.	This information was inadvertently omitted when the FSAR Supplement information was relocated from the SRP-SLR tables to the GALL-SLR tables.
Section 3.5.6	Added the following references. 1) NUREG-1509, "Radiation Effects on Reactor Pressure Vessel Supports," U.S. Nuclear Regulatory Commission, Washington DC, May 1996. 2) ASME Code, Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," Nonmandatory Appendix A, "Analytical Evaluation of Flaws," New York, New York: The American Society of Mechanical Engineers, 1989 Edition up to Edition incorporated by reference in 10 CFR 50.55a. 3) ASTM E693-17, "Standard Practice for Characterizing Neutron Exposures in Iron and	New references are added for the new FE Sections 3.5.2.2.2.7 and 3.5.3.2.2.7 in SRP-SLR to address combined aging effects associated with irradiation of RV steel structural support assembly components.

Table 3-7 SRP-SLR, Revision 1, Chapter 3.5, Containments, Structures, and Component Supports, Differences from SRP-SLR, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of the Change	Technical Basis for Change
	Low Alloy Steels in Terms of Displacement Per Atom (DPA),” ASTM International.	
Table 3.5-1, Item 003 Table 3.5-1, Item 011 Table 3.5-1, Item 012 Table 3.5-1, Item 014 Table 3.5-1, Item 042 Table 3.5-1, Item 043 Table 3.5-1, Item 047 Table 3.5-1, Item 048 Table 3.5-1, Item 049 Table 3.5-1, Item 050 Table 3.5-1, Item 051 Table 3.5-1, Item 097	Modified to provide the option to use plant-specific enhancements to GALL-SLR Report AMP XI.S2, “ASME Section XI, Subsection IWL,” and/or GALL-SLR Report AMP XI.S6, “Structures Monitoring,” in lieu of a plant-specific AMP.	The option to use plant-specific enhancements increases the efficiency of subsequent license renewal application reviews by limiting the use of AMR “Note E” designations for plant-specific aging management activities when aging effects are managed through a plant-specific AMP.
Table 3.5-1, Item 027 Table 3.5-1, Item 040	Added a recommended Further Evaluation section.	Modification reflects the updated SRP-SLR Section 3.5.2.2.1.5 Further Evaluation section.
Table 3.5-1, Item 054	Updated the applicable GALL-SLR Report items.	Item III.A6.TP-25 was deleted since it is a duplicate to GALL-SLR Item no. III.A6.T-34. In addition, this GALL-SLR item is associated with Group 6 structures and the associated SRP-SLR AMR item (i.e., Table 3.5-1, 054) is only intended to address all groups of structures, except Group 6.

Table 3-8 SRP-SLR, Revision 1, Chapter 3.6, Electrical and Instrumentation Controls, Differences from SRP-SLR, Revision 0 and Their Technical Bases

Location of Change	Summary of the Change	Technical Basis for Change
Section 3.6.2.4 Section 3.6.3.4 Aging Management Programs	Revised the discussion on the staff's AMP review to focus on verifying the GALL-consistency of the proposed AMPs, as enhanced, rather than directing the staff to explicitly review and document the acceptability of each enhancement in the safety evaluation.	The revision to the staff's review approach continues to adequately support a GALL-consistency conclusion for each AMP, but in a manner that removes unnecessarily prescriptive staff direction. This revision enhances the approach initially approved by the Commission in SRM-SECY-99-148, "Credit for Existing Programs for License Renewal" (ML003751930) with the more recent Commission direction in SRM-COMCTH-24-0003, "License Renewal and Subsequent License Renewal Review Expectations" (ML24221A319) to implement review efficiencies. The basis for the staff's position is also described in response to comment no. 21 in the GALL-SLR Report, Revision 1.
Section 3.6.3.5 Final Safety Analysis Report (FSAR) Supplement	Add reference to the FSAR Supplement information contained in GALL-SLR Table X-01 and Table XI-01.	This information was inadvertently omitted when the FSAR Supplement information was relocated from the SRP-SLR tables to the GALL-SLR tables.
Table 3.6-1, Item 002	Added toughened glass, polymers, silicone rubber, fiber glass, and aluminum alloy to the list of applicable materials and clarified that loss of material is applicable to metallic connectors.	Modified to incorporate industry operating experience to enhance aging management of high voltage insulators to include additional susceptible materials (toughened glass; polymers silicone rubber; fiberglass, aluminum alloy).
Table 3.6-1, Item 003	Added toughened glass, polymers, silicone rubber, fiber glass, and aluminum alloy as applicable materials and added peeling of silicone rubber sleeves for polymer insulators or degradation of glazing on porcelain insulators as applicable aging effects or mechanisms.	Modified to incorporate industry operating experience to enhance aging management of high voltage insulators to include additional susceptible materials (toughened glass; polymers silicone rubber; fiberglass, aluminum alloy) and aging effects (peeling of silicone rubber sleeves for polymer insulators; or glazing degradation for porcelain insulators).

Table 3-9 SRP-SLR, Revision 1, Chapter 4.1, Identification of Time-Limited Aging Analyses, Differences from SRP-SLR, Revision 0, and Their Technical Bases

Location of Change	Summary of the Change	Technical Basis for Change
No changes from SRP-SLR, Revision 0, to SRP-SLR Revision 1.		

Table 3-10 SRP-SLR, Revision 1, Chapter 4.2 (Neutron Irradiation Embrittlement) Differences from SRP-SLR, Revision 0, and Their Technical Bases

Location of Change	Summary of the Change	Technical Basis for Change
SRP-SLR Section 4.2: Reactor Pressure Vessel Neutron Embrittlement Analysis		
Section 4.2.1, Areas of Review	Section 4.2.1 was revised to provide details from Regulatory Issue Summary (RIS) 2014-11 and to ensure coordination between the U.S. Nuclear Regulatory Commission (NRC) staff review of time-limited aging analyses (TLAAs) related to reactor pressure vessel (RPV) embrittlement.	Revision to Section 4.2.1 to provide context from RIS 2014-11 in terms of the traditional geometric beltline as defined in 10 CFR Part 50 [TN249], Appendix G, and all other reactor vessel (RV) ferritic materials with projected neutron fluence values greater than 1×10^{17} Newton per square centimeter (N/cm^2) (E > 1 MeV). Additionally, Section 4.2.1 was revised to acknowledge the common use of material properties, copper and nickel content values for RV materials in several RPV embrittlement TLAAs and provide guidance to ensure coordination between the NRC staff reviews.
Section 4.2.3.1.2.1 10 CFR 54.21(c)(1)(i) Section 4.2.3.1.2.2 10 CFR 54.21(c)(1)(ii)	Section 4.2.3.1.2.1 was revised to provide additional guidance to the NRC staff to ensure the appropriate disposition of upper-shelf energy TLAA based on the different circumstances. Section 4.2.3.1.2.2 was revised to provide additional context and guidance for the NRC staff review of USE TLAAs.	Revision to Section 4.2.3.1.2.1 and Section 4.2.3.1.2.2 is due to the NRC staff review experience from subsequent license renewal applications (SLRAs). Section 4.2.3.1.2.1 is revised to clarify that the assessment of additional RV materials that were not previously addressed in the current licensing basis (CLB) due to the projected neutron fluence exposure at the end of the subsequent period of extended operation. The assessment of these RV materials constitutes a revision to CLB analysis for USE; thus, a disposition in accordance with 10 CFR 54.21(c)(1)(i) for the USE TLAA of these additional RV materials is not appropriate. Section 4.2.3.1.2.2 was revised to provide additional context and guidance for the NRC staff review of

Table 3-10 SRP-SLR, Revision 1, Chapter 4.2 (Neutron Irradiation Embrittlement) Differences from SRP-SLR, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of the Change	Technical Basis for Change
		USE TLAAs that involve: (1) revision to CLB material property information as part of the application and (2) the inclusion of RV materials not previously addressed in the CLB but are now necessary due to the projected neutron fluence exposure at the end of the subsequent period of extended operation. Additionally, Section 4.2.3.1.2.2 was revised to provide guidance consistent with NRC Regulatory Guide (RG) 1.99, Revision 2. for the NRC staff review of the applicant's use of surveillance data in the USE TLAAs.
Section 4.2.3.1.3.1 10 CFR 54.21(c)(1)(i) Section 4.2.3.1.3.2 10 CFR 54.21(c)(1)(ii)	Section 4.2.3.1.3.1 was revised to provide additional guidance to the NRC staff to ensure the appropriate disposition of pressurized thermal shock (PTS) TLAA based on the different circumstances. Section 4.2.3.1.3.2 was revised to provide additional context and guidance for the NRC staff review of PTS TLAAs.	Revision to Section 4.2.3.1.3.1 and Section 4.2.3.1.3.2 is due to the NRC staff review experience from SLRAs. Section 4.2.3.1.3.1 is revised to clarify that the assessment of additional RV materials that were not previously addressed in the CLB due to the projected neutron fluence exposure at the end of the subsequent period of extended operation. The assessment of these RV materials constitutes a revision to CLB analysis for PTS; thus, a disposition in accordance with 10 CFR 54.21(c)(1)(i).for the PTS TLAA of these additional RV materials is not appropriate. Section 4.2.3.1.3.2 was revised to provide additional context and guidance for the NRC staff review of PTS TLAAs that involve: (1) revision to CLB material property information as part of the application and (2) the inclusion of RV materials not previously addressed in the CLB but are now necessary due to the projected neutron fluence exposure at the end of the subsequent period of extended operation. Additionally, Section 4.2.3.1.3.2 was revised to provide guidance consistent with 10 CFR 50.61 [TN249] and NRC Regulatory Guide 1.99, Revision 2. for the NRC staff review of the applicant's use of surveillance data in the PTS TLAAs.

Table 3-10 SRP-SLR, Revision 1, Chapter 4.2 (Neutron Irradiation Embrittlement) Differences from SRP-SLR, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of the Change	Technical Basis for Change
Section 4.2.3.1.4, Pressure-Temperature Limits	Section 4.2.3.1.4 was revised to provide additional details and guidance related to adjusted reverence temperature, which are used for determining “Pressure-Temperature Limits”.	Revision to Section 4.2.3.1.4 is due to the NRC staff review experience from SLRAs. Based on past experience, some applicants have provided a TLAA for Adjusted Reference Temperature. However, there is not specific acceptance criteria or limits for adjusted reference temperature; rather it is a key input for Pressure-Temperature Limits. As such, Section 4.2.3.1.4 is revised to include additional background and guidance in the event Adjusted Reference Temperature is identified as a TLAA in the SLRAs. This additional guidance is consistent with the guidance established in SRP-SLR Sections 4.2.3.1.2.2 and 4.2.3.1.3.2 for USE and PTS TLAAs, respectively, and NRC Regulatory Guide 1.99, Revision 2, due to the common use of material properties, copper and nickel content values for RV materials in these reactor pressure vessel embrittlement analyses.
Section 4.2.3.1.5, Elimination of Boiling Water Reactor Circumferential Weld Inspections (Acceptance Criteria) Section 4.2.3.1.5, Elimination of Boiling Water Reactor Circumferential Weld Inspections (Review Procedures)	Sections 4.2.2.1.5 and 4.2.3.1.5 were revised to incorporate the guidance from Boiling Water Reactor Vessel and Internals Project (BWRVIP)-329-A, “BWR Vessel and Internals Program, Updated Probabilistic Fracture Mechanics Analyses for BWR RPV Welds to Address Extended Operations” as it relates to boiling water reactor (BWR) circumferential weld inspections.	BWRVIP-329-A is an NRC-approved topical report. The purpose of BWRVIP-329-A is to use NRC safety goals and probabilistic fracture mechanics analysis procedures that have been developed since the publication of BWRVIP-05 to update the evaluation procedure and acceptance criteria specified in BWRVIP-74-A for providing relief from examination of circumferential welds. The results of this report identify the combinations of beltline material conditions for the BWR fleet that will ensure regulatory safety goals are satisfied for the postulated transient. The results from this report can be used to demonstrate that RPV in the BWR fleet have margins against failure that satisfy regulatory criteria through at least an 80-year operating interval for the postulated, low temperature isothermal pressure transient.

Table 3-10 SRP-SLR, Revision 1, Chapter 4.2 (Neutron Irradiation Embrittlement) Differences from SRP-SLR, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of the Change	Technical Basis for Change
Section 4.2.2.1.6 Boiling Water Reactor Axial Welds (Acceptance Criteria) Section 4.2.3.1.6 Boiling Water Reactor Axial Welds (Review Procedures)	Sections 4.2.2.1.6 and 4.2.3.1.6 were revised to incorporate the guidance from BWRVIP-329-A, "BWR Vessel and Internals Program, Updated Probabilistic Fracture Mechanics Analyses for BWR RPV Welds to Address Extended Operations" as it relates to boiling water reactor axial welds.	The BWRVIP-329-A is an NRC-approved topical report. The purpose of BWRVIP-329-A is to use NRC safety goals and probabilistic fracture mechanics analysis procedures that have been developed since the publication of BWRVIP-05 to update the evaluation procedure and acceptance criteria specified in BWRVIP-74-A for assessing axial weld integrity. The results of this report identify the combinations of beltline material conditions for the BWR fleet that will ensure regulatory safety goals are satisfied for the postulated transient. The results from this report can be used to demonstrate that RPV in the BWR fleet have margins against failure that satisfy regulatory criteria through at least an 80-year operating interval for the postulated, low temperature isothermal pressure transient.
Section 4.2.2.1.4.3 of 10 CFR 54.21(c)(1)(iii) *4.2.3.1.4.3 10 CFR 54.21(c)(1)(iii)*	Section 4.2.2.1.4.3 was revised to clarify the circumstances in which pressure-temperature limits would be updated to account for the subsequent period of extended operation. Section 4.2.3.1.4.3 was revised to clarify the circumstances in which P-T limits would be updated to account for the subsequent period of extended operation.	Revision to Sections 4.2.2.1.4.3 and 4.2.3.1.4.3 are due to the NRC staff review experience from SLRAs. Current guidance in these sections of the SRP-SLR could be interpreted that updated P-T limits must be established under the appropriate regulatory process prior to the plant's entry into the subsequent period of extended operation even if the current terms of applicability for the P-T limits have not been exceeded.

