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Subsequent License Renewal Guidance Update

NRC Staff's Public Comment Responses

U.S. Nuclear Regulatory Commission
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May 23, 2024

Agenda

- Introductions
- Background Information
- Public comments overview
- Update Process and Upcoming Milestones
- Summary of Notable Comment Responses
  - General
  - Mechanical
  - Structural
  - Electrical
- Closing Remarks

Meeting Context

- Purposes of this meeting are:
  - to provide a status of Subsequent License Renewal (SLR) guidance update project
  - to provide an overview of public comments received and Staff's preliminary assessments
  - to engage in discussions (accepting feedback, but not accepting new comments)
- Received 202 public comments during comment period (7/11/23 to 10/11/23).
- No Staff decisions, findings, or commitments to be made during this public meeting.

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Background Information

Guidance Documents for Subsequent License Renewal (SLR)

- NUREG-2191, "Generic Aging Lessons Learned for Subsequent License Renewal," (**GALL-SLR**)
  - Revision 0, published May 2017, Vol 1. ML17187A031, Vol 2. ML17187A204
  - Revision 1, Draft for Comment, published July 2023, Vol 1. ML23180A182, Vol 2. ML23180A188

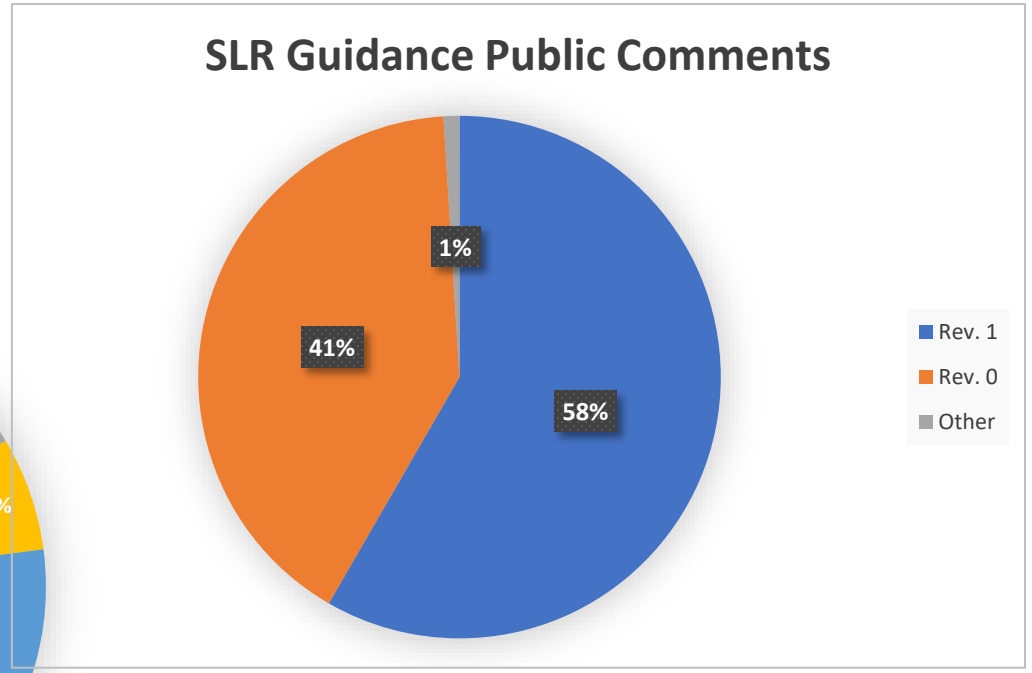
- NUREG–2192, "Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants," (**SRP-SLR**)
  - Revision 0, published May 2017, ML17188A158
  - Revision 1, Draft for Comment, published July 2023, ML23180A191
  - Revision 1, Draft for Comment, Corrected Tables 3.1-1 and Table 3.2-1, published August 2023, ML23213A036
- NUREG–2221, "Technical Bases for Changes in the Subsequent License Renewal Guidance Documents NUREG–2191 and NUREG–2192," (**Tech. Basis Doc.)**
  - Published Dec 2017, ML17362A126
  - Supplement 1, Draft for Comment, Published July 2023, ML23180A208

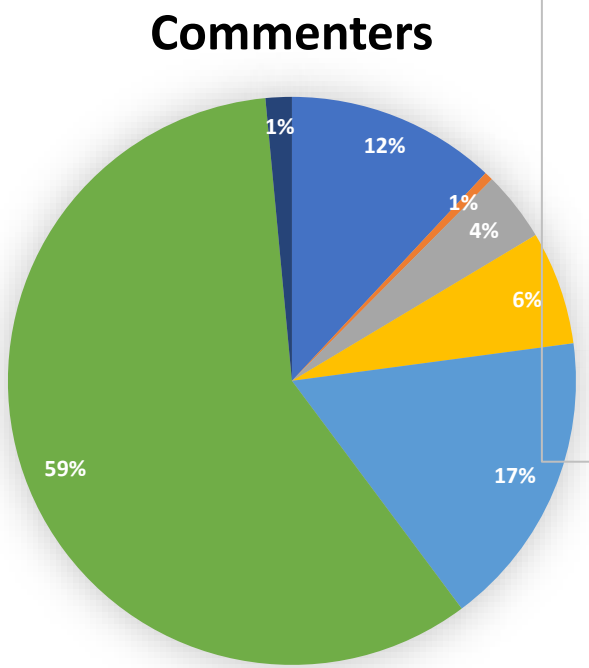
Public Comment Crosswalk: ML24131A137

LR is license renewal from 40 to 60 years
SLR is subsequent license renewal from 60 to 80 years

Public Comments Overview

Public Comment Summary			
Commenter	**Total**	**Rev. 1**	**Rev. 0**
Gallagher	24	7	17
Weitze	1	1	0
AMS	9	2	7
ENERCON	13	11	2
EPRI	34	26	8
NEI	118	71	47
NRC	3	3	0
Total	**202**	**121**	**81**





