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

NUREG-2221
Supplement 1

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

Draft Report for Comment

Office of Nuclear Reactor Regulation

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

Draft Report for Comment

Manuscript Completed: July 2023
Date Published: July 2023

Office of Nuclear Reactor Regulation

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ABSTRACT

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

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," (ADAMS Accession No. 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 (ADAMS Accession Nos. ML17187A031, and ML17187A204, 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)(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 draft 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 2023. This document provides the underlying rationale that the NRC staff used to develop Draft NUREG-2191, Revision 1, and Draft NUREG-2192, Revision 1.

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EXECUTIVE SUMMARY

On July 14, 2017 (82 FR 32588), 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 forNuclear 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. Draft 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 Draft SRP-SLR, Rev, 1, published herewith and the Draft GALL-SLR Report, Revision 1. This draft 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
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, “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) and NUREG–2192, Revision 0, “Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants” (SRP-SLR, Revision 0). Those two subsequent license renewal (SLR) guidance documents were published on July 12, 2017.

This document draft 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 2023, to generate the Revision 1 version of the Draft GALL-SLR Report, and Revision 1 of the Draft 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 andTechnical Bases
New aging management reviews (AMRs) – Structural Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR Report), Revision 1Chapters 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 and Table 2-13
Deleted AMRs – Mechanical GALL-SLR Report, Revision 1, Chapters IV, V, VII, and VIII	Table 2-14, Table 2-15, Table 2-17, Table 2-18
Deleted AMRs – Electrical GALL-SLR Report, Revision 1, Chapter VI	Table 2-16
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
Revised AMRs – Structural GALL-SLR Report, Revision 1, Chapters II and III	Table 2-19 and Table 2-20
Revised AMRs – Electrical GALL-SLR Report, Revision 1, Chapter VI	Table 2-23
GALL-SLR Report, Revision 1, Chapter IX – Use of Terms	Table 2-26 through Table 2-31
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GALL-SLR Report, Revision 1, Chapter XI – Mechanical	Table 2-33
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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 rulemakings, incorporating them by reference in later editions of Section XI. Further, the Commission issued SRM-SECY-21-0029, directing the staff to extend the inservice inspection and inservice testing Code of record update interval specified in 10 CFR 50.55a. Therefore, the NRC staff updated Table I-1 to include the latest Editions of Section XI incorporated by reference in 10 CFR 50.55a. 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 2-26through 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 SignificantChanges	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). 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 SignificantChanges	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 X

Column Heading	Description
Location of Change	Identifies the AMP element that changed.
Summary of SignificantChanges	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 3.5.2.2.2.7 described in Table 3-7.
III.A4.T-37	This new item 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, IWA-2220 and/or 2230, with qualification of personnel to be in accordance with IWA-2300.
III.A4.TP-36	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 3.5.2.2.2.7 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. 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. 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. 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 2-21of 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.
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, 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), and those that would be

New Aging Management Review (AMR) Item No.	Technical Bases for Changes
	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). 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. 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. 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. 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

New Aging Management Review (AMR) Item No.	Technical Bases for Changes
	performed for the components in MRP-2018-022. 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.
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. However, the MRP-227, Revision 1-A Report 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. 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. 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

New Aging Management Review (AMR) Item No.	Technical Bases for Changes
	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, 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, 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. 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.
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. 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. 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

New Aging Management Review (AMR) Item No.	Technical Bases for Changes
	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. 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.
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 ReportReport, the EPRI MRP 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.
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, 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 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.

New Aging Management Review (AMR) Item No.	Technical Bases for Changes
	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.
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, 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. 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.
IV.B4.RP-252a	In SLR-ISG-2021-01-PWRVI, 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, the EPRI MRP included the vent valve bodies as designated “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-

New Aging Management Review (AMR) Item No.	Technical Bases for Changes
	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, 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.
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. 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. 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.
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. 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

New Aging Management Review (AMR) Item No.	Technical Bases for Changes
	Item to be consistent with Item B6 in Table 4-1 of the MRP-227, Revision 1-A Report. 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. Note 4 in Table 4-1 of MRP-227, Revision 1-A 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. 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, 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, 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 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, 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

New Aging Management Review (AMR) Item No.	Technical Bases for Changes
	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. 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.
IV.C1.R-456 IV.C2.R-456	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 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. 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. 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 Water Reactor Vessel and Internals Project (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 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 that has been approved in NRC Regulatory Guide

New Aging Management Review (AMR) Item No.	Technical Bases for Changes
	(RG) 1.147, Revision 18). 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.

New Aging Management Review (AMR) Item No.	Technical Bases for Changes
	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 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."

New Aging Management Review (AMR) Item No.	Technical Bases for Changes
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][EPRI Report 1010639][Metals Handbook Desk Edition, 2nd Edition][EPRI Report 1000975]). 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]. Additionally, these reports noted that the pH range in SLC systems tends to be between 6.8–8.5 [EPRI Report 1010639]. 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 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).
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, and those cited by

New Aging Management Review (AMR) Item No.	Technical Bases for Changes
	industry as part of SLRA lessons learned activities and public comments on the draft 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, and those cited by industry as part of SLRA lessons learned activities and public comments on the draft 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.
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, and those cited by industry as part of SLRA lessons learned activities and public comments on the draft 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.