Table 3-11 SRP-SLR, Revision 1, Chapter 4.3, Metal Fatigue, Differences from SRP-SLR, Revision 0, and Their Technical Bases

Location of Change	Summary of the Change	Technical Basis for Change
Section 4.3.2.1.2 *10 CFR 54.21(c)(1)(ii)* 4.3.3.1.2.2 *10 CFR 54.21(c)(1)(ii)* 4.3.5 References Table 4.3-1	NUREG/CR-6909, Revision 1 provides technical bases for RG 1.207, Revision 1. Both NUREG/CR-6909, Revision 1 and RG 1.207, Revision 1 were published after the publication of SRP-SLR, Revision 0. Accordingly, the outdated footnotes that state, "If and when published as RG 1.207, Revision 1 Final" are removed in SRP-SLR, Revision 1. NUREG/CR-6909, Revision 1 is referenced as the latest guidance for EAF analyses in SRP-SLR, Revision 1. Consistent changes are made in GALL-SLR AMP X.M1, "Fatigue Monitoring," in GALL-SLR, Revision 1.	NUREG/CR-6909, Revision 1 describes the fatigue design curves and environmental fatigue correction factor (Fen) equations for the calculation of environmentally adjusted cumulative usage factor (CUFen) based on the recent fatigue test data. This report also serves as a technical basis document for RG 1.207, Revision 1 that provides the latest guidance for evaluating the environmental effects on the metal fatigue in nuclear power plant components. Therefore, NUREG/CR-6909, Revision 1 and RG 1.207, Revision 1 will be referenced as the latest guidance for EAF analyses in SRP-SLR, Revision 1 and GALL-SLR Revision 1.

Table 3-12 SRP-SLR, Revision 1, Chapter 4.4, Environmental Qualification of Electrical Equipment, Differences from SRP-SLR, Revision 0, and Their Technical Bases

Location of Change	Summary of the Change	Technical Basis for Change
No changes from SRP-SLR, Revision 0, to SRP-SLR, Revision 1.		

Table 3-13 SRP-SLR, Revision 1, Chapter 4.5, Concrete Containment Unbonded Tendon Prestress Analysis, Differences from SRP-SLR, Revision 0, and Their Technical Bases

Location of Change	Summary of the Change	Technical Basis for Change
No changes from SRP-SLR, Revision 0, to SRP-SLR, Revision 1.		

Table 3-14 SRP-SLR, Revision 1, Chapter 4.6, Containment Liner Plate, Metal Containments, and Penetrations Fatigue Analysis, Differences from SRP-SLR, Revision 0, and Their Technical Bases

Location of Change	Summary of the Change	Technical Basis for Change
No changes from SRP-SLR, Revision 0, to SRP-SLR, Revision 1.		

Table 3-15 SRP-SLR, Revision 1, Chapter 4.7, Plant-Specific TLAA, Penetrations Fatigue, Differences from SRP-SLR, Revision 0, and Their Technical Bases

Location of Change	Summary of the Change	Technical Basis for Change
Table 4.7-1	The staff added “EPRI MRP Cycle-based and Fluence-Based Analyses in Support of MRP-227” as an additional example of a potential, plant-specific time-limited aging analyses (TLAA) for PWR-design nuclear plants.	In the license renewal application (LRA) for the Waterford Nuclear Plant, the licensee identified the supporting MRP analyses in the MRP-191, Revision 1 report as a plant-specific TLAA for the LRA. The licensee used its PWR Vessel Internals Program and the RVI component-specific inspection and evaluation criteria called out in the MRP-227-A report to disposition the TLAA in accordance with the TLAA acceptance criterion in 10 CFR 54.21(c)(1)(iii). The addition of this type of TLAA to the list of potential, plant-specific TLAAs for PWR-designed facilities accounts for the possibility that some LRA or SLRA applicants may identify these types of analysis as plant-specific TLAAs for their LRAs or SLRAs.
Section 4.7.4 Section 4.7.5 Section 4.7.6 Table 4.7-1	SRP-SLR Sections 4.7.4, “Evaluation Findings” and 4.7.5, “References” for the other plant-specific TLAAs are renumbered to Sections 4.7.5 and 4.7.6, respectively. Relevant references are also added in the renumbered Section 4.7.6, “References.” The new SRP-SLR Section 4.7.4 is added to provide additional guidance for the TLAA reviews within the scope of SRP-SLR Section 4.7. Specifically, Sections 4.7.4.1 and 4.7.4.2 are added to provide specific guidance for the review of a leak-before-leak (LBB) TLAA and a pump casing flaw tolerance TLAA, respectively.	The SRP-SLR Section 4.7 describes the SLR review plan for the other plant-specific TLAAs (i.e., TLAAs other than those addressed in SRP-SLR Sections 4.1 through 4.6). The SRP-SLR Sections 4.7.1, 4.7.2 and 4.7.3 provide general guidance for the areas of review, acceptance criteria, and review procedures for the TLAA reviews, respectively. However, these sections do not address guidance that pertains to specific TLAAs within the scope of SRP-SLR Section 4.7. Recently, the U.S. Nuclear Regulatory Commission (NRC) staff reviewed subsequent license renewal (SLR) applications for the first time and noted that the applications included LBB TLAAs and cast austenitic stainless steel (CASS) pump casing flaw tolerance TLAAs. Currently, the SRP-SLR does not include specific guidance for the review of these TLAAs. Therefore, new SRP-SLR sections are

Table 3-15 SRP-SLR, Revision 1, Chapter 4.7, Plant-Specific TLAA, Penetrations Fatigue, Differences from SRP-SLR, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of the Change	Technical Basis for Change
		added to provide specific guidance for the review of an LBB TLAA and a CASS pump casing flaw tolerance TLAA. The guidance for the LBB TLAA is based on SRP (NUREG–0800 [NRC 2007-TN613]) Section 3.6.3. The guidance for the pump casing flaw tolerance TLAA is based on the provisions in ASME Code Case N-481 [ASME 1990-TN8131] with a reference to the NRC staff-approved PWROG-17033-NP-A Report, Revision 1 [WEC 2019-TN8132].
Section 4.7.4.1	SRP-SLR, Revision 1, Section 4.7.4.1, “4.7.4.1 Leak-before-break Analysis,” Item (v) in the final sentence of the third paragraph is changed from “locations of critical cracks” to “critical locations for LBB evaluation.”	Item (v) is one of the examples of the aspects or methods of the LBB analysis that may have been changed from those in the current licensing basis LBB analysis. The wording, “critical locations for LBB evaluation,” suggested in the comment may more broadly address the locations of interest in the LBB analysis rather than the current wording, “locations of critical cracks.” Accordingly, the current wording is changed to the wording suggested in the comment.
Section 4.7.4.1	SRP-SLR, Revision 1, Section 4.7.4.1, the final sentence of the fourth paragraph is revised to state as follows. An example of the time-dependent parameters and the associated analysis in the LBB TLAA is the fracture toughness of cast austenitic stainless steel (CASS) piping materials due to thermal aging effect.	The final rule (Ref. [1]) regarding the LBB analysis does not require a fatigue crack growth analysis and the existing LBB analysis may or may not include a fatigue crack growth analysis. Therefore, item (ii), which describes a fatigue crack growth analysis as one of the examples for the time-depended aspect of the LBB analysis, is deleted.
Section 4.7.4.2	In SRP-SLR, Rev. 1, Section 4.7.4.2, “Pump Casing Flaw Tolerance Analysis,” The text in the parentheses in the final sentence of the second paragraph will be changed from “fatigue transient cycles, and fatigue crack sizes” to “fatigue crack growth	The recommended editorial changes improve clarity.

Table 3-15 SRP-SLR, Revision 1, Chapter 4.7, Plant-Specific TLAA, Penetrations Fatigue, Differences from SRP-SLR, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of the Change	Technical Basis for Change
	transient cycles, and fatigue crack growth crack sizes.”	

Table 3-16 SRP-SLR, Revision 1, Chapter 5.0, Technical Specification Changes, Differences from SRP-SLR, Revision 0, and Their Technical Bases

Location of Change	Summary of the Change	Technical Basis for Change
No changes from SRP-SLR, Revision 0, to SRP-SLR, Revision 1.		

Table 3-17 SRP-SLR, Revision 1, Appendices A.1, A.2, A.3, and A.4, Differences from SRP-SLR, Revision 0, and Their Technical Bases

Location of Change	Summary of the Change	Technical Basis for Change
Section A.4.2	Appendix A, Section A.4, “Operating Experience for Aging Management Programs,” subsection A.4.2, “Position,” “Areas of Further Review,” “National Association of Corrosion Engineers [NACE]” is replaced with “Association for Materials Protection and Performance [AMPP].” Added footnote “NACE International and the Society for Protective Coatings (SSPC) merged in 2021 and created the Association for Materials Protection and Performance (AMPP).”	This is a strictly administrative change that recognizes the restructuring of the organization responsible for the coating inspector qualifications and the cathodic protection specialist qualification. These qualifications are relevant to, and will continue to be relevant to, the Buried and Underground Piping and Tanks AMP. This change recognizes the validity of current Coating Inspector Level 2 or 3 and Cathodic Protection CP4 qualifications that may be certified as NACE. This change also recognizes the validity of current and future Coating Inspector Level 2 or 3 and Cathodic Protection CP4 qualifications that may be certified as AMPP.
Section A.1.2.3.6	Clarified that AMP acceptance criteria approved by the staff in a prior SLRA review are not necessarily generically applicable to future SLRAs.	This reinforces existing review practices. Any reference to AMP acceptance criteria approved in a prior SLRA should be justified. Precedents can be cited by an applicant, but it should be accompanied by a justification of plant--specific applicability. This is similar to existing guidance for the review of AMP exceptions in NUREG-2192, Section 1.2.1, “Background on the Types of Reviews.”

Table 3-17 SRP-SLR, Revision 1, Appendices A.1, A.2, A.3, and A.4, Differences from SRP-SLR, Revision 0, and Their Technical Bases (Continued)

Location of Change	Summary of the Change	Technical Basis for Change
Section A.1.2.3.7	Clarified that if the cause of degradation is found to be systemic, periodic inspections will commence, but if the degradation is found to be from an assignable non systemic cause, periodic inspections will not be required.	If an inspection result does not meet the acceptance criteria (whether based on the current inspection result or projected degradation), it is appropriate to transition to a periodic program given the potential adverse impact to the SC’s ability to meet its intended function; however, if the cause can be shown to be non-systemic, then other options, such as an additional one-time inspection, can be implemented.

3.5 SRP-SLR Chapter 4 – Time-Limited Aging Analyses (TLAAs)

There are seven subchapters to the SRP-SLR Chapter 4 on generic and plant-specific time-limited aging analyses (TLAAs). Subchapter 4.1 discusses how to recognize when a TLAA may be appropriate, and changes to that subchapter are summarized in Table 3-9, along with the technical bases for these changes. Subchapter 4.2 deals with RV neutron embrittlement; Subchapter 4.3 covers metal fatigue; Subchapter 4.4 discusses the environmental qualification of electrical equipment; Subchapter 4.5 presents a discussion of concrete containment tendon prestress; Subchapter 4.6 discusses inservice local metal containment corrosion analyses; and Subchapter 4.7 discusses other plant-specific safety analyses that may involve other time-limited assumptions. The changes and technical bases for these changes are shown in Table 3-9 through Table 3-15, respectively.

4 CHANGES TO TECHNICAL BASES DOCUMENTED IN INITIAL NUREG-2221

After the issuance of the initial NUREG-2221, U.S. Nuclear Regulatory Commission (NRC) staff made revisions to either the “Summary of Significant Changes” or “Technical Bases for Changes” information that were documented within NUREG-2221 for certain Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report and Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants (SRP-SLR) changes. These changes do not affect the GALL-SLR Report or SRP-SLR items within the tables of NUREG-2221, but provide a revised summary of significant changes or technical basis to support the change from the GALL Report and SRP-LR to Revisions 0 of the GALL-SLR Report and SRP-SLR. These revised summary of significant changes or technical bases have been made as a result of lessons learned from the staff’s review of subsequent license renewal applications (SLRAs) as all as public comments received during the public comment period.

A summary of specific changes to the “Summary of Significant Changes” or “Technical Bases for Changes” in the initial NUREG-2221 is provided in Table 4-2. The technical bases documented in this Supplement to NUREG-2221 are intended to supersede the technical bases documented in the initial NUREG-2221 for that particular table item. The following describes the information presented in each column of these tables.

Table 4-1 Description of Table Columns for Technical Bases in Initial NUREG-2221

Column Heading	Description
Location of Change	Identifies the location in the initial NUREG-2221 of the applicable change to either or both the Summary of Significant Changes and Technical Bases for Change.
Revised Summary of Changes	Provides the revised summary of the change to supersede the current entry in the initial NUREG-2221. “N/A” means that there a summary of the change is not included for this particular change to the GALL-SLR Report or SRP-SLR. “No change from initial NUREG-2221 entry” means that there is no revision to the current summary in the initial NUREG-2221 table entry.
Revised Technical Bases for Change	Provides the revised technical bases of the change to supersede the current entry in the initial NUREG-2221.

Table 4-2 Changes to Technical Bases in Initial NUREG-2221

Location of Change	Revised Summary of Significant Changes	Revised Technical Bases for Change
Initial NUREG-2221, Table 2-2 III.B1.1.T-36a III.B1.2.T-36a III.B1.3.T-36a III.B1.1.T-36b III.B1.2.T-36b III.B1.3.T-36b III.B1.1.T-36c III.B1.2.T-36c III.B1.3.T-36c III.B2.T-37a III.B3.T-37a III.B4.T-37a III.B5.T-37a III.B2.T-37b III.B3.T-37b III.B4.T-37b III.B5.T-37b III.B2.T-37c III.B3.T-37c III.B4.T-37c III.B5.T-37c	Not applicable (N/A)	The SRP-SLR Section 3.5.2.2.2.4, “Cracking Due to Stress Corrosion Cracking, and Loss of Material Due to Pitting and Crevice Corrosion,” was revised and new line items, T-36 a–c and T-37 a–c were added to address aluminum and stainless steel (SS) support members; welds; bolted connections; and support anchorage to building structure exposed to air or condensation. The basis for the potential for aluminum and SS components to experience loss of material and cracking is established in the GALL-SLR Report and SRP-SLR Supplemental Staff Guidance Document Supplement issued on March 29, 2016, Agencywide Documents Access and Management System (ADAMS) Accession No. ML16041A090 [NRC 2016-TN9439]. An overview of this basis is as follows. The staff concluded that air and condensation environments can be aggressive if halides are present. Halides can be present due to leakage from flanged connections or valve packing through insulation and raw water leakage from flanged connections or valve packing. The staff accepts that pressure boundary leakage would be considered as event driven and not as a potential source to transport halides to the surface of the aluminum component. However, SRP-SLR, Section A.1.2.1 states that, “leakage from bolted connections should not be considered as abnormal events. Although bolted connections are not supposed to leak, experience shows that leaks do occur, and the leakage could cause corrosion.” The outdoor air environment can contain halides due to nearby salted roads, ocean mist, cooling tower fallout if treatment chemicals contain halides, and nearby industrial facilities. Loss of material due to pitting or crevice corrosion, and cracking due to stress corrosion cracking (SCC) of SS components were addressed in GALL Report Revision 2 in Chapters V, VII, and VIII. During the development of the GALL-SLR Report, the staff recognized that SS support members should be addressed in addition to piping system components. As a result, SRP-SLR, Section 3.5.2.2.2.4 was revised and new AMR items were added.