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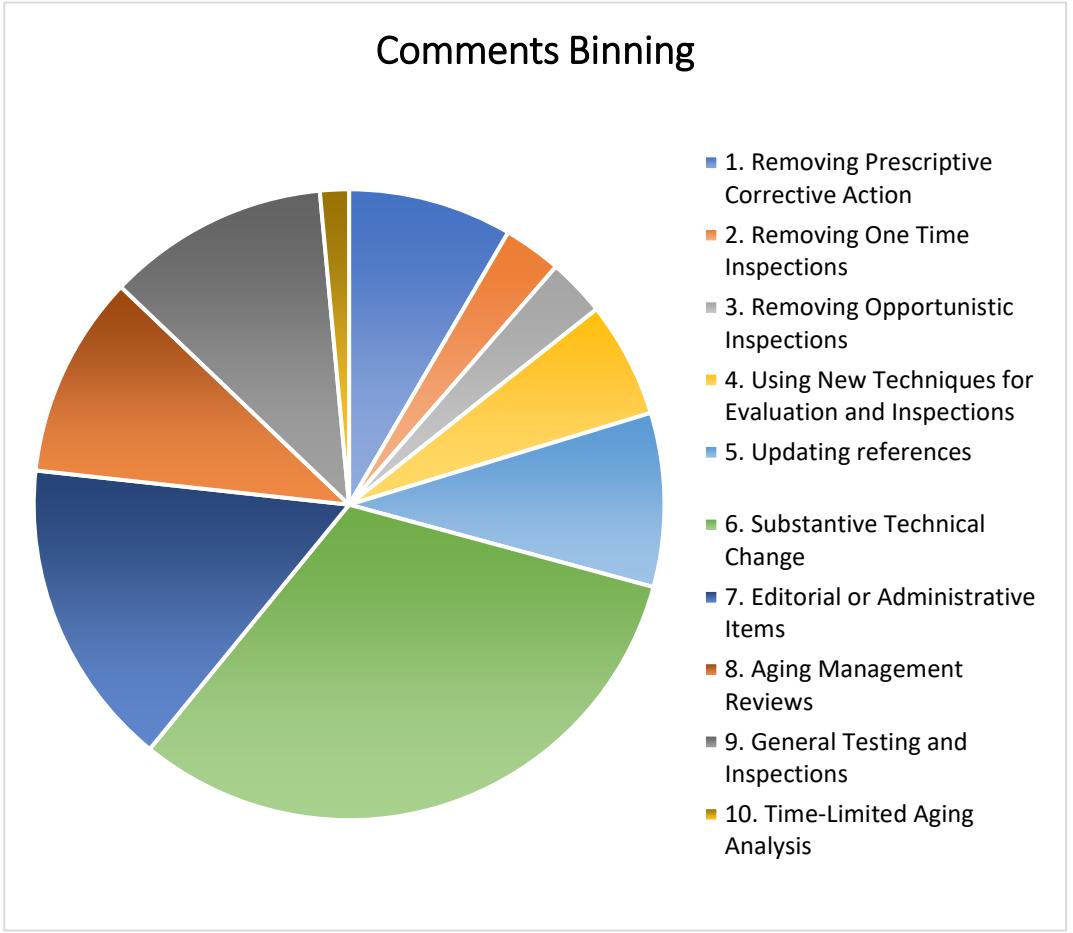
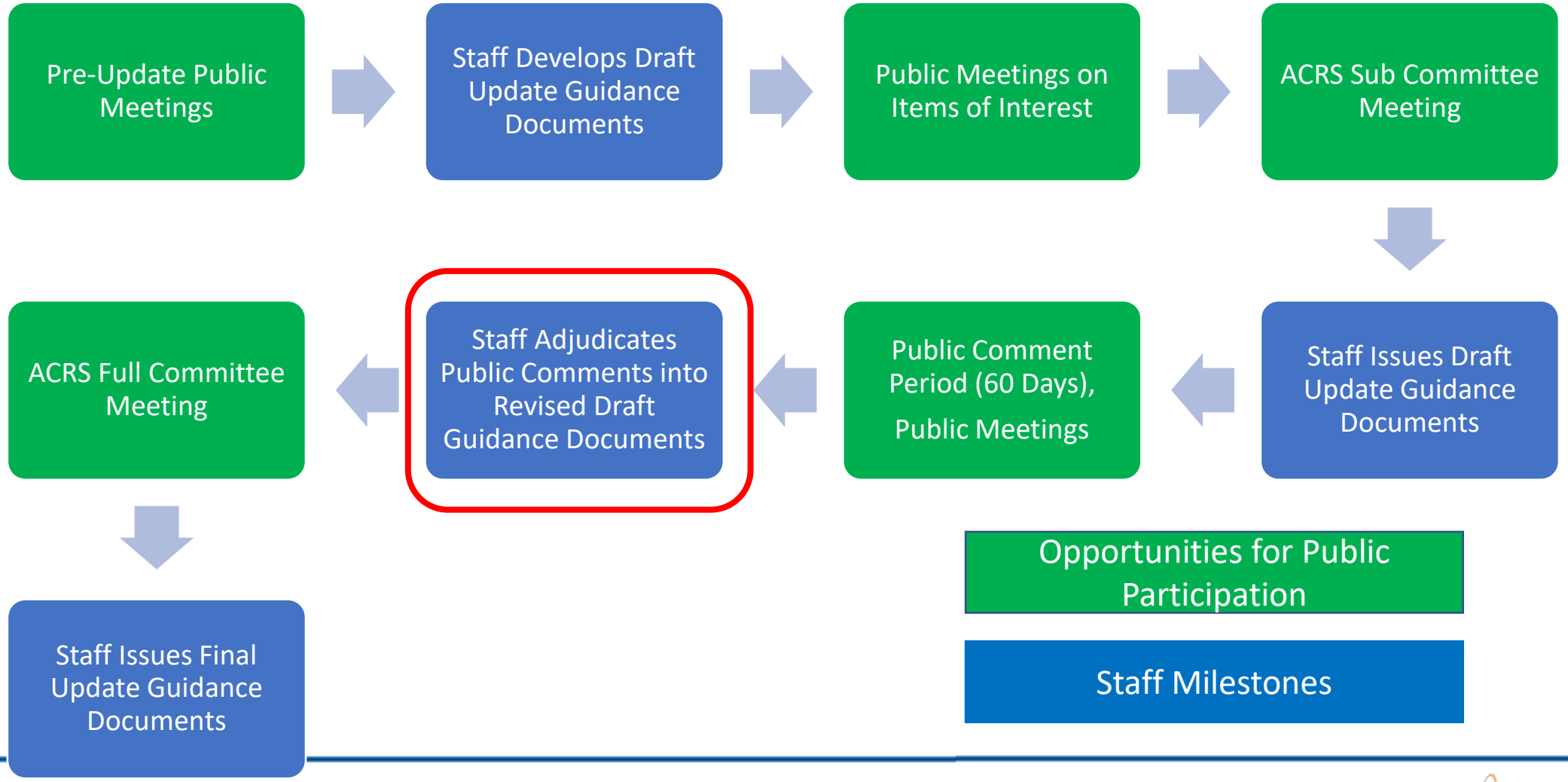
Public Comments Overview