New Aging Management Review (AMR) Item No.	Technical Bases for Changes
	The periodic inspections recommended by AMP XI.M26 are capable of detecting these aging effects for these materials.
VII.H2.A-799 VII.H2.A-800	Two new AMR 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 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 a One-Time Inspection is needed for a given plant.
VII.H2.A-801 VII.H2.A-802	The staff noted that the GALL-SLR Report recommends the use of the Fuel Oil Chemistry and One-Time Inspection AMPs 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, and the One-Time Inspection program to verify the effectiveness of the Fuel Oil Chemistry program. 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 VII.H1.A-482b VII.H1.A-482c	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 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

New Aging Management Review (AMR) Item No.	Technical Bases for Changes
	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.
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 SS. The applicable aging effects were revised to account for 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, SS materials would be. The periodic inspections recommended by GALL-SLR Aging Management Program Report XI.M26 are capable of detecting these aging effects.
VII.E2.A798	The staff modified the AMR Item V.A.E-434 and added AMR Item VII.E2.A798, 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 environmental 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.

New Aging Management Review (AMR) Item No.	Technical Bases for Changes
	Several reports were reviewed by the staff to make this determination. 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. Additionally, these reports noted that the pH range in SLC systems tends to be between 6.8-8.5. 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).

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

New Aging Management Review (AMR) Item No.	Technical Bases for Changes
	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 II 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. 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

Aging Management Review (AMR) Item No.	Technical Bases for Changes
	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 guidelines. For spilt pins made from Type 316 or Type 316L stainless steel (SS) materials, the MRP-227, Revision 1-A 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.
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. 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. However, in Items W3.1, W3.2, W3.3 and W3.4 of Table 4-6 in the MRP-227, Revision 1-A Report, 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.
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.

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	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.
IV.B3.RP-326a	The staff deleted GALL-SLR Item IV.B3.RP-326a in SLR-ISG-2021-01-PWRVI. 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 draft SLR-ISG-PWRVI-2020-XX, 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. 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, 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.
IV.B3.RP-400	The staff deleted GALL-SLR Item IV.B3.RP-400 in SLR-ISG-2021-01-PWRVI. 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

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	RVI management programs. These components are now "No Additional Measures" category components per MRP-227, Revision 1-A 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.
IV.B3.RP-334a	The staff deleted GALL-SLR Item IV.B3.RP-334a in SLR-ISG-2021-01-PWRVI 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 allows the "RP-336" item to be applied for the 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.
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. 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. 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 and with Section 3.6.4 (Page 45) of the staff's safety evaluation for the MRP-227, Revision 1-A Report. 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, 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	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. The previous

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IV.B4.RP-254b	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. 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, In MRP-227, Revision 1-A, the Electric Power Research Institute (EPRI) MRP identified that these components did 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
No aging management review items were deleted from Chapter VII of GALL-SLR Report, Revision 0.	

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.

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	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

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	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.
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. The “RP-301” item applies to management of cracking in the alignment pins. In Item W15 of the MRP-227, Revision 1-A Report, the Electric Power Research Institute (EPRI) MRP only screened the upper

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	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. 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. 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. 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. The MRP-227, Revision 1-A Report 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. 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 draft SLR-ISG-PWRVI-2020-XX, 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-

Aging Management Review (AMR) Item No.	Technical Bases for Changes
	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. The staff acknowledges that in Item W7 of Table 4-3 in the MRP-227, Revision 1-A Report, 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. 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.
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. 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, 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

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	Panel assessment of the baffle edge bolts in EPRI's MRP-2018-022 report. 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 draft SLR-ISG-PWRVI-2020-XX 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. The staff acknowledges that, in Item W6.1 of Table 4-6 in the MRP-227, Revision 1-A Report, 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 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. 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

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	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. The staff acknowledges that, in Item W2.2 of the MRP-227, Revision 1-A Report, 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. 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, 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.
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. The staff acknowledges that, in Item W1 of Table 4-3 in the MRP-227, Revision 1-A Report, 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).

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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 4-3 of the MRP-227, Revision 1-A Report. 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. 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 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 mechanism, with TE also being applicable if the CRGT LFWs are made from CASS materials. Additionally, the MRP-227, Revision 1-A Report 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, 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

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	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 (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 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. 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) 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. 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. 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.

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	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 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 4-3 of the MRP-227, Revision 1-A Report. 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. 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.

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	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. 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. 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 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. 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. 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"

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	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; 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: (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 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. 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 there components in Item W14 of Table 4-9 in the MRP-227, Revision 1-A Report.
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. In the MRP-227, Revision 1-A Report, 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

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	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. 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. 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 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. In item W3.4 of the MRP-227, Revision 1-A Report, 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, 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. The staff acknowledges that in Item W4.4 of the MRP-227, Revision 1-A Report, EPRI only screened the lower support column bodies in for a SCC mechanism, with TE being applicable

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	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 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. 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 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

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	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. 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. Specifically, the gap analysis 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. 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

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	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 C11.1 in Table 4-6 of the MRP-227, Revision 1-A Report. 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. 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

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	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 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 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. 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. In Table 3-2 of the MRP-227, Revision 1-A Report, EPRI

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	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 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. 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

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	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, 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. 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. 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

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	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. 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). 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. 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 . These criteria are no longer included in the updated guidelines in MRP-227, Revision 1-A Report.

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	As a result of this change in the MRP-227, Revision 1-A Report, 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 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. 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.

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	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. 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 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. 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. In Item

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	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 "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. 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. 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

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	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 and C5.3 in Table 4-5 of the MRP-227, Revision 1-A Report. 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 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. 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.