Table 4-2 Changes to Technical Bases in Initial NUREG-2221 (Continued)

Location of Change	Revised Summary of Significant Changes	Revised Technical Bases for Change
		Loss of material of aluminum components was addressed in GALL Report Revision 2 in Chapters V, VII, and VIII by Periodic Inspection programs. During the development of the GALL-SLR Report and SRP-SLR, the staff concluded that cracking of aluminum components should be addressed through a Further Evaluation (FE) Section. During the development of the GALL-SLR Report and SRP-SLR, the staff concluded that it may not be necessary to conduct periodic inspections of aluminum components in order to manage aging effects associated with aluminum components. The staff noted that One-Time Inspections, as described by aging management program (AMP) XI.M32, "One-Time Inspection," for the subsequent license renewal (SLR) period would occur after no less than 50 years of operation. The staff concluded that a One-Time Inspection of aluminum components prior to entry in the subsequent period of extended operation coupled with a search of plant-specific operating experience (OE) related to loss of material of aluminum components would provide sufficient input to determine whether periodic inspections should be conducted. As a result, SRP-SLR, Section 3.5.2.2.2.4 was revised to address loss of material and cracking, and new AMR items were added. If the OE search or one-time inspection results in conducting a periodic inspection of piping, piping components, and tanks, GALL-SLR Report, AMP XI.M36 recommends either surface examinations, American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI VT-1 inspections, or visual inspections where it has been analytically demonstrated that surface cracks can be detected by leakage prior to a crack challenging the structural integrity or intended function of the component. The staff did not include this specificity for the periodic inspection of aluminum and SS support members; welds; bolted connections; and support anchorage to building structure in AMP XI.S3 and AMP XI.S6 because piping, piping components and tanks are less flaw tolerant than supports in that minor through-wall loss of material or cracking will result in leakage. The leakage, in and of itself, may not result in a loss of intended function; however, it could impact

Table 4-2 Changes to Technical Bases in Initial NUREG-2221 (Continued)

Location of Change	Revised Summary of Significant Changes	Revised Technical Bases for Change
		components in the vicinity of the flaw. In contrast, for a support, minor loss of material or cracking that might not be detectable during a walkdown inspection will likely not impact the intended function of the support and the staff has concluded that additional loss of material or crack growth will likely become more evident during periodic inspections of supports. In contrast, the SRP-SLR recommends that one-time inspections for loss of material and cracking of aluminum and SS supports be conducted in accordance with AMP XI.M32. The more rigorous examination techniques cited in AMP XI.M32 can detect minor indications of loss of material and cracking. As a result, in the absence of adverse indications, it is reasonable to conclude that the environmental conditions will not cause loss of material or cracking in the future. If the one-time inspections and plant-specific operation experience (OE) do not reveal loss of material or cracking, no further inspections will be conducted during the subsequent period of extended operation. A less rigorous approach to periodic inspections of supports, as compared to piping, is demonstrated as follows. The ASME Code, Section XI, “Rules for Inservice Inspection of Nuclear Power Plant Components [ASME 2017-TN9258],” Table IWF-2500-1, “Examination Categories,” for Class 1, Class 2, and Class 3 Piping Supports, and Supports Other Than Piping Supports, requires that an owner conduct VT-3 inspections. The purpose of a VT-3, as stated in IWA-2213 is: VT-3 examination is conducted to determine the general mechanical and structural condition of components and their supports by verifying parameters such as clearances, settings, and physical displacements; and to detect discontinuities and imperfections, such as loss of integrity at bolted or welded connections, lose or missing parts, debris, corrosion, wear, or erosion. VT-3 includes examination for conditions that could affect operability or functional adequacy of constant load and spring-type supports.

Table 4-2 Changes to Technical Bases in Initial NUREG-2221 (Continued)

Location of Change	Revised Summary of Significant Changes	Revised Technical Bases for Change
		In contrast, the purpose of VT-1 examinations, as stated in IWA-2211, which are used to inspect pressure retaining components (e.g., nuts; bolts; flange surfaces; internal core support structures; welded attachments to Class 3 vessels, piping, pumps, and valves) is: “VT-1 examination is conducted to detect discontinuities and imperfections on the surface of components, including such conditions as cracks, wear, corrosion, or erosion.” This demonstrates the utilization of a more rigorous inspection methodology for pressure retaining components versus supports.
Initial NUREG-2221, Table 2-17 IV.D1.RP-367 IV.D1.RP-385 IV.D2.RP-185	N/A	The previous line items stated that the AMP in GALL AMP XI.M2, “Water Chemistry,” may be used to manage any cracking that may occur in the components as a result of these types of aging mechanisms, as assessed in conjunction with the further evaluation (FE) of “Acceptance Criteria” and “Review Procedure” guidelines in Sections 3.1.2.2.11 and 3.1.3.2.1.11 of the SRP-LR Revision 2 report and their subsections. The FE criteria basically recommended that the applicants perform an evaluation of these steam generator (SG) components to determine whether additional aging management activities or a plant-specific AMP would need to be implemented (i.e., in addition to implementation of the Water Chemistry program) in order to ensure adequate detection and management of cracking that may occur in the divider plates and tube-to-tubesheet welds during the period of extended operation. The aging management review (AMR) Item No. 025 in Table 3.1-1 of the SRP-SL Revision 2 report referenced the following AMR items in NUREG–1801, Revision 2 for aging management: (a) AMR Item IV.D1.RP-367 for primary side divider plates in recirculating steam generators that are made from either nickel alloy materials or steel with nickel alloy cladding and are exposed to a reactor coolant environments, (b) AMR Item IV.D1.RP-385 for the tube-to-tubesheet welds in recirculating steam generators that are made from nickel alloy materials and are exposed to a reactor coolant environment, and

Table 4-2 Changes to Technical Bases in Initial NUREG-2221 (Continued)

Location of Change	Revised Summary of Significant Changes	Revised Technical Bases for Change
		(c) AMR Item IV.D2.RP-185 for the tube-to-tubesheet welds in once-through SGs that are made from nickel alloy materials and are exposed to a reactor coolant environment. An update of the staff's aging management guidelines for these components were issued in NRC License Renewal Interim Staff Guidance (LR-ISG) No. 2016-01, "Changes to Aging Management Guidance for Various Steam Generator Components," dated November 30, 2016 (ADAMS Accession No. ML16237A383). Therefore, the staff determined that the previous versions of AMR Items IV.D1.RP-367, IV.D1.RP-385, and IV.D2.RP-185 in the GALL Revision 2 report were acceptable for retention in NUREG–2191, but with the need for certain modifications of the line item. Specifically, the staff updated the FE "Acceptance Criteria" guidelines in SRP-SLR Section 3.1.2.2.11 and review procedure guidelines in SRP-SLR 3.1.3.2.11 to be consistent with the changes made to these sections in LR-ISG-2016-01, "Changes to Aging Management Guidance for Various Steam Generator Components,". The AMR Items IV.D1.RP-367, IV.D1.RP-385, and IV.D2.RP-185 were then updated to indicate that the AMPs in GALL-SLR AMP XI.M2, "Water Chemistry," and AMP XI.M19, "Steam Generators," may be used to manage cracking in the components, when coupled to a the staff's FE guidelines in SRP-SLR Section 3.1.2.2.11.1 for the assessment of divider plates in recirculating SGs (i.e., the subject of the AMR in Item IV.D1.RP-367) and in SRP-SLR Section 3.1.2.2.11.2 for the assessment of SG tube-to-tubesheet welds in recirculating and once-through SG designs (i.e., the subject of the AMRs in Items IV.D1.RP-385 and IV.D2.RP-185). AMR Item No. 025 in Table 3.1-1 in Table 3.1-1 of NUREG–2192 was modified accordingly. Under the updated guidelines in LR-ISG-2016-01, implementation of the AMPs in GALL AMP XI.M19, "Steam Generators," and GALL AMP XI.M2, "Water Chemistry," are acceptable bases for managing any cracking that may occur in these components, when subject to and evaluated in accordance with the staff's updated FE acceptance criteria for these components in

Table 4-2 Changes to Technical Bases in Initial NUREG-2221 (Continued)

Location of Change	Revised Summary of Significant Changes	Revised Technical Bases for Change
		SRP-SLR Sections 3.1.2.2.11.1 and 3.1.2.2.11.2. The corresponding review procedures for performing these reviews of these AMR items are given in SRP-SLR Sections 3.1.3.2.11.1 and 3.1.3.2.11.2. The staff added a discussion of plant-specific SG design parameters that should be evaluated against the industry analyses (EPRI 3002002850 [EPRI 2014-TN8060]) to determine whether a given plant is bounded by the industry analyses for SG divider plate cracking. This includes potential use of the checklist in EPRI letter SGMP-IL-16-02 [EPRI 2016-TN11519] to demonstrate that plant-specific parameters are bound by the industry analyses. This is meant to provide clarity to determine whether the industry analyses are "applicable and bounding." Additionally, the reference to a plant-specific AMP was replaced with the One-Time Inspection AMP because the GALL-SLR Report states that a plant-specific AMP "may include a One-Time Inspection that is capable of detecting cracking to verify the effectiveness of the Water Chemistry and Steam Generator programs and the absence of primary water stress corrosion cracking (PWSCC) in the divider plate assemblies." The One-Time Inspection AMP fulfills this recommendation from the GALL-SLR and eliminates the need for a plant-specific AMP to be evaluated.
Initial NUREG-2221, Table 2-29 AMP XI.M19 Steam Generators, Program Description Scope of Program Parameters Monitored or Inspected Detection of Aging Effects Monitoring and Trending Acceptance Criteria	No change from initial NUREG-2221 entry.	Changes were made to this program in a manner consistent with the updated aging management guidance for SG components described in License Renewal Interim Staff Guidance (LR-ISG) 2016-01, "Changes to Aging Management Guidance for Various Steam Generator Components." The technical bases of these changes are described in LR-ISG-2016-01 in detail (ADAMS Accession No. ML16237A383). The associated Federal Register Notice is 81 FR 88276 (December 7, 2016). The LR-ISG-2016-01 also contains the staff's dispositions of public comments for the LR-ISG-2016-01 and indicates that the staff intends to incorporate corresponding changes to the SLR guidance. The technical bases as well as related background information are summarized below.

Table 4-2 Changes to Technical Bases in Initial NUREG-2221 (Continued)

Location of Change	Revised Summary of Significant Changes	Revised Technical Bases for Change
References		The SRP-LR, Revision 2, Sections 3.1.2.2.11 and 3.1.3.2.11, “Cracking due to Primary Water Stress Corrosion Cracking” describe FE regarding PWSCC in SG nickel alloy divider plate assemblies and tube-to-tubesheet welds. The main concern discussed in these FE sections is that, when these components are fabricated with PWSCC-susceptible nickel alloy materials (e.g., Alloy 600/82/182), PWSCC could occur and such cracking could propagate into adjacent reactor coolant pressure boundary components (e.g., SG heads and tubesheets). The FE guidance in the SRP-LR is, in part, based on foreign operating experience that PWSCC occurred in SG divider plate assemblies. In previous license renewal applications (LRAs), applicants typically committed to inspection or analysis approaches that will confirm that PWSCC is not occurring in these components or any potential PWSCC does not affect the integrity or design functions of SG components. Since the development of the FE guidance in the SRP-SLR, the industry performed additional evaluations, tests and analyses regarding operating experience (including inspection results), characterization of material compositions in terms of susceptibility to PWSCC, potential significance of PWSCC to the integrity and design functions of SG components, and inspection activities credible to manage the aging effect. Based on these activities and findings, EPRI submitted to the NRC staff, EPRI 3002002850 [EPRI 2014-TN8060], “Steam Generator Management Program: Investigation of Crack Initiation and Propagation in the Steam Generator Channel Head Assembly.” In its review of the Electric Power Research Institute (EPRI) report and related information, the staff found a need to update the guidance in the SRP-SLR FE sections and GALL AMP XI.M19, “Steam Generators,” as further summarized below. The susceptibility of a material to SCC depends on three main factors: susceptible material, conducive environment, and sufficiently high tensile stress. Therefore, these factors need to be considered in the evaluation of material

Table 4-2 Changes to Technical Bases in Initial NUREG-2221 (Continued)

Location of Change	Revised Summary of Significant Changes	Revised Technical Bases for Change
		susceptibility to PWSCC. The cracks due to PWSCC in divider plate assemblies (foreign operating experience) tend to be very shallow (approximately 0.08 in) and have not grown in depth since detection. These cracks are located in divider plates that were provided primarily by one manufacturer. In addition, the cracks discussed above are believed to have initiated as a result of significant cold work introduced through surface grinding and stub runner distortion primarily attributed to hydrostatic testing of the steam generators. All but one of these instances of PWSCC have been observed in the divider plate assemblies that are approximately 1.3 in thick. Analyses by the industry in the foreign country further indicated that distortion of the stub runner is only expected to occur in thinner divider plates (i.e., 1.3 in thick or less). The foreign operating experience (OE) also indicates that fabrication issues (e.g., a misalignment between the stub runner plate and the divider plate after welding and subsequent realignment) may cause additional residual stresses and strains. The U.S. industry has performed analyses assuming a fully degraded divider plate assembly. These analyses conclude that the potential degradation does not affect the design functions or safety-related analyses of steam generator components. Based on crack growth and fracture mechanics analyses, cracks due to PWSCC in the divider plate assemblies are highly unlikely to affect the integrity of other pressure boundary components (such as the channel head and tube-to-tubesheet welds). The inservice inspections performed in accordance with Section XI [ASME 2017-TN9258] of ASME Code include periodic volumetric inspections of SG head welds and tubesheet-to-head welds. The examination can confirm the structural integrity of the SG head welds and tubesheet-to-head welds.

