SLR-ISG-2021-02-MECHANICAL

Updated Aging Management Criteria for Mechanical Portions of Subsequent License Renewal Guidance

Interim Staff Guidance

February 2021

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INTERIM STAFF GUIDANCE

UPDATED AGING MANAGEMENT CRITERIA FOR MECHANICAL PORTIONS OF SUBSEQUENT LICENSE RENEWAL GUIDANCE

SLR-ISG-2021-02-MECHANICAL

PURPOSE

The U.S. Nuclear Regulatory Commission (NRC) staff is providing this subsequent license renewal (SLR) interim staff guidance (ISG) to provide clarifying guidance to facilitate staff and industry understanding of the aging management of systems, structures, and components required in Title 10 of the Code of Federal Regulations (10 CFR) Part 54, "Requirements for renewal of operating licenses for nuclear power plants."

This SLR-ISG identifies revisions to the mechanical portions of NUREG-2191, "Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report," issued July 2017, and NUREG-2192, "Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants," issued July 2017 (SRP-SLR).

BACKGROUND

The NRC staff has reviewed three applications to extend plant operations to 80 years (i.e., for SLR) for Turkey Point Nuclear Generating Units 3 and 4 (Turkey Point); Peach Bottom Atomic Power Station, Units 2 and 3 (Peach Bottom); and Surry Power Station, Units 1 and 2 (Surry). During these reviews, both the staff and applicants have identified ways to make the preparation and review of future SLR applications more effective and efficient.

RATIONALE

Public meetings took place on March 28, 2019; December 12, 2019; February 20, 2020; March 25, 2020; April 3, 2020; and April 7, 2020, between the staff and industry representatives to discuss staff and industry experience in the preparation and review of the initial license renewal application for River Bend Station, Unit 1, which piloted the optimized 18-month review process for SLR applications, as well as the reviews of the first three SLR applications from Turkey Point, Peach Bottom, and Surry.

This SLR-ISG includes revisions to the following GALL SLR Report and SRP-SLR sections:

- Aging Management Program (AMP) X.M2, "Neutron Fluence Monitoring"
- AMP XI.M2, "Water Chemistry"
- AMP XI.M12, "Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)"
- AMP XI.M21A, "Closed Treated Water System"
- Aging Management Review Line Items Associated with AMP XI.M26, "Fire Protection"
- SRP-SLR Table 3.3-1 and GALL-SLR Table VII H2 to Address Reduction of Heat Transfer for Heat Exchanger Tubes in a Fuel Oil Environment

- SRP-SLR Table 3.3-1 and GALL-SLR Table VII H2 to Address Loss of Material in Nickel Alloy Strainer Components in Fuel Oil
- AMP XI.M42, “Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks”

APPLICABILITY

All holders of operating licenses for nuclear power reactors under 10 CFR Part 50, “Domestic licensing of production and utilization facilities,” except those that have permanently ceased operations and have certified that fuel has been permanently removed from the reactor vessel.

GUIDANCE

The NRC provides requirements for the submission and review of applications to extend plant operations beyond the initial 40-year operating period in 10 CFR Part 54.

The GALL-SLR Report and SRP-SLR provide guidance to licensees that wish to extend their plant operating licenses from 60 years to 80 years, and to the NRC staff who will review the SLR applications.

The staff and nuclear industry have identified a number of areas for which future SLR applications and staff reviews can be completed more effectively and efficiently. A series of SLR-ISGs will capture these areas, known as lessons learned.

The NRC staff considers that the information provided in this ISG provides an acceptable approach for managing aging in mechanical components within the scope of 10 CFR Part 54 and will improve the quality, uniformity, effectiveness, and efficiency of NRC staff reviews of future SLR applications.

IMPLEMENTATION

The staff will use the information discussed in this ISG to determine whether, pursuant to 10 CFR 54.21(a)(3), a subsequent license renewal application demonstrates that the effects of aging on structures and components subject to an aging management review are adequately managed so their intended functions will be maintained consistent with the current licensing basis for the subsequent period of extended operation. This ISG contains an update in redline/strikeout of the AMPs identified in the “Rationale” section above. An applicant may reference this ISG in an SLR application to demonstrate that the AMPs at the applicant’s facility correspond to those described in the GALL-SLR. If an applicant credits an AMP as updated by this ISG, it is incumbent on the applicant to ensure that the conditions and operating experience at the plant are bounded by the conditions and operating experience for which this ISG was evaluated. If these bounding conditions are not met, it is incumbent on the applicant to address any additional aging effects and augment its AMPs. For AMPs that are based on this ISG, the NRC staff will review and verify whether the applicant’s AMPs are consistent with those described in this ISG, including applicable plant conditions and operating experience.

BACKFITTING AND ISSUE FINALITY DISCUSSION

Issuance of this ISG does not constitute a backfit as defined in 10 CFR 50.109(a)(1) and is not otherwise inconsistent with the issue finality provisions in 10 CFR Part 52, “Licenses,

certifications, and approvals for nuclear power plants." Thus, the NRC staff did not prepare a backfit analysis for the issuance of this ISG.

The NRC staff's position is based upon the following considerations:

- The ISG positions do not constitute backfitting, inasmuch as the ISG is guidance directed to the NRC staff with respect to its regulatory responsibilities. The ISG provides interim guidance to the staff on how to review certain requests. Changes in guidance intended for use by only the staff are not matters that constitute backfitting as that term is defined in 10 CFR 50.109, "Backfitting," or that involve the issue finality provisions of 10 CFR Part 52.

- Backfitting and issue finality—with certain exceptions discussed in this section—do not apply to current or future applicants. Applicants and potential applicants are not, with certain exceptions, the subject of either the Backfit Rule or any issue finality provisions under 10 CFR Part 52. This is because neither the Backfit Rule nor the issue finality provisions of 10 CFR Part 52 were intended to apply to every NRC action that substantially changes the expectations of current and future applicants. The exceptions to the general principle are applicable whenever a 10 CFR Part 50 operating license applicant references a construction permit or a 10 CFR Part 52 combined license applicant references a license (e.g., an early site permit) or an NRC regulatory approval (e.g., a design certification rule) (or both) for which specified issue finality provisions apply. The NRC staff does not currently intend to impose the positions represented in this ISG in a manner that constitutes backfitting or is inconsistent with any issue finality provision of 10 CFR Part 52. If in the future the NRC staff seeks to impose positions stated in this ISG in a manner that would constitute backfitting or be inconsistent with these issue finality provisions, the NRC staff must make the requisite showing as set forth in the Backfit Rule or address the regulatory criteria set forth in the applicable issue finality provision, as applicable, that would allow the staff to impose the position.

- The NRC staff has no intention to impose the ISG positions on existing nuclear power plant licensees either now or in the future (absent a voluntary request for a change from the licensee). The staff does not intend to impose or apply the positions described in the ISG to existing (i.e., already issued) licenses (e.g., operating licenses and combined licenses). Hence, the issuance of this ISG—even if considered guidance subject to the Backfit Rule or the issue finality provisions in 10 CFR Part 52— would not need to be evaluated as if it were a backfit or as being inconsistent with issue finality provisions. If, in the future, the NRC staff seeks to impose a position in the ISG on holders of already issued licenses in a manner that would constitute backfitting or does not provide issue finality as described in the applicable issue finality provision, then the staff must make a showing as set forth in the Backfit Rule or address the criteria set forth in the applicable issue finality provision that would allow the staff to impose the position.

CONGRESSIONAL REVIEW ACT

This ISG is a rule as defined in the Congressional Review Act (5 U.S.C. 801-808). However, the Office of Management and Budget has not found it to be a major rule as defined in the Congressional Review Act.

FINAL RESOLUTION

By July 1, 2027, the staff will transition this information into NUREG-2191 (GALL-SLR Report) and NUREG-2192 (SRP-SLR). Following the transition of this guidance to NUREG-2191 and NUREG-2192, this ISG will be closed.

APPENDICES

A. Revisions to Aging Management Program (AMP) X.M2, “Neutron Fluence Monitoring”

B. Revisions to AMP XI.M2, “Water Chemistry”

C. Revisions to AMP XI.M12, “Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)”

D. Revisions to AMP XI.M21A, “Closed Treated Water System”

E. Revisions to Aging Management Review Line Items Associated with AMP XI.M26, “Fire Protection”

F. Revisions to SRP-SLR Table 3.3-1 and GALL-SLR Table VII H2 to Address Reduction of Heat Transfer for Heat Exchanger Tubes in a Fuel Oil Environment

G. Revisions to SRP-SLR Table 3.3-1 and GALL-SLR Table VII H2 to Address Loss of Material in Nickel Alloy Strainer Components in Fuel Oil

H. Revisions to AMP XI.M42, “Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks”

I. Disposition of Public Comments

APPENDIX A

REVISIONS TO AGING MANAGEMENT PROGRAM (AMP) X.M2, "NEUTRON FLUENCE MONITORING"

Summary of Revisions

This ISG revises AMP X.M2 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 NRC staff continues to develop regulatory guidance for such calculations.

Basis for Revisions

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.

AMP Revisions

Program Description

This aging management program (AMP) provides a means to ensure the validity of the neutron fluence analysis and related neutron fluence-based, time-limited aging analyses (TLAAs). In so doing, this AMP also provides an acceptable basis for managing aging effects attributable to neutron fluence in accordance with requirements in Title 10 of the Code of Federal Regulations (10 CFR) 54.21(c)(1)(iii). This program monitors neutron fluence for reactor pressure vessel (RPV) components and reactor vessel internal (RVI) components and is used in conjunction with the Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report AMP XI.M31, "Reactor Vessel Material Surveillance." Neutron fluence is a time-dependent input parameter for evaluating the loss of fracture toughness due to neutron irradiation embrittlement. Accurate neutron fluence values are also necessary to identify the RPV beltline region, for which neutron fluence is projected to exceed 1×10^{17} n/cm^2 (E > 1 MeV) during the subsequent period of extended operation.

Neutron fluence is an input to a number of RPV irradiation embrittlement analyses that are required by specific regulations in 10 CFR Part 50. These analyses are TLAAs for subsequent license renewal applications (SLRAs) and are the topic of the acceptance criteria and review procedures in Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants (SRP-SLR) Section 4.2, "Reactor Vessel Neutron Embrittlement Analyses." The neutron irradiation embrittlement TLAAs that are within the scope of this AMP include, but are not limited to: (a) neutron fluence, (b) pressurized thermal shock analyses for pressurized water reactors, as required by 10 CFR 50.61 or alternatively [if applicable for the current licensing basis (CLB)] by 10 CFR 50.61a; (c) RPV upper-shelf energy analyses, as required by Section IV.A.1 of 10 CFR Part 50, Appendix G, and (d) pressure-temperature (P-T) limit analyses that are required by Section IV.A.2 of 10 CFR Part 50, Appendix G and controlled by plant technical specifications (TS) update and reporting requirements (i.e., the 10 CFR 50.90 license amendment process for updates of P-T limit curves located in the TS limiting conditions

of operation, or TS administrative control section requirements for updates of P-T limit curves that have been relocated into a pressure-temperature limits report).

The calculations of neutron fluence also factor into other analyses or technical report methodologies that assess irradiation-related aging effects. Examples include, but are not limited to: (a) determination of the RPV beltline as defined in Regulatory Issue Summary 2014-11, "Information On Licensing Applications For Fracture Toughness Requirements For Ferritic Reactor Coolant Pressure Boundary Components," (b) evaluation of the susceptibility of RVI components to neutron radiation damage mechanisms, including irradiation embrittlement (IE), irradiation-assisted stress corrosion cracking (IASCC), irradiation-enhanced stress relaxation or creep (IESRC) and void swelling or neutron induced component distortion; and (c) evaluating the dosimetry data obtained from an RPV surveillance program.

Guidance on acceptable methods and assumptions for determining reactor vessel neutron fluence is described in the U.S. Nuclear Regulatory Commission (NRC) Regulatory Guide (RG) 1.190, "Calculational and Dosimetry Methods for Determining Pressure Vessel Neutron Fluence." The methods developed and approved using the guidance contained in RG 1.190 are specifically intended for determining neutron fluence in the region of the RPV close to the active fuel region of the core and are not intended to apply to vessel regions significantly above and below the active fuel region of the core, nor to RVI components. Therefore, the use of RG 1.190-adherent methods to estimate neutron fluence for the RPV regions significantly above and below the active fuel region of the core and RVI components may require additional justification, even if those methods were approved by the NRC for RPV neutron fluence calculations. This program monitors in-vessel or ex-vessel dosimetry capsules and evaluates the dosimetry data, as needed. Additional in-vessel or ex-vessel dosimetry capsules may be needed when the reactor surveillance program has exhausted the available capsules for in-vessel exposure.

Evaluation and Technical Basis

1. ***Scope of Program***: The scope of the program includes RPV and RVI components that are subject to a neutron embrittlement TLAA or other analysis involving time-dependent neutron irradiation. The program monitors neutron fluence throughout the subsequent period of extended operation for determining the susceptibility of the components to IE, IASCC, IESRC, and void swelling or distortion. The use of this program also continues to ensure the adequacy of the neutron fluence estimates by: (a) monitoring plant and core operating conditions relative to the assumptions used in the neutron fluence calculations, and (b) continuously updating the qualification database associated with the neutron fluence method as new calculational and measurement data become available for benchmarking. This program is used in conjunction with GALL-SLR Report AMP XI.M31, "Reactor Vessel Material Surveillance."

   Updated neutron fluence calculations, plant modifications, and RPV surveillance program data are used to identify component locations within the scope of this program, including the beltline region of the RPV. Applicable requirements in 10 CFR Part 50, and if appropriate, plant TS, related to calculating neutron fluence estimates and incorporating those calculations into neutron irradiation analyses for the RPVs and RVIs must be met.

2. ***Preventive Actions***: This program is a condition monitoring program through calculation of neutron fluence values, and continuous monitoring of their validity; thus, there are no specific preventive actions. Because this program can be used to verify that the inputs and assumptions associated with neutron fluence in the irradiation embrittlement TLAAs (described in SRP-SLR Section 4.2) remain within their respective limits, this program can prevent those TLAAs from being outside of the acceptance criteria that are set as regulatory or design limits in the analyses. Since the program is used to determine that the inputs and assumptions associated with neutron fluence in irradiation embrittlement TLAAs will remain within their respective limits, this program does have some preventative aspects to it.

3. ***Parameters Monitored or Inspected***: The program monitors component neutron fluence as determined by the neutron fluence analyses, and appropriate plant and core operating parameters that affect the calculated neutron fluence. The calculational methods, benchmarking, qualification, and surveillance data are monitored to maintain the adequacy of neutron fluence calculations. Neutron fluence levels in specific components are monitored to verify component locations within the scope of this program are identified.

   Neutron fluence is estimated using a computational method that incorporates the following major elements: (1) determination of the geometrical and material input data for the reactor core, vessel and internals, and cavity; (2) determination of the characteristics of the neutron flux emitting from the core; (3) transport of the neutrons from the core to the vessel, and into the cavity; and (4) qualification of the calculational procedure.

   Guidance on acceptable methods and assumptions for determining RPV neutron fluence is described in NRC RG 1.190. The use of RG 1.190-adherent methods to estimate neutron fluence for the RPV beltline regions significantly above and below the active fuel region of the core, and RVI components may require additional justification, even if those methods were approved by the NRC for RPV neutron fluence calculations.

4. ***Detection of Aging Effects***: The program uses applicant-defined activities or methods to track the RPV and RVI component neutron fluence levels. The neutron fluence levels estimated in this program are used as input to the evaluation for determining applicable aging effects for RPV and RVI components, including evaluation of TLAAs as described in SRP-SLR Section 4.2.

5. ***Monitoring and Trending***: Monitoring and trending of neutron fluence are needed to ensure the continued adequacy of various neutron fluence analyses as identified as TLAAs for the SLRA. When applied to RVI components and to components significantly above and below the active fuel region of the core, the program also assesses and justifies whether the current neutron fluence methodology for the CLB is acceptable for monitoring and projecting the neutron fluence values for these components during the subsequent period of extended operation, or else appropriately enhances (with justification) the program's monitoring and trending element activities accordingly on an as-needed basis. Trending is performed to ensure that plant and core operating conditions remain consistent with the assumptions used in the neutron fluence analyses and that the analyses are updated as necessary.

Neutron fluence estimates are typically determined using a combination of plant and core operating history data that address past plant operating conditions, and projections that are intended to address future operation. Although projections for future operation may conservatively over-estimate the core neutron flux to cover potential variations in plant and core operation and increases in neutron flux at any given time, there is no explicit requirement to do so. Therefore, projections for future plant and core operation should be periodically verified to ensure that any projections used in the neutron fluence calculations remain bounding with respect to actual plant operating conditions.

This program monitors in-vessel or ex-vessel dosimetry capsules and evaluates the dosimetry data, as needed. Additional in-vessel or ex-vessel dosimetry capsules may be needed when the reactor surveillance program has exhausted the available capsules for in-vessel exposure.

6. ***Acceptance Criteria****:* There are no specified acceptance values for neutron fluence; the acceptance criteria relate to the different parameters that are evaluated using neutron fluence, as described in SRP-SLR Section 4.2.

NRC RG 1.190 provides guidance for acceptable methods to determine neutron fluence for the RPV beltline region. It should be noted, however, that applying RG 1.190-adherent methods to determine neutron fluence in locations other than those close to the active fuel region of the core may require additional justification regarding, for example, the level of detail used to represent the core neutron source, the methods to synthesize the three-dimensional flux field, and the order of angular quadrature used in the neutron transport calculations. The applicability of existing qualification data may also require additional justification.

Several examples of acceptable approaches used to provide the above-suggested justification are available. The NRC staff reviewed additional qualification data in the safety evaluation approving Licensing Topical Report BWRVIP 145NP-A, "BWR Vessel Internals Project, Evaluation of Susquehanna Unit 2 Top Guide and Core Shroud Materials Samples Using RAMA Fluence Methodology.". An additional example of an approach which uses more refined nuclear and transport methods than recommended in RG 1.190, instead of additional qualification data, is available on Page 3-156 of NUREG-2181, the Safety Evaluation Report Related to the License Renewal of Sequoyah Nuclear Plant Units 1 and 2. These examples supported the qualification of different methods to estimate fluence for RVI components. Another example, specific to subsequent license renewal, is available in the NRC Staff's Safety Evaluation Report [SER] Related to the Subsequent License Renewal of Turkey Point Generating Units 3 and 4. The NRC staff's evaluation of the fluence AMP appears on Pages 3-47 – 3-51, for RPV beltline regions significantly above and below the active fuel region of the core and RVI components. In addition, at Pages 3-72 – 3-74 of that SER, the staff evaluated plant-specific fluence calculations for RVI components to demonstrate the validity of a more generic fluence estimate for downstream consideration in the aging management of those RVI components. These examples all describe ways in which applicants justified the application of RG 1.190-adherent methods, or appropriate alternatives, to evaluate fluence in regions outside the immediate, core-adjacent area of the RPV beltline.

7. ***Corrective Actions***: Results that do not meet the acceptance criteria are addressed in the applicant's corrective action program under those specific portions of the quality assurance (QA) program that are used to meet Criterion XVI, "Corrective Action," of 10 CFR Part 50, Appendix B. Appendix A of the GALL-SLR Report describes how an applicant may apply its 10 CFR Part 50, Appendix B, QA program to fulfill the corrective actions element of this AMP for both safety-related and nonsafety-related structures and components (SCs) within the scope of this program.

   The program provides for corrective actions by updating the analyses for the RPV components, or assessing the need for revising the augmented inspection bases for RVI components, if the neutron fluence assumptions in RPV analyses or augmented inspection bases for RVI components are projected to be exceeded during the subsequent period of extended operation. Acceptable corrective actions include revisions to the neutron fluence calculations to incorporate additional operating history data, as such data become available; use of improved modeling approaches to obtain more accurate neutron fluence estimates; and rescreening of RPV and RVI components when the estimated neutron fluence exceeds threshold values for specific aging mechanisms.

   When the fluence monitoring activities are used to confirm the validity of existing RPV neutron irradiation embrittlement analyses and result in the need for an update of an analysis that is required by a specific 10 CFR Part 50 regulation, the corrective actions to be taken follow those prescribed in the applicable regulation.

8. ***Confirmation Process***: The confirmation process is addressed through those specific portions of the QA program that are used to meet Criterion XVI, "Corrective Action," of 10 CFR Part 50, Appendix B. Appendix A of the GALL-SLR Report describes how an applicant may apply its 10 CFR Part 50, Appendix B, QA program to fulfill the confirmation process element of this AMP for both safety-related and nonsafety-related SCs within the scope of this program.

9. ***Administrative Controls***: Administrative controls are addressed through the QA program that is used to meet the requirements of 10 CFR Part 50, Appendix B, associated with managing the effects of aging. Appendix A of the GALL-SLR Report describes how an applicant may apply its 10 CFR Part 50, Appendix B, QA program to fulfill the administrative controls element of this AMP for both safety-related and nonsafety-related SCs within the scope of this program.

10. ***Operating Experience***: The program reviews industry and plant operating experience (OE) relevant to neutron fluence. Applicable OE affecting the neutron fluence estimate is to be considered in selecting the components for monitoring. RG 1.190 provides expectations for updating the qualification database for the neutron fluence methods via the operational experience gathered from RPV material surveillance program data. This operational experience is in accordance with the requirements of 10 CFR Part 50 Appendix H.

    The program is informed and enhanced when necessary through the systematic and ongoing review of both plant-specific and industry OE including research and development such that the effectiveness of the AMP is evaluated consistent with the discussion in Appendix B of the GALL-SLR Report.

References

10 CFR Part 50, Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants." Washington, DC: U.S. Nuclear Regulatory Commission. 2016.

10 CFR Part 50, Appendix G, "Fracture Toughness Requirements." Washington, DC: U.S. Nuclear Regulatory Commission. 2016.

10 CFR Part 50, Appendix H, "Reactor Vessel Material Surveillance Program Requirements." Washington, DC: U.S. Nuclear Regulatory Commission. 2016.

10 CFR 50.55a, "Codes and Standards." Washington, DC: U.S. Nuclear Regulatory Commission. 2016.

10 CFR 50.60, "Acceptance Criteria for Fracture Prevention Measures for Lightwater Nuclear Power Reactors for Normal Operation." Washington, DC: U.S. Nuclear Regulatory Commission. 2016.

10 CFR 50.61, "Fracture Toughness Requirements for Protection Against Pressurized Thermal Shock Events." Washington, DC: U.S. Nuclear Regulatory Commission. 2016.

10 CFR 50.61a, "Alternate Fracture Toughness Requirements for Protection Against Pressurized Thermal Shock Events." Washington, DC: U.S. Nuclear Regulatory Commission. 2016.

NRC. Regulatory Guide 1.190, "Calculational and Dosimetry Methods for Determining Pressure Vessel Neutron Fluence." Agencywide Documents Access and Management System (ADAMS) Accession No. ML010890301. Washington, DC: U.S. Nuclear Regulatory Commission. March 2001.

_____. NUREG-2181, "Safety Evaluation Report Related to the License Renewal of Sequoyah Nuclear Plant Units 1 and 2." Dockets 50-327 and 50-328, ADAMS Accession No. ML15187A206. Washington, DC: U.S. Nuclear Regulatory Commission. July 2015.

_____. "Safety Evaluation Report Related to the Subsequent License Renewal of Turkey Point Generating Units 3 and 4." Dockets 50-250 and 50-251, ADAMS Accession No. ML19191A057. Washington, DC: U.S. Nuclear Regulatory Commission. December 2019.

Watkins, K.E., "BWR Vessel Internals Project, Evaluation of Susquehanna Unit 2 Top Guide and Core Shroud Materials Samples Using RAMA Fluence Methodology," BWRVIP-145-NP-A, ADAMS Accession No. ML100260948. Palo Alto, CA: Electric Power Research Institute. October 2009.

Revisions to FSAR Supplement

None

Revisions to AMR Items

None

APPENDIX B

REVISIONS TO AGING MANAGEMENT PROGRAM XI.M2, "WATER CHEMISTRY"

Summary of Revisions

This ISG revises AMP XI.M2, "Water Chemistry," to include the latest revision of EPRI guidelines for BWR and PWR.

Basis for Revisions

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 SER 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 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.

AMP Revisions

Program Description

The main objective of this program is to mitigate loss of material due to corrosion, cracking due to stress corrosion cracking (SCC) and related mechanisms, and reduction of heat transfer due to fouling in components exposed to a treated water environment. The program includes periodic monitoring of the treated water in order to minimize loss of material or cracking.

The water chemistry program for boiling water reactors (BWRs) relies on monitoring and control of reactor water chemistry based on industry guidelines contained in the Boiling Water Reactor Vessel and Internals Project (BWRVIP)-190 (Electric Power Research Institute (EPRI) 3002002623, "BWR Vessel and Internals Project: BWR Water Chemistry Guidelines," Revision 1. ~~1016579~~The BWRVIP-190 has three sets of guidelines: (i) one for reactor water, (ii) one for condensate and feedwater, and (iii) one for control rod drive mechanism cooling water. The water chemistry program for pressurized water reactors (PWRs) relies on monitoring and control of reactor water chemistry based on industry guidelines contained in EPRI 300200050~~51014986~~, "PWR Primary Water Chemistry Guidelines," Revision 7 and EPRI 300201064~~51016555~~, "PWR Secondary Water Chemistry Guidelines," Revision 8~~7~~.

The water chemistry programs are generally effective in removing impurities from intermediate and high flow areas. The Generic Aging Lessons Learned for Subsequent License Renewal

(GALL-SLR) Report identifies those circumstances in which the water chemistry program is to be augmented to manage the effects of aging for license renewal. For example, the water chemistry program may not be effective in low flow or stagnant flow areas. Accordingly, in certain cases as identified in the GALL-SLR Report, verification of the effectiveness of the chemistry control program is undertaken to provide reasonable assurance that significant degradation is not occurring and that the component's intended function is maintained during the subsequent period of extended operation. For these specific cases, an acceptable verification program is a one-time inspection of selected components at susceptible locations in the system.

Evaluation and Technical Basis

1. ***Scope of Program****:* The program includes components in the reactor coolant system, the engineered safety features, the auxiliary systems, and the steam and power conversion system. This program addresses the metallic components subject to aging management review that are exposed to a treated water environment controlled by the water chemistry program.

2. ***Preventive Actions****:* The program includes specifications for chemical species, impurities and additives, sampling and analysis frequencies, and corrective actions for control of reactor water chemistry. System water chemistry is controlled to minimize contaminant concentration and mitigate loss of material due to general, crevice, and pitting corrosion and cracking caused by SCC. For BWRs, maintaining high water purity reduces susceptibility to SCC, and chemical additive programs such as hydrogen water chemistry or noble metal chemical application also may be used. For PWRs, additives are used for reactivity control, to control pH and dose rates, and inhibit corrosion.

3. ***Parameters Monitored or Inspected****:* The concentrations of corrosive impurities listed in the EPRI water chemistry guidelines are monitored to mitigate loss of material, cracking, and reduction of heat transfer. Water quality also is maintained in accordance with the guidance. Chemical species and water quality are monitored by in-process methods or through sampling. The chemical integrity of the samples is maintained and verified to provide reasonable assurance that the method of sampling and storage will not cause a change in the concentration of the chemical species in the samples.

4. ***Detection of Aging Effects****:* This is a mitigation program and does not provide for detection of any aging effects of concern for the components within its scope. The monitoring methods and frequency of water chemistry sampling and testing is performed in accordance with the EPRI water chemistry guidelines and based on plant operating conditions. The main objective of this program is to mitigate loss of material due to corrosion and cracking due to SCC in components exposed to a treated water environment.

5. ***Monitoring and Trending****:* Chemistry parameter data are recorded, evaluated, and trended in accordance with the EPRI water chemistry guidelines.

6. ***Acceptance Criteria****:* Maximum levels for various chemical parameters are maintained within the system-specific limits as indicated by the limits specified in the corresponding EPRI water chemistry guidelines.

7. ***Corrective Actions**:* Results that do not meet the acceptance criteria are addressed in the applicant's corrective action program under those specific portions of the quality assurance (QA) program that are used to meet Criterion XVI, "Corrective Action," of Title 10 of the *Code of Federal Regulations* (*10* CFR) Part 50, Appendix B. Appendix A of the GALL-SLR Report describes how an applicant may apply its 10 CFR Part 50, Appendix B, QA program to fulfill the corrective actions element of this aging management program (AMP) for both safety-related and nonsafety-related structures and components (SCs) within the scope of this program.

   Any evidence of aging effects or unacceptable water chemistry results are evaluated, the cause identified, and the condition corrected. When measured water chemistry parameters are outside the specified range, corrective actions are taken to bring the parameter back within the acceptable range (or to change the operational mode of the plant) within the time period specified in the EPRI water chemistry guidelines. Whenever corrective actions are taken to address an abnormal chemistry condition, increased sampling or other appropriate actions are taken and analyzed to verify that the corrective actions were effective in returning the concentrations of contaminants, such as chlorides, fluorides, sulfates, and dissolved oxygen, to within the acceptable ranges.

8. ***Confirmation Process**:* The confirmation process is addressed through those specific portions of the QA program that are used to meet Criterion XVI, "Corrective Action," of 10 CFR Part 50, Appendix B. Appendix A of the GALL-SLR Report describes how an applicant may apply its 10 CFR Part 50, Appendix B, QA program to fulfill the confirmation process element of this AMP for both safety-related and nonsafety-related SCs within the scope of this program.

9. ***Administrative Controls**:* Administrative controls are addressed through the QA program that is used to meet the requirements of 10 CFR Part 50, Appendix B, associated with managing the effects of aging. Appendix A of the GALL-SLR Report describes how an applicant may apply its 10 CFR Part 50, Appendix B, QA program to fulfill the administrative controls element of this AMP for both safety-related and nonsafety-related SCs within the scope of this program.

10. ***Operating Experience**:* The EPRI guideline documents have been developed based on plant experience and have been shown to be effective over time with their widespread use. The specific examples of operating experience (OE) are as follows:

    BWR: Intergranular stress corrosion cracking (IGSCC) has occurred in small- and large-diameter BWR piping made of austenitic stainless steels (SSs) and nickel-base alloys. Significant cracking has occurred in recirculation, core spray, residual heat removal systems, and reactor water cleanup system piping welds. IGSCC has also occurred in a number of vessel internal components, including core shroud, access hole cover, top guide, and core spray spargers [U.S. Nuclear Regulatory Commission (NRC) Inspection and Enforcement Bulletin (IEB) 80-13, NRC Information Notice (IN) 95-17, NRC Generic Letter (GL) 94-03, and NUREG–1544]. No occurrence of SCC in piping and other components in standby liquid control systems exposed to sodium pentaborate solution has ever been reported (NUREG/CR–6001).

PWR Primary System: The potential for SCC-type mechanisms might normally occur because of inadvertent introduction of contaminants into the primary coolant system, including contaminants introduced from the free surface of the spent fuel pool (which can be a natural collector of airborne contaminants) or the introduction of oxygen during plant cooldowns (NRC IN 84–18). Ingress of demineralizer resins into the primary system has caused IGSCC of Alloy 600 vessel head penetrations (NRC IN 96-11, NRC GL 97-01).

Inadvertent introduction of sodium thiosulfate into the primary system has caused IGSCC of steam generator tubes. SCC has occurred in safety injection lines (NRC INs 97-19 and 84-18), charging pump casing cladding (NRC INs 80-38 and 94-63), instrument nozzles in safety injection tanks (NRC IN 91-05), and safety-related SS piping systems that contain oxygenated, stagnant, or essentially stagnant borated coolant (NRC IN 97-19). Steam generator tubes and plugs and Alloy 600 penetrations have experienced primary water SCC (NRC INs 89-33, 94-87, 97-88, 90-10, and 96-11; NRC Bulletin 89-01 and its two supplements). IGSCC-induced circumferential cracking has occurred in PWR pressurizer heater sleeves (NRC IN 2006-27).

PWR Secondary System: Steam generator tubes have experienced outside diameter stress corrosion cracking, intergranular attack, wastage, and pitting (NRC IN 97-88, NRC GL 95-05). Carbon steel support plates in steam generators have experienced general corrosion. The steam generator shell has experienced pitting and SCC (NRC INs 82-37, 85-65, and 90-04). Extensive buildup of deposits at steam generator tube support holes can result in flow-induced vibrations and tube cracking (NRC-IN-2007-37).

Such OE has provided feedback to revisions of the EPRI water chemistry guideline documents.

The program is informed and enhanced when necessary through the systematic and ongoing review of both plant-specific and industry OE including research and development such that the effectiveness of the AMP is evaluated consistent with the discussion in Appendix B of the GALL-SLR Report.

References

10 CFR Part 50, Appendix B, “Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants.” Washington, DC: U.S. Nuclear Regulatory Commission. 2016.

EPRI. BWRVIP-190 (EPRI ~~1016579~~3002002623), “BWR Vessel and Internals Project: BWR Water Chemistry Guidelines~~.~~” ~~2008~~ Revision 1.” Palo Alto, California: Electric Power Research Institute. ~~October 2008~~April 2014.

_____. EPRI ~~1014986~~ 3002000505, “PWR Primary Water Chemistry Guidelines.” Revision 7, Volumes 1 and 2. Palo Alto, California: Electric Power Research Institute. April 2014.

_____. EPRI ~~1016555~~3002010645, “PWR Secondary Water Chemistry Guidelines.” Revision ~~7~~8. Palo Alto, California: Electric Power Research Institute. ~~February 2009~~September 2017.

NRC. Bulletin 89-01, “Failure of Westinghouse Steam Generator Tube Mechanical Plugs.” Washington, DC: U.S. Nuclear Regulatory Commission. May 1989.

_____. Bulletin 89-01, "Supplement 1, "Failure of Westinghouse Steam Generator Tube Mechanical Plugs." Washington, DC: U.S. Nuclear Regulatory Commission. November 1989.