Binning Summary			
Bin	**Total**	**Rev. 1**	**Rev. 0**
1. Removing Prescriptive Corrective Action	17	0	17
2. Removing One Time Inspections	6	0	6
3. Removing Opportunistic Inspections	6	0	6
4. Using New Techniques for Evaluation and Inspections	12	1	11
5. Updating references	18	12	6
6. Substantive Technical Change	64	45	19
7. Editorial or Administrative Items	32	24	8
8. Aging Management Reviews	21	17	4
9. General Testing and Inspections	23	16	7
10. Time-Limited Aging Analysis	3	3	0
Total	**202**	**119**	**83**



Guidance Document Update Process



Upcoming Milestones

- Revised Draft guidance provided to ACRS for review – July 2024
- ACRS full committee meeting – October 2024
- Final SLR Guidance published – February 2025

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Summary of Notable Comment Responses (General)

Reduction of NRC SLR Application Review Time

- Comment 20 Summary: Reduce SLR application review time using existing corrective action program (CAP), operating experience (OE), and targeted scoping and screening review.
  - Referencing the first license renewal application
  - Include description of the process to identify structures, systems, and components (SSCs) proposed to be added to SLR scope since 1st LR
  - Staff to review process and proposed changes only
- Preliminary Response Summary: Staff agrees in part.
  - Staff agrees with intent of the comment, to implement efficiencies in the review process where possible and appropriate.
  - These recommendations are added as issues to be analyzed as part of the NRC's SLR efficiency initiative that is ongoing.

Reduction of NRC SLR Application Review Time

- Comments 21 and 32-000 Summary: reduction in NRC staff review time for SLR Application
  - For activities consistent with GALL-SLR, a detailed App. B Aging Management Program (AMP) description is not necessary.
  - Staff verify consistency claim in AMP audit by reviewing sample 20% of AMP Basis Documents; expand if issues are found.
- Preliminary Response Summary: Staff disagrees.
  - In general, agree with implementing efficiencies to reduce SLR Application review times.
  - Staff developed the License Renewal Roadmap (SECY-24-0026) to ensure timely and predictable review.
  - Staff to implement Tiered Approach for safety review, tailoring the level of review by incorporating risk insights, leveraging operating programs, previous reviews, NRC and industry OE, consideration of consistency with NRC guidance documents.
  - Tiered approach accomplishes the same objective of the 20% sampling proposal.
  - NEI 17-01 describes of the level of AMP detail in App. B, which is not expected to be high.
  - Proposed NUREG-2192 revisions may reduce clarity, potentially reducing efficiency in staff's review.

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Summary of Notable Comment Responses (Mechanical)

Eliminate One-Time Inspections: Multiple AMPs

- Comments 3, 11, 12, and 17 Summary: Elimination of One-Time Inspections for XI.M2 “Water Chemistry,” XI.M30 “Fuel Oil Chemistry,” XI.M32 “One-Time Inspections,” and XI.M39 “Lubricating Oil Analysis”
  - One-Time Inspections were originally proposed for XI.M2, XI.M30, and XI.M39 because of concerns that these programs may not be effective in low-flow or stagnant-flow areas.
  - There was no Operating Experience that drove this recommendation.
  - Should account for CAP, OE, AMP effectiveness reviews.
- Preliminary Response Summary: Staff agrees with the proposal, in part.
  - See following slide.

Eliminate One-Time Inspections (cont.)

Comments 3, 11, 12, and 17 continued.

- The staff agrees with intent and most of recommended changes, as proposed, of eliminating one-time inspections in XI.M2, XI.M30, and XI.M39 AMPs.
  - The staff is proposing alternate wording for some of the recommended changes.
  - The staff disagrees with the comment seeking to eliminate expansion of the inspection scope by a minimum number of additional inspections if some results of the one-time inspections do not meet acceptance criteria.

Eliminate Prescriptive Corrective Actions/Inspections: Multiple AMPs

- Summary of comments 6, 7, 8, 9 (partial)*, 10, 15, 16, 18, and 32-017 : Eliminate prescriptive follow-up inspections specified in GALL-SLR for AMPs XI.M18, XI.M20, XI.M21A, XI.M27, XI.M29, XI.M36, XI.M38, and XI.M42** and instead allow determination by corrective action program.
  - Utilizing GL 90-05 to determine prescriptive follow-up actions is not appropriate.
- Preliminary Response Summary: Staff disagrees, but greater flexibility is proposed.
  - See following slide.