Table 4-2 Changes to Technical Bases in Initial NUREG-2221 (Continued)

Location of Change	Revised Summary of Significant Changes	Revised Technical Bases for Change
		With respect to the tube-to-tubesheet welds, the weld chromium content for Alloy 690 tubes and Alloy 82 tubesheet cladding can range from approximately 24 to 26 percent chromium and the weld chromium content for Alloy 690 tubes and Alloy 182 tubesheet cladding can range from approximately 21 to 23 percent. In addition, the SG tubesheet is in compression. The staff has not identified any instances where cracks have been reported in the tubesheet cladding. Although it is unlikely that any inspections looking specifically for cracking have been performed, if cracking were prevalent, it would have most likely been detected during the performance of steam generator tube inspections. Foreign and domestic OE indicates that loss of material due to boric acid corrosion can occur in the steel base material of the steam generator channel head and tubesheet. This OE is discussed in NRC Information Notice 2013-20, “Steam Generator Channel Head and Tubesheet Degradation.” One means to effectively manage this aging effect is to control the reactor water chemistry to mitigate the loss of material due to boric acid corrosion for the base material if the cladding is compromised and to perform periodic visual inspections of the cladded surfaces within the SG to detect anomalous conditions (e.g., rust stains). Based on the discussion above, general visual inspections of steam generator (SG) head interior surfaces (including the divider plates and tubesheets) are necessary as part of the steam generator program. These inspections are intended to identify signs that cracking or loss of material may be occurring (e.g., through identification of rust stains or other abnormal conditions such as distortion of divider plate assembly). As further details are described in LR-ISG-2016-01, the staff finds that, if the industry analyses (EPRI 3002002850 [EPRI 2014-TN8060]) are bounding and applicable to the applicant’s steam generators, use of the One-Time Inspection program may not be necessary to manage cracking of PWSCC for divider plate assemblies

Table 4-2 Changes to Technical Bases in Initial NUREG-2221 (Continued)

Location of Change	Revised Summary of Significant Changes	Revised Technical Bases for Change
		and tube-to-tubesheet welds in accordance with the revised GALL-SLR Report, AMP XI.M19 and SRP-LR FE sections (along with AMP XI.M2, "Water Chemistry"). However, if the industry analyses are not bounded and applicable to the applicant's SGs, use of the One-Time Inspection program may be necessary. The GALL-SLR, AMP XI.M19 and XI.M2 are also used to manage loss of material due to boric acid corrosion for steam generator heads and tubesheets. These bases and changes are consistently applied to the corresponding GALL-SLR Report and SRP-SLR guidance. In addition, the inspection frequency of the general visual inspections added to AMP XI.M19 is also consistent with the maximum inspection interval allowed by the SG tube inspection requirements in Technical Specifications.
Initial NUREG-2221, Table 2-29 AMP XI.M32 One-Time Inspection Parameters Monitored or Inspected (Third Entry)	As revised by Revision 1 to the SLR AMP XI.M32, footnote no. (3), which stated, "Visual inspections conducted to detect potential loss of material or cracking of SS and aluminum alloy support members; welds; bolted connections; support anchorage to building structure exposed to air or condensation (see SRP-SLR Section 3.5.2.2.2.4) may be conducted consistent with those for the GALL-SLR Report AMP XI.S6, 'Structures Monitoring.'" was deleted.	The staff deleted footnote no. (3) because it has concluded that the more rigorous examination techniques cited in AMP XI.M32 should be conducted when periodic inspections will not be conducted during the subsequent period of extended operation. These techniques can detect minor indications of loss of material and cracking. If the One-Time Inspections and plant-specific OE do not reveal loss of material or cracking, periodic inspections will not be conducted during the subsequent period of extended operation. As a result, it is important to demonstrate that the environment conditions will not promote loss of material or cracking by more rigorous examination techniques. For a support, minor loss of material or cracking that might not be detectable during a one-time walkdown inspection will likely not impact the intended function of the support; however, the staff has concluded that growth of loss of material or cracking will become more evident during periodic inspections of supports.
Initial NUREG-2221, Table 3-1 Table 3.0-1, as previously given in Chapter 3.0, of	Table 3.0-1 in NUREG–1800 Revision 2, which provided examples of Final Safety Analysis Report (FSAR) Supplements for AMPs, was updated, relocated to the GALL-SLR	The staff updated the FSAR Supplements in Table 3.0-1 for consistency with the AMP updates in Chapter XI of the GALL-SLR Report, or with the FSAR Supplement summary descriptions for these types of AMPs provided in past industry-submitted license renewal applications (LRAs).

Table 4-2 Changes to Technical Bases in Initial NUREG-2221 (Continued)

Location of Change	Revised Summary of Significant Changes	Revised Technical Bases for Change
NUREG–1800, Revision 2	Report Section XI, and renumbered as Table XI 01.	The corresponding table (NUREG-2191, Table XI-01, "FSAR Supplement Summaries for GALL-SLR Report Chapter XI Aging Management Programs,") was not included in the SRP-SLR because the information was not considered to be limited to guidance to the NRC staff reviewers, but related to broader considerations by applicants during their license renewal application development.
Initial NUREG-2221, Table 3-3 Section 3.1.2.2.11, Subsections 1 and 2	These AMR FE subsections provide the staff's acceptance criteria and review procedures for managing PWSCC in pressurized water reactor (PWR) SG divider plate assemblies and tube-to-tubesheet welds made from nickel alloy materials. Some changes were made to the previous versions of these FE guidelines for these components in Section 3.1.2.2.11, Subsections 1 and 2 of NUREG–1800, Revision 2. The AMR FE subsections were revised, to clarify the plant-specific parameters to be evaluated against industry analyses to determine whether a given plant is bounded by industry analyses for SG divider plate assembly cracking. Additionally, reference to a plant-specific AMP for plants that are not bounded is replaced with a reference to the One-Time Inspection AMP.	For the SRP-SLR Section 3.1.2.2.11, Subsection 1 guidelines that apply to PWR SG divider plate assemblies, the staff added additional paragraph guidance and criteria that clarified when a prospective SLRA for a PWR-design with recirculating SGs would need to propose use of the One-Time Inspection AMP, in addition to the Steam Generators and Water Chemistry AMPs, for managing cracking due to PWSCC in their SG divider plate assemblies. For the SRP-SLR Section 3.1.2.2.11, Subsection 1 guidelines that apply to PWR SG divider plate assemblies, the staff added additional guidance on the plant-specific parameters that should be compared to industry analyses that show the analyses are 'applicable and bounding' for a given plant. Additionally, for the SRP-SLR Section 3.1.2.2.11, Items 1 and 2 guidelines, the reference to a plant-specific AMP was replaced with a reference to the One-Time Inspection AMP for applicants that would need to use the One-Time Inspection AMP to verify the effectiveness of the Water Chemistry and Steam Generator AMP for managing cracking due to PWSCC in their SG divider plate assemblies tube-to-tubesheet welds. For the SRP-SLR Section 3.1.2.2.11, Subsection 1 guidelines that apply to PWR SG tube to-tubesheet welds, the staff made some minor technical adjustments of the previous guidelines for managing PWSCC in these weld in Section 3.1.2.2.11, Subsection 2, of the NUREG–1800, Revision 2 report. However, these changes do not alter the general approach for managing PWSCC in PWR tube-to-tubesheet welds.

5 SUPPORTING DOCUMENTATION

Federal Register No. 82 FR 32588, “Final Guidance Documents for Subsequent License Renewal.” Issue 134. Washington, DC: U.S. Nuclear Regulatory Commission. July 2017. 82 FR 32588-TN9861

10 CFR Part 50, Appendix B, “Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants.” Washington, DC: U.S. Nuclear Regulatory Commission. 2019. 10 CFR Part 50-TN249

10 CFR 50.55a, “Codes and Standards.” Washington, DC: U.S. Nuclear Regulatory Commission. 2016. 10 CFR Part 50-TN249

10 CFR Part 54, “Requirements for Renewal of Operating Licenses for Nuclear Power Plants.” Washington, DC: U.S. Nuclear Regulatory Commission. 2016. 10 CFR Part 54-TN4878

10 CFR 54.21, “Contents of Application-Technical Information.” Washington, DC: U.S. Nuclear Regulatory Commission. 2016. 10 CFR Part 54-TN4878

Aluminum Standards and Data 2006, The Aluminum Association, Sheet and Plate Division, Arlington, VA, 2006. AA 2006-TN9862

ANS. Xu, H. and S. Fyfitch. “Fracture of Type 17-4 PH CRDM Lead Screw Male Coupling Tangs.” 11th International Conference on Environmental Degradation of Materials in Nuclear Power Systems-Water Reactors. Stevenson, Washington. American Nuclear Society. 2003. Xu and Fyfitch 2003-TN10975

ASM. Bernard S. Covino, Jr., Sophie J. Bullard. (2006). “Corrosion Rate Probes for Soil Environments,” ASM Handbook Volume 13C, page 115. Covino and Bullard 2006-TN9864

ASME. ASME Code, Section XI, “Rules for Inservice Inspection of Nuclear Power Plant Components.” ASME Boiler and Pressure Vessel Code, 2004 Edition. New York, New York: The American Society of Mechanical Engineers. ASME 2004-TN8121

ASME. Code Case N-889, “Reference Stress Corrosion Crack Growth Rate Curves for Irradiated Austenitic Stainless Steels in Light Water Reactor Environments.” New York, NY: ASME International. July 2018. ASME 2018-TN10976

ASME. ASME Code Section XI, Division 1, Code Case N-716-1, “Alternative Classification and Examination Requirements.” New York, New York: The American Society of Mechanical Engineers. Approval Date January 27, 2013. ASME 2013-TN8107

ASME. ASME Code Case N-481, “Alternative Examination Requirements for Cast Austenitic Pump Casings.” New York, New York: The American Society of Mechanical Engineers. March 1990. ASME 1990-TN8131

ASME. ASME Code Section XI, “Rules for Inservice Inspection of Nuclear Power Plant Components.” New York, New York: The American Society of Mechanical Engineers. 2017. ASME 2017-TN9258

ASME. ASME Code, Section III, Mandatory Appendix XXVI – Rules for Construction of Class 3 Buried Polyethylene Piping. ASME 2021-TN10989

ASTM International. Baboian, Robert. (2005). Corrosion Tests and Standards: Application and Interpretation (2nd Edition). ASTM International. ASTM 2005-TN9865

AWWA. Concrete Pressure Pipe — Manual of Water Supply Practices, M9 (3rd Edition). American Water Works Association (AWWA). 2008. AWWA 2008-TN9869

AWWA. C105, "Polyethylene Encasement for Ductile-Iron Pipe Systems." Denver, Colorado: American Water Works Association. 2010. AWWA 2010-TN9870

AWWA. Fire Hydrants: Installation, Field Testing, and Maintenance, M17 (Fifth Edition). American Water Works Association (AWWA). 2016. AWWA 2016-TN11524

AWWA. PVC Pipe – Design and Installation, M23 (Second Edition). American Water Works Association (AWWA). 2002. AWWA 2002-TN11525

Dominion Energy Virginia. Mark D. Sartain. Dominion Energy Virginia Letter (October 15) to NRC, 18-340, "Surry Power Station Units 1 and 2, Application for Subsequent Renewed Operating Licenses," ADAMS Accession No. ML18291A842. Richmond, VA: Virginia Electric and Power Company. 2018. VEPCO 2018-TN9889

E. H. Spuhler and C. L. Burton, Avoiding Stress-Corrosion Cracking in High-Strength Aluminum Alloy Structures, Alcoa Green Letter, Aluminum Company of America, August 1, 1962, Revised January 1982 Spuhler and Burton 1982-TN11514

EPRI. EPRI 1022863, "Materials Reliability Program: Pressurized Water Reactor Internals Inspection and Evaluation Guidelines (MRP-227-A)." ADAMS Accession No. ML12017A193 (Transmittal letter from the EPRI-MRP) and ADAMS Accession Nos. ML12017A194, ML12017A196, ML12017A197, ML12017A191, ML12017A192, ML12017A195 and ML12017A199, (Final Report). Palo Alto, California: Electric Power Research Institute. December 2011. EPRI 2011-TN8163

EPRI. EPRI 3002005349, "Materials Reliability Program: Pressurized Water Reactor Internals Inspection and Evaluations Guideline (MRP-227 Revision 1-A)." ADAMS Accession No. ML19081A001. Palo Alto, California: Electric Power Research Institute. April 2019. NRC 2019-TN9222

EPRI. EPRI 3002007853 (MRP-146), "Materials Reliability Program: Management of Thermal Fatigue in Normally Stagnant Non-Isolable Reactor Coolant System Branch Lines." Revision 2. Palo Alto, California: Electric Power Research Institute. September 2016. EPRI 2016-TN8114

EPRI. EPRI 1009561, "Materials Reliability Program: Generic Guidance for Alloy 600 Management (MRP-126)." Revision 2. Palo Alto, California: Electric Power Research Institute. November 2004. EPRI 2004-TN9201

EPRI. EPRI 3002013098 (BWRVIP-155), "BWR Vessel and Internals Project: Evaluation of Thermal Fatigue Susceptibility in BWR Stagnant Branch Lines." Revision 1. Palo Alto, California: Electric Power Research Institute. November 2018. EPRI 2018-TN8115

EPRI. EPRI 3002000505, “PWR Pressurized Water Reactor Primary Water Chemistry Guidelines.” Revision 7, Volumes 1 and 2. Palo Alto, California: Electric Power Research Institute. April 2014. EPRI 2014-TN8111

EPRI. EPRI 3002010645, “Pressurized Water Reactor PWR Secondary Water Chemistry Guidelines.” Revision 8. Palo Alto, California: Electric Power Research Institute. September 2017. EPRI 2017-TN8112

EPRI. EPRI 3002018267, “PWR Primary-to-Secondary Leak Guidelines.” Revision 5. Palo Alto, California: Electric Power Research Institute. December 2020. EPRI 2020-TN9259

EPRI. EPRI 3002007856, “Steam Generator In -Situ Pressure Test Guidelines.” Revision 5. Palo Alto, California: Electric Power Research Institute. November 2016. EPRI 2016-TN9260

EPRI. EPRI 3002020909, “Steam Generator Integrity Assessment Guidelines.” Revision 5. Palo Alto, California: Electric Power Research Institute. December 2021. EPRI 2021-TN9262

EPRI. EPRI 3002007572, “Pressurized Water Reactor PWR Steam Generator Examination Guidelines.” Revision 8. Palo Alto, California: Electric Power Research Institute. June 2016. EPRI 2016-TN9267

EPRI. EPRI 1021175, “Recommendations for an Effective Program to Control the Degradation of Buried and Underground Piping and Tanks,” (1016456 Revision 1), Palo Alto, California: Electric Power Research Institute, December 23, 2010. EPRI 2010-TN9463

EPRI. EPRI 3002013084, “Long-Term Operations: Subsequent License Renewal Aging Affects for Structures and Structural Components (Structural Tools).” Palo Alto, California: Electric Power Research Institute. November 2018. EPRI 2018-TN9412

EPRI. BWRVIP-02-A, Revision 2-A (EPRI 1012837), “BWR Vessel and Internals Project, BWR Core Shroud Repair Design Criteria.” Palo Alto, California: Electric Power Research Institute. October 2005. EPRI 2005-TN8299

EPRI. BWRVIP-03, Revision 19 (EPRI 105696-R13002010675), “BWR Vessel and Internals Project, Reactor Pressure Vessel and Internals Examination Guidelines.” Palo Alto, California: Electric Power Research Institute. July 1999. EPRI 2016-TN9960