_____. Bulletin 89-01, Supplement 2, "Failure of Westinghouse Steam Generator Tube Mechanical Plugs." Washington, DC: U.S. Nuclear Regulatory Commission. June 1991.

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

_____. Generic Letter 95-05, "Voltage-Based Repair Criteria for Westinghouse Steam Generator Tubes Affected by Outside Diameter Stress Corrosion Cracking." Washington, DC: U.S. Nuclear Regulatory Commission. August 1995.

_____. Generic Letter 97-01, "Degradation of Control Rod Drive Mechanism Nozzle and Other Vessel Closure Head Penetrations." Washington, DC: U.S. Nuclear Regulatory Commission. April 1997.

_____. IE Bulletin 80-13, "Cracking in Core Spray Piping." Washington, DC: U.S. Nuclear Regulatory Commission. May 1980.

_____. Information Notice 80-38, "Cracking In Charging Pump Casing Cladding." Washington, DC: U.S. Nuclear Regulatory Commission. October 1980.

_____. Information Notice 82-37, "Cracking in the Upper Shell to Transition Cone Girth Weld of a Steam Generator at an Operating PWR." Washington, DC: U.S. Nuclear Regulatory Commission. September 1982.

_____. Information Notice 84-18, "Stress Corrosion Cracking in Pressurized Water Reactor Systems." Washington, DC: U.S. Nuclear Regulatory Commission. March 1984.

_____. Information Notice 85-65, "Crack Growth in Steam Generator Girth Welds." Washington, DC: U.S. Nuclear Regulatory Commission. July 1985.

_____. Information Notice 89-33, "Potential Failure of Westinghouse Steam Generator Tube Mechanical Plugs." Washington, DC: U.S. Nuclear Regulatory Commission. March 1989.

_____. Information Notice 90-04, "Cracking of the Upper Shell-to-Transition Cone Girth Welds in Steam Generators." Washington, DC: U.S. Nuclear Regulatory Commission. January 1990.

_____. Information Notice 90-10, "Primary Water Stress Corrosion Cracking (PWSCC) of Inconel 600." Washington, DC: U.S. Nuclear Regulatory Commission. February 1990.

_____. Information Notice 91-05, "Intergranular Stress Corrosion Cracking In Pressurized Water Reactor Safety Injection Accumulator Nozzles." Washington, DC: U.S. Nuclear Regulatory Commission. January 1991.

_____. Information Notice 94-63, "Boric Acid Corrosion of Charging Pump Casing Caused by Cladding Cracks." Washington, DC: U.S. Nuclear Regulatory Commission. August 1994.

_____. Information Notice 94-87, "Unanticipated Crack in a Particular Heat of Alloy 600 Used for Westinghouse Mechanical Plugs for Steam Generator Tubes." Washington, DC: U.S. Nuclear Regulatory Commission. December 1994.

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

_____. Information Notice 96-11, "Ingress of Demineralizer Resins Increase Potential for Stress Corrosion Cracking of Control Rod Drive Mechanism Penetrations." Washington, DC: U.S. Nuclear Regulatory Commission. February 1996.

_____. Information Notice 97-19, "Safety Injection System Weld Flaw at Sequoyah Nuclear Power Plant, Unit 2." Washington, DC: U.S. Nuclear Regulatory Commission. April 1997.

_____. Information Notice 97-88, "Experiences During Recent Steam Generator Inspections." Washington, DC: U.S. Nuclear Regulatory Commission. December 1997.

_____. Information Notice 2006-27, "Circumferential Cracking in the Stainless Steel Pressurizer Heater Sleeves of Pressurized Water Reactors." Washington, DC: U.S. Nuclear Regulatory Commission. December 2006.

_____. Information Notice 2007-37, "Buildup of Deposits in Steam Generators." Washington, DC: U.S. Nuclear Regulatory Commission. November 2007.

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

_____. NUREG/CR–6001, "Aging Assessment of BWR Standby Liquid Control Systems." G.D. Buckley, R.D. Orton, A.B. Johnson Jr., and L.L. Larson. Washington, DC: U.S. Nuclear Regulatory Commission. 1992.

Revisions to SRP-SLR

3.1.6 References

1. NEI. NEI 97-06, "Steam Generator Program Guidelines." Revision 2. Agencywide Documents Access and Management System (ADAMS) Accession No. ML052710007. Washington, DC: Nuclear Energy Institute. September 2005.

2. NEI. NEI 95-10, "Industry Guideline for Implementing the Requirements of 10 CFR Part 54–The License Renewal Rule." Revision 6. ADAMS Accession No. ML051860406. Washington, DC: Nuclear Energy Institute. June 2005.

3. NRC. Information Notice 90-04, "Cracking of the Upper Shell-to-Transition Cone Girth Welds in Steam Generators." ADAMS Accession No. ML031470418. Washington, DC: U.S. Nuclear Regulatory Commission. January 26, 1990.

4. NRC. NUREG–0313, "Technical Report on Material Selection and Processing Guidelines for BWR Coolant Pressure Boundary Piping." Revision 2. ADAMS Accession No. ML031470422. Washington, DC: U.S. Nuclear Regulatory Commission. January 1988.

5. EPRI. EPRI 1013706, "PWR Steam Generator Examination Guidelines." Revision 7. Palo Alto, California: Electric Power Research Institute. October 2007.

6. NRC. Regulatory Guide 1.121, "Bases for Plugging Degraded PWR Steam Generator Tubes (for Comment)." ADAMS Accession No.ML003739366. Washington, DC: U.S. Nuclear Regulatory Commission. May 1976.

7. NRC. Generic Letter 95-05, "Voltage-Based Repair Criteria for Westinghouse Steam Generator Tubes Affected by Outside Diameter Stress Corrosion Cracking." ADAMS Accession No. ML041680635. Washington, DC: U.S. Nuclear Regulatory Commission. August 3, 1995.

8. NRC. Information Notice 90-10, "Primary Water Stress Corrosion Cracking (PWSCC) of Inconel 600." ADAMS Accession No. ML053070392. Washington, DC: U.S. Nuclear Regulatory Commission. February 23, 1990.

9. NRC. Information Notice 90-30, "Ultrasonic Inspection Techniques for Dissimilar Metal Welds." ADAMS Accession No. ML031470652. Washington, DC: U.S. Nuclear Regulatory Commission. May 1, 1990.

10. NRC. Generic Letter 89-08, "Erosion/Corrosion-Induced Pipe Wall Thinning." ADAMS Accession No. ML082320534. Washington, DC: U.S. Nuclear Regulatory Commission. May 2, 1989.

11. NRC. Information Notice 96-11, "Ingress of Demineralizer Resins Increase Potential for Stress Corrosion Cracking of Control Rod Drive Mechanism Penetrations." ADAMS Accession No. ML031060264. Washington, DC: U.S. Nuclear Regulatory Commission. February 14, 1996.

12. EPRI. BWRVIP–190 (EPRI ~~1016579~~3002002623), "BWR Vessel and Internals Project: BWR Water Chemistry Guidelines." Revision 1. Palo Alto, California: Electric Power Research Institute. ~~October 2008~~ April 2014.

13. EPRI. EPRI NP–5769, "Degradation and Failure of Bolting in Nuclear Power Plants." Volumes 1 and 2. Palo Alto, California: Electric Power Research Institute. April 1988.

14. EPRI. EPRI TR–~~1014986~~3002000505, "PWR Primary Water Chemistry Guidelines." Revision 7. Volumes 1 and 2. Palo Alto, California: Electric Power Research Institute. April 2014.

15. NRC. Generic Letter 88-01, "NRC Position on IGSCC in BWR Austenitic Stainless Steel Piping." ADAMS Accession No. ML031130463. Washington, DC: U.S. Nuclear Regulatory Commission. January 25, 1988.

16. NRC. Generic Letter 97-01, "Degradation of Control Rod Drive Mechanism Nozzle and Other Vessel Closure Head Penetrations." ADAMS Accession No. ML993550383. Washington, DC: U.S. Nuclear Regulatory Commission. April 1, 1997.

17. NRC. Information Notice 97-46, "Unisolable Crack in High-Pressure Injection Piping." Washington, DC: U.S. Nuclear Regulatory Commission. July 9, 1997.

18. NRC. Regulatory Guide 1.99, "Radiation Embrittlement of Reactor Vessel Materials." Washington, DC: U.S. Nuclear Regulatory Commission. May 1988.

19. NRC. Information Notice 2013-20, "Steam Generator Channel Head and Tubesheet Degradation." ADAMS Accession No. ML13204A143. Washington, DC: U.S. Nuclear Regulatory Commission. October 3, 2013.

20. NRC. NUREG–0619, "BWR Feedwater Nozzle and Control Rod Drive Return Line Nozzle Cracking." ADAMS Accession No. ML031600712. Washington, DC: U.S. Nuclear Regulatory Commission. November 1980.

21. NRC. NUREG–1339, "Resolution of Generic Safety Issue 29: Bolting Degradation or Failure in Nuclear Power Plants." ADAMS Accession No. ML031430208. Washington, DC: U.S. Nuclear Regulatory Commission. June 1990.

22. EPRI. EPRI TR–104213, "Bolted Joint Maintenance & Application Guide, Electric Power Research Institute." Palo Alto, California: Electric Power Research Institute. December 1995.

23. Dave Modeen. NEI Letter (December 11) to Gus Lainas, "Responses to NRC Requests for Additional Information (RAIs) on GL 97-01." Washington, DC: Nuclear Energy Institute. 1998.

24. EPRI. EPRI TR–~~1016555~~3002010645, "PWR Secondary Water Chemistry Guidelines." Revision ~~7~~8. Palo Alto, California: Electric Power Research Institute. ~~February 2009~~September 2017.

25. NRC. Information Notice 91-19, "Steam Generator Feedwater Distribution Piping Damage." Washington, DC: U.S. Nuclear Regulatory Commission. March 12, 1991.

26. EPRI. EPRI TR–1022863, "Materials Reliability Program: Pressurized Water Reactor Internals Inspection and Evaluation Guidelines (MRP-227-A)." Palo Alto, California: Electric Power Research Institute. December 2011.

27. Entergy Operations, Inc. “Demonstration of the Management of Aging Effects for the Reactor Vessel Internals.” Topical Report BAW-2248A. Russellville, Arkansas: Entergy Operations, Inc. March 2000.

28. EPRI. EPRI TR–1014982, “Divider Plate Cracking in Steam Generators - Results of Phase 1: Analysis of Primary Water Stress Corrosion Cracking and Mechanical Fatigue in the Alloy 600 Stub Runner to Divider Plate Weld Material.” Palo Alto, California: Electric Power Research Institute. June 2007.

29. Dominion Nuclear Connecticut, Inc. Letter (July 13) to NRC, Dominion Nuclear Connecticut, Inc. Millstone Power Station Unit 3 Results of the Reactor Pressure Vessel Head Inspections Required by NRC Order EA-03-009. 2007.

30. Southern Company. Letter (June 21) to the NRC, Vogtle Electric Generating Plant – Unit 2 Results of Reactor Pressure Vessel Head Inspections Required by First Revised Order EA-03-009. Atlanta, Georgia: Southern Company. 2007.

31. EPRI. EPRI 3002002850, “Steam Generator Management Program: Investigation of Crack Initiation and Propagation in the Steam Generator Channel Head Assembly.” Palo Alto, California: Electric Power Research Institute, October 2014.

32. EPRI. EPRI 1020988, “Steam Generator Management Program: Phase II Divider Plate Cracking Engineering Study.” Palo Alto, California: Electric Power Research Institute. November 2010.

33. EPRI. EPRI 1016552, “Divider Plate Cracking in Steam Generators: Results of Phase II: Evaluation of the Impact of a Cracked Divider Plate on LOCA and Non-LOCA Analyses.” Palo Alto, California: Electric Power Research Institute. November 2008.

34. EPRI. Presentation, “NRC/Industry Meeting Regarding Tube-to-Tubesheet Weld and Divider Plate Cracking Report.” Palo Alto, California: Electric Power Research Institute. July 30, 2015.

35. ACI. ACI Standard 318-95, “Building Code Requirements for Reinforced Concrete and Commentary.” Farmington Hills, Michigan: American Concrete Institute. 1995.

36. ACI. ACI Standard. 349-85, “Code Requirements for Nuclear Safety-Related Concrete Structures.” Farmington Hills, Michigan: American Concrete Institute. 1985.

37. NRC. NUREG–1557, “Summary of Technical Information and Agreements from Nuclear Management and Resources Council Industry Reports Addressing License Renewal.” Washington, DC: U.S. Nuclear Regulatory Commission. October 1996.

Revisions to FSAR Supplement

Table XI-01. FSAR Supplement Summaries for GALL-SLR Report Chapter XI Aging Management Programs			
AMP	**GALL-SLR Program**	**Description of Program**	**Implementation Schedule***
XI.M2	Water Chemistry	This program mitigates aging effects of loss of material due to corrosion, cracking due to SCC, and related mechanisms, and reduction of heat transfer due to fouling in components exposed to a treated water environment. Chemistry programs are used to control water chemistry for impurities (e.g., chloride, fluoride, and sulfate) that accelerate corrosion. This program relies on monitoring and control of water chemistry to keep peak levels of various contaminants below the system-specific limits, based on EPRI guidelines (a) BWRVIP-190 (EPRI ~~1016579~~ 3002002623, BWR Water Chemistry Guidelines ~~2008~~ 2014 Revision) for BWRs or (b) EPRI ~~1014986~~3002000505 (PWR Primary Water Chemistry – Revision 7) and EPRI ~~1016555~~ 3002010645 (PWR Secondary Water Chemistry Revision ~~7~~8) for PWRs.	Program is implemented 6 months prior to the subsequent period of extended operation

Revisions to AMR Items

None

APPENDIX C

REVISIONS TO AMP XI.M12, "THERMAL AGING EMBRITTLEMENT OF CAST AUSTENITIC STAINLESS STEEL (CASS)"

Summary of Revisions

The "acceptance criteria" program element of GALL-SLR AMP XI.M12 is changed to add the 2019 Edition of ASME Code, Section XI, Non-mandatory Appendix C, which provides flaw evaluation procedures for cast austenitic stainless steel (CASS) with ferrite content ≥ 20 percent.

Basis for Revisions

Non-mandatory Appendix C to the 2019 Edition of ASME Code, Section XI provides the flaw evaluation procedures for CASS with ferrite content ≥ 20 percent1 The prior edition of the Code did not provide flaw evaluation methods for CASS with ferrite content ≥ 20 percent. The flaw evaluation procedures in the 2019 Edition of the Code were developed by considering the ferrite content, fracture toughness, tensile data of CASS materials and the relevant elastic-plastic correction factors (Z-factors) as a function of ferrite content.

Currently, rulemaking activities are ongoing to incorporate by reference the 2019 Edition of ASME Code, Section XI in 10 CFR 50.55a. Given the ongoing rulemaking status, the NRC staff finds that Appendix C to the 2019 Edition of ASME Code, Section XI may be used in GALL-SLR AMP XI.M12 until the appendix is formally incorporated by reference in 10 CFR 50.55a. Once the appendix is incorporated by reference in 10 CFR 50.55a, the program may use the appendix as incorporated by reference in 10 CFR 50.55a.

AMP Revisions

Program Description

The reactor coolant system components are inspected in accordance with the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI[2]. This inspection is augmented to detect the effects of loss of fracture toughness due to thermal aging embrittlement of cast austenitic stainless steel (CASS) piping components except for valve bodies. This aging management program (AMP) includes determination of the potential significance of thermal aging embrittlement of CASS components based on casting method, molybdenum content, and percent ferrite. For components for which thermal aging embrittlement is "potentially significant" as defined below, aging management is accomplished through either (a) qualified visual inspections, such as enhanced visual examination (EVT-1); (b) a qualified ultrasonic testing (UT) methodology; or (c) a component-specific flaw tolerance evaluation in accordance with the ASME Code, Section XI. Additional inspection or evaluations to

[1] PVP2017-66100, "Technical Basis for Flaw Acceptance Criteria for Cast Austenitic Stainless Steel Piping," D.J. Shim et al., Proceedings of the ASME 2017 Pressure Vessels and Piping Conference, July 16–20, 2017, Waikoloa, Hawaii, United States.

[2] GALL-SLR Report. Chapter 1, Table 1, identifies the ASME Code Section XI editions and addenda that are acceptable to use for this AMP.

demonstrate that the material has adequate fracture toughness are not required for components for which thermal aging embrittlement ~~in~~ is not significant. The scope of the program includes ASME Code Class 1 piping ~~all primary pressure boundary~~ components constructed from CASS with service conditions above 250 °C (Celsius) [482 °F (Fahrenheit)]. ~~(see comment previous section on this)~~

For pump casings, as an alternative to the screening and other actions described above, no further actions are needed if applicants demonstrate that the original flaw tolerance evaluation performed as part of Code Case N-481 implementation remains bounding and applicable for the subsequent license renewal (SLR) period or the evaluation is revised to be applicable for 80 years. For valve bodies, based on the results of the assessment documented in the letter dated May 19, 2000, from Christopher Grimes, U.S. Nuclear Regulatory Commission (NRC), to Douglas Walters, Nuclear Energy Institute (May 19, 2000 NRC letter), screening for significance of thermal aging embrittlement is not required. The existing ASME Code, Section XI inspection requirements are adequate for valve bodies.

Reactor vessel internal (RVI) components fabricated from CASS are not within the scope of this AMP. GALL-SLR Report AMP XI.M9, "BWR Vessel Internals" contains aging management guidance for CASS RVI components of boiling water reactors (BWRs). GALL-SLR Report AMP XI.M16A, "PWR Vessel Internals" contains aging management guidance for CASS RVI components of pressurized water reactors (PWRs).

Evaluation and Technical Basis

1. ***Scope of Program****:* This program manages loss of fracture toughness in ASME Code Class 1 piping components made from CASS. The program includes screening criteria to determine which CASS components have the potential for significant loss of fracture toughness due to thermal aging embrittlement and require augmented inspection. The screening criteria are applicable to all primary pressure boundary components constructed from CASS with service conditions above 250 °C [482 °F]. The screening criteria for the significance of thermal aging embrittlement are not applicable to niobium-containing steels; such steels require evaluation on a case-by-case basis.

   Based on the criteria set forth in the May 19, 2000, NRC letter, the potential significance of thermal aging embrittlement of CASS materials is determined in terms of casting method, molybdenum content, and ferrite content. For low-molybdenum content steels {SA-351 Grades CF3, CF3A, CF8, CF8A or other steels with ≤ 0.5 weight percent [wt.%] Mo}, only static-cast steels with >20 percent ferrite are potentially susceptible to thermal embrittlement. Static-cast low-molybdenum steels with ≤ 20 percent ferrite and all centrifugal-cast low-molybdenum steels are not susceptible. For high-molybdenum content steels (SA-351 Grades CF3M, CF3MA, and CF8M or other steels with 2.0 to 3.0 wt.% Mo), static-cast steels with >14 percent ferrite and centrifugal-cast steels with >20 percent ferrite thermal embrittlement can be potentially significant, (i.e., screens in). For static-cast high-molybdenum steels with ≤14 percent ferrite and centrifugal-cast high-molybdenum steels with ≤ 20 percent ferrite, thermal aging embrittlement is not significant, (i.e., screens out). The thermal embrittlement screening criteria of CASS with different molybdenum and ferrite contents are summarized in Table XI.M12-1, "Thermal Embrittlement Screening Criteria."

   In the significance screening method, ferrite content is calculated by using the Hull's equivalent factors (described in NUREG/CR–4513, Revision 1) or a staff-approved

method for calculating delta ferrite in CASS materials. A fracture toughness value of 255 kilo-joules per square meter (kJ/m^2) [1,450 inch-pounds per square inch] at a crack extension of 2.5 millimeters [0.1 inch] is used to differentiate between CASS materials for which thermal aging embrittlement is not significant and those for which thermal aging embrittlement is potentially significant. Extensive research data indicate that for CASS materials without the potential for significant thermal aging embrittlement, the saturated lower-bound fracture toughness is greater than 255 kJ/m^2 (NUREG/CR–4513, Revision 1).

Table XI.M12-1. Thermal Embrittlement Screening Criteria

Molybdenum (Mo) Content	Fe Content	Casting Method	Potentially Significant (Screens In)	Not Significant (Screens Out)
Low or ≤ 0.5 wt.%	>20% ferrite	Static	X	—
Low or ≤ 0.5 wt.%	≤20% ferrite	Static	—	X
Low or ≤ 0.5 wt.%	Any	Centrifugal	—	X
High or 2.0-3.0 wt.%	>14% ferrite	Static	X	—
High or 2.0-3.0 wt.%	>20% ferrite	Centrifugal	X	—
High or 2.0-3.0 wt.%	≤14% ferrite	Static	—	X
High or 2.0-3.0 wt.%	≤20% ferrite	Centrifugal	—	X

For valve bodies, screening for significance of thermal aging embrittlement is not needed (and thus there are no AMR items). For valve bodies greater than 4 inches nominal pipe size (NPS), the existing ASME Code, Section XI inspection requirements are adequate. ASME Code, Section XI, Subsection IWB requires only surface examination of valve bodies less than 4 inches NPS. For these valve bodies less than 4 inches NPS, the adequacy of inservice inspection (ISI) according to ASME Code, Section XI has been demonstrated by an NRC-performed bounding integrity analysis (May 19, 2000 letter). For pump casings, as an alternative to screening for significance of thermal aging, no further actions are needed if applicants demonstrate that the original flaw tolerance evaluation performed as part of Code Case N-481 implementation remains bounding and applicable for the SLR period, or the evaluation is revised to be applicable to 80 years.

2. ***Preventive Actions****:* This program is a condition monitoring program and does not mitigate thermal aging embrittlement.

3. ***Parameters Monitored or Inspected****:* The program monitors the effects of loss of fracture toughness on the intended function of the component by identifying the CASS materials that are susceptible to thermal aging embrittlement.

The program does not directly monitor for loss of fracture toughness that is induced by thermal aging; instead, the impact of loss of fracture toughness on component integrity is indirectly managed by using visual or volumetric examination techniques to monitor for cracking in the components.

4. ***Detection of Aging Effects****:* For valve bodies, and other "not susceptible" CASS piping components, no additional inspection or evaluations are needed to demonstrate that the material has adequate fracture toughness.

   For piping components for which thermal aging embrittlement is "potentially significant," the AMP provides for qualified inspections of the base metal, such as EVT-1 or a qualified UT methodology, with the scope of the inspection covering the portions determined to be limiting from the standpoint of applied stress, operating time, and environmental considerations. Examination methods that meet the criteria of the ASME Code, Section XI, Appendix VIII are acceptable. Alternatively, a plant-specific or component-specific flaw tolerance evaluation, using specific geometry, stress information, material properties, and ASME Code, Section XI can be used to demonstrate that the thermally-embrittled material has adequate toughness. For CASS piping, UT may be performed in accordance with the methodology of Code Case N-824, as conditioned by Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a.

5. ***Monitoring and Trending****:* Inspection schedules in accordance with ASME Code, Section XI, IWB-2400 or IWC-2400, reliable examination methods, and qualified inspection personnel provide timely and reliable detection of cracks. If flaws are detected, the period of acceptability is determined from analysis of the flaw, depending on the crack growth rate and mechanism.

6. ***Acceptance Criteria****:* Flaws detected in CASS components are evaluated in accordance with the applicable procedures of ASME Code, Section XI. The ~~most~~ recent versions of the ASME Code, Section XI incorporated by reference in 10 CFR 50.55a (~~2007 edition through 2008 addenda~~e.g., 2010 and 2013 Editions), ~~does~~do not contain any evaluation procedures applicable to CASS with ferrite content ≥ 20 percent (nonmandatory Appendix C to the 2013 Edition of ASME Code, Section XI states that flaw evaluation methods for CASS with ≥ 20 percent ferrite are currently in the course of preparation~~.~~). ~~Therefore, methods used for evaluations of flaws detected in CASS piping or components containing ≥ 20 percent ferrite, and methods used for flaw tolerance evaluations of such components, must be approved by the NRC staff on a case-by-case basis until such methods are incorporated into editions of the ASME Code, Section XI or code cases that are incorporated by reference in 10 CFR 50.55a, or in NRC-approved code cases, as documented in the latest revision to Regulatory Guide (RG) 1.147.~~ Non-mandatory Appendix C to the 2019 Edition of ASME Code, Section XI, has not yet been incorporated by reference in 10 CFR 50.55a. Non-mandatory Appendix C to the 2019 ASME Code, Section XI, provides flaw evaluation procedures for CASS with ferrite content ≥ 20 percent. Those procedures may be used for flaw evaluations or flaw tolerance evaluations in this program until Appendix C to the 2019 Edition of ASME Code, Section XI is incorporated by reference in 10 CFR 50.55a. Once it is incorporated by reference in 10 CFR 50.55a, the evaluation procedures, as incorporated by reference in 10 CFR 50.55a, may be used in this program. This program may also use the flaw evaluation or flaw tolerance evaluation methods in the NRC-approved code cases that are documented in the

latest revision of Regulatory Guide 1.147. NUREG/CR–4513, Revision 1 provides methods for predicting the fracture toughness of thermally aged CASS materials with delta ferrite content up to 25 percent.

7. ***Corrective Actions**:* Results that do not meet the acceptance criteria are addressed in the applicant's corrective action program under those specific portions of the quality assurance (QA) program that are used to meet Criterion XVI, "Corrective Action," of 10 CFR Part 50, Appendix B. Appendix A of the Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report describes how an applicant may apply its 10 CFR Part 50, Appendix B, QA program to fulfill the corrective actions element of this AMP for both safety-related and nonsafety-related structures and components (SCs) within the scope of this program.

   Repair and replacement are performed in accordance with ASME Code, Section XI, IWA-4000.

8. ***Confirmation Process**:* The confirmation process is addressed through those specific portions of the QA program that are used to meet Criterion XVI, "Corrective Action," of 10 CFR Part 50, Appendix B. Appendix A of the GALL-SLR Report describes how an applicant may apply its 10 CFR Part 50, Appendix B, QA program to fulfill the confirmation process element of this AMP for both safety-related and nonsafety-related SCs within the scope of this program.

9. ***Administrative Controls**:* Administrative controls are addressed through the QA program that is used to meet the requirements of 10 CFR Part 50, Appendix B, associated with managing the effects of aging. Appendix A of the GALL-SLR Report describes how an applicant may apply its 10 CFR Part 50, Appendix B, QA program to fulfill the administrative controls element of this AMP for both safety-related and nonsafety-related SCs within the scope of this program.

10. ***Operating Experience**:* The AMP was developed by using research data obtained on both laboratory-aged and service-aged materials. Based on this information, the effects of thermal aging embrittlement on the intended function of CASS components will be effectively managed.

    The program is informed and enhanced when necessary through the systematic and ongoing review of both plant-specific and industry operating experience including research and development such that the effectiveness of the AMP is evaluated consistent with the discussion in Appendix B of the GALL-SLR Report.

References

10 CFR Part 50, Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants." Washington, DC: U.S. Nuclear Regulatory Commission. 2016.

10 CFR 50.55a, "Codes and Standards." Washington, DC: U.S. Nuclear Regulatory Commission. 2016.

ASME. ASME Code Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components." New York, New York: The American Society of Mechanical Engineers. 2008.[3]

_____. ASME Code Section XI, Division 1, Code Case N-824, "Ultrasonic Examination of Cast Austenitic Piping Welds From the Outside Surface." New York, New York: The American Society of Mechanical Engineers. Approval Date October 16, 2012.

_____. ASME Code Section XI, Division 1, Code Case N-481, "Alternative Examination Requirements for Cast Austenitic Pump Casings." New York, New York: The American Society of Mechanical Engineers. Approval Date March 5, 1990.

EPRI. BWRVIP-03, Revision 6 (EPRI 105696-R6), "BWR Vessel and Internals Project, Reactor Pressure Vessel and Internals Examination Guidelines." Palo Alto, California: Electric Power Research Institute. December 2003.

_____. MRP-228, "The Materials Reliability Program: Inspection Standard for PWR Internals." Palo Alto, California: Electric Power Research Institute. 2009.

Grimes, Christopher I., U.S. Nuclear Regulatory Commission, License Renewal and Standardization Branch, letter to Douglas J. Walters, Nuclear Energy Institute, License Renewal Issue No. 98-0030, "Thermal Aging Embrittlement of Cast Stainless Steel Components." Agencywide Documents Access and Management System (ADAMS) Accession No. ML003717179. Washington, DC: U.S. Nuclear Regulatory Commission. May 19, 2000.

Lee, S., P.T. Kuo, K. Wichman, and O. Chopra. "Flaw Evaluation of Thermally-Aged Cast Stainless Steel in Light-Water Reactor Applications." *International Journal of Pressure Vessel and Piping*. pp 37–44. 1997.

Maxin, Mark J., letter to Rick Libra (BWRVIP Chairman), Safety Evaluation for Electric Power Research Institute (EPRI) Boiling Water Reactor Vessel and Internals project (BWRVIP) Report TR-105696-R6 (BWRVIP-03), Revision 6, "BWR Vessel and Internals Examination Guidelines (TAC No MC2293)." June 2008. ADAMS Accession No. ML081500814.

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

_____. Regulatory Guide 1.147, Revision 17, "Inservice Inspection Code Case Acceptability." Washington, DC: U.S. Nuclear Regulatory Commission. August 2014.

Revisions to FSAR Supplement

None

Revisions to AMR Items

None

[3] GALL-SLR Report Chapter I, Table 1, identifies the ASME Code Section XI editions and addenda that are acceptable to use for this AMP.

APPENDIX D

REVISIONS TO AMP XI.M21A, "CLOSED TREATED WATER SYSTEM"

Summary of Revisions

This ISG revises AMP XI.M21A, "Closed Treated Water Systems," to include the latest revision of EPRI closed cooling water chemistry guideline.

Basis for Revisions

EPRI issued 3002000590, "Closed Cooling Water Chemistry Guideline," Revision 2 in 2013 from the previous version (1007820). 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 precedents for use of the more recent version of the above guideline are documented in the NRC staff's SERs for subsequent license renewal (SLR) of Turkey Point and Peach Bottom (Agencywide Documents Access Management System (ADAMS) Accession Nos. ML19191A057, and ML20044D902, respectively).

AMP Revisions

Program Description

Nuclear power plants contain many closed, treated water systems. These systems undergo water treatment to control water chemistry and prevent corrosion (i.e., treated water systems). These systems are also recirculating systems in which the rate of recirculation is much higher than the rate of addition of makeup water (i.e., closed systems). This is a mitigation program that also includes condition monitoring to verify the effectiveness of the mitigation activities. The program includes: (a) water treatment, including the use of corrosion inhibitors, to modify the chemical composition of the water such that the function of the equipment is maintained and such that the effects of corrosion are minimized; (b) chemical testing of the water to demonstrate that the water treatment program maintains the water chemistry within acceptable guidelines; and (c) inspections to determine the presence or extent of degradation. Depending on the water treatment program selected for use in association with this aging management program (AMP) and/or plant operating experience (OE), this program also may include corrosion monitoring (e.g., corrosion coupon testing) and microbiological testing.

The water used in systems covered by this AMP may be, but need not be, demineralized and receives chemical treatment, including corrosion inhibitors, unless the systems meet the industry guidance for pure water systems. Otherwise, untreated water systems are addressed using other AMPs, such as Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (XI.M38). Examples of systems managed by this AMP include closed-cycle cooling water (CCCW) systems (as defined by the U.S. Nuclear Regulatory Commission (NRC) Generic Letter

(GL) 89-13[1]); closed portions of heating, ventilation, and air conditioning systems; and diesel generator cooling water. Examples of systems not addressed by this AMP include those systems containing boiling water reactor (BWR) coolant, pressurized water reactor (PWR) primary and secondary water, and PWR/BWR condensate that does not contain corrosion inhibitors. Aging in these systems is managed by the water chemistry AMP (XI.M2) and the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI, Inservice Inspection, Subsections IWB, IWC, and IWD AMP (XI.M1).[2] Treated fire water systems, if present, are also not included in this AMP.

Evaluation and Technical Basis

1. ***Scope of Program****:* This program manages the aging effects of loss of material due to corrosion, cracking due to stress corrosion cracking (SCC), and reduction of heat transfer due to fouling of the internal surfaces of piping, piping components, piping elements and heat exchanger components fabricated from any material and exposed to treated water.

2. ***Preventive Actions****:* This program mitigates the aging effects of loss of material, cracking, and reduction of heat transfer through water treatment. The water treatment program includes corrosion inhibitors and is designed to maintain the function of associated equipment and minimize the corrosivity of the water and the accumulation of corrosion products that can foul heat transfer surfaces.

3. ***Parameters Monitored or Inspected****:* This program monitors water chemistry parameters (preventive monitoring) and the condition of surfaces exposed to the water (condition monitoring). Depending on the water treatment program selected for use in association with this AMP and/or plant OE, this program may also include corrosion monitoring (e.g., corrosion coupon testing) and microbiological testing.

   Water chemistry parameters (such as the concentration of iron, copper, silica, oxygen, and hardness, alkalinity, specific conductivity, and pH) are monitored because maintenance of optimal water chemistry prevents loss of material and cracking due to corrosion and SCC. The specific water chemistry parameters monitored and the acceptable range of values for these parameters are in accordance with the Electric Power Research Institute (EPRI) 3002000590~~1007820~~ "Closed Cooling Water Chemistry Guideline," which is used in its entirety for the water chemistry control or guidance.

   The visual appearance of surfaces is evaluated for evidence of loss of material. The results of surface or volumetric examinations are evaluated for surface discontinuities indicative of cracking. The heat transfer capability of heat exchanger surfaces is evaluated by either visual inspections to determine surface cleanliness, or functional testing to verify that design heat removal rates are maintained.

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[1]NRC GL 89-13 defines a service water system as "the system or systems that transfer heat from safety-related structures, systems, or components to the ultimate heat sink." NRC GL 89-13 further defines a closed-cycle system as a part of the service water system that is not subject to significant sources of contamination, one in which water chemistry is controlled and in which heat is not directly rejected to an ultimate heat sink.