* AMP XI.M27 uses the 20 percent sampling size for the recommended augmented inspections on piping segments that cannot be drained or allow water to collect and to allow for a reduced sampling size under certain conditions (Detection of Aging Effects program element); not for prescriptive corrective actions.
** Additional discussion on actions unique to XI.M42 follows on a later slide

Eliminate Prescriptive Corrective Actions/Inspections: Multiple AMPs

Comments 6, 7, 8, 9 (partial)*, 10, 15, 16, 18 continued.

- The AMP recommendations for additional inspections were the result of staff observations of CAP responses to degraded conditions.
- Basis for inspection quantities on page 2-4 of NUREG-2221 – Commission position supported reliance on sound technical judgment – rather than a precise “level or degree” of confidence
- Since prescriptive follow-up inspections are in response to an initial minimum sample size that established a 90% confidence, a minimum size of expanded scope of 5 samples or 20% provides reasonable assurance that systemic or localized nature of issue is determined and that appropriate corrective actions can be taken.
- Proposed alternative: additional inspections are performed in “multiple locations of the same material, environment, and aging effect” to determine the systemic or localized nature of the issue.

XI.M27: Eliminate Prescriptive Corrective Actions/Inspections

- Comment 9 (partial)* Summary: AMP XI.M27, “Fire Water System,” eliminate prescriptive follow-up inspections, allow determination of corrective actions by the CAP.
- Preliminary Response Summary: Staff disagrees.
  - Corrective Actions program element consistent with NUREG-2192, Rev. 1, Appendix A.1.2.3 (program specifies the number of additional tests, extent of condition and extent of cause analysis).
  - 2 additional tests performed within same interval in which the original test was performed, so that test results from original test and two additional tests provide sufficient data to determine whether flow blockage is localized or a widespread issue.
  - Performing additional tests at other units on site with the same material, environment, and aging effect combination provides data to determine whether flow blockage is occurring at the other units.

See Slides for Comments 6, 8, 9 (partial), 10, 15, 16, 18 regarding the 20 percent sampling size used in Table XI.M27-1 to allow for a reduced sampling size under certain conditions

Eliminate Opportunistic Inspections: Multiple AMPs

- Summary of Comments 32-013, 32-016, 32-021, 32-022, 32-054: Eliminate opportunistic inspections whenever components are made accessible, from the guidance in these AMPs:
  - XI.M17 “Flow Accelerated Corrosion”
  - XI.M18 “Bolting Integrity”
  - XI.M21A “Closed Treated Water Systems”
  - XI.M24 “Compressed Air Monitoring”
  - XI.M38 “Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components”
- Preliminary Response Summary: Staff Agrees.
  - See following slide.

Eliminate Opportunistic Inspections (cont.)

Comments 32-013, 32-016, 32-021, 32-022, 32-054, continued.

- While specific environments vary for components covered by these AMPs, there are common themes:
  1. Recommended minimum sample sizes in the AMPs (or referenced industry standards (e.g. NSAC-202L)) that already provide reasonable assurance that aging will be adequately managed to ensure intended functions are maintained consistent with the station's current licensing basis through the Period of Extended Operation (PEO).
  2. Opportunistic inspections cannot always be performed within normal work planning practices.
  3. Performing opportunistic inspections can result in redundant inspection of certain components.
  4. Taxation of limited station resources from other, higher-priority work.
- Staff agrees with comment 32-016 (on XI.M18 only), to the extent that the word “opportunistic” can be removed from Element 4, “Detection of Aging Effects,” because the guidance is intended to address the case when the specified minimum sample size cannot be met.

XI.M21A, Corrosion Inspection Guidance

- Comment 32-020 Summary: XI.M21A, “Closed Treated Water Systems,” remove corrosion inspection guidance.
  - Sampling of closed-cycle cooling water for iron and copper content effectively monitors for corrosion. The recommended internal inspections are not necessary to ensure intended functions are maintained.
- Preliminary Response Summary: Staff Disagrees.
  - NUREG-2221 discusses potentially severe conditions that led to stress corrosion cracking at heat exchanger surfaces based on OE (LER 263/2014-001).
  - Recent OE of recurring internal corrosion of piping welds in the turbine plant cooling water system (ML24078A230).

XI.M27: Testing and Inspection of Sprinkler System Piping

- Comment 32-024 Summary: AMP XI.M27, "Fire Water System," revise Table XI.M27-1 to perform internal inspections of sprinkler system piping as a one-time inspection, based on LR-ISG-04.
    - LR-ISG-04, …oxygen introduced into sprinkler system each time the system is opened accelerates potential for corrosion, … there is reasonable assurance unacceptable flow blockage will NOT occur through SPEO if inspections following 55 years do not identify unacceptable flow blockage.
    - Table XI.M27-1 contradicts guidance in Detection of Aging Effects program element. “If results of 100% internal visual inspection are acceptable, and segment is not subsequently wetted, no further augmented tests or inspections are necessary.”
- Preliminary Response Summary: Staff disagrees.
    - LR-ISG-04 recommended baseline pipe wall thickness evaluations of fire protection piping prior to end of current license term, and pipe wall thickness evaluations during PEO to detect general corrosion, did not eliminate need to manage general corrosion.
    - LR-ISG-2012-02 eliminated alternative of using wall thickness evaluations instead of flow tests or internal visual examinations for managing flow blockage based on OE.
        - States… “Flow testing and internal visual inspections are capable of identifying flow blockage because of fouling; however, external wall thickness measurements might not be capable of identifying these impacts when general corrosion might be having a minor effect on wall thickness while generating sufficient corrosion products to cause flow blockage.”
    - Augmented tests and inspections (ATI) are beyond those recommended in Table XI.M27-1. Guidance states “no further ATI are necessary,” does not state that tests and inspections recommended in Table XI.M27-1 are not necessary.