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	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. 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 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

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	MRP-227, Revision 1-A Report. 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.
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. 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. 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

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	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. 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 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. 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. 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

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	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. 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. 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. 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.

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	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 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. 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.
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. 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

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	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. 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. 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” 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. 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.

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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. 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. In 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. 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

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	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, 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.
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. 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, 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.

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	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.
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. 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

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	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. 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, Revision 1-A. 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 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.

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	For more information, refer to the technical basis statement in Appendix B.3 of SLR-ISG-2021-01-PWRVI 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. 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 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. 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

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	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 added a discussion of plant-specific steam generator (SG) design parameters that should be evaluated against the industry analyses (EPRI 3002002850) 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 SGMPIL1602 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.
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.

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. Additionally, the One-Time Inspection AMP will help to verify the effectiveness of the Water Chemistry AMP. 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 and One-Time Inspection AMPs 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 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 and One-Time Inspection AMPs 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 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.
V.A.E-401 V.B.E-401	The staff has accepted opportunistic inspections, in lieu of periodic inspections, as an acceptable alternative for buried internally

Aging Management Review Item No.	Technical Bases for Changes
V.D1.E-401 V.D1.E-414 V.D2.E-401 V.D2.E-414	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 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 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
Item No. 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) 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, 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.
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

Aging Management Review Item No.	Technical Bases for Changes
	Water Supply Practices, M23, American Water Works Association, 2nd Edition, 2002, "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.

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	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.
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, 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.

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	Updated the referenced EPRI Report from EPRI Report No. 1022863 (MRP-227-A) to EPRI Report No. 3002017168 (MRP-227, Revision 1-A).	Updated the referenced EPRI report to reflect the most recent revision that has been approved by NRC staff.

"No Additional Measures" components	
"Primary" components	

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."
Stellite	Added the new "Material" terminology to GALL-SLR Table IX.C in SLR-ISG-2021-01-PWRVI 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. 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. The staff has adopted a definition for stellite by ASTM International.

Defined Term	Summary of Significant Changes	Technical Basis for Change
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 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.
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 2-29, 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 2-29, 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 2-29, 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)."	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.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.

X.E1: Environmental Qualification of Electric Components		
Program Description Scope of Program	The AMP program description and scope should include mechanical components associated with electrical equipment, such as gaskets, seals, O rings, etc.	The staff determined that the AMP program description and scope should be clarified to include mechanical components associated with electrical equipment to avoid further questions and clarify the intent of the 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

Location of Change	Summary of Significant Changes	Technical Bases for Changes
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 within the specified time period (e.g., 10-years) prior to the subsequent period of extended operation and not at the specified time.	Although the implementation schedules for the associated programs stated that the activities begin X 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.
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 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 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

Location of Change	Summary of Significant Changes	Technical Bases for Changes
		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.
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 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.	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 and 1, 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). 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

Location of Change	Summary of Significant Changes	Technical Bases for Changes
		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).
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 with errata (March 2021). The references section and FSAR Supplement (GALL-SLR XI-01) were also updated.	The NUREG/CR-4513, Revision 2 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 were corrected in the errata dated March 15, 2021 [2]. The screening criteria and FT estimation methods in NUREG/CR-4513, Revision 2 with errata are consistent with those in NUREG/CR-4513, Revision 2 published in 2016. 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 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.
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 for calculating irradiation-assisted crack growth rates.	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 update to AMP XI.M9 corrects, updates, and standardizes BWRVIP document

Location of Change	Summary of Significant Changes	Technical Bases for Changes
		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 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 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 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 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.
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). Because MRP-227, Revision 1-A, 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 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,”	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. In Section 7 of the MRP-227, Revision 1-A Report, the EPRI MRP calls for the AMPs to be converted over to the I&E guidelines in MRP-227, Revision 1-A 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 before the plants enter into the subsequent period of extended operation.

Location of Change	Summary of Significant Changes	Technical Bases for Changes
	"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" 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 criteria as supplemented by a gap analysis. This definition applies through the revised AMP.	Like the preceding guidelines in EPRI Report No. 1022863 (i.e., MRP-227-A), the EPRI MRP's I&E guidelines in MRP-227, Revision 1-A only assessed 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 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. Although reports like MRP-2018-022 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 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 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 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 basis for the AMP without the need for performing a gap analysis of the components.

Location of Change	Summary of Significant Changes	Technical Bases for Changes
		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), 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) 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 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, 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 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.

Location of Change	Summary of Significant Changes	Technical Bases for Changes
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, 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 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 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.	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 Report 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 or else in MRP-227 (as supplemented). The staff also amended the "Acceptance Criteria" program element to establish	The changes account for the fact that the current component-specific I&E criteria in MRP-227, Revision 1-A 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 may be superseded (on a component-specific basis) by the results of an 80-year RVI gap analysis or by the

Location of Change	Summary of Significant Changes	Technical Bases for Changes
	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.	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; 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 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 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	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. 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

Location of Change	Summary of Significant Changes	Technical Bases for Changes
	Process" program element remains as previously established and written in the analogous program element of AMP XI.16A in the GALL-SLR Report.	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 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 establishes the basis for 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.	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. 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"

Location of Change	Summary of Significant Changes	Technical Bases for Changes
		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 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 correspondence letter to the EPRI MRP that endorsed MRP-227.	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-ISG-2021-01-PWRVI.
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 in the staff's update of GALL-SLR AMP XI.M16A, "PWR Vessel Internals," in SLR-ISG-2021-01-PWRVI.
XI.M17: Flow-Accelerated Corrosion		
Program Description	Clarify that commitments made in response to NRC Generic Letter 89-08 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 had been considered one-time commitments and not ongoing commitments. For license renewal, the staff views the commitments in response to GL 89-08 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.