EPRI. BWRVIP-06, Revision 1-A (EPRI 1019058), “Safety Assessment of BWR Reactor Internals.” Palo Alto, California: Electric Power Research Institute. December 2009. EPRI 2009-TN8300

EPRI. BWRVIP-14-A (EPRI 1016569), “BWR Vessel and Internals Project, Evaluation of Crack Growth in BWR Stainless Steel RPV Internals.” Palo Alto, California: Electric Power Research Institute. September 2008. EPRI 2008-TN8301

EPRI. BWRVIP-16-A (EPRI 1012113), “BWR Vessel and Internals Project, Internal Core Spray Piping and Sparger Replacement Design Criteria.” Palo Alto, California: Electric Power Research Institute. September 2005. EPRI 2005-TN9165

EPRI. BWRVIP-18-A, Revision 12-A (EPRI 1025060), “BWR Vessel and Internals Project, BWR Core Spray Internals Inspection and Flaw Evaluation Guidelines.” Palo Alto, California: Electric Power Research Institute. August 2016. EPRI 2016-TN11515

EPRI. BWRVIP-19-A (EPRI 1012114), “BWR Vessel and Internals Project, Internal Core Spray Piping and Sparger Repair Design Criteria.” Palo Alto, California: Electric Power Research Institute. September 2005. EPRI 2005-TN9166

EPRI. BWRVIP-25, Revision 1-A, (EPRI 107284), “BWR Vessel and Internals Project, BWR Core Plate Inspection and Flaw Evaluation Guidelines.” Palo Alto, California: Electric Power Research Institute. September 2020. EPRI 2020-TN8303

EPRI. BWRVIP-26-A (EPRI 1009946), “BWR Vessel and Internals Project, BWR Top Guide Inspection and Flaw Evaluation Guidelines.” Palo Alto, California: Electric Power Research Institute. November 2004. EPRI 2004-TN8304

EPRI. BWRVIP-38 (EPRI 108823), “BWR Vessel and Internals Project, BWR Shroud Support Inspection and Flaw Evaluation Guidelines.” Palo Alto, California: Electric Power Research Institute. September 1997. EPRI 1997-TN8305

EPRI. BWRVIP-41, Revision 4-A (EPRI 3002014254NP), “BWR Vessel and Internals Project, BWR Jet Pump Assembly Inspection and Flaw Evaluation Guidelines.” Palo Alto, California: Electric Power Research Institute. December 2018. EPRI 2018-TN10970

EPRI. BWRVIP-42-A, Revision 1-A (EPRI 3002010548), “BWR Vessel and Internals Project, BWR LPCI Coupling Inspection and Flaw Evaluation Guidelines.” Palo Alto, California: Electric Power Research Institute. November 2017. EPRI 2017-TN8307

EPRI. BWRVIP-44-A (EPRI 1014352), “BWR Vessel and Internals Project, Underwater Weld Repair of Nickel Alloy Reactor Vessel Internals.” Palo Alto, California: Electric Power Research Institute. August 2006. EPRI 2006-TN9167

EPRI. BWRVIP-45 (EPRI 108707), “BWR Vessel and Internals Project, Weldability of Irradiated LWR Structural Components.” Palo Alto, California: Electric Power Research Institute. June 2000. EPRI 1997-TN9168

EPRI. BWRVIP-47-A (EPRI 1009947), “BWR Vessel and Internals Project, BWR Lower Plenum Inspection and Flaw Evaluation Guidelines.” Palo Alto, California: Electric Power Research Institute. November 2004. EPRI 2004-TN8309

EPRI. BWRVIP-50-A (EPRI 1012115), “BWR Vessel and Internals Project, Top Guide/Core Plate Repair Design Criteria.” Palo Alto, California: Electric Power Research Institute. September 2005. EPRI 2005-TN9169

EPRI. BWRVIP-51-A (EPRI 1012116), “BWR Vessel and Internals Project, Jet Pump Repair Design Criteria.” Palo Alto, California: Electric Power Research Institute. September 2005. EPRI 2005-TN8310

EPRI. BWRVIP-52-A (EPRI 1012119), “BWR Vessel and Internals Project, Shroud Support and Vessel Bracket Repair Design Criteria.” Palo Alto, California: Electric Power Research Institute. September 2005. EPRI 2005-TN8311

EPRI. BWRVIP-55-A (EPRI 1012117), "BWR Vessel and Internals Project, Lower Plenum Repair Design Criteria." Palo Alto, California: Electric Power Research Institute. September 2005. EPRI 2005-TN8371

EPRI. BWRVIP-56-A (EPRI 1012118), "BWR Vessel and Internals Project, LPCI Coupling Repair Design Criteria." Palo Alto, California: Electric Power Research Institute. September 2005. EPRI 2005-TN9170

EPRI. BWRVIP-59-A (EPRI 1014874), "BWR Vessel and Internals Project, Evaluation of Crack Growth in BWR Nickel-Base Austenitic Alloys in RPV Internals." Palo Alto, California: Electric Power Research Institute. May 2007. EPRI 2007-TN8312

EPRI. BWRVIP-60-A (EPRI 1008871), "BWR Vessel and Internals Project, Evaluation of Stress Corrosion Crack Growth in Low Alloy Steel Vessel Materials in the BWR Environment." Palo Alto, California: Electric Power Research Institute. June 2003. EPRI 2003-TN8313

EPRI. BWRVIP-62-A (EPRI 3002014434), "BWR Vessel and Internals Project, Technical Basis for Inspection Relief for BWR Internal Components with Hydrogen Injection." Palo Alto, California: Electric Power Research Institute. May 2019. EPRI 2018-TN8314

EPRI. BWRVIP-76-A, Revision 1-A (EPRI 1022843), "BWR Vessel and Internals Project, BWR Core Shroud Inspection and Flaw Evaluation Guidelines." Palo Alto, California: Electric Power Research Institute. May 2011. EPRI 2011-TN8315

EPRI. BWRVIP-80-A (EPRI 1015457), "BWR Vessel and Internals Project, Evaluation of Crack Growth in BWR Shroud Vertical Welds." Palo Alto, California: Electric Power Research Institute. October 2007. EPRI 2007-TN9171

EPRI. BWRVIP-84, Revision 2-A (EPRI 33002007385), "BWR Vessel and Internals Project, Guidelines for Selection and Use of Materials for Repairs to BWR Internal Components." Revision 2. Palo Alto, California: Electric Power Research Institute. March 2016. EPRI 2016-TN8316

EPRI. EPRI Report 1000975, "Boric Acid Corrosion Guidebook," Revision 1 (Non-Public). EPRI 2001-TN8200

EPRI. BWRVIP-97-A (EPRI 1019054), "BWR Vessel and Internals Project, Guidelines for Performing Weld Repairs to Irradiated BWR Internals." Palo Alto, California: Electric Power Research Institute. June 2009. EPRI 2009-TN8317

EPRI. BWRVIP-99-A (EPRI 1016566), "BWR Vessel and Internals Project, Crack Growth Rates in Irradiated Stainless Steels in BWR Internal Components." Palo Alto, California: Electric Power Research Institute. October 2008. EPRI 2008-TN8318

EPRI. BWRVIP-100-A (EPRI 1013396), "BWR Vessel and Internals Project, Updated Assessment of the Fracture Toughness of Irradiated Stainless Steel for BWR Core Shrouds." Palo Alto, California: Electric Power Research Institute. August 2006. EPRI 2006-TN9997

EPRI. BWRVIP-138, Revision 1-A (EPRI 1025139), "BWR Vessel and Internals Project, Updated Jet Pump Beam Inspection and Flaw Evaluation Guidelines." Palo Alto, California: Electric Power Research Institute. October 2012. EPRI 2012-TN8324

EPRI. BWRVIP-139-A, Revision 1-A (EPRI 3002010541), “BWR Vessel and Internals Project, Steam Dryer Inspection and Flaw Evaluation Guidelines.” Palo Alto, California: Electric Power Research Institute. November 2017. EPRI 2017-TN8325

EPRI. BWRVIP-167NP (EPRI 3002000690) “BWR Vessel and Internals Project Boiling Water Reactor Issue Management Tables.” Revision 1. Palo Alto, California: Electric Power Research Institute. August 2013. EPRI 2013-TN11528

EPRI. BWRVIP-180 (EPRI 1013402), “BWR Vessel and Internals Project, Access Hole Cover Inspection and Flaw Evaluation Guidelines.” Palo Alto, California: Electric Power Research Institute. November 2007. EPRI 2007-TN10974

EPRI. BWRVIP-181-A (EPRI 1020997), “BWR Vessel and Internals Project, Steam Dryer Repair Design Criteria.” Palo Alto, California: Electric Power Research Institute. July 2010. EPRI 2010-TN8329

EPRI. BWRVIP-183-A (EPRI 3002010551), “BWR Vessel and Internals Project, Top Guide Beam Inspection and Flaw Evaluation Guidelines.” Palo Alto, California: Electric Power Research Institute. November 2017. EPRI 2017-TN8331

EPRI. BWRVIP-190 (EPRI 1016579), “BWR Vessel and Internals Project: BWR Water Chemistry Guidelines—2008 Revision.” Palo Alto, California: Electric Power Research Institute. October 2008. EPRI 2008-TN8332

EPRI. BWRVIP-217 (EPRI 1019067), “BWR Vessel and Internals Project, Access Hole Cover Repair Design Criteria.” Palo Alto, California: Electric Power Research Institute. July 2009. EPRI 2009-TN8334

EPRI. BWRVIP-315 (EPRI 3002012535), “BWR Vessel and Internals Project, Reactor Internals Aging Management Evaluation for Extended Operations.” Palo Alto, California: Electric Power Research Institute. July 2019. EPRI 2019-TN8343

EPRI. EPRI 3002000628, “Materials Degradation Matrix.” Revision 13. Palo Alto, California: Electric Power Research Institute. May 2013. EPRI 2013-TN11526

EPRI. “BWR Operating Experience,” presented at the EPRI/NRC Technical Exchange Meeting, May 22-24, 2018, ADAMS Accession Number ML18142A387. EPRI 2018-TN9113

EPRI. Mike Hoehn II. EPRI MRP Letter (September 5) to NRC, MRP 2018-033, ‘Transmittal of NEI-03-08 “Needed” Interim Guidance for PWR CRDM Thermal Sleeve Wear.’ ADAMS Accession No. ML18253A064. Palo Alto, California: Electric Power Research Institute Materials Reliability Program. 2018. EPRI 2018-TN8068

EPRI. Presentation, “Materials Reliability Program: Thermal Fatigue.” ADAMS Accession No. ML19134A143. Palo Alto, California: Electric Power Research Institute. May 21, 2019. EPRI 2019-TN8083

EPRI. EPRI 3002005294, “Soil Sampling and Testing Methods to Evaluate the Corrosivity of the Environment for Buried Piping and Tanks at Nuclear Power Plants.” Palo Alto, California: Electric Power Research Institute. November 6, 2015. EPRI 2015-TN9469

EPRI. EPRI Report 3002002850, “Steam Generator Management Program: Investigation of Crack Initiation and Propagation in the Steam Generator Channel Head Assembly,” dated October 30, 2014 (Non-Public). EPRI 2014-TN8060

EPRI. EPRI TR–107514, “Age Related Degradation Inspection Method and Demonstration.” Palo Alto, California: Electric Power Research Institute. April 1998. EPRI 1998-TN9438

EPRI. EPRI Letter SGMP-IL-16-02, “Guidance for Addressing Aging Management Plans for Steam Generator Channel Head Components,” dated October 10, 2016 (Non-Public). EPRI 2016-TN11519

EPRI. EPRI 1011231, “Recommendations for Controlling Cavitation, Flashing, Liquid Droplet Impingement, and Solid Particle Erosion in Nuclear Power Plant Piping Systems.” Palo Alto, California: Electric Power Research Institute. November 2004. EPRI 2004-TN9223

EPRI. EPRI 1015072, “Flow-Accelerated Corrosion–The Entrance Effect.” Palo Alto, California: Electric Power Research Institute. November 2007. EPRI 2007-TN9224

EPRI. EPRI 3002005530, “Recommendations for an Effective Program Against Erosive Attack,” Palo Alto, California: Electric Power Research Institute. July 2015. EPRI 2015-TN9225

EPRI. EPRI TR–112657, “Revised Risk-Informed Inservice Inspection Evaluation Procedure.” Revision B-A. ADAMS Accession No. ML013470102. Palo Alto, California: Electric Power Research Institute. December 1999. EPRI 2000-TN9226

EPRI. EPRI Report 1010639, “NonClass 1 Mechanical Implementation Guideline and Mechanical Tools,” Revision 4 (Non-Public). EPRI 2006-TN8195

EPRI. EPRI MRP 2018-022, “Transmittal of MRP-191-SLR Screening, Ranking and Categorization Results and Interim Guidance in Support of Subsequent License Renewal at U.S. PWR Plants,” ADAMS Accession No. ML19081A061. Palo Alto, CA: Electric Power Research Institute. August 2018. EPRI 2018-TN9890

Fontana, M.G. Corrosion Engineering. McGraw Hill. pp. 86-90. 1986. Fontana 1986-TN9440

FPL. Mano K. Nazar. FPL Letter (January 30) to NRC, L-2018-004, “Turkey Point Units 3 and 4 Subsequent License Renewal Application,” ADAMS Accession No. ML18037A812. Juno Beach, FL: Florida Power & Light Company. 2018. FPL 2018-TN9891

ISO. ISO 15589-1, “Petroleum and Natural Gas Industries–Cathodic Protection of Pipeline Transportation Systems–Part 1: On Land Pipelines,” Vernier, Geneva, Switzerland: International Organization for Standardization, November 2003. ISO 2003-TN9464

Lee, S., P.T. Kuo, K. Wichman, and O. Chopra. “Flaw Evaluation of Thermally Aged Cast Stainless Steel in Light-Water Reactor Applications.” International Journal of Pressure Vessels and Piping. pp. 37–44. 1997. Lee et al. 1997-TN9174

Licensee Event Report 237/2007-003, “Dresden Unit 2, High Pressure Coolant Injection System Declared Inoperable.” ADAMS Accession No. ML072750663. https://lersearch.inl.gov/LERSearchCriteria.aspx. September 2007. Exelon 2007-TN9228

Licensee Event Report 254/2009-004, "Quad Cities Unit 1, Pinhole Leak in Core Spray Piping Results in Loss of Containment Integrity and Plant Shutdown for Repairs." ADAMS Accession No. ML093170206. https://lersearch.inl.gov/LERSearchCriteria.aspx. November 2009. Exelon 2009-TN9229

Licensee Event Report 277/2006-003, "Peach Bottom Unit 2, Elbow Leak on Piping Attached to Suppression Pool Results in Loss of Containment Integrity." ADAMS Accession No. ML063420059. https://lersearch.inl.gov/LERSearchCriteria.aspx. December 2006 Exelon 2006-TN9231

Licensee Event Report 286/2018-003, "Indian Point Unit 3, Manual Reactor Trip Due to a Steam Leak on a High Pressure Feedwater Heater." ADAMS Accession No. ML18341A122. https://lersearch.inl.gov/LERSearchCriteria.aspx. November 2018. Entergy 2018-TN9232

Licensee Event Report 346/2015-002, "Davis-Besse, Improper Flow Accelerated Corrosion Model Results in 4-Inch Steam Line Failure and Manual Reactor Trip." ADAMS Accession No. ML15194A013. https://lersearch.inl.gov/LERSearchCriteria.aspx. July 2015. FENOC 2015-TN9233

Licensee Event Report 374/2013-001, "LaSalle Unit 2, Pin Hole Leaks Identified in High Pressure Core Spray Piping." ADAMS Accession No. ML13168A576. https://lersearch.inl.gov/LERSearchCriteria.aspx. June 2013. Exelon 2013-TN9234

Licensee Event Report 374/2015-001, "LaSalle Unit 2, High Pressure Core Spray Inoperable Due to Division 3 Diesel Generator Cooling Water Pump Casing Leak." ADAMS Accession No. ML15058A462. https://lersearch.inl.gov/LERSearchCriteria.aspx. February 2015.