[2]GALL-SLR Report Chapter I, Table 1, identifies the ASME Code Section XI editions and addenda that are acceptable to use for this AMP.

4. ***Detection of Aging Effects**:* In this program, aging effects are detected through water testing and periodic inspections. Water testing determines whether the water treatment program effectively maintains acceptable water chemistry. Water testing frequency is conducted in accordance with the selected water treatment program.

   Because the control of water chemistry may not be fully effective in mitigating the aging effects, inspections are conducted. Visual inspections of internal surfaces are conducted whenever the system boundary is opened. At a minimum, in each 10-year period during the subsequent period of extended operation, a representative sample of 20 percent of the population (defined as components having the same material, water treatment program, and aging effect combination) or a maximum of 25 components per population at each unit is inspected using techniques capable of detecting loss of material, cracking, and fouling, as appropriate. The 20 percent minimum is surface area inspected unless the component is measured in linear feet, such as piping. In that case, any combination of 1-foot length sections and components can be used to meet the recommended extent of 25 inspections. Technical justification for an alternative sampling methodology is included in the program's documentation. For multi-unit sites where the sample size is not based on the percentage of the population, it is acceptable to reduce the total number of inspections at the site as follows. For two-unit sites, 19 components are inspected per unit and for a three-unit site, 17 components are inspected per unit. In order to conduct 17 or 19 inspections at a unit in lieu of 25, the subsequent license renewal application includes the basis for why the operating conditions at each unit are sufficiently similar (e.g., flowrate, chemistry, temperature, excursions) to provide representative inspection results. The basis should include consideration of potential differences such as the following:

   - Have power uprates been performed and, if so, could more aging have occurred on one unit that has been in the uprate period for a longer time period?

   - Are there any systems which have had an out-of-spec water chemistry condition for a longer period of time or out-of-spec conditions occur more frequently?

   If degradation is identified in the initial sample, additional samples are inspected to determine the extent of the condition.

   The ongoing opportunistic visual inspections are credited towards the representative samples for the loss of material and fouling; however, surface or volumetric examinations are used to detect cracking. The inspections focus on the components most susceptible to aging because of time in service and severity of operating conditions, including locations where local conditions may be significantly more severe than those in the bulk water (e.g., heat exchanger tube surfaces).

   Inspections and tests are performed by personnel qualified in accordance with site procedures and programs to perform the specified task. Inspections within the scope of the ASME Code should follow procedures consistent with the ASME Code. Non-ASME Code inspections follow site procedures that include requirements for items such as lighting, distance, offset, surface coverage, presence of protective coatings, and cleaning processes.

5. ***Monitoring and Trending****:* Water chemistry data are evaluated against the standards contained in the selected water treatment program. These data are trended, so corrective actions are taken, based on trends in water chemistry, prior to loss of intended function. Where practical, identified degradation is projected until the next scheduled inspection. Results are evaluated against acceptance criteria to confirm that the sampling bases (e.g., selection, size, frequency) will maintain the components' intended functions throughout the subsequent period of extended operation based on the projected rate and extent of degradation.

6. ***Acceptance Criteria****:* Water chemistry concentrations are maintained within the limits specified in the selected industry standard documents. Due to the water chemistry controls, no age-related degradation is expected. Therefore, any detectable loss of material, cracking, or fouling is evaluated in the corrective action program.

7. ***Corrective Actions****:* Results that do not meet the acceptance criteria are addressed in the applicant's corrective action program under those specific portions of the quality assurance (QA) program that are used to meet Criterion XVI, "Corrective Action," of Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, Appendix B. Appendix A of the Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report describes how an applicant may apply its 10 CFR Part 50, Appendix B, QA program to fulfill the corrective actions element of this AMP for both safety-related and nonsafety-related structures and components (SCs) within the scope of this program.

   Water chemistry concentrations that are not in accordance with the selected water treatment program should be returned to the normal operating range within the prescribed timeframe for each action level. If fouling is identified, the overall effect is evaluated for reduction of heat transfer, flow blockage, and loss of material.

   If the cause of the aging effect for each applicable material and environment is not corrected by repair or replacement for all components constructed of the same material and exposed to the same environment, additional inspections are conducted if one of the inspections does not meet acceptance criteria. The number of increased inspections is determined in accordance with the site's corrective action process; however, there are no fewer than five additional inspections for each inspection that did not meet acceptance criteria, or 20 percent of each applicable material, environment, and aging effect combination is inspected, whichever is less. If subsequent inspections do not meet acceptance criteria, an extent of condition and extent of cause analysis is conducted to determine the further extent of inspections. Additional samples are inspected for any recurring degradation to ensure corrective actions appropriately address the associated causes. At multi-unit sites, the additional inspections include inspections at all of the units with the same material, environment, and aging effect combination. The additional inspections are completed within the interval (e.g., refueling outage interval, 10-year inspection interval) in which the original inspection was conducted.

8. ***Confirmation Process****:* The confirmation process is addressed through those specific portions of the QA program that are used to meet Criterion XVI, "Corrective Action," of 10 CFR Part 50, Appendix B. Appendix A of the GALL-SLR Report describes how an applicant may apply its 10 CFR Part 50, Appendix B, QA program to fulfill the confirmation process element of this AMP for both safety-related and nonsafety-related SCs within the scope of this program.

9. ***Administrative Controls**:* Administrative controls are addressed through the QA program that is used to meet the requirements of 10 CFR Part 50, Appendix B, associated with managing the effects of aging. Appendix A of the GALL-SLR Report describes how an applicant may apply its 10 CFR Part 50, Appendix B, QA program to fulfill the administrative controls element of this AMP for both safety-related and nonsafety-related SCs within the scope of this program.

10. ***Operating Experience**:* Degradation of CCCW systems due to corrosion product buildup [Licensee Event Report (LER) 327/1993-029] or through-wall cracks in supply lines (LER 280/1991-019) has been observed in operating plants. In addition, SCC of stainless steel reactor recirculation pump seal heat exchanger coils has been attributed to localized boiling of the closed cooling water, concentrating water impurities on the coil surfaces (LER 263/2014-001). Accordingly, OE demonstrates the need for this program.

    The program is informed and enhanced when necessary through the systematic and ongoing review of both plant-specific and industry OE including research and development such that the effectiveness of the AMP is evaluated consistent with the discussion in Appendix B of the GALL-SLR Report.

References

10 CFR Part 50, Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants." Washington, DC: U.S. Nuclear Regulatory Commission. 2016.

10 CFR 50.55a, "Codes and Standards." Washington, DC: U.S. Nuclear Regulatory Commission. 2016.

ASME. ASME Code Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components." New York, New York: The American Society of Mechanical Engineers. 2008. [3]

EPRI. EPRI 3002000590~~1007820~~, "Closed Cooling Water Chemistry Guideline~~.~~, Revision 2." Palo Alto, California: Electric Power Research Institute. ~~April 2004~~December 2013.

Flynn, Daniel. *The Nalco Water Handbook.* Nalco Company. 2009.

Licensee Event Report 263/2014-001, "Primary System Leakage Found in Recirculation Pump Upper Seal Heat Exchanger." Agencywide Documents Access and Management System (ADAMS) Accession No. ML14073A599. https://lersearch.inl.gov/LERSearchCriteria.aspx. March 2014.

Licensee Event Report 280/1991-019, "Loss of Containment Integrity due to Crack in Component Cooling Water Piping." https://lersearch.inl.gov/LERSearchCriteria.aspx. October 1991.

Licensee Event Report 327/1993-029, "Inoperable Check Valve in the Component Cooling System as a Result of a Build-Up of Corrosion Products between Valve Components." https://lersearch.inl.gov/LERSearchCriteria.aspx. December 1993.

[3]GALL-SLR Report Chapter I, Table 1, identifies the ASME Code Section XI editions and addenda that are acceptable to use for this AMP.

NRC. Generic Letter 89-13, "Service Water System Problems Affecting Safety-Related Components." Washington, DC: U.S. Nuclear Regulatory Commission. July 1989.

_____. Generic Letter 89-13, Supplement 1, "Service Water System Problems Affecting Safety-Related Components." Washington, DC: U.S. Nuclear Regulatory Commission. April 1990.

Revisions to FSAR Supplement

AMP	GALL-SLR Program	Description of Program	Implementation Schedule
XI.21A	Closed Treated Water Systems	This is a mitigation program that also includes a condition monitoring program to verify the effectiveness of the mitigation activities. The program consists of: (a) water treatment, including the use of corrosion inhibitors, to modify the chemical composition of the water such that the effects of corrosion are minimized; (b) chemical testing of the water so that the water treatment program maintains the water chemistry within acceptable guidelines; and (c) inspections to determine the presence or extent of degradation. The program uses as applicable, EPRI ~~1007820~~3002000590, Closed Cooling Water Chemistry Guideline, and includes corrosion coupon testing and microbiological testing.	Program and SLR enhancements, when applicable, are implemented 6 months prior to the subsequent period of extended operation.

Revisions to AMR Items

None

APPENDIX E

REVISIONS TO AGING MANAGEMENT REVIEW LINE ITEMS ASSOCIATED WITH AMP XI.M26, "FIRE PROTECTION"

Summary of Revisions

This ISG adds new AMR Items VII.G.A-805, VII.G.A-806, and VII.G.A-807 to GALL-SLR Report Table VII.G, "Fire Protection," and makes conforming changes to SRP-SLR Table 3.3-1, "Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report."

Basis for Revisions

VII.G.A-805: A new aging management review (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 subsequent license renewal application (SLRAs). The aging effects and aging mechanisms for subliming compounds used as fireproofing/fire barriers exposed to air are based on the U.S. Nuclear Regulatory Commission (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 Electric Power Research Institute (EPRI) 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.

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 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 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.

The periodic inspections recommended by AMP XI.M26 are capable of detecting these aging effects for these materials.

VII.G.A-807: A new AMR item for silicates 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 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 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.

The periodic inspections recommended by AMP XI.M26 are capable of detecting these aging effects for these materials

AMP Revisions

None

Revisions to FSAR Supplement

None

Revisions to GALL-SLR Table VII G

Note – this table is provided below in its entirety. The only changes to this table are the addition of the following three items near the end of the table: VII.G.A-805, VII.G.A-806, and VII.G.A-807.

VII Table G	**AUXILIARY SYSTEMS Fire Protection**							
New, Modified, Deleted, Edited Item	**Item**	**SRP Item (Table, ID)**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/Mechanism**	**Aging Management Program (AMP)/TLAA**	**Further Evaluation**
N	VII.G.A-532	3.3-1, 193	Any	Steel	Raw water, raw water (potable)	Long-term loss of material due to general corrosion	AMP XI.M32, "One-Time Inspection"	No
N	VII.G.A-439	3.3-1, 193	Any	Steel	Treated water	Long-term loss of material due to general corrosion	AMP XI.M32, "One-Time Inspection"	No
M	VII.G.A-19	3.3-1, 057	Fire barrier penetration seals	Elastomer	Air, condensation	Hardening, loss of strength, shrinkage due to elastomer degradation	AMP XI.M26, "Fire Protection"	No
N	VII.G.A-789	3.3-1, 255	Fire damper assemblies	Any	Air	Loss of material due to general, pitting, crevice corrosion; cracking due to SCC; hardening, loss of strength, shrinkage due to elastomer degradation	AMP XI.M26, "Fire Protection"	No
M	VII.G.AP-149	3.3-1, 063	Fire hydrants	Steel	Air – outdoor, raw water, raw water (potable), treated water	Loss of material due to general, pitting, crevice corrosion; flow blockage due to fouling (raw water, raw water (potable) only)	AMP XI.M27, "Fire Water System"	No
M	VII.G.A-21	3.3-1, 059	Fire rated doors	Steel	Air	Loss of material due to wear	AMP XI.M26, "Fire Protection"	No

VII Table G	AUXILIARY SYSTEMS Fire Protection							
New, Modified, Deleted, Edited Item	**Item**	**SRP Item (Table, ID)**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/Mechanism**	**Aging Management Program (AMP)/TLAA**	**Further Evaluation**
N	VII.G.A-623	3.3-1, 185	Fire water storage tanks	Aluminum	Air, condensation, soil, concrete, raw water, raw water (potable), treated water	Cracking due to SCC	AMP XI.M27, "Fire Water System"	No
N	VII.G.A-744	3.3-1, 215	Fire water storage tanks	Aluminum	Air, condensation, soil, concrete, raw water, raw water (potable), treated water	Loss of material due to pitting, crevice corrosion	AMP XI.M27, "Fire Water System"	No
N	VII.G.A-745	3.3-1, 216	Fire water storage tanks	Stainless steel	Air, condensation, soil, concrete	Cracking due to SCC	AMP XI.M27, "Fire Water System"	No
N	VII.G.A-747	3.3-1, 218	Fire water storage tanks	Stainless steel	Air, condensation, soil, concrete, raw water, raw water (potable), treated water	Loss of material due to pitting, crevice corrosion, MIC (water and soil environment only)	AMP XI.M27, "Fire Water System"	No
M	VII.G.A-412	3.3-1, 136	Fire water storage tanks	Steel	Air, condensation, soil, concrete, raw water, raw water (potable), treated water	Loss of material due to general, pitting, crevice corrosion, MIC (raw water, raw water (potable), treated water, soil only)	AMP XI.M27, "Fire Water System"	No

VII Table G	AUXILIARY SYSTEMS Fire Protection							
New, Modified, Deleted, Edited Item	**Item**	**SRP Item (Table, ID)**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/Mechanism**	**Aging Management Program (AMP)/TLAA**	**Further Evaluation**
N	VII.G.A-650	3.3-1, 198	Fire water system piping, piping components, heat exchanger, heat exchanger components with only a leakage boundary (spatial) or structural integrity (attached) intended function	Metallic	Any except soil, concrete	Loss of material due to general (steel, copper alloy only), pitting, crevice corrosion, MIC (all metallic materials except aluminum; in liquid environments only)	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No
N	VII.G.A-649	3.3-1, 197	Fire water system piping, piping components, heat exchanger, heat exchanger components with only a leakage boundary (spatial) or structural integrity (attached) intended function	Metallic	Any external environment except soil, concrete	Loss of material due to general (steel, copper alloy only), pitting, crevice corrosion	AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	No

VII Table G	AUXILIARY SYSTEMS Fire Protection							
New, Modified, Deleted, Edited Item	**Item**	**SRP Item (Table, ID)**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/Mechanism**	**Aging Management Program (AMP)/TLAA**	**Further Evaluation**
M	VII.G.AP-150	3.3-1, 058	Halon/carbon dioxide fire suppression system piping, piping components	Steel	Air – indoor uncontrolled, air – outdoor, condensation	Loss of material due to general, pitting, crevice corrosion	AMP XI.M26, "Fire Protection"	No
N	VII.G.A-565	3.3-1, 161	Heat exchanger tubes	Copper alloy	Condensation	Reduction of heat transfer due to fouling	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No
M	VII.G.AP-187	3.3-1, 042	Heat exchanger tubes	Stainless steel, copper alloy, titanium	Raw water, raw water (potable), treated water	Cracking due to SCC (titanium only), reduction of heat transfer due to fouling	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No
N	VII.G.A-791	3.3-1, 257	Heat exchanger tubes	Steel, stainless steel, copper alloy	Lubricating oil	Reduction of heat transfer due to fouling	AMP XI.M39, "Lubricating Oil Analysis," and AMP XI.M32, "One-Time Inspection"	No
N	VII.G.A-765	3.3-1, 236	Heat exchanger tubes	Titanium	Treated water	Cracking due to SCC, reduction of heat transfer due to fouling	AMP XI.M2, "Water Chemistry," and AMP XI.M32, "One-Time Inspection"	No
M	VII.G.A-415	3.3-1, 140	Piping components with internal coatings/linings	Gray cast iron, ductile iron with internal coating/lining	Closed-cycle cooling water, raw water, raw water (potable), treated water, waste water	Loss of material due to selective leaching	AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	No

VII Table G	AUXILIARY SYSTEMS Fire Protection							
New, Modified, Deleted, Edited Item	**Item**	**SRP Item (Table, ID)**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/Mechanism**	**Aging Management Program (AMP)/TLAA**	**Further Evaluation**
N	VII.G.AP-129	3.3-1, 071	Piping, piping components	Aluminum	Fuel oil	Loss of material due to pitting, crevice corrosion, MIC	AMP XI.M30, "Fuel Oil Chemistry," and AMP XI.M32, "One-Time Inspection"	No
N	VII.G.AP-129a	3.3-1, 071	Piping, piping components	Aluminum	Fuel oil	Loss of material due to pitting, crevice corrosion, MIC	AMP XI.M30, "Fuel Oil Chemistry"	No
N	VII.G.AP-162	3.3-1, 099	Piping, piping components	Aluminum	Lubricating oil	Loss of material due to pitting, crevice corrosion	AMP XI.M39, "Lubricating Oil Analysis," and AMP XI.M32, "One-Time Inspection"	No
M	VII.G.AP-180	3.3-1, 065	Piping, piping components	Aluminum	Raw water, treated water, raw water (potable)	Loss of material due to pitting, crevice corrosion; flow blockage due to fouling (raw water only)	AMP XI.M27, "Fire Water System"	No
N	VII.G.A-451a	3.3-1, 189	Piping, piping components	Aluminum	Air, condensation, raw water, raw water (potable), waste water	Cracking due to SCC	AMP XI.M32, "One-Time Inspection"	Yes
N	VII.G.A-451b	3.3-1, 189	Piping, piping components	Aluminum	Air, condensation, raw water, raw water (potable), waste water	Cracking due to SCC	AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	Yes

VII Table G	AUXILIARY SYSTEMS Fire Protection							
New, Modified, Deleted, Edited Item	**Item**	**SRP Item (Table, ID)**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/Mechanism**	**Aging Management Program (AMP)/TLAA**	**Further Evaluation**
N	VII.G.A-451c	3.3-1, 189	Piping, piping components	Aluminum	Air, condensation, raw water, raw water (potable), waste water	Cracking due to SCC	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	Yes
N	VII.G.A-451d	3.3-1, 189	Piping, piping components	Aluminum	Air, condensation, raw water, raw water (potable), waste water	Cracking due to SCC	AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	Yes
M	VII.G.AP-132	3.3-1, 069	Piping, piping components	Copper alloy	Fuel oil	Loss of material due to pitting, crevice corrosion, MIC	AMP XI.M30, "Fuel Oil Chemistry," and AMP XI.M32, "One-Time Inspection"	No
N	VII.G.AP-132a	3.3-1, 069	Piping, piping components	Copper alloy	Fuel oil	Loss of material due to pitting, crevice corrosion, MIC	AMP XI.M30, "Fuel Oil Chemistry"	No
M	VII.G.AP-133	3.3-1, 099	Piping, piping components	Copper alloy	Lubricating oil	Loss of material due to pitting, crevice corrosion, MIC	AMP XI.M39, "Lubricating Oil Analysis," and AMP XI.M32, "One-Time Inspection"	No
M	VII.G.AP-197	3.3-1, 064	Piping, piping components	Copper alloy	Raw water, treated water, raw water (potable)	Loss of material due to general (raw water, raw water (potable) only), pitting, crevice corrosion, MIC; flow blockage due to fouling (raw water only)	AMP XI.M27, "Fire Water System"	No

VII Table G	AUXILIARY SYSTEMS Fire Protection							
New, Modified, Deleted, Edited Item	**Item**	**SRP Item (Table, ID)**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/Mechanism**	**Aging Management Program (AMP)/TLAA**	**Further Evaluation**
M	VII.G.A-47	3.3-1, 072	Piping, piping components	Copper alloy (>15% Zn or >8% Al)	Raw water, raw water (potable), treated water	Loss of material due to selective leaching	AMP XI.M33, "Selective Leaching"	No
N	VII.G.A-743	3.3-1, 214	Piping, piping components	Copper alloy (>15% Zn or >8% Al)	Soil	Loss of material due to selective leaching	AMP XI.M33, "Selective Leaching"	No
M	VII.G.A-51	3.3-1, 072	Piping, piping components	Gray cast iron, ductile iron	Raw water, raw water (potable), treated water	Loss of material due to selective leaching	AMP XI.M33, "Selective Leaching"	No
M	VII.G.A-02	3.3-1, 072	Piping, piping components	Gray cast iron, ductile iron	Soil	Loss of material due to selective leaching	AMP XI.M33, "Selective Leaching"	No
M	VII.G.AP-31	3.3-1, 072	Piping, piping components	Gray cast iron, ductile iron	Treated water	Loss of material due to selective leaching	AMP XI.M33, "Selective Leaching"	No
N	VII.G.A-458	3.3-1, 172	Piping, piping components	PVC	Air – outdoor	Reduction in impact strength due to photolysis	AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	No
N	VII.G.A-787b	3.3-1, 253	Piping, piping components	PVC	Raw water, raw water (potable), treated water	Loss of material due to wear; flow blockage due to fouling (raw water only)	AMP XI.M27, "Fire Water System"	No
M	VII.G.AP-209a	3.3-1, 004	Piping, piping components	Stainless steel	Air, condensation	Cracking due to SCC	AMP XI.M32, "One-Time Inspection"	Yes
M	VII.G.AP-209b	3.3-1, 004	Piping, piping components	Stainless steel	Air, condensation	Cracking due to SCC	AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	Yes

VII Table G	AUXILIARY SYSTEMS Fire Protection							
New, Modified, Deleted, Edited Item	Item	SRP Item (Table, ID)	Structure and/or Component	Material	Environment	Aging Effect/Mechanism	Aging Management Program (AMP)/TLAA	Further Evaluation
M	VII.G.AP-209c	3.3-1, 004	Piping, piping components	Stainless steel	Air, condensation	Cracking due to SCC	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	Yes
M	VII.G.AP-136	3.3-1, 071	Piping, piping components	Stainless steel	Fuel oil	Loss of material due to pitting, crevice corrosion, MIC	AMP XI.M30, "Fuel Oil Chemistry," and AMP XI.M32, "One-Time Inspection"	No
N	VII.G.AP-136a	3.3-1, 071	Piping, piping components	Stainless steel	Fuel oil	Loss of material due to pitting, crevice corrosion, MIC	AMP XI.M30, "Fuel Oil Chemistry"	No
M	VII.G.AP-138	3.3-1, 100	Piping, piping components	Stainless steel	Lubricating oil	Loss of material due to pitting, crevice corrosion, MIC	AMP XI.M39, "Lubricating Oil Analysis," and AMP XI.M32, "One-Time Inspection"	No
M	VII.G.A-55	3.3-1, 066	Piping, piping components	Stainless steel	Raw water, treated water, raw water (potable)	Loss of material due to pitting, crevice corrosion, MIC; flow blockage due to fouling (raw water only)	AMP XI.M27, "Fire Water System"	No
M	VII.G.AP-221a	3.3-1, 006	Piping, piping components	Stainless steel, nickel alloy	Air, condensation	Loss of material due to pitting, crevice corrosion	AMP XI.M32, "One-Time Inspection"	Yes
M	VII.G.AP-221b	3.3-1, 006	Piping, piping components	Stainless steel, nickel alloy	Air, condensation	Loss of material due to pitting, crevice corrosion	AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	Yes

VII Table G	AUXILIARY SYSTEMS Fire Protection							
New, Modified, Deleted, Edited Item	**Item**	**SRP Item (Table, ID)**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/Mechanism**	**Aging Management Program (AMP)/TLAA**	**Further Evaluation**
M	VII.G.AP-221c	3.3-1, 006	Piping, piping components	Stainless steel, nickel alloy	Air, condensation	Loss of material due to pitting, crevice corrosion	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	Yes
M	VII.G.AP-221d	3.3-1, 006	Piping, piping components	Stainless steel, nickel alloy	Air, condensation	Loss of material due to pitting, crevice corrosion	AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	Yes
M	VII.G.AP-143	3.3-1, 089	Piping, piping components	Steel	Condensation (internal)	Loss of material due to general, pitting, crevice corrosion	AMP XI.M27, "Fire Water System"	No
M	VII.G.AP-234	3.3-1, 070	Piping, piping components	Steel	Fuel oil	Loss of material due to general, pitting, crevice corrosion, MIC	AMP XI.M30, "Fuel Oil Chemistry," and AMP XI.M32, "One-Time Inspection"	No
M	VII.G.AP-127	3.3-1, 097	Piping, piping components	Steel	Lubricating oil	Loss of material due to general, pitting, crevice corrosion, MIC	AMP XI.M39, "Lubricating Oil Analysis," and AMP XI.M32, "One-Time Inspection"	No
M	VII.G.A-33	3.3-1, 064	Piping, piping components	Steel	Raw water, treated water, raw water (potable)	Loss of material due to general, pitting, crevice corrosion, MIC; flow blockage due to fouling (raw water, raw water (potable) only)	AMP XI.M27, "Fire Water System"	No

VII Table G	AUXILIARY SYSTEMS Fire Protection							
New, Modified, Deleted, Edited Item	**Item**	**SRP Item (Table, ID)**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/Mechanism**	**Aging Management Program (AMP)/TLAA**	**Further Evaluation**
M	VII.G.A-404	3.3-1, 131	Piping, piping components	Steel, stainless steel, copper alloy, aluminum	Air, condensation	Flow blockage due to fouling	AMP XI.M27, "Fire Water System"	No
N	VII.G.A-647	3.3-1, 195	Piping, piping components	Concrete, concrete cylinder piping, reinforced concrete, asbestos cement, cementitious	Raw water, treated water, raw water (potable)	Cracking due to chemical reaction, weathering, settlement, or corrosion of reinforcement (reinforced concrete only); loss of material due to delamination, exfoliation, spalling, popout, scaling, or cavitation; flow blockage due to fouling (raw water only)	AMP XI.M27, "Fire Water System"	No
N	VII.G.A-648	3.3-1, 196	Piping, piping components	HDPE	Raw water, treated water, raw water (potable)	Cracking, blistering; flow blockage due to fouling (raw water only)	AMP XI.M27, "Fire Water System"	No
N	VII.G.A-495	3.3-1, 159	Piping, piping components, ducting, ducting components	Fiberglass	Air	Loss of material due to wear	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No

VII Table G	AUXILIARY SYSTEMS Fire Protection							
New, Modified, Deleted, Edited Item	**Item**	**SRP Item (Table, ID)**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/Mechanism**	**Aging Management Program (AMP)/TLAA**	**Further Evaluation**
N	VII.G.A-797b	3.3-1, 263	Piping, piping components, ducting, ducting components, seals	Polymeric	Air, condensation, raw water, raw water (potable), treated water, waste water, underground, concrete, soil	Hardening or loss of strength due to polymeric degradation; loss of material due to peeling, delamination, wear; cracking or blistering due to exposure to ultraviolet light, ozone, radiation, or chemical attack; flow blockage due to fouling	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No
N	VII.G.A-722	3.3-1, 157	Piping, piping components, heat exchanger components	Steel	Air – outdoor	Loss of material due to general, pitting, crevice corrosion	AMP XI.M27, "Fire Water System"	No
M	VII.G.A-416	3.3-1, 138	Piping, piping components, heat exchangers with internal coatings/linings	Any material with an internal coating/lining	Raw water, raw water (potable), treated water, lubricating oil	Loss of coating or lining integrity due to blistering, cracking, flaking, peeling, delamination, rusting, physical damage; loss of material or cracking for cementitious coatings/linings	AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	No
M	VII.G.A-414	3.3-1, 139	Piping, piping components, heat exchangers with internal coatings/linings	Any material with an internal coating/lining	Raw water, raw water (potable), treated water, lubricating oil	Loss of material due to general, pitting, crevice corrosion, MIC	AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	No

VII Table G	AUXILIARY SYSTEMS Fire Protection							
New, Modified, Deleted, Edited Item	Item	SRP Item (Table, ID)	Structure and/or Component	Material	Environment	Aging Effect/Mechanism	Aging Management Program (AMP)/TLAA	Further Evaluation
N	VII.G.A-504	3.3-1, 085	Piping, piping components, seals	Elastomer	Air, condensation	Hardening or loss of strength due to elastomer degradation	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No
M	VII.G.AP-76	3.3-1, 096	Piping, piping components, seals	Elastomer	Air, raw water, raw water (potable), treated water	Loss of material due to wear; flow blockage due to fouling (raw water only)	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No
N	VII.G.A-729	3.3-1, 085	Piping, piping components, seals	Elastomer	Gas	Hardening or loss of strength due to elastomer degradation	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No
N	VII.G.AP-75	3.3-1, 085	Piping, piping components, seals	Elastomer	Raw water, raw water (potable), treated water	Hardening or loss of strength due to elastomer degradation; flow blockage due to fouling (raw water only)	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No
N	VII.G.A-644	3.3-1, 175	Piping, piping components, tanks	Fiberglass	Raw water, raw water (potable), treated water	Cracking, blistering, loss of material due to exposure to ultraviolet light, ozone, radiation, temperature, or moisture; flow blockage due to fouling (raw water only)	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No

VII Table G	AUXILIARY SYSTEMS Fire Protection							
New, Modified, Deleted, Edited Item	Item	SRP Item (Table, ID)	Structure and/or Component	Material	Environment	Aging Effect/Mechanism	Aging Management Program (AMP)/TLAA	Further Evaluation
N	VII.G.A-645	3.3-1, 176	Piping, piping components, tanks	Fiberglass	Raw water, raw water (potable), treated water	Loss of material due to wear; flow blockage due to fouling (raw water only)	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No
M	VII.G.A-400	3.3-1, 127	Piping, piping components, tanks	Metallic	Raw water, raw water (potable), treated water	Loss of material due to recurring internal corrosion	AMP XI.M27, "Fire Water System"	Yes
M	VII.G.AP-209d	3.3-1, 004	Piping, piping components, tanks	Stainless steel	Air, condensation	Cracking due to SCC	AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	Yes
N	VII.G.AP-234a	3.3-1, 070	Piping, piping components, tanks	Steel	Fuel oil	Loss of material due to general, pitting, crevice corrosion, MIC	AMP XI.M30, "Fuel Oil Chemistry"	No
M	VII.G.AP-117	3.3-1, 250	Reactor coolant pump oil collection system: piping, piping components	Steel	Lubricating oil (waste oil)	Loss of material due to general, pitting, crevice corrosion, MIC	AMP XI.M32, "One-Time Inspection"	No
M	VII.G.AP-116	3.3-1, 250	Reactor coolant pump oil collection system: tanks	Steel	Lubricating oil (waste oil)	Loss of material due to general, pitting, crevice corrosion, MIC	AMP XI.M32, "One-Time Inspection"	No

VII Table G	AUXILIARY SYSTEMS Fire Protection							
New, Modified, Deleted, Edited Item	**Item**	**SRP Item (Table, ID)**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/Mechanism**	**Aging Management Program (AMP)/TLAA**	**Further Evaluation**
M	VII.G.A-403	3.3-1, 130	Sprinklers	Metallic	Air, condensation, raw water, raw water (potable), treated water	Loss of material due to general (where applicable), pitting, crevice corrosion, MIC (except for aluminum, and in raw water, raw water (potable), treated water only), flow blockage due to fouling	AMP XI.M27, "Fire Water System"	No
N	VII.G.A-626	3.3-1, 179	Structural fire barrier walls	Masonry walls	Air	Cracking due to restraint shrinkage, creep, aggressive environment; loss of material (spalling, scaling) and cracking due to freeze-thaw	AMP XI.M26, "Fire Protection," and AMP XI.S5, "Masonry Walls"	No
M	VII.G.A-90	3.3-1, 060	Structural fire barriers: walls, ceilings and floors	Reinforced concrete	Air	Cracking due to chemical reaction, weathering, settlement, or corrosion of reinforcement; loss of material due to delamination, exfoliation, spalling, popout, or scaling	AMP XI.M26, "Fire Protection," and AMP XI.S6, "Structures Monitoring"	No

VII Table G	AUXILIARY SYSTEMS Fire Protection							
New, Modified, Deleted, Edited Item	Item	SRP Item (Table, ID)	Structure and/or Component	Material	Environment	Aging Effect/Mechanism	Aging Management Program (AMP)/TLAA	Further Evaluation
N	VII.G.A-805	3.3-1, 267	Fireproofing; fire barriers	Subliming compounds (Thermo-lag®, Darmatt™, 3M™ Interam™, and other similar materials)	Air	Loss of material due to abrasion, flaking, vibration; cracking/delamination due to chemical reaction, settlement; change in material properties due to gamma irradiation exposure; separation	AMP XI.M26, "Fire Protection"	No
N	VII.G.A-806	3.3-1, 268	Fireproofing; fire barriers	Cementitious coatings (Pyrocrete, BIO™ K-10 Mortar, Cafecote, and other similar materials)	Air	Loss of material due to abrasion, exfoliation, elevated temperature, flaking, spalling; cracking/ delamination due to chemical reaction, elevated temperature, settlement, vibration; change in material properties due to elevated temperature, gamma irradiation exposure; separation	AMP XI.M26, "Fire Protection"	No
N	VII.G.A-807	3.3-1, 269	Fireproofing; fire barriers	Silicates (Marinite®, Kaowool™, Cerafiber®, Cera® blanket, or other similar materials)	Air	Loss of material due to abrasion, flaking; cracking/delamination due to settlement; change in material properties due to gamma irradiation exposure; separation	AMP XI.M26, "Fire Protection"	No
D	VII.G.A-20							
D	VII.G.A-22							
D	VII.G.A-23							

VII Table G	AUXILIARY SYSTEMS Fire Protection							
New, Modified, Deleted, Edited Item	Item	SRP Item (Table, ID)	Structure and/or Component	Material	Environment	Aging Effect/Mechanism	Aging Management Program (AMP)/TLAA	Further Evaluation
D	VII.G.A-402							
D	VII.G.A-405							
D	VII.G.A-425							
D	VII.G.A-426							
D	VII.G.A-456							
D	VII.G.A-462							
D	VII.G.A-627							
D	VII.G.A-637							
D	VII.G.A-641							
D	VII.G.A-651							
D	VII.G.A-654							
D	VII.G.A-714a							
D	VII.G.A-714b							
D	VII.G.A-714c							
D	VII.G.A-746							
D	VII.G.A-749							
D	VII.G.A-750							
D	VII.G.A-786							
D	VII.G.A-790a							
D	VII.G.A-790b							
D	VII.G.A-91							
D	VII.G.A-92							
D	VII.G.A-93							
D	VII.G.A-95							
D	VII.G.AP-137							
D	VII.G.AP-198							
D	VII.G.AP-209e							
D	VII.G.AP-40							
D	VII.G.AP-41							

Revisions to SRP-SLR Table 3.3-1

SRP-SLR Table 3.3-1 is provided in its entirety below. The only change to SRP-SLR Table 3.3-1 associated with this appendix is the addition of items 267 through 269.