Location of Change	Summary of Significant Changes	Technical Bases for Changes
Program Description	Add that the guidance in EPRI 3002005530 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, "Recommendations for an Effective Program Against Erosive Attack," can be used as the basis for a program to manage erosion mechanisms.
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 and IN 2019-08). 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 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, "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. 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.
Acceptance Criteria	Add a safety factor of 2.0 from EPRI 3002005530 for erosion mechanism re-inspection interval determinations.	The EPRI 3002005530, 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.
Administrative Controls	Add information that software QA activities should continue even though	The staff has found that, in most cases, the software QA classification for FAC

Location of Change	Summary of Significant Changes	Technical Bases for Changes
	these activities are not required by the FAC program software QA classification.	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 and associated LERs.	Issues identified at Indian Point and Davis-Besse were discussed in IN 2019-08 where legacy issues from initial modeling resulted in loss of pressure boundary integrity.
References	Add EPRI 3002005530, "Recommendations for an Effective Program Against Erosive Attack." In addition, add IN 2019-08, "Flow-Accelerated Corrosion Events," and the associated LER from Indian Point, (286/2018-003) and Davis-Besse (346/2015-002).	During its review of the Surry SLRA (ML20052F523), the staff determined that the guidance in EPRI 3002005530, can be used as the basis for a program to manage erosion mechanisms IN 2019-08, 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.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, "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]); NUREG-1431, "Standard Technical Specifications – Westinghouse Plants" (ML21259A155 [Volume 1]); and NUREG-1432, "Standard Technical Specifications – Combustion Engineering Plants" (ML21258A421 [Volume 1]). 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

Location of Change	Summary of Significant Changes	Technical Bases for Changes
		extensive deposit buildup is expected in the SG.
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, "Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants," dated July 2017 (ADAMS Accession No. ML17188A158), were added, which contain the review procedures for determining whether a plant-specific AMP is required.	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 plant-specific 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 necessary 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 of the One-Time Inspection AMP is necessary.

Location of Change	Summary of Significant Changes	Technical Bases for Changes
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, 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, 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. Therefore, EPRI 3002018267 replaces EPRI 1022832. In December 2021, EPRI published EPRI 3002020909, "Steam Generator Integrity Assessment Guidelines," Revision 5. 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. 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, Revision 1, and NUREG-2192, "Standard Review Plan 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), 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

Location of Change	Summary of Significant Changes	Technical Bases for Changes
		those references with errors in the title were corrected. A reference to NRC-approved TSTF-577, 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. A reference to NUREG-2192, “Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants,” dated July 2017 (ADAMS Accession No. ML17188A158), was added because it is referenced in the Parameters Monitored or Inspection section of AMP XI.M19.
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) states that

Location of Change	Summary of Significant Changes	Technical Bases for Changes
		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. 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.	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. 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

Location of Change	Summary of Significant Changes	Technical Bases for Changes
		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 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, 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.	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.
Detection of Aging Effects Acceptance Criteria	Add clarification that separation of seals can also be from ceilings and floors, not just from walls and components.	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.

Location of Change	Summary of Significant Changes	Technical Bases for Changes
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)," and NRC IN-89-52, "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), 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)," 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," was added because it provides relevant operating history for fire dampers.
XI.M27: Fire Water System		
Program Description	Added replacing or testing using guidance in National Fire Protection Association (NFPA) 25 for dry sprinklers and fast response sprinklers.	Information regarding replacing or testing dry sprinklers and fast response sprinklers because these type sprinklers may exist in nuclear power plants, and it is consistent with NFPA 25. The AMP XI.M27 currently only includes replacing or testing of sprinklers which are at a different frequency from the frequency in NFPA 25 for dry sprinklers and fast response 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 no. 11 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

Location of Change	Summary of Significant Changes	Technical Bases for Changes
		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 no. 12 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 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,” section titled “Types of Dry Barrel Hydrants” states that the main

Location of Change	Summary of Significant Changes	Technical Bases for Changes
		valve is located below the normal frost line to protect the hydrant from freezing.
Detection of Aging Effects	The recommended periodicity of fire pump suction screen and strainer inspections was revised based on the suction source of the fire pump and plant-specific operating experience. New footnote no. 13 was added Table XI.M27-1.	Similar to the basis for the inclusion of the new footnote No. 11 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 examination results for the screens and strainers should predict future performance. However, this is not the case for fire water pumps which take suction directly from sources of makeup with the potential for bulk debris. For example, degraded cooling tower fill and storm generated debris into an ocean or river, which could eventually accumulate on the suction screens or strainers later in life. Fire pump suction strainers was added because depending on the installation, there may be fire pump suction screens and strainers (see NFPA 25 Figure A.8.2.2).
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 no. was added 14 to Table XI.M27-1.	Like the basis for the inclusion of the new footnote no. 11 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%) in several sampling based AMPs (e.g., XI.M38, “Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components”).
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	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