Licensee Event Report 483/1999-003, "Callaway, Manual Reactor Trip due to Heater Drain System Pipe Rupture Caused by Flow Accelerated Corrosion." ADAMS Accession No. ML003712775. https://lersearch.inl.gov/LERSearchCriteria.aspx. May 2000. Union 2000-TN9236

Licensee Event Report 499/2005-004, "South Texas Project Unit 2, Inoperability of Essential Cooling Water 2A and 2B Trains." ADAMS Accession No. ML053410155. https://lersearch.inl.gov/LERSearchCriteria.aspx. November 2005. STP 2005-TN9237

Licensee Event Report 369/2014-002, "Degraded Condition due to Rejectable Flaws on 1B and 1C Safety Injection Lines." https://lersearch.inl.gov/LERSearchCriteria.aspx. September 27, 2014. Duke Energy 2014-TN8106

Metals Handbook Desk Edition, Second Edition, "Corrosion Characteristics of Carbon and Alloy Steels," 1998 (Non-Public). ASM 1998-TN9898

NACE. D.O. Sprowls and R.H. Brown, Stress Corrosion Mechanisms for Aluminum Alloys, Fundamental Aspects of Stress Corrosion Cracking, NACE, 1969, p 466-506. NACE 1969-TN9900

NRL. B.F. Brown, Stress-Corrosion Cracking in High Strength Steels and in Titanium and Aluminum Alloys, Naval Research Laboratory, ARPA No. 878, 1972. Judy and Goode 1972-TN8119

NBS. B.F. Brown, Stress Corrosion Cracking Control Measures, National Bureau of Standards, NBS Monogr 156, June 1977. NBS 1977-TN9901

NEI. NEI 97-06, “Steam Generator Program Guidelines.” Revision 3. Washington, D.C.: Nuclear Energy Institute. January 2011. NEI 2011-TN9268

NFPA. NFPA 805, “Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants, 2001 Edition.” Quincy, Massachusetts: National Fire Protection Association. 2001. NFPA 2001-TN9421

NRC. NUREG–1800, (Ch. 3.3 – End) “Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants.” ADAMS Accession No. ML012070409. Washington, DC: U.S. Nuclear Regulatory Commission. July 2001. NRC 2001-TN8133

NRC. NUREG–1801, “Generic Aging Lessons Learned (GALL) Report.” Revision 2. ADAMS Accession No. ML103490041. Washington, D.C.: U.S. Nuclear Regulatory Commission. December 2010. NRC 2010-TN7791

NRC. NUREG–1950, “Disposition of Public Comments and Technical Bases for Changes in the License Renewal Guidance Documents NUREG–1801 and NUREG–1800.” Washington, DC: ADAMS Accession No. ML11116A062. U.S. Nuclear Regulatory Commission. April 2011. NRC 2011-TN8190

NRC. NUREG–2191, “Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report”. Volume 1. ADAMS Accession No. ML17187A031. Washington, D.C.: U.S. Nuclear Regulatory Commission. July 2017. NRC 2017-TN7797

NRC. NUREG–2191, “Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report”. Volume 2. ADAMS Accession No. ML17187A204. Washington, D.C.: U.S. Nuclear Regulatory Commission. July 2017. NRC 2017-TN9902

NRC. NUREG–2192, “Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants” (SRP-SLR). ADAMS Accession No. ML17188A158. Washington, DC: U.S. Nuclear Regulatory Commission. July 2017. NRC 2017-TN9323

NRC. NUREG-2221, “Technical Bases for Changes in the Subsequent License Renewal Guidance Documents NUREG–2191 and NUREG–2192.” ADAMS Accession No. ML17362A126. Washington, DC: U.S. Nuclear Regulatory Commission. December 2017. NRC 2017-TN9924

NRC. NUREG-2222, “Disposition of Public Comments on the Draft Subsequent License Renewal Guidance Documents NUREG–2191 and NUREG–2192.” ADAMS Accession No. ML17362A143. Washington, DC: U.S. Nuclear Regulatory Commission. December 2017. NRC 2017-TN9926

NRC. Staff Requirements Memoranda, SRM-SECY-21-0029, “Rulemaking Plan on Relaxation of Inservice Testing and Inservice Inspection Program Update Frequencies Required in 10 CFR 50.55a,” ADAMS Accession No. ML21312A490. Washington, DC: U.S. Nuclear Regulatory Commission. November 2011. NRC 2021-TN9928

NRC. Bulletin 88-02, “Rapidly Propagating Fatigue Cracks in Steam Generator Tubes.” Washington, DC: U.S. Nuclear Regulatory Commission. February 1988. NRC 1988-TN9269

NRC. Information Notice 94-05, “Potential Failure of Steam Generator Tubes Sleeved with Kinetically Welded Sleeves.” Washington, DC: U.S. Nuclear Regulatory Commission. January 1994. NRC 1994-TN9289

NRC. NUREG–1430, “Standard Technical Specifications – for Babcock and Wilcox Pressurized Water Reactors Plants.” Volume 1, Revision 5. ADAMS Accession No. Volume 1, ML2127A363; Volume 2, ML21272A370. Washington DC: U.S. Nuclear Regulatory Commission. September 2021. NRC 2021-TN9320 And NRC 2021-TN9930

NRC. NUREG–1431, “Standard Technical Specifications – for Westinghouse Pressurized Water Reactors Plants.” Volume 1, Revision 5. ADAMS Accession No. Volume 1, ML21259A155; Volume 2, ML21259A159. Washington DC: U.S. Nuclear Regulatory Commission. September 2021. NRC 2021-TN9321 and NRC 2021-TN9931

NRC. NUREG–1432, “Standard Technical Specifications – for Combustion Engineering Pressurized Water Reactors Plants.” Volume 1, Revision 5. ADAMS Accession No. Volume 1, ML21258A421; Volume 2, ML21258A424. Washington DC: U.S. Nuclear Regulatory Commission. September 2021. NRC 2021-TN9322 and NRC 2021-TN9933

NRC. NUREG/CR-6001, “Aging Assessment of BWR Standby Liquid Control Systems,” dated August 17, 1992. ADAMS Accession No. ML040340671. NRC 1992-TN8346

NRC. “GALL-SLR and SRP-SLR Supplemental Staff Guidance.” ADAMS Accession No. ML16041A090. Washington, DC: U.S. Nuclear Regulatory Commission. March 2016. NRC 2016-TN9439

NRC. TSTF-577, “Revised Frequencies for Steam Generator Tube Inspections.” Revision 1. ADAMS Accession No. ML21060B434. Rockville MD: Technical Specifications Task Force. March 2021. TSTF 2021-TN9943

NRC. Information Notice 2007-21, “Pipe Wear Due to Interaction of Flow-Induced Vibrations,” Supplement 1, ADAMS Accession No. ML20225A204. Washington, DC: U.S. Nuclear Regulatory Commission. December 11, 2020. NRC 2020-TN8034

NRC. Information Notice 2002-21, “Pipe Wear Due to Interaction of Flow Induces Vibrations,” ADAMS No. ML071150051. Washington, DC: U.S. Nuclear Regulatory Commission. June 11, 2007. NRC 2007-TN8069

NRC. Supplement 1 to PBN SLRA, ADAMS Accession No. ML21111A155. April 21, 2021. NEPB 2021-TN8081

NRC. NUREG/CR–4513, “Estimation of Fracture Toughness of Cast Stainless Steels During Thermal Aging in LWR Systems.” Revision 2. ADAMS Accession No. ML16145A082. Washington, DC: U.S. Nuclear Regulatory Commission. May 2016 NRC 2016-TN9178

NRC. NUREG/CR–4513, “Estimation of Fracture Toughness of Cast Stainless Steels During Thermal Aging in LWR Systems.” Revision 2 with errata. ADAMS Accession No. ML16145A082. Washington, DC: U.S. Nuclear Regulatory Commission. March 2021 NRC 2016-TN9178

NRC. NUREG/CR–4513, “Estimation of Fracture Toughness of Cast Stainless Steels During Thermal Aging in LWR Systems.” Revision 1. ADAMS Accession No ML052360554. Washington, DC: U.S. Nuclear Regulatory Commission. August 1994 NRC 1994-TN9177

NRC. Generic Letter 89-13, “Service Water Systems Problems Affecting Safety Related Equipment.” NRC 1989-TN9367

NRC. Generic Letter 89-13, “Service Water Systems Problems Affecting Safety Related Equipment,” Supplement 1. NRC 1990-TN9368

NRC. “Final Safety Evaluation of the BWRVIP-234: Thermal Aging and Neutron Embrittlement Evaluation of Cast Austenitic Stainless Steel for BWR Internals.” ADAMS Accession No. ML16096A002. Washington, DC: U.S. Nuclear Regulatory Commission. June 22, 2016. NRC 2016-TN9110

NRC. “Surry Power Station, Units 1 and 2 – Final Safety Evaluation Report for the Subsequent License Renewal Application Review,” ADAMS Accession No. ML20052F520. Washington, DC: U.S. Nuclear Regulatory Commission. March 9, 2020. NRC 2020-TN9945

NRC. “Safety Evaluation Report Related to the Subsequent License Renewal of Turkey Point Generating Units 3 and 4,” ADAMS Accession No. ML19191A057. Washington, DC: U.S. Nuclear Regulatory Commission. July 2019. NRC 2019-TN8002

NRC. Generic Letter 94-03, “Intergranular Stress Corrosion Cracking of Core Shrouds in Boiling Water Reactors.” Washington, DC: U.S. Nuclear Regulatory Commission. July 1994. NRC 1994-TN8262

NRC. IE Bulletin 80-07, “BWR Jet Pump Assembly Failure.” Washington, DC: U.S. Nuclear Regulatory Commission. April 1980. NRC 1980-TN9175

NRC. IE Bulletin 80-07, Supplement 1, “BWR Jet Pump Assembly Failure.” Washington, DC: U.S. Nuclear Regulatory Commission. May 1980. NRC 1980-TN9176

NRC. IE Bulletin 80-13, “Cracking in Core Spray Spargers.” Washington, DC: U.S. Nuclear Regulatory Commission. May 1980. NRC 1980-TN8263

NRC. Information Notice 88-03, “Cracks in Shroud Support Access Hole Cover Welds.” Washington, DC: U.S. Nuclear Regulatory Commission. February 1988. NRC 1988-TN8273

NRC. Information Notice 92-57, “Radial Cracking of Shroud Support Access Hole Cover Welds.” Washington, DC: U.S. Nuclear Regulatory Commission. August 1992. NRC 1992-TN8276

NRC. Information Notice 93-101, “Jet Pump Hold-Down Beam Failure.” Washington, DC: U.S. Nuclear Regulatory Commission. December 1993. NRC 1993-TN9118

NRC. Information Notice 94-42, “Cracking in the Lower Region of the Core Shroud in Boiling Water Reactors.” Washington, DC: U.S. Nuclear Regulatory Commission. June 1994. NRC 1994-TN9117

NRC. Information Notice 95-17, “Reactor Vessel Top Guide and Core Plate Cracking.” Washington, DC: U.S. Nuclear Regulatory Commission. March 1995. NRC 1995-TN8278

NRC. Information Notice 97-02, "Cracks Found in Jet Pump Riser Assembly Elbows at Boiling Water Reactors." Washington, DC: U.S. Nuclear Regulatory Commission. February 1997. NRC 1997-TN9116

NRC. Information Notice 97-17, "Cracking of Vertical Welds in the Core Shroud and Degraded Repair." Washington, DC: U.S. Nuclear Regulatory Commission. April 1997. NRC 1997-TN9115

NRC. Information Notice 2007-02, "Failure of Control Rod Drive Mechanism Lead Screw Male Coupling at Babcock and Wilcox-Designed Facility." Washington, DC: U.S. Nuclear Regulatory Commission. March 2007. NRC 2007-TN9114

NRC. Letter from Christopher I. Grimes, U.S. Nuclear Regulatory Commission, License Renewal and Standardization Branch, 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. NRC 2000-TN9112

NRC. NUREG–1544, "Status Report: Intergranular Stress Corrosion Cracking of BWR Core Shrouds and Other Internal Components." Washington, DC: U.S. Nuclear Regulatory Commission. March 1996. NRC 1996-TN8328

NRC. NUREG-0313, "Technical Report on Material Selection and Process Guidelines for BWR Coolant Pressure Boundary," Revision 2, January 1988. ADAMS Accession No. ML031470422. NRC 1988-TN8039

NRC. NUREG/CR–4513, "Estimation of NRC. NRC. Fracture Toughness of Cast Stainless Steels during Thermal Aging in LWR Systems." Revision 1. Washington, DC: U.S. Nuclear Regulatory Commission. August 1994. NRC 1994-TN9177

NRC. NUREG/CR–6923, "Expert Panel Report on Proactive Materials Degradation Assessment." Washington, DC: U.S. Nuclear Regulatory Commission. March 2007. NRC 2007-TN9179

NRC. Memorandum from Joseph J. Holonich, U.S. Nuclear Regulatory Commission, Licensing Processes Branch, to Dennis C. Morey, U.S. Nuclear Regulatory Commission, Licensing Processes Branch, "Summary of the May 27, 2021, Meeting between the U.S. Nuclear Regulatory Commission Staff and the Electric Power Research Institute to Discuss Nonconservatism in BWRVIP-100, Revision 1-A." ADAMS Accession No. ML21153A003. June 8, 2021. NRC 2021-TN9111

NRC. Regulatory Guide 1.65, Revision 0, "Materials and Inspections for Reactor Vessel Closure Studs," October 1973. NRC 1973-TN11529

NRC. Regulatory Guide 1.65, Revision 1, "Materials and Inspections for Reactor Vessel Closure Studs," April 2010. NRC 2010-TN8358

NRC. NRC Bulletin 88-08, "Thermal Stresses in Piping Connected to Reactor Coolant Systems." ADAMS Accession No. ML031220144. Washington, DC: U.S. Nuclear Regulatory Commission. June 22, 1988. NRC 1988-TN8082

NRC. NUREG–0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants," Revision 1, Section 3.6.3, "Leak-before-break Evaluation Procedures."