Table 3.3-1	**Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report**						
New, Modified, Deleted, Edited Item	ID	Type	Component	Aging Effect/Mechanism	Aging Management Program (AMP)/TLAA	Further Evaluation Recommended	GALL-SLR Item
M	001	BWR/PWR	Steel cranes: bridges, structural members, structural components exposed to any environment	Cumulative fatigue damage due to fatigue	TLAA, SRP-SLR Section 4.7 "Other Plant-Specific TLAAs"	Yes (SRP-SLR Section 3.3.2.2.1)	VII.B.A-06
M	002	BWR/PWR	Stainless steel, steel heat exchanger components and tubes, piping, piping components exposed to any environment	Cumulative fatigue damage due to fatigue	TLAA, SRP-SLR Section 4.3 "Metal Fatigue"	Yes (SRP-SLR Section 3.3.2.2.1)	VII.E1.A-100 VII.E1.A-34 VII.E1.A-57 VII.E3.A-34 VII.E3.A-62 VII.E4.A-62
M	003	PWR	Stainless steel heat exchanger tubing, non-regenerative exposed to treated borated water >60°C (>140°F)	Cracking due to SCC; cyclic loading	AMP XI.M2, "Water Chemistry"	Yes (SRP-SLR Section 3.3.2.2.2)	VII.E1.A-69
N	003a	PWR	Stainless steel heat exchanger tubing, non-regenerative exposed to treated borated water >60°C (>140°F)	Cracking due to SCC; cyclic loading	AMP XI.M2, "Water Chemistry," and AMP XI.M21A, "Closed Treated Water Systems"	Yes (SRP-SLR Section 3.3.2.2.2)	VII.E1.A-69a
M	004	BWR/PWR	Stainless steel piping, piping components, tanks exposed to air, condensation	Cracking due to SCC	AMP XI.M32, "One-Time Inspection," AMP XI.M36, "External Surfaces Monitoring of Mechanical Components," AMP XI.M38,	Yes (SRP-SLR Section 3.3.2.2.3)	VII.C1.AP-209a VII.C1.AP-209b VII.C1.AP-209c VII.C1.AP-209d VII.C2.AP-209a VII.C2.AP-209b VII.C2.AP-209c VII.C2.AP-209d VII.C3.AP-209a

Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New, Modified, Deleted, Edited Item	ID	Type	Component	Aging Effect/Mechanism	Aging Management Program (AMP)/TLAA	Further Evaluation Recommended	GALL-SLR Item
					"Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," or AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"		VII.C3.AP-209b VII.C3.AP-209c VII.C3.AP-209d VII.D.AP-209a VII.D.AP-209b VII.D.AP-209c VII.D.AP-209d VII.E1.AP-209a VII.E1.AP-209b VII.E1.AP-209c VII.E1.AP-209d VII.E4.AP-209a VII.E4.AP-209b VII.E4.AP-209c VII.E4.AP-209d VII.F1.AP-209a VII.F1.AP-209b VII.F1.AP-209c VII.F1.AP-209d VII.F2.AP-209a VII.F2.AP-209b VII.F2.AP-209c VII.F2.AP-209d VII.F3.AP-209a VII.F3.AP-209b VII.F3.AP-209c VII.F3.AP-209d VII.F4.AP-209a VII.F4.AP-209b VII.F4.AP-209c VII.F4.AP-209d VII.G.AP-209a VII.G.AP-209b VII.G.AP-209c VII.G.AP-209d VII.H1.AP-209a VII.H1.AP-209b VII.H1.AP-209c VII.H1.AP-209d

Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New, Modified, Deleted, Edited Item	ID	Type	Component	Aging Effect/Mechanism	Aging Management Program (AMP)/TLAA	Further Evaluation Recommended	GALL-SLR Item
							VII.H2.AP-209a VII.H2.AP-209b VII.H2.AP-209c VII.H2.AP-209d
D	005						
M	006	BWR/PWR	Stainless steel, nickel alloy piping, piping components exposed to air, condensation	Loss of material due to pitting, crevice corrosion	AMP XI.M32, "One-Time Inspection," AMP XI.M36, "External Surfaces Monitoring of Mechanical Components," AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," or AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	Yes (SRP-SLR Section 3.3.2.2.4)	VII.C1.AP-221a VII.C1.AP-221b VII.C1.AP-221c VII.C1.AP-221d VII.C2.AP-221a VII.C2.AP-221b VII.C2.AP-221c VII.C2.AP-221d VII.C3.AP-221a VII.C3.AP-221b VII.C3.AP-221c VII.C3.AP-221d VII.D.AP-221a VII.D.AP-221b VII.D.AP-221c VII.D.AP-221d VII.E1.AP-221a VII.E1.AP-221b VII.E1.AP-221c VII.E1.AP-221d VII.E4.AP-221a VII.E4.AP-221b VII.E4.AP-221c VII.E4.AP-221d VII.F1.AP-221a VII.F1.AP-221b VII.F1.AP-221c VII.F1.AP-221d VII.F2.AP-221a VII.F2.AP-221b VII.F2.AP-221c VII.F2.AP-221d VII.F3.AP-221a

Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New, Modified, Deleted, Edited Item	ID	Type	Component	Aging Effect/Mechanism	Aging Management Program (AMP)/TLAA	Further Evaluation Recommended	GALL-SLR Item
							VII.F3.AP-221b VII.F3.AP-221c VII.F3.AP-221d VII.F4.AP-221a VII.F4.AP-221b VII.F4.AP-221c VII.F4.AP-221d VII.G.AP-221a VII.G.AP-221b VII.G.AP-221c VII.G.AP-221d VII.H1.AP-221a VII.H1.AP-221b VII.H1.AP-221c VII.H1.AP-221d VII.H2.AP-221a VII.H2.AP-221b VII.H2.AP-221c VII.H2.AP-221d
	007	PWR	Stainless steel high-pressure pump, casing exposed to treated borated water	Cracking due to cyclic loading	AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD"	No	VII.E1.AP-115
	008	PWR	Stainless steel heat exchanger components and tubes exposed to treated borated water >60°C (>140°F)	Cracking due to cyclic loading	AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD"	No	VII.E1.AP-119
M	009	PWR	Steel, copper alloy (>15% Zn) external surfaces, piping, piping components exposed to air with borated water leakage	Loss of material due to boric acid corrosion	AMP XI.M10, "Boric Acid Corrosion"	No	VII.I.A-79 VII.I.AP-66

Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New, Modified, Deleted, Edited Item	ID	Type	Component	Aging Effect/Mechanism	Aging Management Program (AMP)/TLAA	Further Evaluation Recommended	GALL-SLR Item
M	010	BWR/PWR	High-strength steel closure bolting exposed to air, soil, underground	Cracking due to SCC; cyclic loading	AMP XI.M18, "Bolting Integrity"	No	VII.I.A-04
D	011						
M	012	BWR/PWR	Steel; stainless steel, nickel alloy closure bolting exposed to air – indoor uncontrolled, air – outdoor, condensation	Loss of material due to general (steel only), pitting, crevice corrosion	AMP XI.M18, "Bolting Integrity"	No	VII.I.A-03
D	013						
D	014						
M	015	BWR/PWR	Metallic closure bolting exposed to any environment, soil, underground	Loss of preload due to thermal effects, gasket creep, self-loosening	AMP XI.M18, "Bolting Integrity"	No	VII.I.AP-124
M	016	BWR	Stainless steel piping, piping components outboard the second containment isolation valves with a diameter ≥4 inches nominal pipe size exposed to treated water >93°C (>200°F)	Cracking due to SCC, IGSCC	AMP XI.M2, "Water Chemistry," and AMP XI.M25, "BWR Reactor Water Cleanup System"	No	VII.E3.AP-283
	017	BWR/PWR	Stainless steel heat exchanger tubes exposed to treated water, treated borated water	Reduction of heat transfer due to fouling	AMP XI.M2, "Water Chemistry," and AMP XI.M32, "One-Time Inspection"	No	VII.A4.AP-139 VII.A3.A-101 VII.E1.A-101

Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New, Modified, Deleted, Edited Item	ID	Type	Component	Aging Effect/Mechanism	Aging Management Program (AMP)/TLAA	Further Evaluation Recommended	GALL-SLR Item
M	018	BWR/PWR	Stainless steel high-pressure pump casing, piping, piping components, tanks exposed to treated borated water >60°C (>140°F), sodium pentaborate solution >60°C (>140°F)	Cracking due to SCC	AMP XI.M2, "Water Chemistry," and AMP XI.M32, "One-Time Inspection"	No	VII.E1.AP-114 VII.E2.AP-181
M	019	BWR	Stainless steel regenerative heat exchanger components exposed to treated water >60°C (>140°F)	Cracking due to SCC	AMP XI.M2, "Water Chemistry," and AMP XI.M32, "One-Time Inspection"	No	VII.E3.AP-120
	020	BWR/PWR	Stainless steel, steel with stainless steel cladding heat exchanger components exposed to treated borated water >60°C (>140°F), treated water >60°C (>140°F)	Cracking due to SCC	AMP XI.M2, "Water Chemistry," and AMP XI.M32, "One Time Inspection"	No	VII.E1.AP-118 VII.E3.AP-112
M	021	BWR	Steel piping, piping components exposed to treated water	Loss of material due to general, pitting, crevice corrosion, MIC	AMP XI.M2, "Water Chemistry," and AMP XI.M32, "One-Time Inspection"	No	VII.E3.AP-106 VII.E4.AP-106
M	022	BWR	Copper alloy piping, piping components exposed to treated water	Loss of material due to pitting, crevice corrosion, MIC	AMP XI.M2, "Water Chemistry," and AMP XI.M32, "One-Time Inspection"	No	VII.A4.AP-140 VII.E3.AP-140 VII.E4.AP-140
D	023						
D	024						

Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New, Modified, Deleted, Edited Item	ID	Type	Component	Aging Effect/Mechanism	Aging Management Program (AMP)/TLAA	Further Evaluation Recommended	GALL-SLR Item
M	025	BWR/PWR	Aluminum piping, piping components exposed to treated water, treated borated water	Loss of material due to pitting, crevice corrosion	AMP XI.M2, "Water Chemistry," and AMP XI.M32, "One-Time Inspection"	No	VII.A4.AP-130 VII.C2.AP-130 VII.E3.AP-130 VII.E4.AP-130 VII.H2.AP-130
M	026	BWR	Steel (with stainless steel cladding) piping, piping components exposed to treated water	Loss of material due to general (only after cladding degradation), pitting, crevice corrosion, MIC	AMP XI.M2, "Water Chemistry," and AMP XI.M32, "One-Time Inspection"	No	VII.A4.AP-108
	027	BWR	Stainless steel heat exchanger tubes exposed to treated water	Reduction of heat transfer due to fouling	AMP XI.M2, "Water Chemistry," and AMP XI.M32, "One Time Inspection"	No	VII.E3.AP-139
M	028	PWR	Stainless steel piping, piping components, tanks exposed to treated borated water >60°C (>140°F)	Cracking due to SCC	AMP XI.M2, "Water Chemistry," and AMP XI.M32, "One-Time Inspection"	No	VII.E1.AP-82
D	029						
M	030	BWR/PWR	Concrete, concrete cylinder piping, reinforced concrete, asbestos cement, cementitious piping, piping components exposed to raw water	Cracking due to chemical reaction, weathering, settlement, or corrosion of reinforcement (reinforced concrete only); loss of material due to delamination, exfoliation, spalling, popout, scaling, or cavitation; flow blockage due to fouling	AMP XI.M20, "Open-Cycle Cooling Water System"	No	VII.C1.AP-250
M	030a	BWR/PWR	Fiberglass, HDPE piping, piping components exposed to raw water	Cracking, blistering, loss of material due to exposure to ultraviolet light, ozone, radiation, temperature, or moisture; flow blockage due to fouling	AMP XI.M20, "Open-Cycle Cooling Water System"	No	VII.C1.AP-238 VII.C1.AP-239
D	031						

Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New, Modified, Deleted, Edited Item	ID	Type	Component	Aging Effect/Mechanism	Aging Management Program (AMP)/TLAA	Further Evaluation Recommended	GALL-SLR Item
D	032						
D	032a						
D	033						
M	034	BWR/PWR	Nickel alloy, copper alloy piping, piping components exposed to raw water	Loss of material due to general (copper alloy only), pitting, crevice corrosion, MIC; flow blockage due to fouling	AMP XI.M20, "Open-Cycle Cooling Water System"	No	VII.C1.AP-196 VII.C1.AP-206 VII.C3.AP-195 VII.C3.AP-206 VII.H2.AP-193
D	035						
D	036						
M	037	BWR/PWR	Steel piping, piping components exposed to raw water	Loss of material due to general, pitting, crevice corrosion, MIC; flow blockage due to fouling	AMP XI.M20, "Open-Cycle Cooling Water System"	No	VII.C1.AP-194 VII.C3.AP-194 VII.H2.AP-194
M	038	BWR/PWR	Copper alloy, steel heat exchanger components exposed to raw water	Loss of material due to general, pitting, crevice corrosion, MIC; flow blockage due to fouling	AMP XI.M20, "Open-Cycle Cooling Water System"	No	VII.C1.AP-179 VII.C1.AP-183
D	039						
M	040	BWR/PWR	Stainless steel piping, piping components exposed to raw water	Loss of material due to pitting, crevice corrosion, MIC; flow blockage due to fouling	AMP XI.M20, "Open-Cycle Cooling Water System"	No	VII.C1.A-54 VII.C3.A-53 VII.H2.AP-55
D	041						
M	042	BWR/PWR	Copper alloy, titanium, stainless steel heat exchanger tubes exposed to raw water, raw water (potable), treated water	Cracking due to SCC (titanium only), reduction of heat transfer due to fouling	AMP XI.M20, "Open-Cycle Cooling Water System," or AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	VII.C1.AP-187 VII.C3.AP-187 VII.G.AP-187 VII.H2.AP-187
M	043	BWR/PWR	Stainless steel piping, piping components exposed to closed-cycle cooling water >60°C (>140°F)	Cracking due to SCC	AMP XI.M21A, "Closed Treated Water Systems"	No	VII.C2.AP-186 VII.E3.AP-186 VII.E4.AP-186

Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New, Modified, Deleted, Edited Item	ID	Type	Component	Aging Effect/Mechanism	Aging Management Program (AMP)/TLAA	Further Evaluation Recommended	GALL-SLR Item
	044	BWR/PWR	Stainless steel; steel with stainless steel cladding heat exchanger components exposed to closed-cycle cooling water >60°C (>140°F)	Cracking due to SCC	AMP XI.M21A, "Closed Treated Water Systems"	No	VII.E3.AP-192
M	045	BWR/PWR	Steel piping, piping components, tanks exposed to closed-cycle cooling water	Loss of material due to general, pitting, crevice corrosion, MIC	AMP XI.M21A, "Closed Treated Water Systems"	No	VII.C2.AP-202 VII.F1.AP-202 VII.F2.AP-202 VII.F3.AP-202 VII.F4.AP-202 VII.H2.AP-202
M	046	BWR/PWR	Steel, copper alloy heat exchanger components, piping, piping components exposed to closed-cycle cooling water	Loss of material due to general (steel only), pitting, crevice corrosion, MIC	AMP XI.M21A, "Closed Treated Water Systems"	No	VII.A3.AP-189 VII.A3.AP-199 VII.A4.AP-189 VII.A4.AP-199 VII.C2.AP-189 VII.C2.AP-199 VII.E1.AP-189 VII.E1.AP-199 VII.E1.AP-203 VII.E3.AP-189 VII.E3.AP-199 VII.E4.AP-189 VII.E4.AP-199 VII.F1.AP-189 VII.F1.AP-199 VII.F1.AP-203 VII.F2.AP-189 VII.F2.AP-199 VII.F3.AP-189 VII.F3.AP-199 VII.F3.AP-203 VII.F4.AP-189 VII.F4.AP-199 VII.H1.AP-199 VII.H2.AP-199

Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New, Modified, Deleted, Edited Item	ID	Type	Component	Aging Effect/Mechanism	Aging Management Program (AMP)/TLAA	Further Evaluation Recommended	GALL-SLR Item
M	047	BWR	Stainless steel; steel with stainless steel cladding heat exchanger components exposed to closed-cycle cooling water	Loss of material due to pitting, crevice corrosion, MIC	AMP XI.M21A, "Closed Treated Water Systems"	No	VII.E3.AP-191 VII.E4.AP-191
M	048	BWR/PWR	Aluminum piping, piping components exposed to closed-cycle cooling water	Loss of material due to pitting, crevice corrosion	AMP XI.M21A, "Closed Treated Water Systems"	No	VII.C2.AP-254 VII.H2.AP-255
M	049	BWR/PWR	Stainless steel piping, piping components exposed to closed-cycle cooling water	Loss of material due to pitting, crevice corrosion, MIC	AMP XI.M21A, "Closed Treated Water Systems"	No	VII.C2.A-52
M	050	BWR/PWR	Stainless steel, copper alloy, steel heat exchanger tubes exposed to closed-cycle cooling water	Reduction of heat transfer due to fouling	AMP XI.M21A, "Closed Treated Water Systems"	No	VII.C2.AP-188 VII.C2.AP-205 VII.E3.AP-188 VII.E4.AP-188 VII.F1.AP-204 VII.F1.AP-205 VII.F2.AP-204 VII.F2.AP-205 VII.F3.AP-204 VII.F3.AP-205 VII.F4.AP-204 VII.F4.AP-205
	051	BWR/PWR	Boraflex spent fuel storage racks: neutron-absorbing sheets (PWR), spent fuel storage racks: neutron-absorbing sheets (BWR) exposed to treated borated water, treated water	Reduction of neutron-absorbing capacity due to boraflex degradation	AMP XI.M22, "Boraflex Monitoring"	No	VII.A2.A-86 VII.A2.A-87

Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New, Modified, Deleted, Edited Item	ID	Type	Component	Aging Effect/Mechanism	Aging Management Program (AMP)/TLAA	Further Evaluation Recommended	GALL-SLR Item
M	052	BWR/PWR	Steel cranes: rails, bridges, structural members, structural components exposed to air	Loss of material due to general corrosion, wear, deformation, cracking	AMP XI.M23, "Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems"	No	VII.B.A-07
D	053						
D	054						
M	055	BWR/PWR	Steel piping, piping components, tanks exposed to condensation	Loss of material due to general, pitting, crevice corrosion	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	VII.D.A-26 VII.E5.A-26 VII.F1.A-26 VII.F2.A-26 VII.F3.A-26 VII.F4.A-26 VII.H2.A-26
D	056						
M	057	BWR/PWR	Elastomer fire barrier penetration seals exposed to air, condensation	Hardening, loss of strength, shrinkage due to elastomer degradation	AMP XI.M26, "Fire Protection"	No	VII.G.A-19
M	058	BWR/PWR	Steel halon/carbon dioxide fire suppression system piping, piping components exposed to air – indoor uncontrolled, air – outdoor, condensation	Loss of material due to general, pitting, crevice corrosion	AMP XI.M26, "Fire Protection"	No	VII.G.AP-150
M	059	BWR/PWR	Steel fire rated doors exposed to air	Loss of material due to wear	AMP XI.M26, "Fire Protection"	No	VII.G.A-21
M	060	BWR/PWR	Reinforced concrete structural fire barriers: walls, ceilings and floors exposed to air	Cracking due to chemical reaction, weathering, settlement, or corrosion of reinforcement; loss of material due to delamination, exfoliation, spalling, popout, or scaling	AMP XI.M26, "Fire Protection," and AMP XI.S6, "Structures Monitoring"	No	VII.G.A-90

Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New, Modified, Deleted, Edited Item	ID	Type	Component	Aging Effect/Mechanism	Aging Management Program (AMP)/TLAA	Further Evaluation Recommended	GALL-SLR Item
D	061						
D	062						
M	063	BWR/PWR	Steel fire hydrants exposed to air – outdoor, raw water, raw water (potable), treated water	Loss of material due to general, pitting, crevice corrosion; flow blockage due to fouling (raw water, raw water (potable) only)	AMP XI.M27, "Fire Water System"	No	VII.G.AP-149
M	064	BWR/PWR	Steel, copper alloy piping, piping components exposed to raw water, treated water, raw water (potable)	Loss of material due to general (steel; copper alloy in raw water and raw water (potable) only), pitting, crevice corrosion, MIC; flow blockage due to fouling (raw water; raw water (potable) for steel only)	AMP XI.M27, "Fire Water System"	No	VII.G.A-33 VII.G.AP-197
M	065	BWR/PWR	Aluminum piping, piping components exposed to raw water, treated water, raw water (potable)	Loss of material due to pitting, crevice corrosion; flow blockage due to fouling (raw water only)	AMP XI.M27, "Fire Water System"	No	VII.G.AP-180
M	066	BWR/PWR	Stainless steel piping, piping components exposed to raw water, treated water, raw water (potable)	Loss of material due to pitting, crevice corrosion, MIC; flow blockage due to fouling (raw water only)	AMP XI.M27, "Fire Water System"	No	VII.G.A-55
D	067						
D	068						
M	069	BWR/PWR	Copper alloy piping, piping components exposed to fuel oil	Loss of material due to pitting, crevice corrosion, MIC	AMP XI.M30, "Fuel Oil Chemistry," and AMP XI.M32, "One-Time Inspection," or AMP XI.M30, "Fuel Oil Chemistry"	No	VII.G.AP-132 VII.G.AP-132a VII.H1.AP-132 VII.H1.AP-132a VII.H2.AP-132 VII.H2.AP-132a

Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New, Modified, Deleted, Edited Item	ID	Type	Component	Aging Effect/Mechanism	Aging Management Program (AMP)/TLAA	Further Evaluation Recommended	GALL-SLR Item
M	070	BWR/PWR	Steel piping, piping components, tanks exposed to fuel oil	Loss of material due to general, pitting, crevice corrosion, MIC	AMP XI.M30, "Fuel Oil Chemistry," and AMP XI.M32, "One-Time Inspection," or AMP XI.M30, "Fuel Oil Chemistry"	No	VII.H1.AP-105 VII.H1.AP-105a VII.H2.AP-105 VII.H2.AP-105a VII.G.AP-234 VII.G.AP-234a
M	071	BWR/PWR	Stainless steel, aluminum, nickel alloy piping, piping components exposed to fuel oil	Loss of material due to pitting, crevice corrosion, MIC	AMP XI.M30, "Fuel Oil Chemistry," and AMP XI.M32, "One-Time Inspection," or AMP XI.M30, "Fuel Oil Chemistry"	No	VII.G.AP-129 VII.G.AP-129a VII.G.AP-136 VII.G.AP-136a VII.H1.AP-129 VII.H1.AP-129a VII.H1.AP-136 VII.H1.AP-136a VII.H2.AP-129 VII.H2.AP-129a VII.H2.AP-136 VII.H2.AP-136a VII.H2.A-801 VII.H2.A-802
M	072	BWR/PWR	Gray cast iron, ductile iron, copper alloy (>15% Zn or >8% Al) piping, piping components, heat exchanger components exposed to treated water, closed-cycle cooling water, soil, raw water, raw water (potable), waste water	Loss of material due to selective leaching	AMP XI.M33, "Selective Leaching"	No	VII.A3.AP-31 VII.A3.AP-43 VII.A4.AP-31 VII.A4.AP-32 VII.A4.AP-43 VII.C1.A-02 VII.C1.A-47 VII.C1.A-51 VII.C1.A-66 VII.C2.A-50 VII.C2.AP-31 VII.C2.AP-32 VII.C2.AP-43 VII.C3.A-02 VII.C3.A-47 VII.C3.A-51 VII.E1.AP-31 VII.E1.AP-43

Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New, Modified, Deleted, Edited Item	ID	Type	Component	Aging Effect/Mechanism	Aging Management Program (AMP)/TLAA	Further Evaluation Recommended	GALL-SLR Item
							VII.E1.AP-65 VII.E3.AP-31 VII.E3.AP-32 VII.E3.AP-43 VII.E4.AP-31 VII.E4.AP-32 VII.E4.AP-43 VII.E5.A-547 VII.E5.A-724 VII.F1.AP-31 VII.F1.AP-43 VII.F1.AP-65 VII.F2.AP-31 VII.F2.AP-43 VII.F3.A-50 VII.F3.AP-43 VII.F3.AP-65 VII.F4.AP-31 VII.F4.AP-43 VII.G.A-02 VII.G.A-47 VII.G.A-51 VII.G.AP-31 VII.H1.A-02 VII.H1.AP-43 VII.H2.A-02 VII.H2.A-47 VII.H2.A-51 VII.H2.AP-43
M	073	BWR/PWR	Concrete, concrete cylinder piping, reinforced concrete, asbestos cement, cementitious piping, piping components exposed to air – outdoor	Cracking due to chemical reaction, weathering, or corrosion of reinforcement (reinforced concrete only); loss of material due to delamination, exfoliation, spalling, popout, or scaling	AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	VII.I.AP-253
D	074						

Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New, Modified, Deleted, Edited Item	ID	Type	Component	Aging Effect/Mechanism	Aging Management Program (AMP)/TLAA	Further Evaluation Recommended	GALL-SLR Item
D	075						
M	076	BWR/PWR	Elastomer piping, piping components, ducting, ducting components, seals exposed to air, condensation	Hardening or loss of strength due to elastomer degradation	AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	VII.I.AP-102
D	077						
M	078	BWR/PWR	Steel external surfaces exposed to air – indoor uncontrolled, air – outdoor, condensation	Loss of material due to general, pitting, crevice corrosion	AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	VII.I.A-77
D	079						
M	080	BWR/PWR	Steel heat exchanger components, piping, piping components exposed to air – indoor uncontrolled, air – outdoor	Loss of material due to general, pitting, crevice corrosion	AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	VII.I.A-24 VII.I.AP-40 VII.I.AP-41
D	081						
M	082	BWR/PWR	Elastomer, fiberglass piping, piping components, ducting, ducting components, seals exposed to air	Loss of material due to wear	AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	VII.I.A-719 VII.I.AP-113
M	083	BWR/PWR	Stainless steel diesel engine exhaust piping, piping components exposed to diesel exhaust	Cracking due to SCC	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	VII.H2.AP-128

Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New, Modified, Deleted, Edited Item	ID	Type	Component	Aging Effect/Mechanism	Aging Management Program (AMP)/TLAA	Further Evaluation Recommended	GALL-SLR Item
M	085	BWR/PWR	Elastomer piping, piping components, seals exposed to air, condensation, closed-cycle cooling water, treated borated water, treated water, raw water, raw water (potable), waste water, gas, fuel oil, lubricating oil	Hardening or loss of strength due to elastomer degradation; flow blockage due to fouling (raw water, waste water only)	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	VII.A3.AP-100 VII.A4.AP-101 VII.C1.AP-75 VII.C2.AP-259 VII.D.A-729 VII.E1.A-504 VII.E2.A-504 VII.E3.A-504 VII.E4.A-504 VII.E5.A-504 VII.E5.A-728 VII.F1.A-504 VII.F2.A-504 VII.F3.A-504 VII.F4.A-504 VII.G.A-504 VII.G.A-729 VII.G.AP-75 VII.H1.A-660 VII.H2.A-677
D	086						
M	088	BWR/PWR	Steel; stainless steel piping, piping components, diesel engine exhaust exposed to raw water (potable), diesel exhaust	Loss of material due to general (steel only), pitting, crevice corrosion, flow blockage due to fouling (steel only for raw water (potable) environment)	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	VII.E5.AP-270 VII.H2.AP-104
M	089	BWR/PWR	Steel piping, piping components exposed to condensation (internal)	Loss of material due to general, pitting, crevice corrosion	AMP XI.M27, "Fire Water System"	No	VII.G.AP-143
M	090	BWR/PWR	Steel ducting, ducting components (internal surfaces) exposed to condensation	Loss of material due to general, pitting, crevice corrosion, MIC (for drip pans and drain lines only)	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	VII.F1.A-08 VII.F2.A-08 VII.F3.A-08 VII.F4.A-08

Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New, Modified, Deleted, Edited Item	ID	Type	Component	Aging Effect/Mechanism	Aging Management Program (AMP)/TLAA	Further Evaluation Recommended	GALL-SLR Item
M	091	BWR/PWR	Steel piping, piping components, heat exchanger components, tanks exposed to waste water	Loss of material due to general, pitting, crevice corrosion, MIC; flow blockage due to fouling	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	VII.E5.AP-281
D	092						
M	093	BWR/PWR	Copper alloy piping, piping components exposed to raw water (potable)	Loss of material due to general, pitting, crevice corrosion, MIC	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	VII.E5.AP-271
M	094	BWR/PWR	Stainless steel ducting, ducting components exposed to air, condensation	Loss of material due to pitting, crevice corrosion	AMP XI.M32, "One-Time Inspection," AMP XI.M36, "External Surfaces Monitoring of Mechanical Components," or AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	Yes (SRP-SLR Section 3.3.2.2.4)	VII.F1.AP-99a VII.F2.AP-99a VII.F3.AP-99a VII.F4.AP-99a VII.F1.AP-99b VII.F2.AP-99b VII.F3.AP-99b VII.F4.AP-99b VII.F1.AP-99c VII.F2.AP-99c VII.F3.AP-99c VII.F4.AP-99c

Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New, Modified, Deleted, Edited Item	ID	Type	Component	Aging Effect/Mechanism	Aging Management Program (AMP)/TLAA	Further Evaluation Recommended	GALL-SLR Item
N	094a	BWR/PWR	Stainless steel ducting, ducting components exposed to air, condensation	Cracking due to SCC	AMP XI.M32, "One-Time Inspection," AMP XI.M36, "External Surfaces Monitoring of Mechanical Components," or AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	Yes (SRP-SLR Section 3.3.2.2.3)	VII.F1.A-781a VII.F2.A-781a VII.F3.A-781a VII.F4.A-781a VII.F1.A-781b VII.F2.A-781b VII.F3.A-781b VII.F4.A-781b VII.F1.A-781c VII.F2.A-781c VII.F3.A-781c VII.F4.A-781c
M	095	BWR/PWR	Copper alloy, stainless steel, nickel alloy piping, piping components, heat exchanger components, tanks exposed to waste water	Loss of material due to general (copper alloy only), pitting, crevice corrosion, MIC; flow blockage due to fouling	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	VII.E5.AP-272 VII.E5.AP-275 VII.E5.AP-276 VII.E5.AP-278 VII.E5.AP-279
M	096	BWR/PWR	Elastomer piping, piping components, seals exposed to air, raw water, raw water (potable), treated water, waste water	Loss of material due to wear; flow blockage due to fouling (raw water, waste water only)	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	VII.C1.AP-76 VII.E5.A-550 VII.F1.AP-103 VII.F2.AP-103 VII.F3.AP-103 VII.F4.AP-103 VII.G.AP-76
N	096a	BWR/PWR	Steel, aluminum, copper alloy, stainless steel, titanium heat exchanger tubes internal to components exposed to air, condensation (external)	Reduction of heat transfer due to fouling	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	VII.C1.A-419 VII.F1.A-419 VII.F2.A-419 VII.F3.A-419 VII.F4.A-419

Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New, Modified, Deleted, Edited Item	ID	Type	Component	Aging Effect/Mechanism	Aging Management Program (AMP)/TLAA	Further Evaluation Recommended	GALL-SLR Item
N	096b	BWR/PWR	Steel heat exchanger components exposed to condensation	Loss of material due to general, pitting, crevice corrosion	AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	VII.C1.A-417 VII.F1.A-417 VII.F2.A-417 VII.F3.A-417 VII.F4.A-417
M	097	BWR/PWR	Steel piping, piping components exposed to lubricating oil	Loss of material due to general, pitting, crevice corrosion, MIC	AMP XI.M39, "Lubricating Oil Analysis," and AMP XI.M32, "One-Time Inspection"	No	VII.C1.AP-127 VII.C2.AP-127 VII.E1.AP-127 VII.E4.AP-127 VII.F1.AP-127 VII.F2.AP-127 VII.F3.AP-127 VII.F4.AP-127 VII.G.AP-127 VII.H2.AP-127
M	098	BWR/PWR	Steel heat exchanger components exposed to lubricating oil	Loss of material due to general, pitting, crevice corrosion, MIC	AMP XI.M39, "Lubricating Oil Analysis," and AMP XI.M32, "One-Time Inspection"	No	VII.H2.AP-131
M	099	BWR/PWR	Copper alloy, aluminum piping, piping components exposed to lubricating oil	Loss of material due to pitting, crevice corrosion, MIC (copper alloy only)	AMP XI.M39, "Lubricating Oil Analysis," and AMP XI.M32, "One-Time Inspection"	No	VII.C1.AP-133 VII.C2.AP-133 VII.E1.AP-133 VII.E4.AP-133 VII.G.AP-133 VII.G.AP-162 VII.H2.AP-133 VII.H2.AP-162
M	100	BWR/PWR	Stainless steel piping, piping components exposed to lubricating oil	Loss of material due to pitting, crevice corrosion, MIC	AMP XI.M39, "Lubricating Oil Analysis," and AMP XI.M32, "One-Time Inspection"	No	VII.C1.AP-138 VII.C2.AP-138 VII.E1.AP-138 VII.E4.AP-138 VII.G.AP-138 VII.H2.AP-138

Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New, Modified, Deleted, Edited Item	ID	Type	Component	Aging Effect/Mechanism	Aging Management Program (AMP)/TLAA	Further Evaluation Recommended	GALL-SLR Item
	101	BWR/PWR	Aluminum heat exchanger tubes exposed to lubricating oil	Reduction of heat transfer due to fouling	AMP XI.M39, "Lubricating Oil Analysis," and AMP XI.M32, "One-Time Inspection"	No	VII.H2.AP-154
	102	BWR/PWR	Boral®; boron steel, and other materials (excluding Boraflex) spent fuel storage racks: neutron-absorbing sheets (PWR), spent fuel storage racks: neutron-absorbing sheets (BWR) exposed to treated borated water, treated water	Reduction of neutron-absorbing capacity; change in dimensions and loss of material due to effects of SFP environment	AMP XI.M40, "Monitoring of Neutron-Absorbing Materials other than Boraflex"	No	VII.A2.AP-235 VII.A2.AP-236
M	103	BWR/PWR	Concrete, concrete cylinder piping, reinforced concrete, asbestos cement, cementitious piping, piping components exposed to soil, concrete	Cracking due to chemical reaction, weathering, or corrosion of reinforcement (reinforced concrete only); loss of material due to delamination, exfoliation, spalling, popout, or scaling	AMP XI.M41, "Buried and Underground Piping and Tanks"	No	VII.I.AP-157
M	104	BWR/PWR	HDPE, fiberglass piping, piping components exposed to soil, concrete	Cracking, blistering, loss of material due to exposure to ultraviolet light, ozone, radiation, temperature, or moisture	AMP XI.M41, "Buried and Underground Piping and Tanks"	No	VII.I.AP-175 VII.I.AP-176
D	105						
D	106						
M	107	BWR/PWR	Stainless steel, nickel alloy piping, piping components exposed to soil, concrete	Loss of material due to pitting, crevice corrosion, MIC (soil only)	AMP XI.M41, "Buried and Underground Piping and Tanks"	No	VII.I.AP-137

Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New, Modified, Deleted, Edited Item	ID	Type	Component	Aging Effect/Mechanism	Aging Management Program (AMP)/TLAA	Further Evaluation Recommended	GALL-SLR Item
M	108	BWR/PWR	Titanium, super austenitic, copper alloy, stainless steel, nickel alloy piping, piping components, tanks, closure bolting exposed to soil, concrete, underground	Loss of material due to general (copper alloy only), pitting, crevice corrosion, MIC (super austenitic, copper alloy, stainless steel, nickel alloy; soil environment only)	AMP XI.M41, "Buried and Underground Piping and Tanks"	No	VII.I.AP-171 VII.I.AP-172 VII.I.AP-174 VII.I.AP-243
M	109	BWR/PWR	Steel piping, piping components, closure bolting exposed to soil, concrete, underground	Loss of material due to general, pitting, crevice corrosion, MIC (soil only)	AMP XI.M41, "Buried and Underground Piping and Tanks"	No	VII.I.AP-198 VII.I.AP-241 VII.I.AP-284
D	109a						
M	110	BWR	Stainless steel, nickel alloy piping, piping components greater than or equal to 4 NPS exposed to treated water >93°C (>200°F)	Cracking due to SCC, IGSCC	AMP XI.M7, "BWR Stress Corrosion Cracking," and AMP XI.M2, "Water Chemistry"	No	VII.E4.A-61
M	111	BWR/PWR	Steel structural steel exposed to air – indoor uncontrolled	Loss of material due to general, pitting, crevice corrosion	AMP XI.S6, "Structures Monitoring"	No	VII.A1.A-94
M	112	BWR/PWR	Steel piping, piping components exposed to concrete	None	None	Yes (SRP-SLR Section 3.3.2.2.9)	VII.J.AP-282
M	113	BWR/PWR	Aluminum piping, piping components exposed to gas	None	None	No	VII.J.AP-37
M	114	BWR/PWR	Copper alloy piping, piping components exposed to air, condensation, gas	None	None	No	VII.J.AP-144 VII.J.AP-9

Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New, Modified, Deleted, Edited Item	ID	Type	Component	Aging Effect/Mechanism	Aging Management Program (AMP)/TLAA	Further Evaluation Recommended	GALL-SLR Item
M	115	BWR/PWR	Copper alloy, copper alloy (>8% Al) piping, piping components exposed to air with borated water leakage	None	None	No	VII.J.AP-11
M	116	BWR/PWR	Galvanized steel piping, piping components exposed to air – indoor uncontrolled	None	None	No	VII.J.AP-13
M	117	BWR/PWR	Glass piping elements exposed to air, lubricating oil, closed-cycle cooling water, fuel oil, raw water, treated water, treated borated water, air with borated water leakage, condensation, gas, underground	None	None	No	VII.J.AP-14 VII.J.AP-15 VII.J.AP-166 VII.J.AP-48 VII.J.AP-49 VII.J.AP-50 VII.J.AP-51 VII.J.AP-52 VII.J.AP-96 VII.J.AP-97 VII.J.AP-98
D	118						
M	119	BWR/PWR	Nickel alloy, PVC, glass piping, piping components exposed to air with borated water leakage, air – indoor uncontrolled, condensation, waste water, raw water (potable)	None	None	No	VII.J.AP-260 VII.J.AP-268 VII.J.AP-269 VII.J.AP-277
M	120	BWR/PWR	Stainless steel piping, piping components exposed to air with borated water leakage, gas	None	None	No	VII.J.AP-18 VII.J.AP-22

Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New, Modified, Deleted, Edited Item	ID	Type	Component	Aging Effect/Mechanism	Aging Management Program (AMP)/TLAA	Further Evaluation Recommended	GALL-SLR Item
M	121	BWR/PWR	Steel piping, piping components exposed to air – indoor controlled, gas	None	None	No	VII.J.AP-2 VII.J.AP-6
M	122	BWR/PWR	Titanium heat exchanger components, piping, piping components exposed to air – indoor uncontrolled, air – outdoor	None	None	No	VII.J.AP-151 VII.J.AP-160
M	123	BWR/PWR	Titanium heat exchanger components other than tubes, piping and piping components exposed to raw water	Cracking due to SCC, flow blockage due to fouling	AMP XI.M20, "Open-Cycle Cooling Water System," or AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	VII.C1.AP-152a VII.C3.AP-152a VII.E4.AP-152a VII.H2.AP-152a VII.C1.AP-152b VII.C1.AP-161a VII.C3.AP-161a VII.E4.AP-161a VII.H2.AP-161a VII.C1.AP-161b
M	124	BWR/PWR	Stainless steel, steel (with stainless steel or nickel alloy cladding) spent fuel storage racks (BWR), spent fuel storage racks (PWR), piping, piping components exposed to treated water >60°C (>140°F), treated borated water >60°C (>140°F)	Cracking due to SCC	AMP XI.M2, "Water Chemistry," and AMP XI.M32, "One-Time Inspection"	No	VII.A2.A-96 VII.A2.A-97 VII.A3.A-56 VII.E1.A-103

Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New, Modified, Deleted, Edited Item	ID	Type	Component	Aging Effect/Mechanism	Aging Management Program (AMP)/TLAA	Further Evaluation Recommended	GALL-SLR Item
M	125	BWR/PWR	Stainless steel, steel (with stainless steel cladding), nickel alloy spent fuel storage racks (BWR), spent fuel storage racks (PWR), piping, piping components exposed to treated water, treated borated water	Loss of material due to pitting, crevice corrosion, MIC	AMP XI.M2, "Water Chemistry," and AMP XI.M32, "One-Time Inspection"	No	VII.A2.AP-79 VII.A3.AP-79 VII.E1.AP-79 VII.A2.A-98 VII.A2.A-99
M	126	BWR/PWR	Metallic piping, piping components exposed to treated water, treated borated water, raw water	Wall thinning due to erosion	AMP XI.M17, "Flow-Accelerated Corrosion"	No	VII.C1.A-409 VII.E1.A-407 VII.E3.A-408
M	127	BWR/PWR	Metallic piping, piping components, tanks exposed to closed-cycle cooling water, raw water, raw water (potable), treated water, waste water	Loss of material due to recurring internal corrosion	AMP XI.M20, "Open-Cycle Cooling Water System," AMP XI.M27, "Fire Water System," or AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	Yes (SRP-SLR Section 3.3.2.2.7)	VII.C1.A-400 VII.C3.A-400 VII.E5.A-400 VII.G.A-400
M	128	BWR/PWR	Steel tanks (within the scope of AMP XI.M29, "Outdoor and Large Atmospheric Metallic Storage Tanks") exposed to soil, concrete, air, condensation, raw water	Loss of material due to general, pitting, crevice corrosion, MIC (soil, raw water only)	AMP XI.M29, "Outdoor and Large Atmospheric Metallic Storage Tanks"	No	VII.C3.A-401 VII.E5.A-401 VII.H1.A-401
D	129						

Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New, Modified, Deleted, Edited Item	ID	Type	Component	Aging Effect/Mechanism	Aging Management Program (AMP)/TLAA	Further Evaluation Recommended	GALL-SLR Item
M	130	BWR/PWR	Metallic sprinklers exposed to air, condensation, raw water, raw water (potable), treated water	Loss of material due to general (where applicable), pitting, crevice corrosion, MIC (except for aluminum, and in raw water, raw water (potable), treated water only); flow blockage due to fouling	AMP XI.M27, "Fire Water System"	No	VII.G.A-403
M	131	BWR/PWR	Steel, stainless steel, copper alloy, aluminum piping, piping components exposed to air, condensation	Flow blockage due to fouling	AMP XI.M27, "Fire Water System"	No	VII.G.A-404
M	132	BWR/PWR	Insulated steel, copper alloy (>15% Zn or >8% Al), piping, piping components, tanks, tanks (within the scope of AMP XI.M29, "Outdoor and Large Atmospheric Metallic Storage Tanks") exposed to air, condensation	Loss of material due to general (steel only), pitting, crevice corrosion; cracking due to SCC (copper alloy (>15% Zn or >8% Al) only)	AMP XI.M36, "External Surfaces Monitoring of Mechanical Components" or AMP XI.M29, "Outdoor and Large Atmospheric Metallic Storage Tanks"	No	VII.I.A-405a VII.I.A-405b
M	133	BWR/PWR	HDPE underground piping, piping components	Cracking, blistering	AMP XI.M41, "Buried and Underground Piping and Tanks"	No	VII.I.A-406
M	134	BWR/PWR	Steel, stainless steel, copper alloy piping, piping components, and heat exchanger components exposed to raw water (for components not covered by NRC GL 89-13)	Loss of material due to general (steel, copper alloy only), pitting, crevice corrosion, MIC; flow blockage due to fouling	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	VII.C1.A-727

Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New, Modified, Deleted, Edited Item	ID	Type	Component	Aging Effect/Mechanism	Aging Management Program (AMP)/TLAA	Further Evaluation Recommended	GALL-SLR Item
M	135	BWR/PWR	Steel, stainless steel pump casings exposed to waste water environment	Loss of material due to general (steel only), pitting, crevice corrosion, MIC	AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	VII.E5.A-410 VII.E5.A-411
M	136	BWR/PWR	Steel fire water storage tanks exposed to air, condensation, soil, concrete, raw water, raw water (potable), treated water	Loss of material due to general, pitting, crevice corrosion, MIC (raw water, raw water (potable), treated water, soil only)	AMP XI.M27, "Fire Water System"	No	VII.G.A-412
M	137	BWR/PWR	Steel, stainless steel, aluminum tanks (within the scope of AMP XI.M29, "Outdoor and Large Atmospheric Metallic Storage Tanks") exposed to treated water, raw water, waste water	Loss of material due to general (steel only), pitting, crevice corrosion, MIC (steel, stainless steel only)	AMP XI.M29, "Outdoor and Large Atmospheric Metallic Storage Tanks"	No	VII.C3.A-413 VII.E5.A-413 VII.H1.A-413
M	138	BWR/PWR	Any material piping, piping components, heat exchangers, tanks with internal coatings/linings exposed to closed-cycle cooling water, raw water, raw water (potable), treated water, treated borated water, fuel oil, lubricating oil, waste water	Loss of coating or lining integrity due to blistering, cracking, flaking, peeling, delamination, rusting, or physical damage; loss of material or cracking for cementitious coatings/linings	AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	No	VII.C1.A-416 VII.C2.A-416 VII.C3.A-416 VII.E4.A-416 VII.E5.A-416 VII.F1.A-416 VII.F2.A-416 VII.F3.A-416 VII.F4.A-416 VII.G.A-416 VII.H1.A-416 VII.H2.A-416

Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New, Modified, Deleted, Edited Item	ID	Type	Component	Aging Effect/Mechanism	Aging Management Program (AMP)/TLAA	Further Evaluation Recommended	GALL-SLR Item
M	139	BWR/PWR	Any material piping, piping components, heat exchangers, tanks with internal coatings/linings exposed to closed-cycle cooling water, raw water, raw water (potable), treated water, treated borated water, fuel oil, lubricating oil, waste water	Loss of material due to general, pitting, crevice corrosion, MIC	AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	No	VII.C1.A-414 VII.C2.A-414 VII.C3.A-414 VII.E4.A-414 VII.E5.A-414 VII.F1.A-414 VII.F2.A-414 VII.F3.A-414 VII.F4.A-414 VII.G.A-414 VII.H1.A-414 VII.H2.A-414
M	140	BWR/PWR	Gray cast iron, ductile iron piping components with internal coatings/linings exposed to closed-cycle cooling water, raw water, raw water (potable), treated water, waste water	Loss of material due to selective leaching	AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	No	VII.C1.A-415 VII.C2.A-415 VII.C3.A-415 VII.E2.A-415 VII.E3.A-415 VII.E4.A-415 VII.E5.A-415 VII.G.A-415 VII.H1.A-415 VII.H2.A-415
D	141						
N	142	BWR/PWR	Stainless steel, steel, nickel alloy, copper alloy closure bolting exposed to fuel oil, lubricating oil, treated water, treated borated water, raw water, waste water	Loss of material due to general (steel; copper alloy in raw water, waste water only), pitting, crevice corrosion, MIC (raw water and waste water environments only)	AMP XI.M18, "Bolting Integrity"	No	VII.I.A-423
D	143						
N	144	BWR/PWR	Stainless steel, steel, aluminum piping, piping components, tanks exposed to soil, concrete	Cracking due to SCC (steel in carbonate/bicarbonate environment only)	AMP XI.M41, "Buried and Underground Piping and Tanks"	No	VII.I.A-425

Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New, Modified, Deleted, Edited Item	ID	Type	Component	Aging Effect/Mechanism	Aging Management Program (AMP)/TLAA	Further Evaluation Recommended	GALL-SLR Item
N	145	BWR/PWR	Stainless steel closure bolting exposed to air, soil, concrete, underground, waste water	Cracking due to SCC	AMP XI.M18, "Bolting Integrity"	No	VII.I.A-426
N	146	BWR/PWR	Stainless steel underground piping, piping components, tanks	Cracking due to SCC	AMP XI.M32, "One-Time Inspection," AMP XI.M41, "Buried and Underground Piping and Tanks," or AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	Yes (SRP-SLR Section 3.3.2.2.3)	VII.I.A-714a VII.I.A-714b VII.I.A-714c
N	147	BWR/PWR	Nickel alloy, nickel alloy cladding piping, piping components exposed to closed-cycle cooling water	Loss of material due to pitting, crevice corrosion, MIC	AMP XI.M21A, "Closed Treated Water Systems"	No	VII.C2.A-471
D	148						
N	149	BWR/PWR	Fiberglass piping, piping components, ducting, ducting components exposed to air – outdoor	Cracking, blistering, loss of material due to exposure to ultraviolet light, ozone, radiation, temperature, or moisture	AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	VII.I.A-428
N	150	BWR/PWR	Fiberglass piping, piping components, ducting, ducting components exposed to air	Cracking, blistering, loss of material due to exposure to ultraviolet light, ozone, radiation, temperature, or moisture	AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	VII.I.A-720

Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New, Modified, Deleted, Edited Item	ID	Type	Component	Aging Effect/Mechanism	Aging Management Program (AMP)/TLAA	Further Evaluation Recommended	GALL-SLR Item
N	151	BWR/PWR	Stainless steel, steel, aluminum, copper alloy, titanium heat exchanger tubes exposed to air, condensation	Reduction of heat transfer due to fouling	AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	VII.I.A-716
D	153						
D	154						
N	155	BWR/PWR	Stainless steel piping, piping components, and tanks exposed to waste water >60°C (>140°F)	Cracking due to SCC	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	VII.E5.A-721
D	156						
N	157	BWR/PWR	Steel piping, piping components, heat exchanger components exposed to air-outdoor	Loss of material due to general, pitting, crevice corrosion	AMP XI.M27, "Fire Water System," or AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	VII.E1.A-722 VII.E2.A-722 VII.E3.A-722 VII.E4.A-722 VII.E5.A-722 VII.F1.A-722 VII.F2.A-722 VII.F3.A-722 VII.F4.A-722 VII.G.A-722 VII.H1.A-722 VII.H2.A-722
N	158	BWR/PWR	Nickel alloy piping, piping components heat exchanger components (for components not covered by NRC GL 89-13) exposed to raw water	Loss of material due to pitting, crevice corrosion, MIC; flow blockage due to fouling	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	VII.C1.A-454

Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New, Modified, Deleted, Edited Item	ID	Type	Component	Aging Effect/Mechanism	Aging Management Program (AMP)/TLAA	Further Evaluation Recommended	GALL-SLR Item
N	159	BWR/PWR	Fiberglass piping, piping components, ducting, ducting components exposed to air	Loss of material due to wear	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	VII.D.A-495 VII.E5.A-495 VII.F1.A-495 VII.F2.A-495 VII.F3.A-495 VII.F4.A-495 VII.G.A-495 VII.H1.A-495 VII.H2.A-495
N	160	BWR/PWR	Copper alloy (>15% Zn or >8% Al) piping, piping components, heat exchanger components exposed to closed-cycle cooling water, raw water, waste water	Cracking due to SCC	AMP XI.M20, "Open-Cycle Cooling Water System," AMP XI.M21A, "Closed Treated Water Systems," or AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	VII.C1.A-473b VII.C2.A-473a VII.E5.A-473c
N	161	BWR/PWR	Copper alloy heat exchanger tubes exposed to condensation	Reduction of heat transfer due to fouling	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	VII.F1.A-565 VII.F2.A-565 VII.F3.A-565 VII.F4.A-565 VII.G.A-565 VII.H2.A-565
D	162						
D	164						
D	165						
N	166	BWR/PWR	Copper alloy piping, piping components exposed to concrete	None	None	No	VII.J.A-711
N	167	BWR/PWR	Zinc piping components exposed to air-indoor controlled, air – indoor uncontrolled	None	None	No	VII.J.A-712

Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New, Modified, Deleted, Edited Item	ID	Type	Component	Aging Effect/Mechanism	Aging Management Program (AMP)/TLAA	Further Evaluation Recommended	GALL-SLR Item
N	169	BWR/PWR	Steel, copper alloy piping, piping components exposed to steam	Loss of material due to general (steel only), pitting, crevice corrosion	AMP XI.M2, "Water Chemistry," and AMP XI.M32, "One-Time Inspection"	No	VII.F1.A-566 VII.F2.A-566 VII.F3.A-566 VII.F4.A-566
N	170	BWR/PWR	Stainless steel piping, piping components exposed to steam	Loss of material due to pitting, crevice corrosion	AMP XI.M2, "Water Chemistry," and AMP XI.M32, "One-Time Inspection"	No	VII.F1.A-567 VII.F2.A-567 VII.F3.A-567 VII.F4.A-567
D	171						
N	172	BWR/PWR	PVC piping, piping components exposed to air-outdoor	Reduction in impact strength due to photolysis	AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	VII.C1.A-458 VII.E5.A-458 VII.G.A-458
D	173						
D	174						
N	175	BWR/PWR	Fiberglass piping, piping components, tanks exposed to raw water (for components not covered by NRC GL 89-13), raw water (potable), treated water, waste water	Cracking, blistering, loss of material due to exposure to ultraviolet light, ozone, radiation, temperature, or moisture; flow blockage due to fouling (raw water, waste water only)	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	VII.C1.A-460 VII.E5.A-551 VII.G.A-644
N	176	BWR/PWR	Fiberglass piping, piping components, tanks exposed to raw water environment (for components not covered by NRC GL 89-13), raw water (potable), treated water, waste water	Loss of material due to wear; flow blockage due to fouling (raw water, waste water only)	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	VII.C1.A-461 VII.E5.A-552 VII.G.A-645
N	177	BWR/PWR	Fiberglass piping, piping components exposed to soil	Loss of material due to wear	AMP XI.M41, "Buried and Underground Piping and Tanks"	No	VII.I.A-462

Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New, Modified, Deleted, Edited Item	ID	Type	Component	Aging Effect/Mechanism	Aging Management Program (AMP)/TLAA	Further Evaluation Recommended	GALL-SLR Item
N	178	BWR/PWR	Fiberglass piping and piping components exposed to concrete	None	None	No	VII.J.A-710
N	179	BWR/PWR	Masonry walls: structural fire barriers exposed to air	Cracking due to restraint shrinkage, creep, aggressive environment; loss of material (spalling, scaling) and cracking due to freeze-thaw	AMP XI.M26, "Fire Protection," and AMP XI.S5, "Masonry Walls"	No	VII.G.A-626
D	180						
N	181	BWR/PWR	Titanium piping, piping components exposed to condensation	None	None	No	VII.J.A-703
N	182	BWR/PWR	Non-metallic thermal insulation exposed to air, condensation	Reduced thermal insulation resistance due to moisture intrusion	AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	VII.I.A-704
N	184	BWR/PWR	PVC piping, piping components, tanks exposed to concrete	None	None	No	VII.J.A-709
N	185	BWR/PWR	Aluminum fire water storage tanks exposed to air, condensation, soil, concrete, raw water, raw water (potable), treated water	Cracking due to SCC	AMP XI.M27, "Fire Water System"	No	VII.G.A-623

Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New, Modified, Deleted, Edited Item	ID	Type	Component	Aging Effect/Mechanism	Aging Management Program (AMP)/TLAA	Further Evaluation Recommended	GALL-SLR Item
N	186	BWR/PWR	Aluminum tanks (within the scope of AMP XI.M29, "Outdoor and Large Atmospheric Metallic Storage Tanks") exposed to air, condensation, soil, concrete, raw water, waste water	Cracking due to SCC	AMP XI.M29, "Outdoor and Large Atmospheric Metallic Storage Tanks," AMP XI.M32, "One-Time Inspection," or AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	Yes (SRP-SLR Section 3.3.2.2.8)	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
D	187						
N	189	BWR/PWR	Aluminum piping, piping components, tanks exposed to air, condensation, raw water, raw water (potable), waste water	Cracking due to SCC	AMP XI.M32, "One-Time Inspection," AMP XI.M36, "External Surfaces Monitoring of Mechanical Components," AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," or AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	Yes (SRP-SLR Section 3.3.2.2.8)	VII.A2.A-451a VII.A2.A-451b VII.A2.A-451c VII.A2.A-451d VII.A3.A-451a VII.A3.A-451b VII.A3.A-451c VII.A3.A-451d VII.A4.A-451a VII.A4.A-451b VII.A4.A-451c VII.A4.A-451d VII.C1.A-451a VII.C1.A-451b VII.C1.A-451c VII.C1.A-451d VII.C2.A-451a VII.C2.A-451b VII.C2.A-451c VII.C2.A-451d VII.C3.A-451a VII.C3.A-451b VII.C3.A-451c

Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New, Modified, Deleted, Edited Item	ID	Type	Component	Aging Effect/Mechanism	Aging Management Program (AMP)/TLAA	Further Evaluation Recommended	GALL-SLR Item
							VII.C3.A-451d VII.D.A-451a VII.D.A-451b VII.D.A-451c VII.D.A-451d VII.E1.A-451a VII.E1.A-451b VII.E1.A-451c VII.E1.A-451d VII.E2.A-451a VII.E2.A-451b VII.E2.A-451c VII.E2.A-451d VII.E3.A-451a VII.E3.A-451b VII.E3.A-451c VII.E3.A-451d VII.E4.A-451a VII.E4.A-451b VII.E4.A-451c VII.E4.A-451d VII.E5.A-451a VII.E5.A-451b VII.E5.A-451c VII.E5.A-451d VII.F1.A-451a VII.F1.A-451b VII.F1.A-451c VII.F1.A-451d VII.F2.A-451a VII.F2.A-451b VII.F2.A-451c VII.F2.A-451d VII.F3.A-451a VII.F3.A-451b VII.F3.A-451c VII.F3.A-451d VII.F4.A-451a VII.F4.A-451b

Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New, Modified, Deleted, Edited Item	ID	Type	Component	Aging Effect/Mechanism	Aging Management Program (AMP)/TLAA	Further Evaluation Recommended	GALL-SLR Item
							VII.F4.A-451c VII.F4.A-451d VII.G.A-451a VII.G.A-451b VII.G.A-451c VII.G.A-451d VII.H1.A-451a VII.H1.A-451b VII.H1.A-451c VII.H1.A-451d VII.H2.A-451a VII.H2.A-451b VII.H2.A-451c VII.H2.A-451d
D	190						
D	191						
N	192	BWR/PWR	Aluminum underground piping, piping components, tanks	Cracking due to SCC	AMP XI.M32, "One-Time Inspection," AMP XI.M41, "Buried and Underground Piping and Tanks," or AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	Yes (SRP-SLR Section 3.3.2.2.8)	VII.I.A-706a VII.I.A-706b VII.I.A-706c

Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New, Modified, Deleted, Edited Item	ID	Type	Component	Aging Effect/Mechanism	Aging Management Program (AMP)/TLAA	Further Evaluation Recommended	GALL-SLR Item
N	193	BWR/PWR	Steel components exposed to treated water, raw water, raw water (potable), waste water	Long-term loss of material due to general corrosion	AMP XI.M32, "One-Time Inspection"	No	VII.A3.A-439 VII.A4.A-439 VII.C1.A-532 VII.C2.A-439 VII.C3.A-532 VII.E1.A-439 VII.E2.A-439 VII.E3.A-439 VII.E4.A-532 VII.E5.A-785 VII.G.A-439 VII.G.A-532 VII.H2.A-439 VII.H2.A-532
N	194	BWR/PWR	PVC piping, piping components, and tanks exposed to soil	Loss of material due to wear	AMP XI.M41, "Buried and Underground Piping and Tanks"	No	VII.I.A-537
N	195	BWR/PWR	Concrete, concrete cylinder piping, reinforced concrete, asbestos cement, cementitious piping, piping components exposed to raw water, treated water, raw water (potable)	Cracking due to chemical reaction, weathering, settlement, or corrosion of reinforcement (reinforced concrete only); loss of material due to delamination, exfoliation, spalling, popout, scaling, or cavitation; flow blockage due to fouling (raw water only)	AMP XI.M27, "Fire Water System"	No	VII.G.A-647
N	196	BWR/PWR	HDPE piping, piping components exposed to raw water, treated water, raw water (potable)	Cracking, blistering; flow blockage due to fouling (raw water only)	AMP XI.M27, "Fire Water System"	No	VII.G.A-648

Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New, Modified, Deleted, Edited Item	ID	Type	Component	Aging Effect/Mechanism	Aging Management Program (AMP)/TLAA	Further Evaluation Recommended	GALL-SLR Item
N	197	BWR/PWR	Metallic fire water system piping, piping components, heat exchanger, heat exchanger components (any material) with only a leakage boundary (spatial) or structural integrity (attached) intended function exposed to any external environment except soil, concrete	Loss of material due to general (steel, copper alloy only), pitting, crevice corrosion	AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	VII.G.A-649
N	198	BWR/PWR	Metallic fire water system piping, piping components, heat exchanger, heat exchanger components (any material) with only a leakage boundary (spatial) or structural integrity (attached) intended function	Loss of material due to general (steel, copper alloy only), pitting, crevice corrosion, MIC (all metallic materials except aluminum; in liquid environments only)	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	VII.G.A-650
N	199	BWR/PWR	Cranes: steel structural bolting exposed to air	Loss of preload due to self-loosening; loss of material due to general corrosion; cracking	AMP XI.M23, "Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems"	No	VII.B.A-730
D	200						
N	202	BWR/PWR	Stainless steel piping, piping components exposed to concrete	None	None	Yes (SRP-SLR Section 3.3.2.2.9)	VII.J.AP-19

Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New, Modified, Deleted, Edited Item	ID	Type	Component	Aging Effect/Mechanism	Aging Management Program (AMP)/TLAA	Further Evaluation Recommended	GALL-SLR Item
N	203	BWR	Stainless steel; steel with stainless steel cladding, nickel alloy piping, piping components, heat exchanger components, tanks exposed to treated water, sodium pentaborate solution	Loss of material due to pitting, crevice corrosion, MIC	AMP XI.M2, "Water Chemistry," and AMP XI.M32, "One Time Inspection"	No	VII.A4.AP-110 VII.A4.AP-111 VII.E2.AP-141 VII.E3.AP-110 VII.E4.AP-110
D	204						
N	205	BWR/PWR	Insulated stainless steel piping, piping components, tanks exposed to air, condensation	Cracking due to SCC	AMP XI.M29, "Outdoor and Large Atmospheric Metallic Storage Tanks," AMP XI.M32, "One-Time Inspection," AMP XI.M36, "External Surfaces Monitoring of Mechanical Components," or AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	Yes (SRP-SLR Section 3.3.2.2.3)	VII.I.A-734a VII.I.A-734b VII.I.A-734c VII.I.A-734d
D	206						
N	207	BWR/PWR	Stainless steel, copper alloy, titanium heat exchanger tubes exposed to raw water (for components not covered by NRC GL 89-13)	Cracking due to SCC (titanium only), reduction of heat transfer due to fouling	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	VII.C1.A-736

Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New, Modified, Deleted, Edited Item	ID	Type	Component	Aging Effect/Mechanism	Aging Management Program (AMP)/TLAA	Further Evaluation Recommended	GALL-SLR Item
N	208	BWR/PWR	Concrete, concrete cylinder piping, reinforced concrete, asbestos cement, cementitious piping, piping components exposed to raw water (for components not covered by NRC GL 89-13)	Cracking due to chemical reaction, weathering, settlement, or corrosion of reinforcement (reinforced concrete only); loss of material due to delamination, exfoliation, spalling, popout, scaling, or cavitation; flow blockage due to fouling	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	VII.C1.A-737
D	209						
N	210	BWR/PWR	HDPE piping, piping components exposed to raw water (for components not covered by NRC GL 89-13)	Cracking, blistering; flow blockage due to fouling	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	VII.C1.A-739
D	211						
D	212						
D	213						
N	214	BWR/PWR	Copper alloy (>15% Zn or >8% Al) piping, piping components exposed to soil	Loss of material due to selective leaching	AMP XI.M33, "Selective Leaching"	No	VII.C1.A-743 VII.C2.A-743 VII.C3.A-743 VII.D.A-743 VII.E4.A-743 VII.E5.A-743 VII.G.A-743 VII.H1.A-743 VII.H2.A-743
N	215	BWR/PWR	Aluminum fire water storage tanks exposed to air, condensation, soil, concrete, raw water, raw water (potable), treated water	Loss of material due to pitting, crevice corrosion	AMP XI.M27, "Fire Water System"	No	VII.G.A-744

Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New, Modified, Deleted, Edited Item	ID	Type	Component	Aging Effect/Mechanism	Aging Management Program (AMP)/TLAA	Further Evaluation Recommended	GALL-SLR Item
N	216	BWR/PWR	Stainless steel fire water storage tanks exposed to air, condensation, soil, concrete	Cracking due to SCC	AMP XI.M27, "Fire Water System"	No	VII.G.A-745
D	217						
N	218	BWR/PWR	Stainless steel fire water storage tanks exposed to air, condensation, soil, concrete, raw water, raw water (potable), treated water	Loss of material due to pitting, crevice corrosion, MIC (water and soil environment only)	AMP XI.M27, "Fire Water System"	No	VII.G.A-747
N	219	BWR/PWR	Stainless steel piping, piping components exposed to steam	Cracking due to SCC	AMP XI.M2, "Water Chemistry," and AMP XI.M32, "One-Time Inspection"	No	VII.F1.A-748 VII.F2.A-748 VII.F3.A-748 VII.F4.A-748
D	220						
D	221						

Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New, Modified, Deleted, Edited Item	ID	Type	Component	Aging Effect/Mechanism	Aging Management Program (AMP)/TLAA	Further Evaluation Recommended	GALL-SLR Item
N	222	BWR/PWR	Stainless steel, nickel alloy tanks exposed to air, condensation (internal/external)	Loss of material due to pitting, crevice corrosion	AMP XI.M32, "One-Time Inspection," AMP XI.M36, "External Surfaces Monitoring of Mechanical Components," AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," or AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	Yes (SRP-SLR Section 3.3.2.2.4)	VII.I.A-751b VII.I.A-751c VII.I.A-751d VII.I.A-751e
N	223	BWR/PWR	Aluminum underground piping, piping components, tanks	Loss of material due to pitting, crevice corrosion	AMP XI.M32, "One-Time Inspection," AMP XI.M41, "Buried and Underground Piping and Tanks," or AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	Yes (SRP-SLR Section 3.3.2.2.10)	VII.I.A-752a VII.I.A-752b VII.I.A-752c
D	224						
D	225						

Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New, Modified, Deleted, Edited Item	ID	Type	Component	Aging Effect/Mechanism	Aging Management Program (AMP)/TLAA	Further Evaluation Recommended	GALL-SLR Item
N	226	BWR/PWR	Aluminum tanks (within the scope of AMP XI.M29, "Outdoor and Large Atmospheric Metallic Storage Tanks") exposed to soil, concrete	Loss of material due to pitting, crevice corrosion	AMP XI.M29, "Outdoor and Large Atmospheric Metallic Storage Tanks"	No	VII.I.A-755
N	227	BWR/PWR	Aluminum tanks (within the scope of AMP XI.M29, "Outdoor and Large Atmospheric Metallic Storage Tanks") exposed to air, condensation	Loss of material due to pitting, crevice corrosion	AMP XI.M29, "Outdoor and Large Atmospheric Metallic Storage Tanks," AMP XI.M32, "One-Time Inspection," or AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	Yes (SRP-SLR Section 3.3.2.2.10)	VII.C3.A-756a VII.C3.A-756b VII.C3.A-756c VII.E5.A-756a VII.E5.A-756b VII.E5.A-756c VII.H1.A-756a VII.H1.A-756b VII.H1.A-756c
N	228	BWR/PWR	Stainless steel, nickel alloy tanks (within the scope of AMP XI.M29, "Outdoor and Large Atmospheric Metallic Storage Tanks") exposed to air, condensation	Loss of material due to pitting, crevice corrosion	AMP XI.M29, "Outdoor and Large Atmospheric Metallic Storage Tanks," AMP XI.M32, "One Time Inspection," or AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	Yes (SRP-SLR Section 3.3.2.2.4)	VII.C3.A-757a VII.C3.A-757b VII.C3.A-757c VII.E5.A-757a VII.E5.A-757b VII.E5.A-757c VII.H1.A-757a VII.H1.A-757b VII.H1.A-757c

Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New, Modified, Deleted, Edited Item	ID	Type	Component	Aging Effect/Mechanism	Aging Management Program (AMP)/TLAA	Further Evaluation Recommended	GALL-SLR Item
N	229	BWR/PWR	Stainless steel tanks (within the scope of AMP XI.M29, "Outdoor and Large Atmospheric Metallic Storage Tanks") exposed to soil, concrete	Loss of material due to pitting, crevice corrosion, MIC (soil only)	AMP XI.M29, "Outdoor and Large Atmospheric Metallic Storage Tanks"	No	VII.C3.A-758 VII.E5.A-758 VII.H1.A-758
N	230	BWR/PWR	Stainless steel tanks (within the scope of AMP XI.M29, "Outdoor and Large Atmospheric Metallic Storage Tanks") exposed to soil, concrete	Cracking due to SCC	AMP XI.M29, "Outdoor and Large Atmospheric Metallic Storage Tanks"	No	VII.C3.A-759 VII.E5.A-759 VII.H1.A-759
N	231	BWR/PWR	Stainless steel tanks (within the scope of AMP XI.M29, "Outdoor and Large Atmospheric Metallic Storage Tanks") exposed to air, condensation	Cracking due to SCC	AMP XI.M29, "Outdoor and Large Atmospheric Metallic Storage Tanks," AMP XI.M32, "One-Time Inspection," or AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	Yes (SRP-SLR Section 3.3.2.2.3)	VII.C3.A-760a VII.C3.A-760b VII.C3.A-760c VII.E5.A-760a VII.E5.A-760b VII.E5.A-760c VII.H1.A-760a VII.H1.A-760b VII.H1.A-760c

Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New, Modified, Deleted, Edited Item	ID	Type	Component	Aging Effect/Mechanism	Aging Management Program (AMP)/TLAA	Further Evaluation Recommended	GALL-SLR Item
N	232	BWR/PWR	Insulated stainless steel, nickel alloy piping, piping components, tanks exposed to air, condensation	Loss of material due to pitting, crevice corrosion	AMP XI.M29, "Outdoor and Large Atmospheric Metallic Storage Tanks," AMP XI.M32, "One-Time Inspection," AMP XI.M36, "External Surfaces Monitoring of Mechanical Components," or AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	Yes (SRP-SLR Section 3.3.2.2.4)	VII.I.A-761a VII.I.A-761b VII.I.A-761c VII.I.A-761d
N	233	BWR/PWR	Insulated aluminum piping, piping components, tanks exposed to air, condensation	Cracking due to SCC	AMP XI.M29, "Outdoor and Large Atmospheric Metallic Storage Tanks," AMP XI.M32, "One-Time Inspection," AMP XI.M36, "External Surfaces Monitoring of Mechanical Components," or AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	Yes (SRP-SLR Section 3.3.2.2.8)	VII.I.A-762a VII.I.A-762b VII.I.A-762c VII.I.A-762d

Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New, Modified, Deleted, Edited Item	ID	Type	Component	Aging Effect/Mechanism	Aging Management Program (AMP)/TLAA	Further Evaluation Recommended	GALL-SLR Item
N	234	BWR/PWR	Aluminum piping, piping components, tanks exposed to air, condensation	Loss of material due to pitting, crevice corrosion	AMP XI.M32, "One-Time Inspection," AMP XI.M36, "External Surfaces Monitoring of Mechanical Components," AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," or AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	Yes (SRP-SLR Section 3.3.2.2.10)	VII.A4.A-763a VII.A4.A-763b VII.A4.A-763c VII.A4.A-763d VII.C1.A-763a VII.C1.A-763b VII.C1.A-763c VII.C1.A-763d VII.C3.A-763a VII.C3.A-763b VII.C3.A-763c VII.C3.A-763d VII.E5.A-763a VII.E5.A-763b VII.E5.A-763c VII.E5.A-763d VII.F1.A-763a VII.F1.A-763b VII.F1.A-763c VII.F1.A-763d VII.F2.A-763a VII.F2.A-763b VII.F2.A-763c VII.F2.A-763d VII.F3.A-763a VII.F3.A-763b VII.F3.A-763c VII.F3.A-763d VII.F4.A-763a VII.F4.A-763b VII.F4.A-763c VII.F4.A-763d VII.H1.A-763a VII.H1.A-763b VII.H1.A-763c VII.H1.A-763d VII.H2.A-763a VII.H2.A-763b

Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New, Modified, Deleted, Edited Item	ID	Type	Component	Aging Effect/Mechanism	Aging Management Program (AMP)/TLAA	Further Evaluation Recommended	GALL-SLR Item
							VII.H2.A-763c VII.H2.A-763d
N	235	BWR/PWR	Metallic piping, piping components exposed to air-dry (internal)	Loss of material due to general (steel only), pitting, crevice corrosion	AMP XI.M24, "Compressed Air Monitoring"	No	VII.D.A-764
N	236	BWR/PWR	Titanium heat exchanger tubes exposed to treated water	Cracking due to SCC, reduction of heat transfer due to fouling	AMP XI.M2, "Water Chemistry," and AMP XI.M32, "One-Time Inspection"	No	VII.A3.A-765 VII.A4.A-765 VII.C1.A-765 VII.C3.A-765 VII.E1.A-765 VII.E3.A-765 VII.G.A-765 VII.H2.A-765
N	237	BWR/PWR	Titanium (ASTM Grades 1, 2, 7, 9, 11, or 12) heat exchanger components other than tubes, piping, piping components exposed to treated water	None	None	No	VII.J.A-766
N	238	BWR/PWR	Titanium heat exchanger tubes exposed to closed-cycle cooling water	Cracking due to SCC, reduction of heat transfer due to fouling	AMP XI.M21A, "Closed Treated Water Systems"	No	VII.C2.A-767 VII.E3.A-767 VII.E4.A-767 VII.F1.A-767 VII.F2.A-767 VII.F3.A-767 VII.F4.A-767
N	239	BWR/PWR	Titanium (ASTM Grades 1, 2, 7, 9, 11, or 12) heat exchanger components other than tubes, piping, piping components exposed to closed-cycle cooling water	None	None	No	VII.J.A-768

Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New, Modified, Deleted, Edited Item	ID	Type	Component	Aging Effect/Mechanism	Aging Management Program (AMP)/TLAA	Further Evaluation Recommended	GALL-SLR Item
N	240	BWR/PWR	Aluminum heat exchanger components exposed to waste water	Loss of material due to pitting, crevice corrosion	AMP XI.M32, "One-Time Inspection," AMP XI.M36, "External Surfaces Monitoring of Mechanical Components," AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," or AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	Yes (SRP-SLR Section 3.3.2.2.10)	VII.E5.A-769a VII.E5.A-769b VII.E5.A-769c VII.E5.A-769d

Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New, Modified, Deleted, Edited Item	ID	Type	Component	Aging Effect/Mechanism	Aging Management Program (AMP)/TLAA	Further Evaluation Recommended	GALL-SLR Item
N	241	BWR/PWR	Stainless steel, nickel alloy heat exchanger components exposed to air, condensation	Loss of material due to pitting, crevice corrosion	AMP XI.M32, "One-Time Inspection," AMP XI.M36, "External Surfaces Monitoring of Mechanical Components," AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," or AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	Yes (SRP-SLR Section 3.3.2.2.4)	VII.F1.A-770a VII.F1.A-770b VII.F1.A-770c VII.F1.A-770d VII.F2.A-770a VII.F2.A-770b VII.F2.A-770c VII.F2.A-770d VII.F3.A-770a VII.F3.A-770b VII.F3.A-770c VII.F3.A-770d VII.F4.A-770a VII.F4.A-770b VII.F4.A-770c VII.F4.A-770d

Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New, Modified, Deleted, Edited Item	ID	Type	Component	Aging Effect/Mechanism	Aging Management Program (AMP)/TLAA	Further Evaluation Recommended	GALL-SLR Item
N	242	BWR/PWR	Aluminum heat exchanger components exposed to air, condensation	Loss of material due to pitting, crevice corrosion	AMP XI.M32, "One-Time Inspection," AMP XI.M36, "External Surfaces Monitoring of Mechanical Components," AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," or AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	Yes (SRP-SLR Section 3.3.2.2.10)	VII.F1.A-771a VII.F1.A-771b VII.F1.A-771c VII.F1.A-771d VII.F2.A-771a VII.F2.A-771b VII.F2.A-771c VII.F2.A-771d VII.F3.A-771a VII.F3.A-771b VII.F3.A-771c VII.F3.A-771d VII.F4.A-771a VII.F4.A-771b VII.F4.A-771c VII.F4.A-771d
D	243						
N	244	BWR	Stainless steel, nickel alloy piping, piping components exposed to treated water >60°C (>140°F)	Cracking due to SCC	AMP XI.M2, "Water Chemistry," and AMP XI.M32, "One-Time Inspection"	No	VII.E3.A-773 VII.E4.A-773

Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New, Modified, Deleted, Edited Item	ID	Type	Component	Aging Effect/Mechanism	Aging Management Program (AMP)/TLAA	Further Evaluation Recommended	GALL-SLR Item
N	245	BWR/PWR	Insulated aluminum piping, piping components, tanks exposed to air, condensation	Loss of material due to pitting, crevice corrosion	AMP XI.M29, "Outdoor and Large Atmospheric Metallic Storage Tanks," AMP XI.M32, "One-Time Inspection," AMP XI.M36, "External Surfaces Monitoring of Mechanical Components," or AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	Yes (SRP-SLR Section 3.3.2.2.10)	VII.I.A-774a VII.I.A-774b VII.I.A-774c VII.I.A-774d
N	246	BWR/PWR	Stainless steel, nickel alloy underground piping, piping components, tanks	Loss of material due to pitting, crevice corrosion	AMP XI.M32, "One-Time Inspection," AMP XI.M41, "Buried and Underground Piping and Tanks," or AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	Yes (SRP-SLR Section 3.3.2.2.4)	VII.I.A-775a VII.I.A-775b VII.I.A-775c

Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New, Modified, Deleted, Edited Item	ID	Type	Component	Aging Effect/Mechanism	Aging Management Program (AMP)/TLAA	Further Evaluation Recommended	GALL-SLR Item
N	247	BWR/PWR	Aluminum piping, piping components, tanks exposed to raw water, waste water	Loss of material due to pitting, crevice corrosion	AMP XI.M29, "Outdoor and Large Atmospheric Metallic Storage Tanks," AMP XI.M32, "One-Time Inspection," AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," or AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	Yes (SRP-SLR Section 3.3.2.2.10)	VII.C1.A-776a VII.C1.A-776b VII.C1.A-776c VII.C1.A-776d VII.C3.A-776a VII.C3.A-776b VII.C3.A-776c VII.C3.A-776d VII.E5.A-776a VII.E5.A-776b VII.E5.A-776c VII.E5.A-776d
N	248	BWR/PWR	Aluminum piping, piping components, tanks exposed to air with borated water leakage	None	None	No	VII.J.A-777
N	249	BWR/PWR	Steel heat exchanger tubes internal to components exposed to air-outdoor, air-indoor uncontrolled, condensation	Loss of material due to general, pitting, crevice corrosion	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	VII.C1.A-778 VII.F1.A-778 VII.F2.A-778 VII.F3.A-778 VII.F4.A-778
N	250	BWR/PWR	Steel reactor coolant pump oil collection system tanks, piping, piping components exposed to lubricating oil (waste oil)	Loss of material due to general, pitting, crevice corrosion, MIC	AMP XI.M32, "One-Time Inspection"	No	VII.G.AP-116 VII.G.AP-117
D	251						

Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New, Modified, Deleted, Edited Item	ID	Type	Component	Aging Effect/Mechanism	Aging Management Program (AMP)/TLAA	Further Evaluation Recommended	GALL-SLR Item
N	252	BWR/PWR	Aluminum piping, piping components exposed to soil, concrete	Loss of material due to pitting, crevice corrosion	AMP XI.M41, "Buried and Underground Piping and Tanks"	No	VII.I.AP-173
N	253	BWR/PWR	PVC piping, piping components exposed to raw water, raw water (potable), treated water, waste water	Loss of material due to wear; flow blockage due to fouling (raw water only)	AMP XI.M20, "Open-Cycle Cooling Water System," AMP XI.M27, "Fire Water System," or AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	VII.C1.A-787a VII.C1.A-787c VII.E5.A-787d VII.G.A-787b
N	254	BWR/PWR	Aluminum heat exchanger components exposed to air, condensation	Cracking due to SCC	AMP XI.M32, "One-Time Inspection," AMP XI.M36, "External Surfaces Monitoring of Mechanical Components," AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," or AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	Yes (SRP-SLR Section 3.3.2.2.8)	VII.F1.A-788a VII.F1.A-788b VII.F1.A-788c VII.F1.A-788d VII.F2.A-788a VII.F2.A-788b VII.F2.A-788c VII.F2.A-788d VII.F3.A-788a VII.F3.A-788b VII.F3.A-788c VII.F3.A-788d VII.F4.A-788a VII.F4.A-788b VII.F4.A-788c VII.F4.A-788d

Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New, Modified, Deleted, Edited Item	ID	Type	Component	Aging Effect/Mechanism	Aging Management Program (AMP)/TLAA	Further Evaluation Recommended	GALL-SLR Item
N	255	BWR/PWR	Any material fire damper assemblies exposed to air	Loss of material due to general, pitting, crevice corrosion; cracking due to SCC; hardening, loss of strength, shrinkage due to elastomer degradation	AMP XI.M26, "Fire Protection"	No	VII.G.A-789
D	256						
N	257	BWR/PWR	Steel, stainless steel, copper alloy heat exchanger tubes exposed to lubricating oil	Reduction of heat transfer due to fouling	AMP XI.M39, "Lubricating Oil Analysis," and AMP XI.M32, "One-Time Inspection"	No	VII.C1.A-791 VII.C2.A-791 VII.C3.A-791 VII.E1.A-791 VII.E4.A-791 VII.F1.A-791 VII.F2.A-791 VII.F3.A-791 VII.F4.A-791 VII.G.A-791 VII.H2.A-791
N	258	BWR/PWR	Metallic, elastomer, fiberglass, HDPE piping, piping components exposed to waste water	Flow blockage due to fouling	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	VII.E5.A-780

Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New, Modified, Deleted, Edited Item	ID	Type	Component	Aging Effect/Mechanism	Aging Management Program (AMP)/TLAA	Further Evaluation Recommended	GALL-SLR Item
N	259	BWR/PWR	Aluminum piping, piping components exposed to raw water	Flow blockage due to fouling	AMP XI.M20, "Open-Cycle Cooling Water System," or AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	VII.A3.A-793 VII.A4.A-793 VII.C1.A-793a VII.C1.A-793b VII.C2.A-793 VII.C3.A-793 VII.E1.A-793 VII.E2.A-793 VII.E3.A-793 VII.E4.A-793 VII.F1.A-793 VII.F2.A-793 VII.F3.A-793 VII.F4.A-793 VII.H1.A-793 VII.H2.A-793
N	260	BWR/PWR	Metallic HVAC closure bolting exposed to air, condensation	Loss of material due to general (where applicable), pitting, crevice corrosion; cracking due to SCC, loss of preload	AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	VII.F1.A-794 VII.F2.A-794 VII.F3.A-794 VII.F4.A-794
N	261	BWR/PWR	Titanium (ASTM Grades 3, 4, or 5) heat exchanger tubes exposed to closed-cycle cooling water, raw water	Cracking due to SCC	AMP XI.M20, "Open-Cycle Cooling Water System," or AMP XI.M21A, "Closed Treated Water Systems"	No	VII.C1.A-795a VII.C2.A-795b VII.C3.A-795a VII.E4.A-795a VII.H2.A-795a

Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New, Modified, Deleted, Edited Item	ID	Type	Component	Aging Effect/Mechanism	Aging Management Program (AMP)/TLAA	Further Evaluation Recommended	GALL-SLR Item
N	262	BWR/PWR	Titanium piping, piping components, heat exchanger components exposed to closed-cycle cooling water, treated water	Cracking due to SCC	AMP XI.M20, "Open-Cycle Cooling Water System," or AMP XI.M21A, "Closed Treated Water Systems," or AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	VII.C1.A-796a VII.C2.A-796b VII.C3.A-796a VII.E2.A-796c VII.E3.A-796c VII.E4.A-796a VII.H2.A-796a
N	263	BWR/PWR	Polymeric piping, piping components, ducting, ducting components, seals exposed to air, condensation, raw water, raw water (potable), treated water, waste water, underground, concrete, soil	Hardening or loss of strength due to polymeric degradation; loss of material due to peeling, delamination, wear; cracking or blistering due to exposure to ultraviolet light, ozone, radiation, or chemical attack; flow blockage due to fouling	AMP XI.M36, "External Surfaces Monitoring of Mechanical Components," or AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	VII.C1.A-797b VII.C2.A-797b VII.C3.A-797b VII.D.A-797b VII.E5.A-797b VII.F1.A-797b VII.F2.A-797b VII.F3.A-797b VII.F4.A-797b VII.G.A-797b VII.H1.A-797b VII.H2.A-797b VII.I.A-797a
Reserved for ID number 264							
N	265	BWR/PWR	Steel heat exchanger tubes exposed to fuel oil	Reduction of heat transfer due to fouling	XI.M30, "Fuel Oil Chemistry," and XI.M32, "One-Time Inspection"	No	VII.H2.A-799
N	266	BWR/PWR	Steel heat exchanger tubes exposed to fuel oil	Reduction of heat transfer due to fouling	XI.M30, "Fuel Oil Chemistry,"	No	VII.H2.A-800

Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New, Modified, Deleted, Edited Item	ID	Type	Component	Aging Effect/Mechanism	Aging Management Program (AMP)/TLAA	Further Evaluation Recommended	GALL-SLR Item
N	267	BWR/PWR	Subliming compound fireproofing/fire barriers (Thermo-lag®, Darmatt™, 3M™ Interam™, and other similar materials) exposed to air	Loss of material due to abrasion, flaking, vibration; cracking/delamination due to chemical reaction, settlement; change in material properties due to gamma irradiation exposure; separation	AMP XI.M26, "Fire Protection"	No	VII.G.A-805
N	268	BWR/PWR	Cementitious coating fireproofing/fire barriers (Pyrocrete, BIO™ K-10 Mortar, Cafecote, and other similar materials) exposed to air	Loss of material due to abrasion, exfoliation, elevated temperature, flaking, spalling; cracking/delamination due to chemical reaction, elevated temperature, settlement, vibration; change in material properties due to elevated temperature, gamma irradiation exposure; separation	AMP XI.M26, "Fire Protection"	No	VII.G.A-806
N	269	BWR/PWR	Silicate fireproofing/fire barriers (Marinite®, Kaowool™, Cerafiber®, Cera® blanket, or other similar materials) exposed to air	Loss of material due to abrasion, flaking; cracking/delamination due to settlement; change in material properties due to gamma irradiation exposure; separation	AMP XI.M26, "Fire Protection"	No	VII.G.A-807

APPENDIX F

REVISIONS TO ADDRESS REDUCTION OF HEAT TRANSFER FOR HEAT EXCHANGER TUBES IN A FUEL OIL ENVIRONMENT

Summary of Revisions

This ISG revises the SRP-SLR and GALL-SLR Volume 1 to include a line item to manage the reduction of heat transfer for a steel heat exchanger radiator exposed internally to diesel fuel oil. The NRC staff's review of an SLRA identified an acceptable way to manage this aging effect for the material and environment described; this may occur in other SLRAs as well.

Basis for Revisions

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 are tested for under ASTM D975 that could contribute to heat exchanger tube fouling. In the GALL-SLR, Element 4, "Detection of Aging Effects," of AMP XI.M30, "Fuel Oil Chemistry," describes scenarios where inspections of fuel oil tanks may be used to inform the condition of downstream components. As described in the AMP, if the tank is coated or constructed of a different material than the steel heat exchanger tubes, a one-time inspection may be necessary.

AMP Revisions

None

Revisions to FSAR Supplement

None

Revisions to SRP-SLR Table 3.3-1

SRP-SLR Table 3.3-1 is provided in its entirety in Appendix E of this ISG. The only change to SRP-SLR Table 3.3-1 associated with this appendix is the addition of line items 265 and 266.

Revisions to GALL-SLR Chapter VII, Table H2

On the next page, GALL-SLR Chapter VII, Table H2 is reproduced in its entirety. Most of the line items in this table are unchanged. The revisions are the addition of the following four items near the end of the table: VII.H2.A-799, VII.H2.A-800, VII.H2.A-801, and, VII.H2.A-802.

VII AUXILIARY SYSTEMS Table H2 Emergency Diesel Generator System								
New, Modified, Deleted, Edited Item	**Item**	**SRP Item (Table, ID)**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/Mechanism**	**Aging Management Program (AMP)/TLAA**	**Further Evaluation**
N	VII.H2.A-532	3.3-1, 193	Any	Steel	Raw water	Long-term loss of material due to general corrosion	AMP XI.M32, "One-Time Inspection"	No
N	VII.H2.A-439	3.3-1, 193	Any	Steel	Treated water	Long-term loss of material due to general corrosion	AMP XI.M32, "One-Time Inspection"	No
M	VII.H2.AP-128	3.3-1, 083	Diesel engine exhaust piping, piping components	Stainless steel	Diesel exhaust	Cracking due to SCC	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No
M	VII.H2.AP-131	3.3-1, 098	Heat exchanger components	Steel	Lubricating oil	Loss of material due to general, pitting, crevice corrosion, MIC	AMP XI.M39, "Lubricating Oil Analysis," and AMP XI.M32, "One-Time Inspection"	No
M	VII.H2.AP-152a	3.3-1, 123	Heat exchanger components other than tubes	Titanium	Raw water	Cracking due to SCC, flow blockage due to fouling	AMP XI.M20, "Open-Cycle Cooling Water System"	No
	VII.H2.AP-154	3.3-1, 101	Heat exchanger tubes	Aluminum	Lubricating oil	Reduction of heat transfer due to fouling	AMP XI.M39, "Lubricating Oil Analysis," and AMP XI.M32, "One-Time Inspection"	No
N	VII.H2.A-565	3.3-1, 161	Heat exchanger tubes	Copper alloy	Condensation	Reduction of heat transfer due to fouling	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No

VII AUXILIARY SYSTEMS Table H2 Emergency Diesel Generator System								
New, Modified, Deleted, Edited Item	**Item**	**SRP Item (Table, ID)**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/Mechanism**	**Aging Management Program (AMP)/TLAA**	**Further Evaluation**
M	VII.H2.AP-187	3.3-1, 042	Heat exchanger tubes	Stainless steel, copper alloy, titanium	Raw water	Cracking due to SCC (titanium only), reduction of heat transfer due to fouling	AMP XI.M20, "Open-Cycle Cooling Water System"	No
N	VII.H2.A-765	3.3-1, 236	Heat exchanger tubes	Titanium	Treated water	Cracking due to SCC, reduction of heat transfer due to fouling	AMP XI.M2, "Water Chemistry," and AMP XI.M32, "One-Time Inspection"	No
N	VII.H2.A-795a	3.3-1, 261	Heat exchanger tubes	Titanium (ASTM Grades 3, 4, or 5)	Raw water	Cracking due to SCC	AMP XI.M20, "Open-Cycle Cooling Water System"	No
M	VII.H2.A-415	3.3-1, 140	Piping components with internal coatings/linings	Gray cast iron, ductile iron with internal coating/lining	Closed-cycle cooling water, raw water, treated water, waste water	Loss of material due to selective leaching	AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	No
M	VII.H2.AP-255	3.3-1, 048	Piping, piping components	Aluminum	Closed-cycle cooling water	Loss of material due to pitting, crevice corrosion	AMP XI.M21A, "Closed Treated Water Systems"	No
M	VII.H2.AP-129	3.3-1, 071	Piping, piping components	Aluminum	Fuel oil	Loss of material due to pitting, crevice corrosion, MIC	AMP XI.M30, "Fuel Oil Chemistry," and AMP XI.M32, "One-Time Inspection"	No
N	VII.H2.AP-129a	3.3-1, 071	Piping, piping components	Aluminum	Fuel oil	Loss of material due to pitting, crevice corrosion, MIC	AMP XI.M30, "Fuel Oil Chemistry"	No

VII AUXILIARY SYSTEMS Table H2 Emergency Diesel Generator System								
New, Modified, Deleted, Edited Item	**Item**	**SRP Item (Table, ID)**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/Mechanism**	**Aging Management Program (AMP)/TLAA**	**Further Evaluation**
M	VII.H2.AP-162	3.3-1, 099	Piping, piping components	Aluminum	Lubricating oil	Loss of material due to pitting, crevice corrosion	AMP XI.M39, "Lubricating Oil Analysis," and AMP XI.M32, "One-Time Inspection"	No
N	VII.H2.A-793	3.3-1, 259	Piping, piping components	Aluminum	Raw water	Flow blockage due to fouling	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No
N	VII.H2.AP-130	3.3-1, 025	Piping, piping components	Aluminum	Treated water	Loss of material due to pitting, crevice corrosion	AMP XI.M2, "Water Chemistry," and AMP XI.M32, "One-Time Inspection"	No
M	VII.H2.AP-199	3.3-1, 046	Piping, piping components	Copper alloy	Closed-cycle cooling water	Loss of material due to pitting, crevice corrosion, MIC	AMP XI.M21A, "Closed Treated Water Systems"	No
M	VII.H2.AP-132	3.3-1, 069	Piping, piping components	Copper alloy	Fuel oil	Loss of material due to pitting, crevice corrosion, MIC	AMP XI.M30, "Fuel Oil Chemistry," and AMP XI.M32, "One-Time Inspection"	No
N	VII.H2.AP-132a	3.3-1, 069	Piping, piping components	Copper alloy	Fuel oil	Loss of material due to pitting, crevice corrosion, MIC	AMP XI.M30, "Fuel Oil Chemistry"	No

VII AUXILIARY SYSTEMS Table H2 Emergency Diesel Generator System								
New, Modified, Deleted, Edited Item	**Item**	**SRP Item (Table, ID)**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/Mechanism**	**Aging Management Program (AMP)/TLAA**	**Further Evaluation**
M	VII.H2.AP-133	3.3-1, 099	Piping, piping components	Copper alloy	Lubricating oil	Loss of material due to pitting, crevice corrosion, MIC	AMP XI.M39, "Lubricating Oil Analysis," and AMP XI.M32, "One-Time Inspection"	No
M	VII.H2.AP-193	3.3-1, 034	Piping, piping components	Copper alloy	Raw water	Loss of material due to general, pitting, crevice corrosion, MIC; flow blockage due to fouling	AMP XI.M20, "Open-Cycle Cooling Water System"	No
M	VII.H2.AP-43	3.3-1, 072	Piping, piping components	Copper alloy (>15% Zn or >8% Al)	Closed-cycle cooling water	Loss of material due to selective leaching	AMP XI.M33, "Selective Leaching"	No
M	VII.H2.A-47	3.3-1, 072	Piping, piping components	Copper alloy (>15% Zn or >8% Al)	Raw water	Loss of material due to selective leaching	AMP XI.M33, "Selective Leaching"	No
N	VII.H2.A-743	3.3-1, 214	Piping, piping components	Copper alloy (>15% Zn or >8% Al)	Soil	Loss of material due to selective leaching	AMP XI.M33, "Selective Leaching"	No
M	VII.H2.A-51	3.3-1, 072	Piping, piping components	Gray cast iron, ductile iron	Raw water	Loss of material due to selective leaching	AMP XI.M33, "Selective Leaching"	No
M	VII.H2.A-02	3.3-1, 072	Piping, piping components	Gray cast iron, ductile iron	Soil	Loss of material due to selective leaching	AMP XI.M33, "Selective Leaching"	No
M	VII.H2.AP-209a	3.3-1, 004	Piping, piping components	Stainless steel	Air, condensation	Cracking due to SCC	AMP XI.M32, "One-Time Inspection"	Yes
M	VII.H2.AP-209b	3.3-1, 004	Piping, piping components	Stainless steel	Air, condensation	Cracking due to SCC	AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	Yes

VII AUXILIARY SYSTEMS Table H2 Emergency Diesel Generator System								
New, Modified, Deleted, Edited Item	**Item**	**SRP Item (Table, ID)**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/Mechanism**	**Aging Management Program (AMP)/TLAA**	**Further Evaluation**
M	VII.H2.AP-209c	3.3-1, 004	Piping, piping components	Stainless steel	Air, condensation	Cracking due to SCC	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	Yes
M	VII.H2.AP-136	3.3-1, 071	Piping, piping components	Stainless steel	Fuel oil	Loss of material due to pitting, crevice corrosion, MIC	AMP XI.M30, "Fuel Oil Chemistry," and AMP XI.M32, "One-Time Inspection"	No
N	VII.H2.AP-136a	3.3-1, 071	Piping, piping components	Stainless steel	Fuel oil	Loss of material due to pitting, crevice corrosion, MIC	AMP XI.M30, "Fuel Oil Chemistry"	No
M	VII.H2.AP-138	3.3-1, 100	Piping, piping components	Stainless steel	Lubricating oil	Loss of material due to pitting, crevice corrosion, MIC	AMP XI.M39, "Lubricating Oil Analysis," and AMP XI.M32, "One-Time Inspection"	No
M	VII.H2.AP-55	3.3-1, 040	Piping, piping components	Stainless steel	Raw water	Loss of material due to pitting, crevice corrosion, MIC; flow blockage due to fouling	AMP XI.M20, "Open-Cycle Cooling Water System"	No
M	VII.H2.AP-221a	3.3-1, 006	Piping, piping components	Stainless steel, nickel alloy	Air, condensation	Loss of material due to pitting, crevice corrosion	AMP XI.M32, "One-Time Inspection"	Yes
M	VII.H2.AP-221b	3.3-1, 006	Piping, piping components	Stainless steel, nickel alloy	Air, condensation	Loss of material due to pitting, crevice corrosion	AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	Yes

VII AUXILIARY SYSTEMS Table H2 Emergency Diesel Generator System								
New, Modified, Deleted, Edited Item	**Item**	**SRP Item (Table, ID)**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/Mechanism**	**Aging Management Program (AMP)/TLAA**	**Further Evaluation**
M	VII.H2.AP-221c	3.3-1, 006	Piping, piping components	Stainless steel, nickel alloy	Air, condensation	Loss of material due to pitting, crevice corrosion	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	Yes
M	VII.H2.AP-221d	3.3-1, 006	Piping, piping components	Stainless steel, nickel alloy	Air, condensation	Loss of material due to pitting, crevice corrosion	AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	Yes
M	VII.H2.AP-105	3.3-1, 070	Piping, piping components	Steel	Fuel oil	Loss of material due to general, pitting, crevice corrosion, MIC	AMP XI.M30, "Fuel Oil Chemistry," and AMP XI.M32, "One-Time Inspection"	No
M	VII.H2.AP-127	3.3-1, 097	Piping, piping components	Steel	Lubricating oil	Loss of material due to general, pitting, crevice corrosion, MIC	AMP XI.M39, "Lubricating Oil Analysis," and AMP XI.M32, "One-Time Inspection"	No
M	VII.H2.AP-194	3.3-1, 037	Piping, piping components	Steel	Raw water	Loss of material due to general, pitting, crevice corrosion, MIC; flow blockage due to fouling	AMP XI.M20, "Open-Cycle Cooling Water System"	No
M	VII.H2.AP-161a	3.3-1, 123	Piping, piping components	Titanium	Raw water	Cracking due to SCC, flow blockage due to fouling	AMP XI.M20, "Open-Cycle Cooling Water System"	No

VII AUXILIARY SYSTEMS Table H2 Emergency Diesel Generator System								
New, Modified, Deleted, Edited Item	**Item**	**SRP Item (Table, ID)**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/Mechanism**	**Aging Management Program (AMP)/TLAA**	**Further Evaluation**
M	VII.H2.AP-104	3.3-1, 088	Piping, piping components, diesel engine exhaust	Steel; stainless steel	Diesel exhaust	Loss of material due to general (steel only), pitting, crevice corrosion	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No
N	VII.H2.A-495	3.3-1, 159	Piping, piping components, ducting, ducting components	Fiberglass	Air	Loss of material due to wear	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No
N	VII.H2.A-797b	3.3-1, 263	Piping, piping components, ducting, ducting components, seals	Polymeric	Air, condensation, raw water, raw water (potable), treated water, waste water, underground, concrete, soil	Hardening or loss of strength due to polymeric degradation; loss of material due to peeling, delamination, wear; cracking or blistering due to exposure to ultraviolet light, ozone, radiation, or chemical attack; flow blockage due to fouling	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No
N	VII.H2.A-722	3.3-1, 157	Piping, piping components, heat exchanger components	Steel	Air – outdoor	Loss of material due to general, pitting, crevice corrosion	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No