Location of Change	Summary of Significant Changes	Technical Bases for Changes
	Storage Tanks." In addition, the reference to footnote no. 10 was added to Table XI.M271 was deleted and the inspections are recommended as occurring on a refueling outage interval in lieu of annually. New footnote no. 15 was added to Table XI.M27-1.	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	The "NFPA 25 Section" column in Table XI.M271 was revised to "Periodicity." Footnotes were revised accordingly.	Specificity was removed while still referencing the appropriate portions of NFPA 25, so that the title of the tests or examinations remains while providing applicants flexibility in meeting the appropriate portions of NFPA 25.
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 no. 16 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% reduction from the previous test.
Detection of Aging Effects	A recommendation to visually inspect and clean the mainline strainers of the private fire service main was added. New footnote no. 17 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.
XI.M29: Outdoor and Large Atmospheric Metallic Storage Tanks		
Detection of Aging Effects	Clarify that the 1 ft^2 sections of insulation should be taken from multiple locations to ascertain that the samples are representative of the entire exterior of the tank.	During the Staff's review of 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.

Location of Change	Summary of Significant Changes	Technical Bases for Changes
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. 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.
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

Location of Change	Summary of Significant Changes	Technical Bases for Changes
		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%. 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

Location of Change	Summary of Significant Changes	Technical Bases for Changes
		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 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, "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% 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% with a maximum of 25

Location of Change	Summary of Significant Changes	Technical Bases for Changes
		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. 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

Location of Change	Summary of Significant Changes	Technical Bases for Changes
		susceptible to selective leaching are also commonly exposed to a soil environment (e.g., buried cast iron fire water system piping).
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.
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.
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.
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.

Location of Change	Summary of Significant Changes	Technical Bases for Changes
XI.M36: External Surfaces Monitoring of Mechanical 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.
XI.M38: Inspection of Internal Surfaces in Miscellaneous Piping and Ducting 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.
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

Location of Change	Summary of Significant Changes	Technical Bases for Changes
		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 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* 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, 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),

Location of Change	Summary of Significant Changes	Technical Bases for Changes
		the staff did not identify a need to provide a specific 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.
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-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	Recent OE at a station with a renewed license revealed a significant failure of prestressed concrete cylindrical piping in

Location of Change	Summary of Significant Changes	Technical Bases for Changes
	recommend external coatings for underground cementitious piping.	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* 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.
Detection of Aging Effects	Revise GALL-SLR AMP XI.M41 to include EPRI Report 3002005294, "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, "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, 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 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), 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 associated

Location of Change	Summary of Significant Changes	Technical Bases for Changes
		with aluminum and copper alloys, the staff finds a threshold of ten points or less to also be acceptable for these two material types.
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.
XI.M43: High Density Polyethylene (HDPE) Piping and Carbon Fiber Reinforced Polymer (CFRP) Repaired Piping		
GALL-SLR Report, Chapter XI	The AMP XI.43 is a new AMP. This AMP manages the aging of buried 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, disbondment, damage and leaking. 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 CFRP repaired 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. Depending on the material, the AMP addresses the preventive and mitigative techniques and may include external coatings, cathodic protection, and the quality of backfill. In addition, depending on the material, inspection activities may include electrochemical verification of the effectiveness of cathodic protection, nondestructive evaluation of pipe wall thicknesses, pressure testing of the pipe, volumetric inspections, and visual inspections of the pipe from the exterior and/or interior.

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.
Detection of Aging Effects	Clarify ambiguities when applying the term "groundwater/soil" in the GALL-SLR AMP.	

Location of Change	Summary of Significant Changes	Technical Basis for Change
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.	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/soil” it is intended to be used as “aggressive groundwater or aggressive soil”; and when the guidance document refers to a “nonaggressive groundwater/soil” it is intended to be used as “nonaggressive groundwater and nonaggressive soil.”
XI.S8: Protective Coating Monitoring and Maintenance		
Program Description Detection of Aging Effects Monitoring and Trending Operating Experience References Program Description Detection of Aging Effects Monitoring and Trending Operating Experience References	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, based on trending of the total amount of permitted degraded coatings. 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.	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 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

Location of Change	Summary of Significant Changes	Technical Basis for Change
		allowed in containment will also performed. 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 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

Location of Change	Summary of Significant Changes	Technical Basis for Change
		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 Environmental Qualification Requirements		
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.
XI.E3A: Electrical Insulation for Inaccessible Medium-Voltage Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements		
Program Description	The proposed revisions add inspection of manholes with water level monitoring and alarms that result in consistent,	The staff finds that there is no need to perform annual inspections for manholes that have an installed water level

Changed Program Elements	Summary of Significant Changes	Technical Basis for Change
Scope of Program Preventative Actions Parameters Monitored or Inspected Acceptance Criteria Table XI-01	subsequent pump out of accumulated water prior to wetting or submergence of cable at least once every five 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.	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 five 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.
XI.E3B: Electrical Insulation for Inaccessible Instrument and Control Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements		
Program Description Scope of Program Preventative Actions Parameters Monitored or Inspected Acceptance Criteria	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 five 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-	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 alarms every five years is acceptable. Additionally, because of the level

Changed Program Elements	Summary of Significant Changes	Technical Basis for Change
Table XI-01	monitoring, and therefore do not require annual inspection for water accumulation.	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.
XI.E3C: Electrical Insulation for Inaccessible Low-Voltage Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements		
Program Description Scope of Program Preventative Actions Parameters Monitored or Inspected Detection of Aging Effects Acceptance Criteria Corrective Actions 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 five 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 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

Changed Program Elements	Summary of Significant Changes	Technical Basis for Change
		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.
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 advance indications. Surface buildup of contamination can be worse for SIR

Changed Program Elements	Summary of Significant Changes	Technical Basis for Change
		(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. 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

Changed Program Elements	Summary of Significant Changes	Technical Basis for Change
		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.