XI.M27: Eliminate Prescriptive Corrective Actions/Inspections

- Comment 32-025 Summary: AMP XI.M27, eliminate prescriptive follow-up inspections.
  - Corrective actions dependent on the specific details of the issue.
  - Prescriptive corrective actions may not be warranted due to comprehensive nature of fire water system testing regimes and the specific issue identified and may not be possible based on plant-specific design.
- Preliminary Response Summary: Staff disagrees.
  - See Following Page.

Note: See Slide for Comment 9 (partial)* regarding additional flow and main drain tests when acceptance criteria not met

XI.M27: Fire Pump Suction Strainer and Intake Screen Inspections

- Comments 32-029 and 32-030 Summary: XI.M27, "Fire Water System," eliminate the recommendations to perform fire pump suction strainer and fire pump intake screen inspections annually and after system actuation.
  - Not feasible and unnecessary.
  - Unnecessary where intake screens are located behind circulation water traveling screens.
- Preliminary Response Summary: Staff disagrees.
  - See Following Slide.

XI.M27: Eliminate Prescriptive Corrective Actions/Inspections

Comment 32-025 continued.

- Appropriate for AMP XI.M27 to recommend removing sufficient foreign organic or inorganic material to obstruct pipe or sprinklers because if pipe or sprinklers are obstructed, then they may not be able to perform their intended function, and there has been industry OE related to flow blockage of fire water sprinkler systems.
- Appropriate for AMP XI.M27 to recommend an obstruction investigation when conditions (2), (3), (4), (5), (6), (13), or (14) in Section 14.3.1 of the 2011 Edition of NFPA 25 occur (e.g., discharge of obstructive material during routine water tests, plugged sprinklers, pinhole leaks), which could be indicative of the aging effects of loss of material and flow blockage.
- Appropriate for AMP XI.M27 to recommend removing loose fouling products that could block sprinklers because if the sprinklers are obstructed, then they may not be able to perform their intended function, and, as noted above, there has been industry operating experience related to flow blockage of fire water sprinkler systems.
- Section 14.3.3 of the 2011 Edition of NFPA 25 requires a complete flushing program when sufficient material to block pipe or sprinklers is identified during the obstruction investigation. Appendix A14.3.3 refers to NFPA 25 Appendix D.5 for obstruction investigation flushing procedures, which provides the industry consensus methods for conducting flushes.
- Applicants have the option to propose using a different approach to remove loose fouling products that could block sprinklers by taking an exception to the AMP and providing a technical justification for the staff to evaluate.

XI.M27: Fire Pump Suction Strainer and Intake Screen Inspections (cont.)

Comments 32-029 and 32-030 continued.

- AMP XI.M27 recommends inspections and tests in NFPA 25 related to managing effects of aging associated with loss of material/flow blockage for passive long-lived in-scope components in FWS.
- Section 8.3.3.7 of the 2011 Edition of NFPA 25 requires fire pump suction screens be inspected and cleared of debris or obstructions after the waterflow portions of annual test or after system activations.
  - These periodic inspections could reasonably be expected to identify loss of material leading to a loss of intended function of the suction screens.
- Appropriate to recommend inspection (loss of material) and clear of debris or obstructions (flow blockage) at the fire pump suction screens because:
  - They may become blocked, damaged, or corroded over time, which could impact their ability to perform their intended function.
  - NFPA 25 requires inspections related to age-managing applicable aging effects associated with loss of material and flow blockage.
- New Footnote (i) allows for fire pump suction screen inspections to be conducted every 5 years in lieu of annually and after each system actuation under certain conditions.
- Applicants have the option to propose using a different approach for managing flow blockage and loss of material of the fire pump suction screens by taking an exception to the AMP and providing a technical justification for the staff to evaluate.

XI.M27: Flow Testing of Automatic Standpipe System

- Comment 32-031 Summary: XI.M27, “Fire Water System (FWS) ” remove new Footnote (f) related to hose station flow testing.
  - Fire protection systems at nuclear plants are single zone systems and, therefore, the sample-based approach does not apply.

- Preliminary Response Summary: Staff disagrees.
  - AMP XI.M27 recommends inspections and tests in NFPA 25 that are related to managing the effects of aging associated with loss of material and flow blockage for passive long-lived in-scope components in the fire water system.
  - Section 6.3.1.1 of the 2011 Edition of NFPA 25 requires flow testing at the hydraulically most remote hose connections of each zone of an automatic standpipe system every 5 years.
  - Nuclear power plant buildings (e.g., Reactor Building, Control Building, Turbine Building) have a basement and multiple floors and, therefore, may have multiple automatic standpipe system zones.
  - The FWS design varies, and a single zone standpipe system may not apply to all nuclear power plants.
  - The “each zone” requirement in Section 6.3.1.1 of the 2011 Edition of NFPA 25 would not apply to a specific nuclear power plant with a single zone automatic standpipe system.

XI.M27: Alternative Methods of Verifying Fire Water System Intended Functions

- Comment 32-032 Summary: XI.M27, “Fire Water System (FWS), ” acknowledge alternative methods to NFPA 25 for verifying FWS intended functions.
  - NFPA 25 is written for commercial structures, and certain NFPA 25 testing is problematic for nuclear plants.

- Preliminary Response Summary: Staff disagrees.
  - Based on OE and for consistency with industry standards, LR-ISG-2012-2 added appropriate inspections and tests in NFPA 25 related to age-managing aging effects associated with loss of material and flow blockage for passive long-lived in-scope components in FWS.
  - LR-ISG-2012-2, degradation in fire protection systems can be detected before a loss of intended function by inspecting and testing systems in accordance with NFPA 25.
  - Applicants have option to propose alternative methods (take AMP exception and providing technical justification).

XI.M32: Eliminate Prescriptive Corrective Actions/Inspections

- Comment 32-040 Summary: XI.M32, “One-time Inspection,” eliminate prescriptive corrective actions (PCA)
  - Aging degradation adequately addressed through CAP, dependent on the specific details of the issue
  - If periodic program is established, there would be no need for sample expansion
  - Periodic inspection program is not warranted for local issues associated with the specific component(s)
- Preliminary Response Summary: Staff agrees clarification is needed.
  - See following slide.