ADAMS Accession No. ML063600396. Washington, DC: U.S. Nuclear Regulatory Commission. March 2007. NRC 2007-TN613

NRC. “Safety Evaluation Report Related to the Subsequent License Renewal of Turkey Point Generating Units 3 and 4,” dated December 2019 (ADAMS Accession No. ML19191A057). NRC 2019-TN8002

NRC. 10 CFR 50.65, “Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants.” Washington, DC: U.S. Nuclear Regulatory Commission. 2021. 10 CFR Part 50-TN249

NRC. Information Notice 2018-10, “Thermal Sleeve Flange Wear Leads to Stuck Control Rod at Foreign Nuclear Plant.” ADAMS Accession No. ML18214A710. Washington, DC: U.S. Nuclear Regulatory Commission. August 29, 2018. NRC 2018-TN8048

NRC. 10 CFR Part 50, Appendix R, “Fire Protection Program for Nuclear Power Facilities Operating Prior to January 1, 1979.” Washington, DC: U.S. Nuclear Regulatory Commission. 2021. 10 CFR Part 50-TN249

NRC. 10 CFR 50.48, “Fire protection.” Washington, DC: U.S. Nuclear Regulatory Commission. 2021. 10 CFR Part 50-TN249

NRC. Generic Letter 92-08, “Thermo-Lag 330-1 Fire Barrier.” ADAMS Accession No. ML031130425. Washington, DC: U.S. Nuclear Regulatory Commission. December 17, 1992. NRC 1992-TN9413

NRC. Information Notice 88-56, “Potential Problems with Silicone Foam Fire Barrier Penetration Seals.” ADAMS Accession No. ML031150042. Washington, DC: U.S. Nuclear Regulatory Commission. August 4, 1988. NRC 1988-TN9415

NRC. Information Notice 91-47, “Failure of Thermo-Lag Fire Barrier Material to Pass Fire Endurance Test.” ADAMS Accession No. ML031190452. Washington, DC: U.S. Nuclear Regulatory Commission. August 6, 1991. NRC 1991-TN9416

NRC. Information Notice 94-28, “Potential Problems with Fire-Barrier Penetration Seals.” ML031060475. Washington, DC: U.S. Nuclear Regulatory Commission. April 5, 1994. NRC 1994-TN9417

NRC. Information Notice 97-70, “Potential Problems with Fire Barrier Penetration Seals.” ADAMS Accession No. ML031050108. Washington, DC: U.S. Nuclear Regulatory Commission. September 19, 1997. NRC 1997-TN9418

NRC. Regulatory Guide 1.189, “Fire Protection for Nuclear Power Plants.” Revision 4. ADAMS Accession No. ML21048A441. Washington, DC: U.S. Nuclear Regulatory Commission. May 2021. NRC 2021-TN9419

NRC. Regulatory Guide 1.205, “Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants.” Revision 2. ADAMS Accession No. ML21048A448. Washington, DC: U.S. Nuclear Regulatory Commission. May 2021. NRC 2021-TN9420

NRC. Regulatory Guide 1.147, “Inservice Inspection Code Case Acceptability, ASME Section Xi, Division 1,” Revision 18. ADAMS Accession No. ML16321A336. Washington, DC: U.S. Nuclear Regulatory Commission. March 2017. NRC 2017-TN9957

NRC. Information Notice 89-52, “Potential Fire Damper Operational Problems.” ADAMS Accession No. ML031180663. Washington, DC: U.S. Nuclear Regulatory Commission. June 1989. NRC 1989-TN9414

NRC. Bulletin 87-01, “Thinning of Pipe Walls in Nuclear Power Plants.” ADAMS Accession No. ML031210862. Washington, DC: U.S. Nuclear Regulatory Commission. July 1987. NRC 1987-TN9238

NRC. Generic Letter 89-08, “Erosion/Corrosion-Induced Pipe Wall Thinning.” ADAMS Accession No. ML031200731. Washington, DC: U.S. Nuclear Regulatory Commission. May 1989. NRC 1989-TN8046

NRC. Information Notice 89-53, “Rupture of Extraction Steam Line on High Pressure Turbine.” ADAMS Accession No. ML031180660. Washington, DC: U.S. Nuclear Regulatory Commission. June 1989. NRC 1989-TN9239

NRC. Information Notice 91-18, “High-Energy Piping Failures Caused by Wall Thinning.” ADAMS Accession No. ML031190529. Washington, DC: U.S. Nuclear Regulatory Commission. March 1991. NRC 1991-TN9240

NRC. Information Notice 91-18, “High-Energy Piping Failures Caused by Wall Thinning.” Supplement 1. ADAMS Accession No. ML082840749. Washington, DC: U.S. Nuclear Regulatory Commission. December 1991. NRC 1991-TN9241

NRC. Information Notice 92-35, “Higher than Predicted Erosion/Corrosion in Unisolable Reactor Coolant Pressure Boundary Piping inside Containment at a Boiling Water Reactor.” ADAMS Accession No. ML031200365. Washington, DC: U.S. Nuclear Regulatory Commission. May 1992. NRC 1992-TN9242

NRC. Information Notice 93-21, “Summary of NRC Staff Observations Compiled During Engineering Audits or Inspections of Licensee Erosion/Corrosion Programs.” ADAMS Accession No. ML031080042. Washington, DC: U.S. Nuclear Regulatory Commission. March 1993. NRC 1993-TN9243

NRC. Information Notice 95-11, “Failure of Condensate Piping Because of Erosion/Corrosion at a Flow Straightening Device.” ADAMS Accession No. ML031060332. Washington, DC: U.S. Nuclear Regulatory Commission. February 1995. NRC 1995-TN9244

NRC. Information Notice 97-84, “Rupture in Extraction Steam Piping as a Result of Flow-Accelerated Corrosion.” ADAMS Accession No. ML031050037. Washington, DC: U.S. Nuclear Regulatory Commission. December 1997. NRC 1997-TN9245

NRC. Information Notice 99-19, “Rupture of the Shell Side of a Feedwater Heater at the Point Beach Nuclear Plant.” ADAMS Accession No. ML031040409. Washington, DC: U.S. Nuclear Regulatory Commission. June 1999. NRC 1999-TN9246

NRC. Information Notice 2006-08, “Secondary Piping Rupture at the Mihama Power Station in Japan.” ADAMS Accession No. ML052910008. Washington, DC: U.S. Nuclear Regulatory Commission. March 2006. NRC 2006-TN9247

NRC. Information Notice 2019-08, “Flow-Accelerated Corrosion Events.” ADAMS Accession No. ML19065A123. Washington, DC: U.S. Nuclear Regulatory Commission. October 2019. NRC 2019-TN9248

NRC. License Renewal Interim Staff Guidance LR-ISG-2012-01, “Wall Thinning Due to Erosion Mechanisms.” ADAMS Accession No. ML12352A057. Washington, DC: U.S. Nuclear Regulatory Commission. April 2013. NRC 2013-TN9249

NRC. License Renewal Interim Staff Guidance LR-ISG-2021-01, “Updated Aging Management Criteria for Reactor Vessel Internal Components of Pressurized Water Reactors of Subsequent License Renewal Guidance.” ADAMS Accession No. ML20217L203. Washington, DC: U.S. Nuclear Regulatory Commission. January 2021. NRC 2021-TN9958

NRC. NUREG–1344, “Erosion/Corrosion-Induced Pipe Wall Thinning in U.S. Nuclear Power Plants.” ADAMS Accession No. ML20247A046. Washington, DC: U.S. Nuclear Regulatory Commission. April 1989. NRC 1989-TN9250

NRC. NUREG/CR–6031, “Cavitation Guide for Control Valves.” ADAMS Accession No. ML20044G005. Washington DC: U.S. Nuclear Regulatory Commission. April 1993. NRC 1993-TN9251

NRC. NUREG/CR-6031, “Errata Sheet, Cavitation Guide for Control Valves.” Washington, D.C. U.S. Nuclear Regulatory Commission. 1994. ADAMS Accession No. ML20079A126. NRC 1994-TN11561

NSAC. NSAC-202L-R2, “Recommendations for an Effective Flow-Accelerated Corrosion Program.” Palo Alto, California: Electric Power Research Institute, Nuclear Safety Analysis Center (NSAC). April 1999. EPRI 1999-TN9252

NSAC. NSAC-202L-R3, “Recommendations for an Effective Flow-Accelerated Corrosion Program (1011838).” Palo Alto, California: Electric Power Research Institute, Nuclear Safety Analysis Center (NSAC). May 2006. EPRI 2007-TN9253

NSAC. NSAC-202L-R4, “Recommendations for an Effective Flow-Accelerated Corrosion Program (3002000563).” Palo Alto, California: Electric Power Research Institute, Nuclear Safety Analysis Center (NSAC). November 2013. EPRI 2013-TN9137

OECD-NEA. McDevitt, M., Childress T., Hoehn M and McGill R. “Analysis and Impact of Recent Thermal Fatigue Operating Experience in the USA.” Fourth International Conference on Fatigue of Nuclear Reactor Components. Sevilla, Spain. Organisation for Economic Co-operation and Development (OECD)/ Nuclear energy Agency (NEA). 2015. Document No. NEA/CSNI/R(2017)2/ADD1. McDevitt et al. 2015-TN8105

Oregon State University. Morrell, J. Jeffrey, “Estimated Service Life of Wood Poles,” Technical Bulletin No. 16-U-101, North American Wood Pole Council, Oregon State University, February 2016. NAWPC 2016-TN8144

PWROG. Presentation, “Industry Plans to Address Thermal Sleeve Operating Experience.” ADAMS Accession No. ML18254A400. Cranberry Township, Pennsylvania: PWR Owners Group. September 12, 2018. PWROG 2018-TN8067

USDA. U.S. Department of Agriculture, “Wood Pole Inspection and Maintenance,” Rural Utility Service (RUS) Bulletin 1730B-121, August 13, 2013. USDA 2013-TN8142

USDA. U.S. Department of Agriculture Report, “Durability of Preservative-Treated Wood Utility Poles in Guam,” May 1986. USDA 1986-TN8143

Westinghouse. James A. Gresham. Westinghouse Letter (July 17) to NRC, LTR-NRC-18-53, ‘NSAL-18-1 Revision 0, “Thermal Sleeve Flange Wear Leads to Stuck Control Rod”.’ ADAMS Accession No. ML18198A275. Pittsburgh, Pennsylvania: Westinghouse Electric Company. 2018. WEC 2018-TN9959

Westinghouse. PWR Owners Group Report Nos. PWROG-17033-NP-A and PWROG-17033-P-A (non-proprietary and proprietary versions), Revision 1, “Update for Subsequent License Renewal: WCAP-13045, ‘Compliance to ASME Code Case N-481 of the Primary Loop Pump Casings of Westinghouse Type Nuclear Steam Supply Systems’.” ADAMS Accession Nos. ML19319A188 and ML19319A195 (non-proprietary and proprietary versions). Pittsburgh, Pennsylvania: Westinghouse Electric Company. November 2019. WEC 2019-TN8132 and WEC 2019-TN11523

6 REFERENCES

10 CFR Part 50. *Code of Federal Regulations*, Title 10, *Energy*, Part 50, “Domestic Licensing of Production and Utilization Facilities.” TN249.

10 CFR Part 54. *Code of Federal Regulations*, Title 10, *Energy*, Part 54, “Requirements for Renewal of Operating Licenses for Nuclear Power Plants.” TN4878.

82 FR 32588. July 14, 2017. “Final Guidance Documents for Subsequent License Renewal.” *Federal Register*, Nuclear Regulatory Commission. TN9861.

ASME (American Society of Mechanical Engineers). 1990. *Boiler and Pressure Vessel Code, Section XI, Division 1, Code Case N-481 - Alternative Examination Requirements for Cast Austenitic Pump Casings.* ASME BPVC.XI.1.N-481, New York, New York. TN8131.

ASME (American Society of Mechanical Engineers). 2013. *2013 ASME Boiler & Pressure Vessel Code, Code Cases: Nuclear Components, Supplement 4*. Code Case N-716-1, Approved January 27, 2013, American Society of Mechanical Engineers, New York, New York. TN8107.

ASME (American Society of Mechanical Engineers). 2017. *Boiler and Pressure Vessel Code, Section XI, Rules for Inservice Inspection of Nuclear Power Plant Components*. American Society of Mechanical Engineers, New York, New York. TN9258.

ASME (American Society of Mechanical Engineers). 2018. *Code Case N-889, Reference Stress Corrosion Crack Growth Rate Curves for Irradiated Austenitic Stainless Steels in Light Water Reactor Environments*. American Society of Mechanical Engineers, New York, New York. TN10976.

ASTM (American Society of Testing and Materials). 2005. *Corrosion Tests and Standards, Application and Interpretation, 2nd Edition*. R. Baboian, ed., West Conshocken, Pennsylvania. TN9865.

AWWA (American Water Works Association). 2002. *M23 PVC Pipe – Design and Installation, Second Edition*. Denver, Colorado. TN11525.

AWWA (American Water Works Association). 2008. *Concrete Pressure Pipe*. AWWA Manual M9, Third Edition, Denver, Colorado. TN9869.

AWWA (American Water Works Association). 2010. *Polyethylene Encasement for Ductile-Iron Pipe Systems*. ANSI/AWWA C105/A21.5-10, Denver, Colorado. TN9870.

AWWA (American Water Works Association). 2016. *M17 Fire Hydrants: Installation, Field Testing, and Maintenance, Fifth Edition (Manual of Water Supply Practices, 17)*. Denver, Colorado. TN11524.

Covino, Jr., B.S. and S.J. Bullard. 2006. *Corrosion Rate Probes for Soil Environments*. In ASM Handbook, Volume 13C, "Corrosion: Environments and Industries." Novelty, Ohio. Available at https://dl.asminternational.org/handbooks/edited-volume/26/chapter/353264/Corrosion-Rate-Probes-for-Soil-Environments. TN9864.