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3 SUBSEQUENT LICENSE RENEWAL CHANGES TO STANDARD REVIEW PLAN FOR REVIEW OF SUBSEQUENT LICENSE RENEWAL APPLICATIONS FOR NUCLEAR POWER PLANTS, REVISION 2 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 SRP-SLR Chapter 1 – Administrative Information

There are no major technical changes in Chapter 1 of the SRP-SLR, Revision 0.

3.2 SRP-SLR Chapter 2 – Scoping and Screening

There are no major technical changes to SRP-LR Chapter 2 of SRP-SLR, Revision 0, with the exception of clarifications for 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 SRP-SLR Chapter 3 – Aging Management Review

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 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.

3.5 SRP-SLR Appendices A.1, A.2, A.3, and A.4

There were no changes to the appendices in the SRP-SLR, Revision 0.

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		
No changes from SRP-SLR, Revision 0, to SRP-SLR, 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
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).	The Statements of Consideration for Title 10 *Code of Federal Regulations* (10 CFR) Part 54 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 aging management review. The SCs that perform both passive and active functions require an AMR for their intended passive function[s] only." Accordingly, Table 2.2-2 was changed to indicate that if complex assemblies performed passive intended functions (which meet the criteria of 10 CFR Part 54.4(a) 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)." 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 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
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 analysis (TLAAs) for these components, as defined in SRP-SLR Section 4.3. In addition, the further evaluation (FE) "Acceptance Criteria" and "Review	This information was inadvertently omitted when the FSAR Supplement information was relocated from the SRP-SLR tables to the GALL-SLR tables.

Location of Change	Summary of the Change	Technical Basis for Change
	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.	
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, "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, 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. In December of 2020 IN 2007-21 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

Location of Change	Summary of the Change	Technical Basis for Change
		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 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 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

Location of Change	Summary of the Change	Technical Basis for Change
		(SLR) reviewed the OE in the updated IN 2007-21, 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).
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: 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." 5) Deleted GALL-SLR Items IV.B2.RP-356, IV.B3.RP-357, and	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. 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 Code Class components and the ISI program is credited for aging management of the pins. The

Location of Change	Summary of the Change	Technical Basis for Change
	IV.B3.RP-400 as referenced GALL-SLR Items in Item 028.	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 3.1-1, Item 032	The staff deleted SRP-SLR Table 3.1-1, Item 032 in SLR-ISG-2021-01-PWRVI.	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 Code Class

Location of Change	Summary of the Change	Technical Basis for Change
		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. 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. 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. 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: 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 stress corrosion cracking mechanism as "IASCC."	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, 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. 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. 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

Location of Change	Summary of the Change	Technical Basis for Change
		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 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 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: 1) Added GALL-SLR Items IV.B4.RP-246c and IV.B4.RP-246d as new	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, the EPRI MRP

Location of Change	Summary of the Change	Technical Basis for Change
	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."	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 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 draft 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

Location of Change	Summary of the Change	Technical Basis for Change
		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 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: 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

Location of Change	Summary of the Change	Technical Basis for Change
		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 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: 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.

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: 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 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.

Location of Change	Summary of the Change	Technical Basis for Change
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: 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 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

Location of Change	Summary of the Change	Technical Basis for Change
		components for Primary UFW inspections. Therefore, the staff deleted GALL-SLR Item IV.B2.RP-278 in SLR-ISG-2021-01-PWRVI 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: 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. 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 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, 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

Location of Change	Summary of the Change	Technical Basis for Change
		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-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 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:	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.

Location of Change	Summary of the Change	Technical Basis for Change
	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 SRP-SLR Table 3.1-1, Item 056b.	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. 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

Location of Change	Summary of the Change	Technical Basis for Change
		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 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: 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, 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 in SLR-ISG-2021-01-PWRVI:	The SRP-SLR Table 3.1-1, Item 058a remains as the AMR line item for B&W "Primary" category RVI components that are subject to non-cracking aging effect and mechanism combinations.

Location of Change	Summary of the Change	Technical Basis for Change
	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	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 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

Location of Change	Summary of the Change	Technical Basis for Change
		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 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: 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 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.	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 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

Location of Change	Summary of the Change	Technical Basis for Change
		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. 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: 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.	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-

Location of Change	Summary of the Change	Technical Basis for Change
	3) Deleted GALL-SLR Item IV.B2.RP-278a as a referenced GALL-SLR item in Item 059b.	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 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.

Location of Change	Summary of the Change	Technical Basis for Change
		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 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: 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: 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 of	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

Location of Change	Summary of the Change	Technical Basis for Change
	the components listed in the line item.	Table 3.1-1 Item 032, which is being deleted in SLR-ISG-2021-01-PWRVI. 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: 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". 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	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 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

Location of Change	Summary of the Change	Technical Basis for Change
	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.	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 draft SLR-ISG-PWRVI-2020-XX, 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-PWRVI 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

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		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 coveres 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, 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

Location of Change	Summary of the Change	Technical Basis for Change
		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 Experience" program element of its PWR vessel internals program and in the technical basis document for the AMP.	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 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-

Location of Change	Summary of the Change	Technical Basis for Change
		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 3.1.2.2.12 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.
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-

Location of Change	Summary of the Change	Technical Basis for Change
		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 3.1.2.2.11, 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, the reference to a plant-specific AMP was replaced with a reference to the One-Time Inspection AMP for applicants that would need to manage cracking due to PWSCC in their SG divider plates.
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 3.1.3.2.16	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.
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	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

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	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).	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. 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. 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 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

Location of Change	Summary of the Change	Technical Basis for Change
		include an examination item for thermal fatigue cracking (e.g., as specified in ASME Code Case N-716-1 that has been approved in NRC Regulatory Guide [RG] 1.147, Revision 18). 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 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 3.1.2.2.10 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 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

Location of Change	Summary of the Change	Technical Basis for Change
		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).