XI.M32: Eliminate Prescriptive Corrective Actions/Inspections

Comment 32-040 continued.

- Corrective Actions element: 2nd paragraph recommends sample expansion, while the 3rd paragraph recommends implementation of a periodic program.
- Because inspection is taking place in one-time inspection program, that means degradation is not expected; therefore, when acceptance criteria are not met, scope expansion is needed.
- Staff will clarify that for any inspection (original or expanded scope) that does not meet acceptance criteria, if the cause of degradation is found to be systemic, periodic inspections will commence. If degradation is shown to be from an assignable non-systemic cause, periodic inspections will not be required.

XI.M33: Substantial Changes To Guidance Due to Single OE

- Comment 32-115 Summary: XI.33, “Selective Leaching” substantial changes to guidance imposing significant burden on stations based on a single isolated event.
  - Issue better addressed through further evaluation (FE) with plant specific evaluation of design, operating history, and conditions.
- Preliminary Response Summary: Staff agrees in part.
  - NRC Information Notice 2020-04 was not intended to be an exhaustive list and the staff is aware of other instances of significant external surface selective leaching of buried gray cast iron piping.
  - Staff considered new FE section however, requesting technical justification within the AMP for the reduced sample size (i.e., 3% with a max. of 10 components) is consistent with language in other AMPs (such as XI.M41).

XI.M33: Eliminate Opportunistic Inspections

- Comment 32-041 Summary: XI.M33, “Selective Leaching,” recommend removal of opportunistic inspections whenever components are made accessible from XI.M33 guidance.
- Preliminary Response Summary: Staff disagrees.
  - NUREG-2222 states, in part, the basis for reducing inspections for selective leaching during the subsequent PEO (i.e., 3% with a max. of 10 components) from inspections for selective leaching during the initial PEO (i.e., 20% with a max. of 25 components) was …opportunistic inspections will be conducted throughout the PEO whenever components are opened and buried or submerged surfaces are exposed…

XI.M33: Hardness Testing to Detect Selective Leaching

- Comment 32-042 Summary: XI.M33, “Selective Leaching,“ Include hardness testing (HT) as available option for inspections for selective leaching, with acceptance criteria from GALL Rev. 2.
  - Enhance the number of techniques available, improve chances of detecting
  - EPRI reports suggest effectiveness of HT in detecting selective leaching
- Preliminary Response Summary: Staff disagrees.
  - Technical basis for removing HT documented in NUREG-2221, Rev. 0.
  - Audit report on NEI proposed revision to AMP XI.M33 (ML22353A608) further supports not re-introducing hardness testing.
  - Applicants have option of taking an exception to AMP, proposing to use HT and providing a technical justification for staff evaluation.

XI.M33 Eliminate Prescriptive Corrective Actions/Inspections

- Comment 13 Summary: XI.M33 “Selective Leaching,” eliminate prescriptive follow-up inspections specified in GALL-SLR, instead allow determination by CAP analysis.
  - Utilizing GL 90-05 to determine prescriptive follow-up actions is not appropriate (for performing temporary non-code pipe repairs, GL inspection criteria does not meet AMP acceptance criteria, GL criteria technical basis not explained)
- Preliminary Response Summary: Staff disagrees.
  - Explicit follow-up inspections were added in GALL-SLR in a wider restructuring of XI.M33 that also included periodic inspection population sizes that are significantly smaller than other sampling-based condition monitoring programs
  - Minimum size of the expanded scope of 5 samples or 20% provides reasonable assurance that systemic or localized nature of the issue is determined and that appropriate corrective actions can be taken. (See page 2-4 of NUREG-2221, standard of sound technical judgment)

XI.M33: Additional Non-destructive Examination Techniques

- Comment 29-024 Summary: XI.33, “Selective Leaching” revised to include additional non-destructive examination (NDE) techniques.
- Preliminary Response Summary: Staff disagrees.
  - Applicants have option to propose NDE technique in lieu of destructive examinations, by taking an exception to AMP and providing a technical justification.
  - NDE for selective leaching has not achieved widespread acceptance.
  - Cited EPRI reports describe ongoing research with limited application.
  - NDE can be non-conservative.
  - Not clear that NDE that is only capable of detecting selective leaching can also be used to evaluate fitness-for-service comparable to a destructive examination.

XI.M36 & XI.M38
Similar VT-1/VT-3 Inspections for non-ASME Code Components

- Comment 32-099 Summary: for non-ASME Code components, should refer to inspections similar to VT-1 and VT-3.
  - Implementation of recommendation difficult as site procedures for VT-1 and VT-3 adhere to Code inspection requirements that do not apply to non-Code components.
- Preliminary Response Summary: Staff agrees.
  - The commentor may have misunderstood Element 4 in XI.M36 and XI.M38.
  - Line 29 (page XI-231) and line 14 (page XI-244) under Element 4 “Detection of Aging Effects" states, “ASME Code Section XI VT-1 inspections (including those inspections conducted on non-ASME Code components).”
  - Although the current wording references VT-1 inspections for non-ASME Code components, the preceding paragraph allows use of one or more of the three listed options.
  - The parenthetical portion will be revised to clarify the intent that it is optional to perform VT-1 inspections on non-ASME Code components.

XI.M41: Sample Size Internal Volumetric Exams

- Comment 29-027 Summary: XI.M41, “Buried and Underground Piping and Tanks” deleting the 25 percent inspection sample size for internal volumetric examinations of piping; internal volumetric exams should be treated equivalent to any external visual exams.
- Preliminary Response Summary: Staff agrees in part.
  - Staff agrees inspecting 25% of piping can be overly burdensome and not consistent with staff’s sampling approach in other programs
  - Staff does not agree that a reduction to the minimum number of inspections in GALL-SLR Report Table XI.M41-2 provides a reasonable sample in all instances
  - Staff determined maximum number of inspections in GALL-SLR Table XI.M41-2 (i.e., the smaller of 10 percent of the piping length or 60 feet) would provide a reasonable sample (instead of 25%)
  - Option to propose a further reduction by taking exception to AMP and providing a technical justification.