VII AUXILIARY SYSTEMS Table H2 Emergency Diesel Generator System								
New, Modified, Deleted, Edited Item	**Item**	**SRP Item (Table, ID)**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/Mechanism**	**Aging Management Program (AMP)/TLAA**	**Further Evaluation**
N	VII.H2.A-796a	3.3-1, 262	Piping, piping components, heat exchanger components	Titanium	Closed-cycle cooling water, treated water	Cracking due to SCC	AMP XI.M20, "Open-Cycle Cooling Water System"	No
M	VII.H2.A-416	3.3-1, 138	Piping, piping components, heat exchangers, tanks with internal coatings/linings	Any material with an internal coating/lining	Raw water, treated water	Loss of coating or lining integrity due to blistering, cracking, flaking, peeling, delamination, rusting, physical damage; loss of material or cracking for cementitious coatings/linings	AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	No
M	VII.H2.A-414	3.3-1, 139	Piping, piping components, heat exchangers, tanks with internal coatings/linings	Any material with an internal coating/lining	Raw water, treated water	Loss of material due to general, pitting, crevice corrosion, MIC	AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	No
N	VII.H2.A-677	3.3-1, 085	Piping, piping components, seals	Elastomer	Lubricating oil	Hardening or loss of strength due to elastomer degradation	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No
N	VII.H2.A-763a	3.3-1, 234	Piping, piping components, tanks	Aluminum	Air, condensation	Loss of material due to pitting, crevice corrosion	AMP XI.M32, "One-Time Inspection"	Yes

VII AUXILIARY SYSTEMS Table H2 Emergency Diesel Generator System								
New, Modified, Deleted, Edited Item	**Item**	**SRP Item (Table, ID)**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/Mechanism**	**Aging Management Program (AMP)/TLAA**	**Further Evaluation**
N	VII.H2.A-763b	3.3-1, 234	Piping, piping components, tanks	Aluminum	Air, condensation	Loss of material due to pitting, crevice corrosion	AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	Yes
N	VII.H2.A-763c	3.3-1, 234	Piping, piping components, tanks	Aluminum	Air, condensation	Loss of material due to pitting, crevice corrosion	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	Yes
N	VII.H2.A-763d	3.3-1, 234	Piping, piping components, tanks	Aluminum	Air, condensation	Loss of material due to pitting, crevice corrosion	AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	Yes
N	VII.H2.A-451a	3.3-1, 189	Piping, piping components, tanks	Aluminum	Air, condensation, raw water, waste water	Cracking due to SCC	AMP XI.M32, "One-Time Inspection"	Yes
N	VII.H2.A-451b	3.3-1, 189	Piping, piping components, tanks	Aluminum	Air, condensation, raw water, waste water	Cracking due to SCC	AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	Yes
N	VII.H2.A-451c	3.3-1, 189	Piping, piping components, tanks	Aluminum	Air, condensation, raw water, waste water	Cracking due to SCC	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	Yes

VII AUXILIARY SYSTEMS Table H2 Emergency Diesel Generator System								
New, Modified, Deleted, Edited Item	**Item**	**SRP Item (Table, ID)**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/Mechanism**	**Aging Management Program (AMP)/TLAA**	**Further Evaluation**
N	VII.H2.A-451d	3.3-1, 189	Piping, piping components, tanks	Aluminum	Air, condensation, raw water, waste water	Cracking due to SCC	AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	Yes
M	VII.H2.AP-209d	3.3-1, 004	Piping, piping components, tanks	Stainless steel	Air, condensation	Cracking due to SCC	AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	Yes
M	VII.H2.AP-202	3.3-1, 045	Piping, piping components, tanks	Steel	Closed-cycle cooling water	Loss of material due to general, pitting, crevice corrosion, MIC	AMP XI.M21A, "Closed Treated Water Systems"	No
M	VII.H2.A-26	3.3-1, 055	Piping, piping components, tanks	Steel	Condensation	Loss of material due to general, pitting, crevice corrosion	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No
N	VII.H2.AP-105a	3.3-1, 070	Piping, piping components, tanks	Steel	Fuel oil	Loss of material due to general, pitting, crevice corrosion, MIC	AMP XI.M30, "Fuel Oil Chemistry"	No
D	VII.H2.A-23							
D	VII.H2.A-400							
D	VII.H2.A-405							
D	VII.H2.A-425							
D	VII.H2.A-426							
D	VII.H2.A-456							
D	VII.H2.A-651							

VII AUXILIARY SYSTEMS Table H2 Emergency Diesel Generator System								
New, Modified, Deleted, Edited Item	**Item**	**SRP Item (Table, ID)**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/Mechanism**	**Aging Management Program (AMP)/TLAA**	**Further Evaluation**
D	VII.H2.A-667							
D	VII.H2.A-714a							
D	VII.H2.A-714b							
D	VII.H2.A-714c							
D	VII.H2.A-733							
D	VII.H2.A-749							
D	VII.H2.A-750							
D	VII.H2.A-790a							
D	VII.H2.A-790b							
D	VII.H2.AP-258							
D	VII.H2.AP-40							
D	VII.H2.AP-41							
N	VII.H2.A-799	3.3.1-265	Heat exchanger tubes	Steel	Fuel oil	Reduction of heat transfer due to fouling	AMP XI.M30, "Fuel Oil Chemistry," and AMP XI.M32, One Time Inspection"	No
N	VII.H2.A-800	3.3.1-266	Heat exchanger tubes	Steel	Fuel oil	Reduction of heat transfer due to fouling	AMP XI.M30, "Fuel Oil Chemistry"	No
N	VII.H2.A-801	3.3-1, 071	Piping, piping components	Nickel Alloy	Fuel oil	Loss of material due to pitting, crevice corrosion, MIC	AMP XI.M30, "Fuel Oil Chemistry," and AMP XI.M32, One Time Inspection"	No
N	VII.H2.A-802	3.3-1, 071	Piping, piping components	Nickel Alloy	Fuel oil	Loss of material due to pitting, crevice corrosion, MIC	AMP XI.M30, "Fuel Oil Chemistry"	No

APPENDIX G

REVISIONS TO ADDRESS LOSS OF MATERIAL IN NICKEL ALLOY STRAINER COMPONENTS IN FUEL OIL

Summary of Revisions

This ISG revises SRP-SLR and GALL-SLR Volume 1 to include a line item for managing loss of material for nickel alloy externally exposed to diesel fuel oil. The review of an SLRA identified an acceptable way to manage aging effects for the material and environment described here; this may occur in other SLRAs as well.

Basis for Revisions

The staff noted that the GALL-SLR 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 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 the Fuel Oil Chemistry program will be effective in managing loss of material for nickel alloy strainer elements exposed to diesel fuel oil.

AMP Revisions

None

Revisions to FSAR Supplement

None

Revisions to SRP-SLR Table 3.3-1

SRP-SLR Table 3.3-1 is provided in its entirety in Appendix E of this ISG. The only change to SRP-SLR Table 3.3-1 associated with this appendix is a modification of item 071.

Revisions to GALL-SLR Chapter VII, Table H2

GALL-SLR Chapter VII, Table H2 is reproduced in its entirety in Appendix F of this ISG. Most of the line items in this table are unchanged. The revisions are the addition of the following four items near the end of the table: VII.H2.A-799, VII.H2.A-800, VII.H2.A-801, and, VII.H2.A-802.

APPENDIX H

REVISIONS TO AMP XI.M42, "INTERNAL COATINGS/LININGS FOR IN-SCOPE PIPING, PIPING COMPONENTS, HEAT EXCHANGERS, AND TANKS"

Summary of Revisions

This ISG revises AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks," to recommend opportunistic inspections, in lieu of periodic inspections, as an acceptable alternative for buried internally coated/lined fire water system piping provided: (a) flow tests and internal piping inspections will occur at intervals specified in NFPA 25, "Standard for the Inspection, Testing, and Maintenance of Water Based Fire Protection Systems," or as modified by AMP XI.M27, "Fire Water System," Table XI.M27-1, "Fire Water System Inspection and Testing Recommendations"; (b) through-wall flaws in the piping can be detected through continuous system pressure monitoring; and (c) plant-specific operating experience (OE) is acceptable (i.e., no leaks due to the age related degradation of representative internal coatings/linings used in buried in scope fire water system components).

This ISG also revises AMP XI.M42 environments as follows: (a) adds air and condensation environments to the scope of the program; (b) adds soil, concrete, and underground external environments to the final safety analysis report (FSAR) supplement; and (c) corrects inconsistencies for the lubricating oil environment. In addition, this ISG adds new aging management review (AMR) items in NUREG-2191, "Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report," issued July 2017, for managing loss of coating/lining integrity and loss of material in piping, piping components, heat exchangers, and tanks with internal coatings/linings exposed to air dry using AMP XI.M42.

Further, this ISG revises Table 3.3-1 in NUREG-2192, "Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants," issued July 2017 (SRP-SLR), and the tables in GALL-SLR Report Volume 1, Section VII, to include AMR items for managing recurring internal corrosion of metallic components exposed to raw water that are not covered by Generic Letter (GL) 89-13, "Service Water System Problems Affecting Safety-Related Equipment," dated July 18, 1989, using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program. Additionally, this ISG corrects other associated AMR items by including the "a," "b," or "c" designation after the AMR item number to distinguish among the various AMPs that are acceptable for managing the cited aging effect, and deletes "closed-cycle cooling water" from environments listed in the associated AMR Item 3.3-1-127.

Basis for Revisions

The staff has accepted opportunistic inspections, in lieu of periodic inspections, as an acceptable alternative for buried internally coated/lined fire water system piping provided: (a) flow tests and internal piping inspections will occur at intervals specified in 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 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 operating experience. 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. This ISG corrects this error in conjunction with the adjustments above for the use of multiple AMPs.

AMP Revisions

Program Description

Proper maintenance of internal coatings/linings is essential to provide reasonable assurance that the intended functions of in-scope components are met. Degradation of coatings/linings can lead to loss of material or cracking of base materials and downstream effects such as reduction in flow, reduction in pressure, or reduction of heat transfer when coatings/linings become debris. The program consists of periodic visual inspections of internal coatings/linings exposed to closed-cycle cooling water (CCCW), raw water, treated water, treated borated water, waste water, fuel oil, ~~and~~ lubricating oil, air, and condensation. Where the visual inspection of the coated/lined surfaces determines that the coating/lining is deficient or degraded, physical tests are performed, where physically possible, in conjunction with the visual inspection. Electric Power Research Institute (EPRI) Report 1019157, "Guideline on Nuclear Safety-Related Coatings," provides information on the American Society for Testing and Materials (ASTM) standard guidelines and coatings. American Concrete Institute (ACI) Standard 201.1R, "Guide for Conducting a Visual Inspection of Concrete in Service," provides guidelines for inspecting concrete. In addition, this program may be used to manage aging effects associated with coatings on external surfaces.

Evaluation and Technical Basis

1. ***Scope of Program****:* The scope of the program is internal coatings/linings for in-scope piping, piping components, heat exchangers, and tanks exposed to CCCW, raw water, treated water, treated borated water, waste water, fuel oil, ~~and~~ lubricating oil, air, and condensation, where loss of coating or lining integrity could prevent satisfactory accomplishment of any of the component's or downstream component's current licensing basis (CLB) intended functions identified under Title 10 of the *Code of Federal Regulations* (10 CFR) 54.4(a)(1), (a)(2), or (a)(3). The aging effects associated with fire water tank internal coatings/linings are managed by Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report aging management program (AMP) XI.M27, "Fire Water System," instead of this AMP. However, where the fire water storage tank internals are coated, the Fire Water System Program and Final Safety Analysis Report (FSAR) Summary Description of the Program should be enhanced to include the

recommendations associated with training and qualification of personnel and the "corrective actions" program element. The Fire Water System Program should also be enhanced to include the recommendations from the "acceptance criteria" program element.

If a coating/lining has a qualified life, and it will be replaced prior to the end of its qualified life without consideration of extending the life through condition monitoring, it would not be considered long lived and therefore, it would not be within the scope of this AMP.

Coatings/linings are an integral part of an in-scope component. The CLB-intended function(s) of the component dictates whether the component has an intended function(s) that meets the scoping criteria of 10 CFR 54.4(a). Internal coatings/linings for in-scope piping, piping components, heat exchangers, and tanks are not evaluated as standalone components to determine whether they meet the scoping criteria of 10 CFR 54.4(a). It is immaterial whether the coating/lining has an intended function identified in the CLB because it is the CLB-intended function of the component that dictates whether the component is in-scope and thereby the aging effects of the coating/lining integral to the component must be evaluated for potential impact on the component's and downstream component's intended function(s).

An applicant may elect to manage the aging effects for internal coatings/linings for in-scope piping, piping components, heat exchangers, and tanks in an alternative AMP that is specific to the component or system in which the coatings/linings are installed (e.g., GALL-SLR Report AMP XI.M20, "Open-Cycle Cooling Water System," for service water coatings/linings) as long as the following are met:

- The recommendations of this AMP are incorporated into the alternative program.
- Exceptions or enhancements associated with the recommendations in this AMP are included in the alternative AMP.
- The FSAR supplement for this AMP as shown in the GALL-SLR Report Table XI-01, "FSAR Supplement Summaries for GALL-SLR Report Chapter XI Aging Management Programs," is included in the application with a reference to the alternative AMP.

For components where the aging effects of internally coated/lined surfaces are managed by this program, loss of material, cracking, and loss of material due to selective leaching need not be managed for these components by another program.

This program may be used to manage aging effects associated with external surfaces as indicated in in GALL-SLR Report AMR items and corresponding SRP-SLR Further Evaluation sections[e.g., Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants (SRP-SLR) Section 3.2.2.2.2]. When the external coatings are credited to isolate the external surface of a component from the environment, the recommendations as noted in this AMP are metthe following recommendations are met as noted.

2. ***Preventive Actions**:* The program is a condition monitoring program and does not recommend any preventive actions. However, external coatings can be credited as a

preventive action based on the coating isolating the external surfaces of a component from the environment.

3. ***Parameters Monitored or Inspected****:* Visual inspections are intended to identify coatings/linings that do not meet acceptance criteria, such as peeling and delamination. Aging mechanisms associated with coatings/linings are described as follows:

   - Blistering–formation of bubbles in a coating/lining
   - Cracking–formation of breaks in a coating/lining that extend through to the underlying surface
   - Flaking–detachment of pieces of the coating/lining itself either from its substrate or from previously applied layers
   - Peeling–separation of one or more coats or layers of a coating/lining from the substrate
   - Delamination–separation of one coat or layer from another coat or layer, or from the substrate
   - Rusting–corrosion of the substrate that occurs beneath or through the applied coating/lining

   Loss of material and cracking is managed for cementitious materials. See the term "Cracking due to chemical reaction, weathering, settlement, or corrosion of reinforcement (reinforced concrete only); loss of material due to delamination, exfoliation, spalling, popout, scaling, or cavitation," in the GALL-SLR Report Chapter IX.F.

   Physical damage consists of removal or reduction of the thickness of coating/lining by mechanical damage. For the purposes of this AMP, this would include damage such as that which could occur downstream of a throttled valve as a result of cavitation or erosion. It does not include physical damage caused by actions such as installing scaffolding or assembly and disassembly of flanged joints.

   Physical testing is intended to identify the extent of potential degradation of the coating/lining.

4. ***Detection of Aging Effects****:* If a baseline has not been previously established, baseline coating/lining inspections occur in the 10-year period prior to the subsequent period of extended operation. Subsequent inspections are based on an evaluation of the effect of a coating/lining failure on the in-scope component's intended function, potential problems identified during prior inspections, and known service life history. Subsequent inspection intervals are established by a coating specialist qualified in accordance with an ASTM International standard endorsed in Regulatory Guide (RG) 1.54. However, inspection intervals should not exceed those in Table XI.M42-1, "Inspection Intervals for Internal Coatings/Linings for Tanks, Piping, Piping Components, and Heat Exchangers."

   The extent of baseline and periodic inspections is based on an evaluation of the effect of a coating/lining failure on the in-scope component's intended function(s), potential problems identified during prior inspections, and known service life history; however, the extent of

inspection is not any less than the following for each coating/lining material and environment combination.

- All tanks–all accessible internal surfaces (and external surfaces when credited to isolate the external surfaces of a component from the environment).
- All heat exchangers–all accessible internal surfaces (and external surfaces when credited to isolate the external surfaces of a component from the environment.)
- Piping–either inspect a representative sample of seventy-three 1-foot axial length circumferential segments of piping or 50 percent of the total length of each coating/lining material and environment combination, whichever is less at each unit. The inspection surface includes the entire inside (or outside when applicable) surface of the 1-foot sample. If geometric limitations impede movement of remote or robotic inspection tools, the number of inspection segments is increased in order to cover an equivalent of seventy-three 1-foot axial length sections. For example, if the remote tool can only be maneuvered to view one-third of the inside surface, 219 feet of pipe is inspected.

Table XI.M42-1. Inspection Intervals for Internal Coatings/Linings for Tanks, Piping, Piping Components, and Heat Exchangers[1, 6]

Inspection Category[2]	Inspection Interval
A	6 years[3]
B[4,5]	4 years

1. CLB requirements (e.g., Generic Letter 89-13) might require more frequent inspections.
2. Inspection Categories
   A. No peeling, delamination, blisters, or rusting are observed during inspections. Any cracking and flaking has been found acceptable in accordance with the "acceptance criteria" program element of this AMP. No cracking or loss of material in cementitious coatings/linings.
   B. Prior inspection results do not meet Category A.
      - As an alternative to conducting inspections at the intervals in inspection Category B, an extent of condition inspection is conducted prior to the end of the next refueling outage. The extent of condition inspects either double the number of components or an additional five piping inspections (i.e., five 1-foot segments of piping). If Inspection Category A criteria are satisfied for the other coatings in the initial sample and the expanded scope, Inspection Category A may be used for subsequent inspections.
3. If the following conditions are met, the inspection interval may be extended to 12 years:
   a. The identical coating/lining material was installed with the same installation requirements in redundant trains (e.g., piping segments, tanks) with the same operating conditions and at least one of the trains is inspected every 6 years.
   b. The coating/lining is not in a location subject to erosion that could result in damage to the coating/lining (e.g., certain heat exchanger end bells, piping downstream of certain control valves, wind—born erosive particles for external coatings).
4. Subsequent inspections for Inspection Category B are reinspections at the original location(s), when the coatings/linings have not been repaired, replaced, or removed, as well as inspections of new locations.
5. When conducting inspections for Inspection Category B, if two sequential subsequent inspections demonstrate no change in coating/lining condition (i.e., at least three consecutive inspections with no change in condition), subsequent inspections at those locations may be conducted to Inspection Category A.
6. Internal inspection intervals for diesel fuel oil storage tanks may meet either Table XI.M42-1, or if the inspection results meet Inspection Category A, GALL-SLR Report AMP XI.M30, "Fuel Oil Chemistry."

Where documentation exists that manufacturer recommendations and industry consensus documents (i.e., those recommended in RG 1.54, or earlier versions of those standards) were complied with during installation, the extent of piping inspections may be reduced to the lesser of twenty-five 1-foot axial length circumferential segments of piping or 20 percent of the total length of each coating/lining material and environment combination at each unit.

For multiunit sites where the piping sample size is not based on the percentage of the population, it is acceptable to reduce the total number of inspections at the site as follows:

- For two-unit sites, fifty-five 1-foot axial length sections of piping (19 if manufacturer recommendations and industry consensus documents were complied with during installation) are inspected per unit.

- For a three-unit site, forty-nine 1-foot axial length sections of piping (17 if manufacturer recommendations and industry consensus documents were complied with during installation) are inspected per unit.

  In order to conduct the reduced number of inspections, the applicant states in the subsequent license renewal application the basis for why the operating conditions at each unit are similar enough (e.g., flowrate, temperature, excursions) to provide representative inspection results.

The coating/lining environment includes both the environment inside (and outside when applicable) the component and the metal to which the coating/lining is attached. Inspection locations are selected based on susceptibility to degradation and consequences of failure.

Coating/lining surfaces captured between interlocking surfaces (e.g., flange faces) are not required to be inspected unless the joint has been disassembled to allow access for an internal coating/lining inspection or other reasons. For areas not readily accessible for direct inspection, such as small pipelines, heat exchangers, and other equipment, consideration is given to the use of remote or robotic inspection tools.

Either of the following options [i.e., item (a) or (b)] is an acceptable alternative to the inspections recommended in this AMP for internal coatings when all of the following conditions exist:

- Loss of coating or lining integrity cannot result in downstream effects such as reduction in flow, drop in pressure, or reduction of heat transfer for in-scope components,

- The component's only CLB intended function is leakage boundary (spatial) or structural integrity (attached) as defined in SRP-SLR Table 2.1-4(b),

- The internal environment does not contain chemical compounds that could cause accelerated corrosion of the base material if coating/lining degradation resulted in exposure of the base metal,

- The internal environment would not promote microbiologically influenced corrosion of the base metal,

- The coated/lined components are not located in the vicinity of uncoated components that could cause a galvanic couple to exist, and

- The design for the component did not credit the coating/lining (e.g., the corrosion allowance was not zero).

(a) A representative sample of external wall thickness measurements can be performed every 10 years commencing 10 years prior to the subsequent period of extended operation to confirm the acceptability of the corrosion rate of the base metal. For heat exchangers and tanks, a representative sample includes 25 percent coverage of the accessible external surfaces. For piping, a representative sample size is defined above.

(b) In lieu of external wall thickness measurements, use GALL-SLR Report AMP XI.M36, "External Surfaces Monitoring of Mechanical Components," and GALL-SLR Report AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," or other appropriate internal surfaces inspection program (e.g., GALL-SLR Report AMP XI.M20, AMP XI M21A) to manage loss of coating or lining integrity.

In addition, where loss of internal coating or lining integrity cannot result in downstream effects such as reduction in flow, drop in pressure, or reduction of heat transfer for in-scope components, a representative sample of external wall thickness measurements can be performed every 10 years commencing 10 years prior to the subsequent period of extended operation to confirm the acceptability of the corrosion rate of the base metal in lieu of visual inspections of the coatings/linings. For heat exchangers and tanks, a representative sample includes 25 percent coverage of the accessible external surfaces. For piping, a representative sample size is described above.

The training and qualification of individuals involved in coating/lining inspections and evaluating degraded conditions is conducted in accordance with an ASTM International standard endorsed in RG 1.54 including staff limitations associated with a particular standard, except for cementitious materials. For cementitious coatings/linings inspectors should have a minimum of 5 years of experience inspecting or testing concrete structures or cementitious coatings/linings or a degree in the civil/structural discipline and a minimum of 1 year of experience.

Opportunistic inspections, in lieu of periodic inspections, are an acceptable alternative for buried internally lined/coated fire water system piping provided the following are met: (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; (b) through-wall flaws in the piping can be detected through continuous system pressure monitoring; and (c) plant-specific OE is acceptable (i.e., no leaks due to age-related degradation of representative internal coatings/linings used in buried in-scope fire water system components). If exceptions are taken to Table XI.M27-1 related to flow tests or internal piping inspections, the exception should justify why the exceptions will not impact detecting potential internal loss of coating/lining integrity.

5. ***Monitoring and Trending****:* A preinspection review of the previous two inspections, when available (i.e., two sets of inspection results may not be available to review for the baseline and first subsequent inspection of a particular coating/lining location), is conducted that includes reviewing the results of inspections and any subsequent repair activities. A coatings specialist prepares the post-inspection report to include: a list and location of all areas evidencing deterioration, a prioritization of the repair areas into areas that must be repaired before returning the system to service and areas where repair can be postponed to the next refueling outage, and where possible, photographic documentation indexed to inspection locations.

Where practical, (e.g., wall thickness measurements, blister size and frequency), degradation is projected until the next scheduled inspection. Results are evaluated against acceptance criteria to confirm that the sampling bases (e.g., selection, size, frequency) will maintain the components' intended functions throughout the subsequent period of extended operation based on the projected rate and extent of degradation.

6. ***Acceptance Criteria**:* Acceptance criteria are as follows:

   a. There are no indications of peeling or delamination.

   b. Blisters are evaluated by a coatings specialist qualified in accordance with an ASTM International standard endorsed in RG 1.54 including staff limitations associated with use of a particular standard. Blisters should be limited to a few intact small blisters that are completely surrounded by sound coating/lining bonded to the substrate. Blister size or frequency should not be increasing between inspections (e.g., ASTM D714-02, "Standard Test Method for Evaluating Degree of Blistering of Paints").

   c. Indications such as cracking, flaking, and rusting are to be evaluated by a coatings specialist qualified in accordance with an ASTM International standard endorsed in RG 1.54 including staff limitations associated with use of a particular standard.

   d. Minor cracking and spalling of cementitious coatings/linings is acceptable provided there is no evidence that the coating/lining is debonding from the base material.

   e. As applicable, wall thickness measurements, projected to the next inspection, meet design minimum wall requirements.

   f. Adhesion testing results, when conducted, meet or exceed the degree of adhesion recommended in plant-specific design requirements specific to the coating/lining and substrate.

7. ***Corrective Actions**:* Results that do not meet the acceptance criteria are addressed in the applicant's corrective action program under those specific portions of the quality assurance (QA) program that are used to meet Criterion XVI, "Corrective Action," of 10 CFR Part 50, Appendix B. Appendix A of the GALL-SLR Report describes how an applicant may apply its 10 CFR Part 50, Appendix B, QA program to fulfill the corrective actions element of this AMP for both safety-related and nonsafety-related structures and components (SCs) within the scope of this program.

   Coatings/linings that do not meet acceptance criteria are repaired, replaced, or removed. Physical testing is performed where physically possible (i.e., sufficient room to conduct testing) or examination is conducted to ensure that the extent of repaired or replaced coatings/linings encompasses sound coating/lining material.

   As an alternative, internal coatings exhibiting indications of peeling and delamination may be returned to service if: (a) physical testing is conducted to ensure that the remaining coating is tightly bonded to the base metal; (b) the potential for further degradation of the coating is minimized, (i.e., any loose coating is removed, the edge of the remaining coating is feathered); (c) adhesion testing using ASTM International standards endorsed in RG 1.54 (e.g., pull-off testing, knife adhesion testing) is conducted at a minimum of

3 sample points adjacent to the defective area; (d) an evaluation is conducted of the potential impact on the system, including degraded performance of downstream components due to flow blockage and loss of material or cracking of the coated component; and (e) follow-up visual inspections of the degraded coating are conducted within 2 years from detection of the degraded condition, with a reinspection within an additional 2 years, or until the degraded coating is repaired or replaced.

If coatings/linings are credited for corrosion prevention (e.g., corrosion allowance in design calculations is zero, the "preventive actions" program element of a SLRA AMP credited the coating/lining) and the base metal has been exposed or it is beneath a blister, the component's base material in the vicinity of the degraded coating/lining is examined to determine if the minimum wall thickness is met and will be met until the next inspection.

When a blister does not meet acceptance criteria, and it is not repaired, physical testing is conducted to ensure that the blister is completely surrounded by sound coating/lining bonded to the surface. Physical testing consists of adhesion testing using ASTM International standards endorsed in RG 1.54. Where adhesion testing is not possible due to physical constraints, another means of determining that the remaining coating/lining is tightly bonded to the base metal is conducted such as lightly tapping the coating/lining. Acceptance of a blister to remain inservice should be based both on the potential effects of flow blockage and degradation of the base material beneath the blister.

Additional inspections are conducted if one of the inspections does not meet acceptance criteria due to current or projected degradation (i.e., trending) unless the cause of the aging effect for each applicable material and environment is corrected by repair or replacement for all components constructed of the same material and exposed to the same environment. The number of increased inspections is determined in accordance with the site's corrective action process; however, there are no fewer than five additional inspections for each inspection that did not meet acceptance criteria, or 20 percent of each applicable material, environment, and aging effect combination is inspected, whichever is less. When inspections are based on the percentage of piping length, an additional 5 percent of the total length is inspected. The timing of the additional inspections is based on the severity of the degradation identified and is commensurate with the potential for loss of intended function. However, in all cases, the additional inspections are completed within the interval in which the original inspection was conducted, or if identified in the latter half of the current inspection interval, within the next refueling outage interval. These additional inspections conducted in the next inspection interval cannot also be credited towards the number of inspections in the latter interval. If subsequent inspections do not meet acceptance criteria, an extent of condition and extent of cause analysis is conducted to determine the further extent of inspections. Additional samples are inspected for any recurring degradation to provide reasonable assurance that corrective actions appropriately address the associated causes. At multi-unit sites, the additional inspections include inspections at all of the units with the same material, environment, and aging effect combination.

8. ***Confirmation Process****:* The confirmation process is addressed through those specific portions of the QA program that are used to meet Criterion XVI, "Corrective Action," of 10 CFR Part 50, Appendix B. Appendix A of the GALL-SLR Report describes how an applicant may apply its 10 CFR Part 50, Appendix B, QA program to fulfill the confirmation process element of this AMP for both safety-related and nonsafety-related SCs within the scope of this program.

9. ***Administrative Controls**:* Administrative controls are addressed through the QA program that is used to meet the requirements of 10 CFR Part 50, Appendix B, associated with managing the effects of aging. Appendix A of the GALL-SLR Report describes how an applicant may apply its 10 CFR Part 50, Appendix B, QA program to fulfill the administrative controls element of this AMP for both safety-related and nonsafety-related SCs within the scope of this program.

10. ***Operating Experience**:* The inspection techniques and training of inspection personnel associated with this program are consistent with industry practice and have been demonstrated effective at detecting loss of coating or lining integrity. Not to exceed inspection intervals have been established that are dependent on the results of previous plant-specific inspection results. The following examples describe operating experience (OE) pertaining to loss of coating or lining integrity for coatings/linings installed on the internal surfaces of piping systems:

    a. In 1982, a licensee experienced degradation of internal coatings in its spray pond piping system. This issue contains many key aspects related to coating degradation. These include installation details such as improper curing time, restricted availability of air flow leading to improper curing, installation layers that were too thick, and improper surface preparation (e.g., oils on surface, surface too smooth). The aging mechanisms included severe blistering, moisture entrapment between layers of the coating, delamination, peeling, and widespread rusting. The failure to install the coatings to manufacturer recommendations resulted in flow restrictions to the ultimate heat sink and blockage of an emergency diesel generator governor oil cooler. (Information Notice 85-24, “Failures of Protective Coatings in Pipes and Heat Exchangers.”)

    b. During an U.S. Nuclear Regulatory Commission inspection, the staff found that coating degradation, which occurred as a result of weakening of the adhesive bond of the coating to the base metal due to turbulent flow, resulted in the coating eroding away and leaving the base metal subject to wall thinning and leakage. [Agencywide Documents Access and Management System (ADAMS) Accession No. ML12045A544].

    c. In 1994, a licensee replaced a portion of its cement lined steel service water piping with piping lined with polyvinyl chloride material. The manufacturer stated that the lining material had an expected life of 15–20 years. An inspection in 1997 showed some bubbles and delamination in the coating material at a flange. A 2002 inspection found some locations that had lack of adhesion to the base metal. In 2011, diminished flow was observed downstream of this line. Inspections revealed that a majority of the lining in one spool piece was loose or missing. The missing material had clogged a downstream orifice. A sample of the lining was sent to a testing lab where it was determined that cracking was evident on both the base metal and water side of the lining and there was a noticeable increase in the hardness of the in service sample as compared to an unused sample. (ADAMS Accession No. ML12041A054).

    d. A licensee has experienced multiple instances of coating degradation resulting in coating debris found downstream in heat exchanger end bells. None of the debris had been large enough to result in reduced heat exchanger performance. (ADAMS Accession No. ML12097A064).

e. A licensee experienced continuing flow reduction over a 14 day period, resulting in the service water room cooler being declared inoperable. The flow reduction occurred due to the rubber coating on a butterfly valve becoming detached. (ADAMS Accession No. ML073200779).

f. At an international plant, cavitation in the piping system damaged the coating of a piping system, which subsequently resulted in unanticipated corrosion through the pipe wall. (ADAMS Accession No. ML13063A135).

g. A licensee experienced degradation of the protective concrete lining which allowed brackish water to contact the unprotected carbon steel piping resulting in localized corrosion. The degradation of the concrete lining was likely caused by the high flow velocities and turbulence from the valve located just upstream of the degraded area. (ADAMS Accession No. ML072890132).

h. A licensee experienced through-wall corrosion when a localized area of coating degradation resulted in base metal corrosion. The cause of the coating degradation is thought to have been nonage related mechanical damage. (ADAMS Accession No. ML14087A210).

i. A licensee experienced through-wall corrosion when a localized polymeric repair of a rubber lined spool failed. (ADAMS Accession No. ML14073A059).

j. A licensee experienced accelerated galvanic corrosion when loss of coating integrity occurred in the vicinity of carbon steel components attached to AL6XN components. (ADAMS Accession No. ML12297A333).

The program is informed and enhanced when necessary through the systematic and ongoing review of both plant-specific and industry OE including research and development such that the effectiveness of the AMP is evaluated consistent with the discussion in Appendix B of the GALL-SLR Report.

References

10 CFR Part 50, Appendix B, “Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants.” Washington, DC: U.S. Nuclear Regulatory Commission. 2016.

10 CFR 54.4(a), “Scope.” Washington, DC: U.S. Nuclear Regulatory Commission. 2016.

ACI. ACI Standard 201.1R-08, “Guide for Conducting a Visual Inspection of Concrete in Service.” Farmington Hills, Michigan: American Concrete Institute. 2008.

_____. ACI Standard 349.3R-02, “Evaluation of Existing Nuclear Safety-Related Concrete Structures.” Farmington Hills, Michigan: American Concrete Institute. 2002.

ASTM. ASTM 6677-07, “Standard Test Method for Evaluating Adhesion by Knife.” West Conshohocken, Pennsylvania: ASTM International. 2013.