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, "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, 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

Location of Change	Summary of the Change	Technical Basis for Change
		marks were located inside containment and at insulation end caps. In December 2020, IN 2007-21 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 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 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 have performed engineering evaluations as well as completed extent of conditions and installed a modified RMI to

Location of Change	Summary of the Change	Technical Basis for Change
		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, 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

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 3.2.3.2.4	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 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 3.2.3.2.8	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	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.

Location of Change	Summary of the Change	Technical Basis for Change
	identify LOM as applicable for SLR and identify the AMP that will be used to manage the integrity of the coating.	
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 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

Location of Change	Summary of the Change	Technical Basis for Change
		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.
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. 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 “heat transfer.” The Water Chemistry AMP can be used to

Location of Change	Summary of the Change	Technical Basis for Change
		minimize the potential for deposits that can lead to fouling through the control of primary side water chemistry. Additionally, the One-Time Inspection AMP will help to verify the effectiveness of the Water Chemistry AMP. 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 and One-Time Inspection AMPs 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 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 and One-Time Inspection AMPs 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 detected through continuous system

Location of Change	Summary of the Change	Technical Basis for Change
		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 3.2-1, 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

Location of Change	Summary of the Change	Technical Basis for Change
		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 3-5 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 3.3.3.5 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.

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.
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	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

Location of Change	Summary of the Change	Technical Basis for Change
	issues related to loss of material due to pitting or crevice corrosion.	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 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	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.”.	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

Location of Change	Summary of the Change	Technical Basis for Change
Table 3.3-1, Item 253	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.	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, 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 and One-Time Inspection AMPs 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, and the One-Time Inspection program to verify the effectiveness of the Fuel Oil Chemistry program. 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 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

Location of Change	Summary of the Change	Technical Basis for Change
		(ML17362A143), 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 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.

Location of Change	Summary of the Change	Technical Basis for Change
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 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][EPRI Report 1010639][Metals Handbook Desk Edition, 2nd Edition][EPRI Report 1000975]. 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]. Additionally, these reports noted that the pH range in SLC systems tends to be between 6.8–8.5 [EPRI Report 1010639]. 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,

Location of Change	Summary of the Change	Technical Basis for Change
		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).
Table 3.3-1, Item 255	Clarified applicable materials a metallic, replaced the term, “assemblies,” with “housings”, and removed hardening, loss of strength, and shrinkage due to elastomer degradation as applicable aging effects/mechanisms.	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. 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

Location of Change	Summary of the Change	Technical Basis for Change
		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 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][EPRI Report 1010639][Metals Handbook Desk Edition, 2nd Edition][EPRI Report 1000975]. 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]. Additionally, these reports noted that the pH range in SLC systems tends to be between 6.8–8.5 [EPRI Report 1010639]. 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).

Location of Change	Summary of the Change	Technical Basis for Change
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 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 draft 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.

Location of Change	Summary of the Change	Technical Basis for Change
		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 3002013084, and those cited by industry as part of SLRA lessons learned activities and public comments on the draft 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 draft 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

Location of Change	Summary of the Change	Technical Basis for Change
		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 3-6 SRP-SLR, Revision 1, Chapter 3.4, Steam and Power Conversion Systems, Differences from SRP-SLR, Revision 0, and Their Technical

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 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 3.4.2.2.2 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 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	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

Location of Change	Summary of the Change	Technical Basis for Change
	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.	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 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 3.4.3.2.7	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 3.4.3.2.9	Revised the wording in the last paragraph to delete the statement that LOM does not require aging management if a barrier coating is	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

Location of Change	Summary of the Change	Technical Basis for Change
	used. Deleted the statement that the reviewer verifies the barrier coating is impermeable.	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.
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

Location of Change	Summary of the Change	Technical Basis for Change
		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) 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.	The item is revised to include CFRP repaired piping components and credit the 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 3-7 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	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])	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

Location of Change	Summary of the Change	Technical Basis for Change
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	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.	"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). 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

Location of Change	Summary of the Change	Technical Basis for Change
		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, “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 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

Location of Change	Summary of the Change	Technical Basis for Change
		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 3.5.2.2.2.7 (and corresponding review procedure Section 3.5.3.2.2.7) 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 101 and 102 (notwithstanding those considered additionally by an applicant as plant-specific AMRs) associated with the new FE and corresponding references are also added to SRP-SLR Table 3.5-1.	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 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 3.5.2.2.2.7, and corresponding review procedures Section 3.5.3.2.2.7, 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

Location of Change	Summary of the Change	Technical Basis for Change
		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 101 and 102 (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.
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 weathering, chemical degradation, insect infestation, repeated wetting and drying, or fungal decay.	The staff added wooden poles as a new structural component requiring an AMR since current guidance does not provide recommendations to 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

Location of Change	Summary of the Change	Technical Basis for Change
		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 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

Location of Change	Summary of the Change	Technical Basis for Change
		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.
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.	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.