XI.M41: Coating Recommendation, Buried Cementitious Piping

- Comment 32-055 Summary: XI.M41, "Buried and Underground Piping and Tanks," elimination or clarification of the coating recommendation for buried cementitious piping.
  - NACE documents identify polymeric coatings not typically installed on cementitious piping. AMP guidance does not align with the NACE standards.
- Preliminary Response Summary: Staff disagrees.
  - Unclear if the commenter intended to refer to underground (not buried) components
  - Recommendation is to provide external coatings for buried cementitious piping (since GALL Rev. 2),
  - Draft GALL-SRL Rev. 1 recommendation is to provide external coatings for underground cementitious piping
  - Draft GALL-SLR Rev. 1 technical basis for external coatings in an underground environment
    - Could prevent recent failure of buried prestressed concrete cylindrical piping.
    - Are recommended for atmospheric exposure of concrete pressure pipe exposed to large temperature fluctuations, wetting and drying cycles, freezing and thawing cycles, and atmospheric carbonation.

XI.M42: Eliminate Prescriptive Corrective Actions/Inspections

- Comment 32-067 Summary: XI.M42, “Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, And Tanks,“ eliminate prescriptive corrective actions (PCA)
  - PCA may not be warranted, depending on the specific findings from inspections.
  - Coating delamination typically due to improper coating system selection or installation.
  - Erosion of HX coatings not immediate concern, rather financial decision should be left to individual station.
  - Follow-up inspections every 2 years causes additional system unavailability.
  - Recommendation for coatings/linings credited for corrosion protection is unclear.
- Preliminary Response Summary: Staff disagrees.
  - See following slide.

XI.M42: Eliminate Prescriptive Corrective Actions/Inspections (cont.)

- Comment 32-067 Continued.
  - Staff agrees that coating delamination may be due to improper coating selection or installation. XI.M42 provides reasonable assurance that delamination does not "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." Guidance is valid whether root cause of delamination is improper selection/installation, age related degradation, or some other cause.
  - Follow up inspections every two years are appropriate actions to ensure intended functions of in-scope components are met, and that degradation of coatings/linings does not 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.
  - XI.M42 allows but does not require that external coatings be credited as being a preventive action based on the coating isolating the external surfaces of a component from the environment. If licensee chooses to take this credit and if base material is either exposed or is beneath a blister, it is reasonable to apply the XI.M42 guidance to assure that the minimum wall thickness is met and will be met until next inspection.

XI.M43: Eliminate New AMP

- Comment 25, 32-068 Summary: XI.M43, "HDPE Piping and CFRP Repaired Piping," should be deleted for no sufficient technical basis.
  - Only one OE cited by staff driving entire industry implement program
- Preliminary Response Summary: Staff disagrees.
  - New AMP developed to manage effects of age-related degradation mechanisms applicable to HDPE and CFRP repaired piping.
  - OE exists on the failure of CFRP-repaired pipe related to loss of material due to delamination and flow blockage.
  - HDPE piping is not immune to degradation.
  - Aging issues and aging management approaches for CFRP and HDPE piping are considered to be most effectively addressed with a dedicated AMP.

XI.M43: No Adequate Technical Basis for New AMP

- Comment 32-116 Summary: XI.M43, “HDPE Piping and CFRP Repaired Piping,” No adequate technical basis is provided for the new proposed AMP.
  - NUREG-2221 Suppl. 1 provides purpose of AMP but not technical basis for why AMP is necessary
  - Regarding "unique aging issues" for HDPE and CFRP, does not explain what these are or provide a basis for how these could potentially impact ability of SSCs to perform their intended functions through PEO.
- Preliminary Response Summary: Staff agrees that more clarity is needed.
  - Staff established AMP XI.M43 to monitor CFRP repaired pipe and HDPE pipe for materials degradation, cracking, loss of materials, leakage, loss of structural integrity, flow blockage, and/or fouling,
  - These problems may result from improper installation, from many years of inservice operation, or a combination of both. Since this would be difficult to determine, AMP XI.M43 was established,
  - Staff to clarify XI.M43 Program Description as follows:

    This program manages the effects of the aging of the internal and external surfaces of safety-related and in-scope non-safety-related buried and underground HDPE piping and CFRP-repaired piping.

XI.M43:Eliminate Prescriptive Corrective Actions/Inspections

- Comment 24 Summary: XI.M43, “High- Density Polyethylene (HDPE) Piping and Carbon Fiber - Reinforced Polymer (CFRP) Repaired Piping,” eliminate prescriptive follow-up inspections specified in GALL-SLR; instead, allow determination by CAP analysis.
  - Utilizing GL 90-05 to determine prescriptive follow-up actions is not appropriate (for performing temporary non-code pipe repairs, GL inspection criteria do not meet AMP acceptance criteria, GL criteria technical basis not explained).
- Preliminary Response Summary: Staff disagrees.
  - AMP XI.M43 established to monitor CFRP repaired pipe and HDPE pipe for materials degradation, cracking, loss of material, leakage, loss of structural integrity, flow blockage, and/or fouling.
  - It is not a temporary repair, but a repair/replacement activity.
  - Prescriptive follow-up inspections based on sound technical judgement, to provide reasonable assurance (a Commission Memorandum addressed in staff’s position for the inspections).