Entergy (Entergy Nuclear Operations Inc.). 2018. Letter from A.J. Vitale, Site Vice President, to NRC Document Control Desk, dated November 19, 2018, regarding "Licensee Event Report #2018-003-00 "Manual Reactor Trip Due To A Steam Leak On A High Pressure Feedwater Heater." NL-18-083, Buchanan, New York. ADAMS Accession No. ML18341A122. TN9232.

EPRI (Electric Power Research Institute). 2000. Letter from J.T. Mitman, Project Manager, to NRC Document Control Desk, dated February 10, 2000, regarding "EPRI Topical Report TR-112657 Revision B-A, Revised Risk-Informed Inservice Inspection Procedure. Reference Project #669." Palo Alto, California. ADAMS Accession No. ML013470102. TN9226.

EPRI (Electric Power Research Institute). 2001. *Boric Acid Corrosion Guidebook, Revision 1, Managing Boric Acid Corrosion Issues at PWR Power Stations*. EPRI-1000975, Palo Alto, California. TN8200.

EPRI (Electric Power Research Institute). 2006. *Non-Class 1 Mechanical Implementation Guideline and Mechanical Tools*. EPRI-1010639, Palo Alto, California. TN8195.

EPRI (Electric Power Research Institute). 2006. *Updated Assessment of the Fracture Toughness of Irradiated Stainless Steel for BWR Core Shrouds (BWRVIP-100-A)*. EPRI 1013396, Palo Alto, California. TN9997.

EPRI (Electric Power Research Institute). 2011. *Materials Reliability Program: Pressurized Water Reactor Internals Inspection and Evaluation Guidelines (MRP-227-A)*. EPRI-1022863, Palo Alto, California. ADAMS Accession Nos. ML12017A194, ML12017A196, ML12017A197, ML12017A191, ML12017A192, ML12017A195, ML12017A199, ML12017A193. TN8163.

EPRI (Electric Power Research Institute). 2014. *Steam Generator Management Program: Investigation of Crack Initiation and Propagation in the Steam Generator Channel Head Assembly*. EPRI-3002002850, Palo Alto, California. TN8060.

EPRI (Electric Power Research Institute). 2015. *Recommendations for an Effective Program Against Erosive Attack*. EPRI TR-3002005530, Palo Alto, California. TN9225.

EPRI (Electric Power Research Institute). 2015. *Soil Sampling and Testing Methods to Evaluate the Corrosivity of the Environment for Buried Piping and Tanks at Nuclear Power Plants*. EPRI TR-3002005294, Palo Alto, California. TN9469.

EPRI (Electric Power Research Institute). 2016. *Guidance for Addressing Aging Management Plans for Steam Generator Channel Head Components, dated October 10, 2016*. SGMP-IL-16-02, Palo Alto, California. TN11519.

EPRI (Electric Power Research Institute). 2016. *Materials Reliability Program: Management of Thermal Fatigue in Normally Stagnant Non-Isolable Reactor Coolant System Branch Lines (MRP-146).* EPRI-3002007853, Revision 2, Palo Alto, California. TN8114.

EPRI (Electric Power Research Institute). 2016. *Steam Generator Management Program: Steam Generator In Situ Pressure Test Guidelines, Revision 5*. EPRI TR-3002018267, Palo Alto, California. TN9260.

EPRI (Electric Power Research Institute). 2017. *Pressurized Water Reactor Secondary Water Chemistry Guidelines.* EPRI-3002010645, Revision 8, Palo Alto, California. TN8112.

EPRI (Electric Power Research Institute). 2018. *BWR Vessel and Internals Project: Evaluation of Thermal Fatigue Susceptibility in BWR Stagnant Branch Lines (BWRVIP-155).* EPRI-3002013098, Revision 1, Palo Alto, California. TN8115.

EPRI (Electric Power Research Institute). 2018. Letter from D.M. Czufin, PMMP Chair, TVA, And B. Burgos, Program Manager, EPRI-MRP, to MRP Research Integration Committee and MRP Assessment TAC Members, dated August 31, 2018, regarding “Transmittal of MRP-191-SLR Screening, Ranking and Categorization Results and Interim Guidance in Support of Subsequent License Renewal at U.S. PWR Plants.” MRP 2018-022, Palo Alto, California. ADAMS Accession No. ML19081A061. TN9890.

EPRI (Electric Power Research Institute). 2018. *Long-Term Operations: Subsequent License Renewal Aging Effects for Structures and Structural Components (Structural Tools)*. EPRI TR-3002013084, Palo Alto, California. TN9412.

EPRI (Electric Power Research Institute). 2019. *BWRVIP-315: BWR Vessel and Internals Project, Reactor Internals Aging Management Evaluation for Extended Operations.* EPRI-3002012535, Palo Alto, California. TN8343.

EPRI (Electric Power Research Institute). 2020. *BWRVIP-25: BWR Vessel and Internals Project, BWR Core Plate Inspection and Flaw Evaluation Guidelines.* EPRI- 3002018310, Revision 1-A, Palo Alto, California. TN8303.

EPRI (Electric Power Research Institute). 2020. *Steam Generator Management Program: PWR Primary-to-Secondary Leak Guidelines, Revision 5*. EPRI TR-3002018267, Palo Alto, California. TN9259.

EPRI (Electric Power Research Institute). 2021. *Steam Generator Management Program: Steam Generator Integrity Assessment Guidelines, Revision 5*. EPRI TR-3002020909, Palo Alto, California. TN9262.

FENOC (FirstEnergy Nuclear Operating Company). 2015. Letter from B.D. Boles, Vice President, to NRC Document Control Desk, dated July 8, 2015, regarding “Licensee Event Report 2015-002.” L-15-175, Oak Harbor, Ohio. ADAMS Accession No. ML15194A013. TN9233.

NRC (U.S. Nuclear Regulatory Commission). 1973. *Materials and Inspections for Reactor Vessel Closure Studs*. Regulatory Guide 1.65, Washington, D.C. ADAMS Accession No. ML003740228. TN11529.

NRC (U.S. Nuclear Regulatory Commission). 1988. *Technical Report on Material Selection and Processing Guidelines for BWR Coolant Pressure Boundary Piping*. NUREG-0313, Revision 2, Washington, D.C. ADAMS Accession No. ML031470422. TN8039.

NRC (U.S. Nuclear Regulatory Commission). 1988. Thermal Stresses in Piping Connected to Reactor Coolant Systems. NRC Bulletin 88-08, Washington, D.C. ADAMS Accession No. ML031220144. TN8082.

NRC (U.S. Nuclear Regulatory Commission). 1989. *Erosion/Corrosion-Induced Pipe Wall Thinning*. Generic Letter 89-08, Washington, D.C. ADAMS Accession No. ML031200731. TN8046.

NRC (U.S. Nuclear Regulatory Commission). 1989. *Potential Fire Damper Operational Problems*. NRC Information Notice No. 89-52, Washington, D.C. ADAMS Accession No. ML031180663. TN9414.

NRC (U.S. Nuclear Regulatory Commission). 1989. *Service Water System Problems Affecting Safety-Related Equipment*. Generic Letter 89-13, Washington, D.C. TN9367.

NRC (U.S. Nuclear Regulatory Commission). 1992. *Aging Assessment of BWR Standby Liquid Control Systems*. NUREG/CR-6001, Washington, D.C. ADAMS Accession No. ML040340671. TN8346.

NRC (U.S. Nuclear Regulatory Commission). 2007. *Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants, LWR Edition.* NUREG-0800, Washington, D.C. ADAMS Accession No. ML070660036. TN613.

NRC (U.S. Nuclear Regulatory Commission). 2010. *Generic Aging Lessons Learned (GALL) Report, Final Report.* NUREG-1801, Rev. 2. Washington, D.C. ADAMS Accession No. ML103490041. TN7791.

NRC (U.S. Nuclear Regulatory Commission). 2010. *Materials and Inspections for Reactor Vessel Closure Studs*. Regulatory Guide 1.65, Revision 1, Washington, D.C. ADAMS Accession No. ML092050716. TN8358.

NRC (U.S. Nuclear Regulatory Commission). 2016. *Estimation of Fracture Toughness of Cast Stainless Steels during Thermal Aging in LWR Systems*. NUREG/CR-4513, Revision 2, Washington, D.C. ADAMS Accession No. ML16145A082. TN9178.

NRC (U.S. Nuclear Regulatory Commission). 2016. *GALL-SLR and SRP-SLR Supplemental Staff Guidance*. Washington, D.C. ADAMS Accession No. ML16041A090. TN9439.

NRC (U.S. Nuclear Regulatory Commission). 2017. *10 CFR Part 50 [NRC-2012-0059], RIN 3150-AJ13, Approval of American Society of Mechanical Engineers' Code Cases*. 7590-01-P, Washington, D.C. ADAMS Accession Package No. ML16285A003. TN9957.

NRC (U.S. Nuclear Regulatory Commission). 2017. *Disposition of Public Comments on the Draft Subsequent License Renewal Guidance Documents NUREG-2191 and NUREG-2191*. NUREG-2222, Washington, D.C. ADAMS Accession No. ML17362A143. TN9926.

NRC (U.S. Nuclear Regulatory Commission). 2017. *Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report: Final Report*. NUREG–2191, Volume 1, Washington, D.C. ADAMS Accession No. ML17187A031. TN7797.

NRC (U.S. Nuclear Regulatory Commission). 2017. *Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report: Final Report*. NUREG-2191, Volume 2, Washington, D.C. ADAMS Accession No. ML17187A204. TN9902.

NRC (U.S. Nuclear Regulatory Commission). 2017. *Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants*, *Final Report*. NUREG-2192, Washington, D.C. ADAMS Accession No. ML17188A158. TN9323.

NRC (U.S. Nuclear Regulatory Commission). 2017. *Technical Bases for Changes in the Subsequent License Renewal Guidance Documents NUREG-2191 and NUREG-2192*. NUREG-2221, Washington, D.C. ADAMS Accession No. ML17362A126. TN9924.

NRC (U.S. Nuclear Regulatory Commission). 2019. *Flow-Accelerated Corrosion Events*. NRC Information Notice No. 2019-08, Washington, D.C. ADAMS Accession No. ML19065A123. TN9248.

NRC (U.S. Nuclear Regulatory Commission). 2019. Letter from D.C. Morey, Chief, to B. Burgos, Electric Power Research Institute, dated April 25, 2019, regarding "Final Safety Evaluation for Electric Power Research Institute Topical Report MRP-227, Revision 1, "Materials Reliability Program: Pressurized Water Reactor Internals Inspection and Evaluations Guideline" (CAC No.MF7223; EPID L-2016-TOP-0001)." Washington, D.C. ADAMS Accession No. ML19081A001. TN9222.

NRC (U.S. Nuclear Regulatory Commission). 2020. Letter from A.H. Bradford, Director, Division of New and Renewed Licenses, to D.G. Stoddard, Senior Vice President and Chief Nuclear Officer, dated March 9, 2020, regarding "Surry Power Station, Units 1 and 2 - Final Safety Evaluation Report for the Subsequent License Renewal Application Review." ADAMS Accession Package No. ML20052F520. TN9945.

NRC (U.S. Nuclear Regulatory Commission). 2020. *Pipe Wear Due to Interaction of Flow-Induced Vibration and Reflective Metal Insulation*. NRC Information Notice 2007-21, Supplement 1, Washington, D.C. ADAMS Accession No. ML20225A204. TN8034.

NRC (U.S. Nuclear Regulatory Commission). 2021. Memorandum from A.L. Vietti-Cook, Secretary, to D.H. Dorman, Executive Director for Operations, dated November 8, 2021, regarding "Staff Requirements - SECY-21-0029 - Rulemaking Plan on Revision of Inservice Testing and Inservice Inspection Program Update Frequencies Required in 10 CFR 50.55a." ADAMS Accession No. ML21312A490. TN9928.

NRC (U.S. Nuclear Regulatory Commission). 2021. *Standard Technical Specifications, Babcock and Wilcox Plants*. NUREG-1430, Volume 1, Revision 5.0, Washington, D.C. ADAMS Accession No. ML21272A363. TN9320.

NRC (U.S. Nuclear Regulatory Commission). 2021. *Standard Technical Specifications, Combustion Engineering Plants*. NUREG-1432, Volume 1, Revision 5.0, Washington, D.C. ADAMS Accession No. ML21258A421. TN9322.

NRC (U.S. Nuclear Regulatory Commission). 2021. *Standard Technical Specifications, Westinghouse Plants*. NUREG-1431, Volume 1, Revision 5.0, Washington, D.C. ADAMS Accession No. ML21259A155. TN9321.

NRC (U.S. Regulatory Commission). 2021. Memorandum from J.J. Holonich, Senior Project Manager, to D.C. Morey, Chief of Licensing Processes Branch, dated June 8, 2021, regarding "Summary of the May 27, 2021, Meeting Between the U.S. Nuclear Regulatory Commission Staff and the Electric Power Research Institute to Discuss Nonconservatism in BWRVIP-100, Revision 1-A." Washington, D.C. ADAMS Accession No. ML21153A003. TN9111.

NRC (U.S. Nuclear Regulatory Commission). 2021. *Updated Aging Management Criteria for Reactor Vessel Internal Components for Pressurized-Water Reactors, Interim Staff Guidance*. SLR-ISG-2021-01-PWRVI, Washington, D.C. ADAMS Accession No. ML20217L203. TN9958.

NRC FORM 335 U.S. NUCLEAR REGULATORY COMMISSION (12-2010) NRCMD 3.7 **BIBLIOGRAPHIC DATA SHEET** *(See instructions on the reverse)*		1. REPORT NUMBER **(Assigned by NRC, Add Vol., Supp., Rev., and Addendum Numbers, if any.)** NUREG–2221, Supplement 1	
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10. SUPPLEMENTARY NOTES

11. ABSTRACT (200 words or less)

This document is a knowledge management and knowledge transfer document associated with NUREG–2191, Revision 1, "NUREG-2191, "Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR), Final Report," Revision 1 (GALL-SLR Report, Rev. 1), NUREG–2192, Revision 1, "Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants, Final Report," (SRP-SLR Rev. 1).
The initial iteration of NUREG-2221, (Agencywide Documents Access and Management System (ADAMS) Accession No. ML17362A126) documented the technical changes and bases that were made from the guidance contained in NUREG–1801, Revision 2, "Generic Aging Lessons Learned (GALL) Report," (ML103490041), for utilities applying for first license renewal, to the updated guidance for utilities wishing to apply for subsequent license renewal (i.e., for operation from 60 to 80 years), published as NUREG-2191, Revision 0 (ML17187A031 and ML17187A204, for Volumes 1 and 2 respectively).
This publication is a supplement to the initial NUREG-2221, and it documents the technical changes and underlying rationale or technical bases that the NRC staff used to develop NUREG-2191, Revision 1, and NUREG-2192, Revision 1.

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