Location of Change	Summary of the Change	Technical Basis for Change
	3 ASTM E693-17, “Standard Practice for Characterizing Neutron Exposures in Iron and 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 3.6.3.5 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 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 3-10 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		
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 analysis (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, 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

Location of Change	Summary of the Change	Technical Basis for Change
		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.
4.2.3.1.2.1 10 CFR 54.21(c)(1)(i) 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 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.
4.2.3.1.3.1 10 CFR 54.21(c)(1)(i) 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.	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

Location of Change	Summary of the Change	Technical Basis for Change
	Section 4.2.3.1.3.2 was revised to provide additional context and guidance for the NRC staff review of PTS TLAAs.	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 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.
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,

Location of Change	Summary of the Change	Technical Basis for Change
		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.
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.

Location of Change	Summary of the Change	Technical Basis for Change
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
No changes from SRP-SLR, Revision 0, to SRP-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-	In the license renewal application (LRA) for the Waterford Nuclear Plant,

Location of Change	Summary of the Change	Technical Basis for Change
	Based Analyses in Support of MRP-227" as an additional example of a potential, plant-specific time-limited aging analysis (TLAA) for PWR-design nuclear plants.	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 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) Section 3.6.3. The guidance for the

Location of Change	Summary of the Change	Technical Basis for Change
		pump casing flaw tolerance TLAA is based on the provisions in ASME Code Case N-481 with a reference to the NRC staff-approved PWROG-17033-NP-A Report, Revision 1.

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
No changes from SRP-SLR, Revision 0, to SRP-SLR, Revision 1.		

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	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

Location of Change	Revised Summary of Significant Changes	Revised Technical Bases for Change
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		and SRP-SLR Supplemental Staff Guidance Document Supplement issued on March 29, 2016, Agencywide Documents Access and Management System (ADAMS) Accession No. ML16041A090. 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. 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

Location of Change	Revised Summary of Significant Changes	Revised Technical Bases for Change
		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 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

Location of Change	Revised Summary of Significant Changes	Revised Technical Bases for Change
		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," 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. 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	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

Location of Change	Revised Summary of Significant Changes	Revised Technical Bases for Change
IV.D2.RP-185		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 (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

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		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 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) 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 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

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		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 References	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 draft 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. 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.

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		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, “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 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

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		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 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. 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

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		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) 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 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	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

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	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.	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 NUREG–1800, Revision 2	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 Report Section XI, and renumbered as Table XI 01.	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). 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	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, the reference to a plant-specific AMP was replaced with a reference to the One-Time Inspection AMP for applicants that would need to manage cracking due to PWSCC in their SG divider plate assemblies.

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	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 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.

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NRC FORM 335
(12-2010)
NRCMD 3.7

U.S. NUCLEAR REGULATORY COMMISSION

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
Draft

2. TITLE AND SUBTITLE
Technical Bases for Changes in the Subsequent License Renewal Guidance Documents, NUREG–2191, Revision 1, Draft Report for Comment and NUREG–2192, Revision 1, Draft Report for Comment

3. DATE REPORT PUBLISHED

MONTH	YEAR
July	2023

4. FIN OR GRANT NUMBER

5. AUTHOR(S)

6. TYPE OF REPORT
Technical

7. PERIOD COVERED (Inclusive Dates)

8. PERFORMING ORGANIZATION - NAME AND ADDRESS (If NRC, provide Division, Office or Region, U. S. Nuclear Regulatory Commission, and mailing address; if contractor, provide name and mailing address.)
Division of New and Renewed Licenses
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

9. SPONSORING ORGANIZATION - NAME AND ADDRESS (If NRC, type "Same as above", if contractor, provide NRC Division, Office or Region, U. S. Nuclear Regulatory Commission, and mailing address.)
Same as above

10. SUPPLEMENTARY NOTES
When finalized, this report will supplement NUREG-2221 (Rev. 0)

11. ABSTRACT (200 words or less)

This document is a knowledge management and knowledge transfer document associated with Draft NUREG–2191, Revision 1, "Generic Aging Lessons Learned for Subsequent License Renewal Draft Report for Comment," (GALL-SLR Report, Rev. 1,), and Draft NUREG–2192, Revision 1, "Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants, Draft Report for Comment" (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 draft 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 2023. This document provides the underlying rationale that the NRC staff used to develop Draft NUREG-2191, Revision 1, and Draft NUREG-2192, Revision 1.

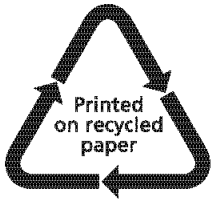
12. KEY WORDS/DESCRIPTORS (List words or phrases that will assist researchers in locating the report.)
License Renewal
Long-term Operations
Aging
Nuclear Safety
Aging Mechanisms
Aging Effects
Aging Management Programs
Subsequent License Renewal
Second License Renewal
Further Evaluations
Technical Bases

13. AVAILABILITY STATEMENT
unlimited

14. SECURITY CLASSIFICATION
(This Page)
unclassified
(This Report)
unclassified

15. NUMBER OF PAGES

16. PRICE



Federal Recycling Program

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, DC 20555-0001

OFFICIAL BUSINESS

NUREG-2192
Supplement 1, Draft

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

July 2023