_____. ASTM D714-02, “Standard Test Method for Evaluating Degree of Blistering of Paints.” West Conshohocken, Pennsylvania: ASTM International. 2009.

_____. ASTM D4538-05, “Standard Terminology Relating to Protective Coating and Lining Work for Power Generation Facilities.” West Conshohocken, Pennsylvania: ASTM International. 2006.

_____. ASTM D4541-09, “Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers.” West Conshohocken, Pennsylvania: ASTM International. 2011.

_____. ASTM D7167-12, “Standard Guide for Establishing Procedures to Monitor the Performance of Safety-Related Coating Service Level III Lining Systems in an Operating Nuclear Power Plant.” West Conshohocken, Pennsylvania: ASTM International. 2012.

EPRI. EPRI 1019157, “Guideline on Nuclear Safety-Related Coatings.” Revision 2. (Formerly TR-109937 and 1003102). Palo Alto, California: Electric Power Research Institute. December 2009.

NRC. Information Notice 85-24, “Failures of Protective Coatings in Pipes and Heat Exchangers.” Washington, DC: U.S. Nuclear Regulatory Commission. March 1985.

_____. Regulatory Guide 1.54, “Service Level I, II, and III Protective Coatings Applied to Nuclear Power Plants.” Revision 2. Washington, DC: U.S. Nuclear Regulatory Commission. October 2010.

Revisions to FSAR Supplement

Table XI-01. FSAR Supplement Summaries for GALL-SLR Report Chapter XI Aging Management Programs			
AMP	**GALL-SLR Program**	**Description of Program**	**Implementation Schedule***
XI.M42	Internal Coatings/ Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks	This program is a condition monitoring program that manages degradation of internal coatings/linings exposed to closed-cycle cooling water, raw water, treated water, treated borated water, waste water, lubricating oil, ~~or~~ fuel oil, air, or condensation, that can lead to loss of material of base materials or downstream effects such as reduction in flow, reduction in pressure or reduction of heat transfer when coatings/linings become debris. This program can also be used to manage loss of coating integrity for external coatings exposed to any air environment or condensation, soil, concrete, or underground environment, that are credited with isolating the external surface of a component from ~~the environment~~these environments (e.g., as discussed in SRP-SLR Section 3.2.2.2.2). This program manages these aging effects for internal coatings by conducting periodic visual inspections of all coatings/linings applied to the internal surfaces of in-scope components where loss of coating or lining integrity could impact the component's or downstream component's current licensing basis intended function(s). Visual inspections are conducted on external surfaces when applicable. For tanks and heat exchangers, all accessible surfaces are inspected. Piping inspections are sampling-based. The training and qualification of individuals involved in coating/lining inspections of non-cementitious coatings/linings are conducted in accordance with ASTM International Standards endorsed in RG 1.54 including guidance from the staff associated with a particular standard. For cementitious coatings, training and qualifications are based on an appropriate combination of education and experience related to inspecting concrete surfaces. Peeling and delamination is not acceptable. Blisters are evaluated by a coatings specialist with the blisters being surrounded by sound material and with the size and frequency not increasing. Minor cracks in cementitious coatings are acceptable provided there is no evidence of debonding. All other degraded conditions are evaluated by a coatings specialist. For coated/lined surfaces determined to not meet the acceptance criteria, physical testing is performed where physically possible (i.e., sufficient room to conduct testing) in conjunction with repair or replacement of the coating/lining.	Program is implemented and inspections begin 10 years before the subsequent period of extended operation. Inspections that are to be completed prior to the subsequent period of extended operation are completed 6 months prior to the subsequent period of extended operation or no later than the last refueling outage prior to the subsequent period of extended operation.

Revisions to GALL-SLR Report Tables V.A, V.B, V.D1, V.D2, VII.C1, VII.C3, VII.D, VII.E5, and VII.G

The following tables provide changes to AMR items related to this ISG, with redline formatting indicating changes from the GALL-SLR Report.

V Table A	**ENGINEERED SAFETY FEATURES Containment Spray System (PWR)**							
New, Modified, Deleted, Edited Item	**Item**	**SRP Item (Table, ID)**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/Mechanism**	**Aging Management Program (AMP)/TLAA**	**Further Evaluation**
M	V.A.E-401	3.2-1, 072	Piping, piping components, heat exchangers, tanks with internal coatings/linings	Any material with an internal coating/lining	Treated borated water, lubricating oil	Loss of coating or lining integrity due to blistering, cracking, flaking, peeling, delamination, rusting, physical damage; loss of material or cracking for cementitious coatings/linings	AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	No

V Table B	**ENGINEERED SAFETY FEATURES Standby Gas Treatment System (BWR)**							
New, Modified, Deleted, Edited Item	**Item**	**SRP Item (Table, ID)**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/Mechanism**	**Aging Management Program (AMP)/TLAA**	**Further Evaluation**
M	V.B.E-401	3.2-1, 072	Piping, piping components, heat exchangers, tanks with internal coatings/linings	Any material with an internal coating/lining	Treated water, raw water, lubricating oil	Loss of coating or lining integrity due to blistering, cracking, flaking, peeling, delamination, rusting, physical damage; loss of material or cracking for cementitious coatings/linings	AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	No

V Table D1	ENGINEERED SAFETY FEATURES Emergency Core Cooling System (PWR)							
New, Modified, Deleted, Edited Item	**Item**	**SRP Item (Table, ID)**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/Mechanism**	**Aging Management Program (AMP)/TLAA**	**Further Evaluation**
M	V.D1.E-401	3.2-1, 072	Piping, piping components, heat exchangers, tanks with internal coatings/linings	Any material with an internal coating/lining	Treated borated water, lubricating oil, condensation	Loss of coating or lining integrity due to blistering, cracking, flaking, peeling, delamination, rusting, physical damage; loss of material or cracking for cementitious coatings/linings	AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	No
M	V.D1.E-414	3.2-1, 073	Piping, piping components, heat exchangers, tanks with internal coatings/linings	Any material with an internal coating/lining	Treated borated water, lubricating oil, condensation	Loss of material due to general, pitting, crevice corrosion, MIC	AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	No

V Table D2	ENGINEERED SAFETY FEATURES Emergency Core Cooling System (BWR)							
New, Modified, Deleted, Edited Item	**Item**	**SRP Item (Table, ID)**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/Mechanism**	**Aging Management Program (AMP)/TLAA**	**Further Evaluation**
M	V.D2.E-401	3.2-1, 072	Piping, piping components, heat exchangers, tanks with internal coatings/linings	Any material with an internal coating/lining	Treated water, lubricating oil, condensation	Loss of coating or lining integrity due to blistering, cracking, flaking, peeling, delamination, rusting, physical damage; loss of material or cracking for cementitious coatings/linings	AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	No
M	V.D2.E-414	3.2-1, 073	Piping, piping components, heat exchangers, tanks with internal coatings/linings	Any material with an internal coating/lining	Treated water, lubricating oil, condensation	Loss of material due to general, pitting, crevice corrosion, MIC	AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	No

VII Table C1	AUXILIARY SYSTEMS Open-Cycle Cooling Water System (Service Water System)							
New, Modified, Deleted, Edited Item	**Item**	**SRP Item (Table, ID)**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/Mechanism**	**Aging Management Program (AMP)/TLAA**	**Further Evaluation**
M	VII.C1.A-400a	3.3-1, 127	Piping, piping components, tanks	Metallic	Raw water	Loss of material due to recurring internal corrosion	AMP XI.M20, "Open-Cycle Cooling Water System"	Yes
N	VII.C1.A-400b	3.3-1, 127	Piping, piping components, tanks (for components not covered by NRC GL 89-13)	Metallic	Raw water	Loss of material due to recurring internal corrosion	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	Yes

VII Table C3	AUXILIARY SYSTEMS Ultimate Heat Sink							
New, Modified, Deleted, Edited Item	**Item**	**SRP Item (Table, ID)**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/Mechanism**	**Aging Management Program (AMP)/TLAA**	**Further Evaluation**
M	VII.C3.A-400a	3.3-1, 127	Piping, piping components, tanks	Metallic	Raw water	Loss of material due to recurring internal corrosion	AMP XI.M20, "Open-Cycle Cooling Water System"	Yes
N	VII.C3.A-400b	3.3-1, 127	Piping, piping components, tanks (for components not covered by NRC GL 89-13)	Metallic	Raw water	Loss of material due to recurring internal corrosion	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	Yes

VII Table D	AUXILIARY SYSTEMS Compressed Air System							
New, Modified, Deleted, Edited Item	Item	SRP Item (Table, ID)	Structure and/or Component	Material	Environment	Aging Effect/Mechanism	Aging Management Program (AMP)/TLAA	Further Evaluation
~~D~~N	VII.D.A-414	3.3-1, 139	Piping, piping components, heat exchangers, tanks with internal coatings/linings	Any material with an internal coating/lining	Air-dry, air, condensation	Loss of material due to general, pitting, crevice corrosion, MIC	AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	No
~~D~~N	VII.D.A-416	3.3-1, 138	Piping, piping components, heat exchangers, tanks with internal coatings/linings	Any material with an internal coating/lining	Air-dry, air, condensation	Loss of coating or lining integrity due to blistering, cracking, flaking, peeling, delamination, rusting, physical damage; loss of material or cracking for cementitious coatings/linings	AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	No

VII Table E5	AUXILIARY SYSTEMS Waste Water Systems							
New, Modified, Deleted, Edited Item	**Item**	**SRP Item (Table, ID)**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/Mechanism**	**Aging Management Program (AMP)/TLAA**	**Further Evaluation**
M	VII.E5.A-400b	3.3-1, 127	Piping, piping components, tanks	Metallic	Waste water	Loss of material due to recurring internal corrosion	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	Yes

VII Table G	AUXILIARY SYSTEMS Fire Protection							
New, Modified, Deleted, Edited Item	**Item**	**SRP Item (Table, ID)**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/Mechanism**	**Aging Management Program (AMP)/TLAA**	**Further Evaluation**
M	VII.G.A-400c	3.3-1, 127	Piping, piping components, tanks	Metallic	Raw water, raw water (potable), treated water	Loss of material due to recurring internal corrosion	AMP XI.M27, "Fire Water System"	Yes

Revisions to SRP-SLR Tables 3.2-1 and 3.3-1

The following tables provide changes to "Table 1" items related to this ISG, with redline formatting indicating changes from the SRP-SLR.

Table 3.2-1 Summary of Aging Management Programs for Engineered Safety Features Evaluated in Chapter V of the GALL-SLR Report

New, Modified, Deleted, Edited Item	ID	Type	Component	Aging Effect/Mechanism	Aging Management Program (AMP)/TLAA	Further Evaluation Recommended	GALL-SLR Item
M	072	BWR/PWR	Any material piping, piping components, heat exchangers, tanks with internal coatings/linings exposed to closed-cycle cooling water, raw water, treated water, treated borated water, lubricating oil, condensation	Loss of coating or lining integrity due to blistering, cracking, flaking, peeling, delamination, rusting, or physical damage; loss of material or cracking for cementitious coatings/linings	AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	No	V.A.E-401 V.B.E-401 V.C.E-401 V.D1.E-401 V.D2.E-401
M	073	BWR/PWR	Any material piping, piping components, heat exchangers, tanks with internal coatings/linings exposed to closed-cycle cooling water, raw water, treated water, treated borated water, lubricating oil, condensation	Loss of material due to general, pitting, crevice corrosion, MIC	AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	No	V.A.E-414 V.B.E-414 V.C.E-414 V.D1.E-414 V.D2.E-414

Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report

New, Modified, Deleted, Edited Item	ID	Type	Component	Aging Effect/Mechanism	Aging Management Program (AMP)/TLAA	Further Evaluation Recommended	GALL-SLR Item
M	127	BWR/PWR	Metallic piping, piping components, tanks exposed to ~~closed-cycle cooling water,~~ raw water, raw water (potable), treated water, waste water	Loss of material due to recurring internal corrosion	AMP XI.M20, "Open-Cycle Cooling Water System," AMP XI.M27, "Fire Water System," or AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	Yes (SRP-SLR Section 3.3.2.2.7)	VII.C1.A-400a VII.C1.A-400b VII.C3.A-400a VII.C3.A-400b VII.E5.A-400b VII.G.A-400c
M	138	BWR/PWR	Any material piping, piping components, heat exchangers, tanks with internal coatings/linings exposed to closed-cycle cooling water, raw water, raw water (potable), treated water, treated borated water, fuel oil, lubricating oil, waste water, air-dry, air, condensation	Loss of coating or lining integrity due to blistering, cracking, flaking, peeling, delamination, rusting, or physical damage; loss of material or cracking for cementitious coatings/linings	AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	No	VII.C1.A-416 VII.C2.A-416 VII.C3.A-416 VII.D.A-416 VII.E4.A-416 VII.E5.A-416 VII.F1.A-416 VII.F2.A-416 VII.F3.A-416 VII.F4.A-416 VII.G.A-416 VII.H1.A-416 VII.H2.A-416
M	139	BWR/PWR	Any material piping, piping components, heat exchangers, tanks with internal coatings/linings exposed to closed-cycle cooling water, raw water, raw water (potable), treated water, treated borated water, fuel oil, lubricating oil, waste water, air-dry, air, condensation	Loss of material due to general, pitting, crevice corrosion, MIC	AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	No	VII.C1.A-414 VII.C2.A-414 VII.C3.A-414 VII.D.A-414 VII.E4.A-414 VII.E5.A-414 VII.F1.A-414 VII.F2.A-414 VII.F3.A-414 VII.F4.A-414 VII.G.A-414 VII.H1.A-414 VII.H2.A-414

APPENDIX I

Disposition of Public Comments

Comments received on the draft interim staff guidance (ISG) are available electronically through the U.S. Nuclear Regulatory Commission's (NRC's) electronic Reading Room at http://www.nrc.gov/reading-rm/adams.html.

From this page, the public can access the Agencywide Documents Access and Management System (ADAMS), which provides text and image files of the NRC's public documents. The following table lists the comments the NRC received on the draft version of this ISG.

Letter Number	ADAMS Accession No	Commenter Affiliation	Commenter Name
1	ML20224A465	Nuclear Energy Institute	Peter W. Kissinger

The NRC received one public comment letter, with comments presented in separate tables for the original draft Mechanical ISG and the errata letter. The two tables below provide the comment number as listed in the public comment letter, the original comment as written by the commenter, and the NRC staff's response.

Disposition of Public Comments – Original Draft ISG

Comment #	ISG Section/Page	Comment	NRC Staff Response
ISG-1	Appendix B AMP XI.M2 Page 1, 4, 8 of 10	AMP XI.M2, Water Chemistry The correct EPRI document number for EPRI "PWR Primary Water Chemistry Guidelines" Rev 7, April 2014 is EPRI 3002000505. The following ISG sections for AMP XI.M2 require update of the EPRI document number: -Program Description (pg 1)-References (pg 4)-3.1.6 References (pg 8)	Agreed and incorporated.
ISG-2	Appendix B, XI.M2, "Water Chemistry," Page 1 of 10	Proposed Revisions to Aging Management Program XI.M2, "Water Chemistry," incorrectly state that the EPRI Secondary Water Chemistry Guidelines Rev 8 was published in 2014. EPRI Report 3002010645 Revision 8 was published in 2017.	Agreed and incorporated.
ISG-3	Appendix E VII.G.A-806 Page 1, 17, 77	Cementitious Coatings AMP XI.M26 manages cracking and loss of materials for cementitious coatings. ISG proposed aging effects are not consistent with aging effects managed for cementitious coatings identified in NUREG-2191 AMP XI.M42 element 3 and Peach Bottom SER (ML# 19317E013), Section 3.3.2.3.5. Based on the intended function, delamination and separation are aging mechanisms that potentially result in a loss of material. Change in material properties is not an aging effect that results in a loss of intended function in cementitious coatings. No reference is provided in the Basis for Revision section of the ISG for change in material properties of cementitious materials.	A new AMR Item A-806 for cementitious coatings (Pyrocrete, BIO™ K-10 Mortar, Cafecote, and other similar materials) used as fireproofing/fire barriers exposed to air was proposed because they are materials that are widely used throughout industry and are likely to be cited in future subsequent license renewal applications (SLRAs). The NRC staff notes that the components with cementitious coatings for which aging effects are managed by AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks," in NUREG-2191, "Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report" (Agencywide Documents Access and Management System (ADAMS) Accession Nos. ML1787A031 and ML17187A204), have a different intended function and may be exposed to different environments than cementitious coatings used for fireproofing/fire barriers. Therefore, the aging effects/mechanisms may be different. AMR items related to fire barrier seals, fire stops, fire wraps and coatings, and radiant energy shields in Table 3.5.2-37, "Containments, Structures and Component Supports – Miscellaneous Structural Commodities – Aging Management Evaluation," of the Surry Power Station SLRA (ADAMS

Comment #	ISG Section/Page	Comment	NRC Staff Response
			Accession No. ML18291A828), included loss of material, change in material properties, cracking/delamination, and separation as applicable aging effects for certain cementitious coatings, subliming compounds, and silicates. These aging effects are consistent with Section 6, "Fire Barriers," of EPRI 3002013084, "Long-Term Operations: Subsequent License Renewal Aging Affects for Structures and Structural Components (Structural Tools)," issued November 2018, that cites loss of material, cracking/delamination, change in material properties, and separation as aging effects that potentially result in the loss of intended function of fire barriers. Table 6-3, "Structural Tools Comparison with GALL-SLR-Fire Barriers," in Section 6 of EPRI 3002013084 provides applicability criteria for aging effects/mechanisms for fire barrier materials. Table 6-3 notes that change in material properties due to gamma irradiation exposure is applicable for cementitious fireproofing when exposures exceed 1 x 10^6 rads. A plant-specific determination would need to be made on whether cementitious coatings used as fireproofing/fire barriers would be exposed to greater than 1 x 10^6 rads. Therefore, the NRC staff disagrees with the comment to remove change in material properties as an aging effect for cementitious coatings used as fireproofing/fire barriers. However, consistent with EPRI 3002013084, the staff updated AMR item A-806 for cementitious coatings to include the aging mechanism of gamma irradiation exposure that potentially results in a change of material properties. Table 5-3, "Structural Tools Comparison with GALL-SLR-Structural Concrete Members," in Section 5, "Structural Concrete Members," of EPRI 3002013084 provides applicability criteria for aging effects/mechanisms for concrete structures and concrete components. Table 5-3 notes that change in material properties due to elevated temperature is applicable for concrete structures and concrete components when the general area temperature exceeds 150°F (65.6°C) or when the local area temperature exceeds 200°F (93.3°C). Therefore, applicants need to make a plant-specific determination of whether concrete structures and concrete components are exposed to temperatures exceeding these values. This is consistent with further evaluations related to concrete exposed to elevated temperatures recommended in Section 3.5, "Aging

Comment #	ISG Section/Page	Comment	NRC Staff Response
			Management of Containments, Structures, and Component Supports," of NUREG-2192, "Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants," issued July 2017 (ADAMS Accession No. ML17188A158). Table 5-3 of EPRI 3002013084 also notes that temperatures exceeding these values potentially result in loss of material and cracking of concrete structures and concrete components. Therefore, consistent with EPR 3002013084, the staff updated AMR item A-806 for cementitious coatings to include change in material properties, cracking, and loss of material due to elevated temperature. The NRC staff does not agree with citing delamination and separation as aging mechanisms that potentially result in a loss of material. The Surry Power Station SLRA and EPRI 3002013084 cite delamination and separation as aging effects, not aging mechanisms. Specifically, the Surry Power Station SLRA and EPRI 3002013084 cite "cracking/delamination" as an aging effect. Therefore, the staff updated AMR item A-806 for cementitious coatings to cite cracking/delamination as an aging effect. EPRI 3002013084 describes separation as an aging effect in which the adhesion between fire barrier materials and adjacent surfaces is degraded which could allow communication between different fire zones. Therefore, the staff did not remove separation as an aging effect for cementitious coatings used as fireproofing/fire barriers. The NRC staff agrees that, if available, the aging mechanisms that potentially result in the aging effects should be included for completeness and to be consistent with other AMR items in NUREG-2191. Therefore, the staff updated AMR item A-806 for cementitious coatings used for fireproofing/fire barriers to include available aging mechanisms cited in EPRI 3002013084, and those cited by industry as part of SLRA lessons learned activities and public comments on the draft AMR item. For the above reasons, the staff revised the aging effects/mechanisms for AMR Item A-806 to read as follows: Loss of material due to abrasion, exfoliation, elevated temperature, flaking, spalling; cracking/delamination due to chemical reaction, elevated temperature, settlement, vibration; change in material properties due to elevated temperature, gamma irradiation exposure; separation.

Comment #	ISG Section/Page	Comment	NRC Staff Response
ISG-4	Appendix E VII.G.A-805 Page 1, 16 and 77	Subliming Compounds Subliming compounds are fire-resistant coating materials. Based on the fire proofing application, loss of material and cracking are the appropriate aging effects to be managed by the Fire Protection program based upon the intended function of enclosing the material to be protected. Based on the intended function, delamination and separation are aging mechanisms that potentially result in a loss of material. Change in material properties is not an aging effect that results in a loss of intended function in subliming compounds. No reference is provided in the Basis for Revision section of the ISG for change in material properties of subliming materials.	A new AMR Item A-805 for subliming compounds (Thermo-lag®, Darmatt™, 3M™ Interam™, and other similar materials) used as fireproofing/fire barriers exposed to air was proposed because they are materials that are widely used throughout industry and are likely to be cited in future SLRAs. AMR items related to fire barrier seals, fire stops, fire wraps and coatings, and radiant energy shields in Table 3.5.2-37, "Containments, Structures and Component Supports – Miscellaneous Structural Commodities – Aging Management Evaluation," of the Surry Power Station SLRA (ADAMS Accession No. ML18291A828) included loss of material, change in material properties, cracking/delamination, and separation as applicable aging effects for certain cementitious coatings, subliming compounds, and silicates. These aging effects are consistent with Section 6, "Fire Barriers," of EPRI 3002013084, "Long-Term Operations: Subsequent License Renewal Aging Affects for Structures and Structural Components (Structural Tools)," issued November 2018, that cites loss of material, cracking/delamination, change in material properties, and separation as aging effects that potentially result in the loss of intended function of fire barriers. Table 6-3, "Structural Tools Comparison with GALL-SLR-Fire Barriers," in Section 6 of EPRI 3002013084 provides applicability criteria for aging effects/mechanisms for fire barrier materials. Table 6-3 notes that change in material properties due to gamma irradiation exposure is applicable for rigid fire boards (subliming compounds) when exposures exceed 1×10^6 rads. A plant-specific determination would need to be made on whether subliming compounds used as fireproofing/fire barriers would be exposed to greater than 1×10^6 rads. Therefore, the NRC staff disagrees with the comment to remove change in material properties as an aging effect for subliming compounds used as fireproofing/fire barriers. However, consistent with EPRI 3002013084, the staff updated AMR item A-805 for subliming compounds to include the aging mechanism of gamma irradiation exposure that potentially results in a change of material properties. The NRC staff does not agree with citing delamination and separation as aging mechanisms that potentially result in a loss of material. The Surry Power Station SLRA and

Comment #	ISG Section/Page	Comment	NRC Staff Response
			EPRI 3002013084 cite delamination and separation as aging effects, not aging mechanisms. Specifically, the Surry Power Station SLRA and EPRI 3002013084 cite "cracking/delamination" as an aging effect. Therefore, the staff updated AMR item A-805 for subliming compounds to cite cracking/delamination as an aging effect. EPRI 3002013084 describes separation as an aging effect where the adhesion between fire barrier materials and adjacent surfaces is degraded which could allow communication between different fire zones. Therefore, the staff did not remove separation as an aging effect for subliming compounds used as fireproofing/fire barriers. The NRC staff agrees that, if available, the aging mechanisms that potentially result in the aging effects should be included for completeness and to be consistent with other AMR items in NUREG-2191, "Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report" (ADAMS Accession Nos. ML1787A031 and ML17187A204). Therefore, the staff updated AMR item A-805 for subliming compounds used for fireproofing/fire barriers to include available aging mechanisms cited in EPRI 3002013084, and those cited by industry as part of SLRA lessons learned activities and their public comments on the draft AMR item. For the above reasons, the staff revised the aging effects/mechanisms for AMR Item A-805 to read: Loss of material due to abrasion, flaking, vibration; cracking/delamination due to chemical reaction, settlement; change in material properties due to gamma irradiation exposure; separation.
ISG-5	Appendix E, VII.G.A-807 Page 1, 17and 77	Silicates Silicates are fire-resistant insulation or barrier materials. Based on the fire proofing application, loss of material and cracking are the appropriate aging effects to be managed by the Fire Protection program based upon the intended function of enclosing or acting as a barrier for the material to be protected. Based on the intended function, delamination or separation are aging mechanisms that potentially result in a loss of material. Change	A new AMR Item A-807 for silicates (Marinite®, Kaowool™, Cerafiber®, Cera® blanket, or other similar materials) used as fireproofing/fire barriers exposed to air was proposed because they are materials that are widely used throughout industry and are likely to be cited in future subsequent license renewal applications (SLRAs). AMR items related to fire barrier seals, fire stops, fire wraps and coatings, and radiant energy shields in Table 3.5.2-37, "Containments, Structures and Component Supports – Miscellaneous Structural Commodities – Aging Management Evaluation," of the Surry Power Station SLRA (ADAMS

Comment #	ISG Section/Page	Comment	NRC Staff Response
		in material properties is not an aging effect that results in a loss of intended function in silicates. No reference is provided in the Basis for Revision section of the ISG for change in material properties of silicates	Accession No. ML18291A828) included loss of material, change in material properties, cracking/delamination, and separation as applicable aging effects for certain cementitious coatings, subliming compounds, and silicates. These aging effects are consistent with Section 6, "Fire Barriers," of EPRI 3002013084, "Long-Term Operations: Subsequent License Renewal Aging Affects for Structures and Structural Components (Structural Tools)," November 2018, that cites loss of material, cracking/delamination, change in material properties, and separation as aging effects that potentially result in the loss of intended function of fire barriers. Table 6-3, "Structural Tools Comparison with GALL-SLR-Fire Barriers," in Section 6 of EPRI 3002013084 provides applicability criteria for aging effects/mechanisms for fire barrier materials. Table 6-3 notes that change in material properties due to gamma irradiation exposure is applicable for fibrous fire wraps (silicates) when exposures exceed 1 x 10^6 rads. A plant-specific determination would need to be made on whether silicates used as fireproofing/fire barriers would be exposed to greater than 1 x 10^6 rads. Therefore, the NRC staff disagrees with the comment to remove change in material properties as an aging effect for silicates used as fireproofing/fire barriers. However, consistent with EPRI 3002013084, the staff updated AMR item A-807 for silicates to include the aging mechanism of gamma irradiation exposure that potentially results in a change of material properties. The NRC staff does not agree with citing delamination and separation as aging mechanisms that potentially result in a loss of material. The Surry Power Station SLRA and EPRI 3002013084 cite delamination and separation as aging effects, not aging mechanisms. Specifically, the Surry Power Station SLRA and EPRI 3002013084 cite "cracking/delamination" as an aging effect. Therefore, the staff updated AMR item A-807 for silicates to cite cracking/delamination as an aging effect. EPRI 3002013084 describes separation as an aging effect in which the adhesion between fire barrier materials and adjacent surfaces is degraded which could allow communication between different fire zones. Therefore, the staff did not remove separation as an aging effect for silicates used as fireproofing/fire barriers.

Comment #	ISG Section/Page	Comment	NRC Staff Response
			The NRC staff agrees that, if available, the aging mechanisms that potentially result in the aging effects should be included for completeness and to be consistent with other AMR items in NUREG-2191, "Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report" (ADAMS Accession Nos. ML1787A031 and ML17187A204). Therefore, the staff updated AMR item A-807 for silicates used for fireproofing/fire barriers to include available aging mechanisms cited in EPRI 3002013084, and those cited by industry as part of SLRA lessons learned activities and their public comments on the draft AMR item. For the above reasons, the staff revised the aging effects/mechanisms for AMR Item A-807 to read as follows: Loss of material due to abrasion, flaking; cracking/delamination due to settlement; change in material properties due to gamma irradiation exposure; separation.
ISG-6	Appendix E Page 76 and Appendix F, Page 12	NUREG-2192 Table 3.3-1 item 265 & 266 NUREG-2191 VII.H2.A-790 and VII.H2.A-800: Don't limit the component type to "radiator tubes". Recommend using a component type of heat exchanger tubes.	Agreed and incorporated. The staff notes that the applicable AMR items are VII.H2.A-799 (instead of VII.H2.A-790 as listed in the NEI comment letter) and VII.H2.A-800.
ISG-7	Appendix H Page 7 of 12	AMP XI.M42 Internal Coatings: Delete item (c) in the last paragraph of AMP element 4 that permits opportunistic inspections of internally coated fire water system piping if plant-specific OE is acceptable (i.e., no leaks due to aging). This sets an unreasonable standard that is not consistent with plant CLB [current licensing basis] and License Renewal guidance. One age related leak allowed by the CLB anytime during plant lifetime that was corrected with no recurrence at a dual unit site (fire water is typically a common system) could be considered unacceptable OE for both units. This is also inconsistent with NUREG-2191/2192 guidance on the use of operating experience that permits corrective actions to prevent recurrence and augmenting	The staff does not agree with this comment. The operating experience condition relates specifically to leaks attributed to the age-related degradation of representative internal coatings/linings used in buried in-scope fire water system components (i.e., not "no leaks due to aging"). Leaks due to external corrosion or leakage at mechanical joints would not preclude the use of this alternative approach. If leaks have been attributed to the age related degradation of representative internal coatings/linings used in buried in-scope fire water system components, opportunistic inspections of these coatings/linings would not be appropriate during the subsequent period of extended operation (SPEO), unless a technical basis is provided to explain why similar degradation would not be expected during the SPEO. The use of operating experience as one of the criteria for allowing opportunistic inspections is neither inconsistent with plant CLB nor license renewal guidance. Overall fire water

Comment #	ISG Section/Page	Comment	NRC Staff Response
		AMPs beyond GALL-SLR to effectively manage aging.	system leakage, as allowed by a plant's current licensing basis, is not germane to this issue, only leakage due to age-related degradation of internal coatings/linings. Leakage that is allowed by a plant's CLB may detrimentally affect aging of passive components. License renewal guidance in many further evaluation sections (e.g., 3.3.2.2.3, 3.3.2.2.4, 3.3.2.2.7, 3.3.2.2.9, 3.3.2.2.10) include discussions where operating experience reviews establish the need for additional aging management activities. The issue for the Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks program only pertains to the allowance of opportunistic inspections in lieu of periodic inspections.
ISG-8	Appendix H Page 1 of 12, Basis for Revision Section	AMP XI.M42 Internal Coatings: Delete Operating Experience discussion in the Basis for Revision Section. It implies that OE associated with different materials, environments and aging effects (buried externally fire water piping vs Internally coated fire water piping with different coatings) could be used to demonstrate OE is unacceptable.	The staff does not agree with this comment. The operating experience discussion in the "Basis for Revision" section provides the rationale for the addition of the operating experience condition (i.e., condition (c)) in the "Summary of Proposed Revisions" section. Condition (c) specifically addresses "age-related degradation of representative internal coatings/linings used in buried in-scope fire water system components." Operating experience related to different materials, environments, or aging effects (e.g., leaks due to the age-related degradation of external coatings used in buried in-scope fire water system piping, leaks due to the age-related degradation of non-representative internal coatings/linings) would not preclude the use of this alternative approach.
ISG-9	TBD (missing AMRs)	The following AMRs were discussed with the Industry during prior ISG meetings are missing from the Draft Mechanical ISG: -Loss of coating integrity in compressed air steel tanks (#2) -LOM in compressed air steel tanks (#3) -LOM/etc. in Zn in condensation environment (#4) -LOM/etc. in carbon steel, SS, and copper alloy intreated water (#12) -Use of XI.M20 or XI.M38 for AMR items VII.C1.A-400 & VII.C3.A-400 (#16)	The staff issued an errata letter dated July 24, 2020 (ADAMS Accession No. ML20198M382), which is integrated into this final ISG. Comments regarding the errata letter are discussed below in this table.

Disposition of Public Comments – Draft ISG Errata

Comment #	ISG Section/Page	Comment	NRC Staff Response
Errata-1	Mechanical ISG, Appendix H, pages 5 to 15 of 15, Revised AMRs Table VII.E1	Changes to add NUREG-2191 Chapter VII AMR lines for stainless steel in a treated water environment were discussed during the lessons learned meetings but not provided in the ISGs. Revise existing AMR lines to provide PWR stainless steel in a treated water environment AMR lines in NUREG-2191 Chapter VII consistent with those in NUREG-2191 Chapter VIII. *(See Comment 1 details on the next page).*	The staff does not agree with the industry's proposed resolution. As discussed during public lessons learned meetings, the use of cross-chapter annotations has never caused an issue with the NRC staff reviews of past license renewal applications. The NRC staff notes that previous LRAs and SLRAs used a number of cross-chapter AMR items, many with and some without cross-chapter annotations, which did not complicate the staff's review. The need for applicants to provide cross-chapter annotations in SLRA Table 1s is not clear.
Errata-2	Mechanical ISG, Appendix H, pages 5 to 15 of 15, Revised AMRs Table VII.E1	As discussed in the GALL Lesson learned meeting, a NUREG-2191 Chapter VII AMR line and an associated NUREG-2192 Table 1 line are requested for carbon steel in a treated water environment consistent with NUREG-2192 Table 3.4-1 item 14.	See the NRC staff response discussion above for industry comment 1 related to Draft ISG Errata.
Errata-3	Mechanical ISG, Appendix H, page 15 of 15	On NUREG-2192 Table 3.3-1 item 138 and item 139, add air-dry, air, and condensation environments in the component column to be consistent with the proposed changes for AMR lines VII.D.A-416 and VII.V.A-414.	Agreed and incorporated.