XI.M43: Loss of Material, Exposure to Temp./Moisture in AMRs

- Comment 29-006 Summary: Delete “loss of material due to exposure to temperature or moisture” as aging effect/mechanisms for AMR, or otherwise provide basis and reference,
  - Not obvious how loss of material occurs in HDPE due to exposure to temperature and moisture; technical basis not provided.
- Preliminary Response Summary: Staff disagrees.
  - Loss of material due to degradation and/or envir. effects can occur in HDPE piping if incorrect material selected or an improper fusion butt joint (e.g. electrofused joint) is performed.
  - HDPE is sensitive to high temperatures and could deform leading to loss of material and strength.
  - HDPE fabrication can introduce moisture in resin/hydrocarbon mixture, which can cause future degradation.
  - Difficult to determine if loss of material occurred due to aging, improper materials, improper fusion joint, or combination.

XI.M43: Delete “Moisture” From AMR Aging Mechanism

- Comment 29-007 Summary: delete “moisture” from aging mechanisms, technical basis not clear for CFRP material susceptible to loss of material or cracking simply due to moisture exposure, recommend NUREG-2221 be revised to provide an explanation for the phenomenon.
- Preliminary Response Summary: Staff disagrees.
  - For CFRP, exposure to env. effects such as temperature and/or moisture can cause degradation of the epoxy resin matrix and the bond between CFRP laminate and metal substrate.
  - Degradation of matrix will result in debonding/cracking of fiber-matrix interfacial bond, debonding/delamination/cracking of laminate layers, lowering matrix glass transition temperature, swelling of matrix, microcracking of matrix, loss watertightness, and loss of maintaining design load.
  - Degradation of the bond between laminate and metal substrate can result in loss of material, loss of watertightness, and loss of maintaining design loads.

XI.M43: Loss of Material Due to Radiation, Temp. and Moisture

- Comment 29-031 Summary: XI.M43, “HDPE Piping and CFRP Repaired Piping,” delete “loss of material due to radiation, temperature, and moisture”
  - Not obvious how loss of material occurs due to environmental exposure of the CFRP HDPE/CFRP.
  - Technical basis and references not provided.
- Preliminary Response Summary: Staff agrees in part.
  - Staff determined, for BWRs, tritium may occur in discharge section of the service water pipe. However, tritium does not significantly affect structural integrity of CFRP-repaired or HDPE pipes. Staff will delete “radiation” from env. phrase.
  - Staff finds temperature variation and moisture may cause loss of material in the CFRP-repaired and HDPE pipe; these will remain in the AMP.

XI.M43: CFRP Delamination, Disbonding, Flow Blockage

- Comment 32-113 Summary: Without supporting CFRP OE, delamination/disbonding should be removed from Loss of Material definition and flow blockage should be removed as an applicable aging effect.
- Preliminary Response Summary: Staff disagrees.
  - Staff determined that delamination or disbanding of CFRP should not be removed from the loss of material definition.
  - The NRC staff is aware of OE related to the delamination or disbanding of CFRP repaired piping (cited in GALL-SLR and non-cited proprietary reports).

XI.M43: AMP for Buried/Aboveground Non-safety HDPE Piping

- Comment 29-030 Summary: XI.M43, "HDPE Piping and CFRP Repaired Piping," clarifying which AMP should be credited with managing effects of aging for buried and above-ground non-safety related HDPE piping.
  - Neither XI.M41 nor XI.M43 appears to address these pipes.
- Preliminary Response Summary: Staff agrees.
  - Staff to revise AMP XI.M43 Program Description, Scope of the Program, and paragraph 3.a.1 to more clearly specify AMP applicability,
  - As an example, Program Description to be revised as follows:

    This program manages the effects of the aging of the internal and external surfaces of safety-related and in-scope non-safety-related buried and underground HDPE piping and CFRP-repaired piping.

    There is no known above ground safety-related piping; the aging of above ground non-safety-related piping should be managed by a plant-specific approach.

XI.M43: Accumulation of Particulate Fouling

- Comment 29-032 Summary: XI.M43, “HDPE Piping and CFRP Repaired Piping,” delete “accumulation of particulate fouling”
  - Technical basis for HDPE/CFRP materials accumulating particulates is not clear.
  - These materials are more resistant to fouling than metallic materials they replace.
- Preliminary Response Summary: Staff disagrees.
  - Staff recognizes that HDPE and CFRP-repaired pipes may be less susceptible than metals to fouling,
  - However, it is not certain these pipes will not have fouling problems after many years transporting raw water from untreated water sources.

XI.M43: Accumulation of Particulate Fouling

- Comment 29-033 Summary: XI.M43, “HDPE Piping and CFRP Repaired Piping,” expand program scope to also address external applications of CFRP.
  - AMP more completely address safety-related and non-safety related systems for: HDPE, Internal CFRP applications, External CFRP applications.
- Preliminary Response Summary: Staff disagrees.
  - Staff approved use of CFRP on internal surface of Class 3 buried and underground piping as structural lining,
  - No requests received for application of CFRP on external surface of pipes. Therefore, Staff determined that external surface application of CFRP is not required to be included in this AMP at this time,

XI.M43: Remove Cracking as Applicable Aging Effect for CFRP

- Comment 32-001 Summary: Table IX.E, “Aging Effects,” remove cracking as an applicable aging effect for CFRP.
  - Delamination/disbonding of CFRP caused by improper installation/quality control and is not caused by aging
- Preliminary Response Summary: Staff disagrees.
  - Staff notes that exposure to env. effects such as temperature and/or moisture can cause degradation of epoxy resin matrix in CFRP composite.
  - Degradation of matrix can result in cracking of fiber-matrix interfacial bonds, delamination of layers, lowering matrix glass transition temperature, swelling of matrix, and microcracking of matrix.

XI.M43: Tests and Inspections for HDPE and CFRP

- Comment 32-078 Summary: XI.M43, "HDPE Piping and CFRP Repaired Piping," add clarification if the frequency and scope in Table XI.M43-2 apply to the tests and inspections for HDPE and CFRP.
  - Table XI.M43-2 recommends inspections on 10-linear-ft sections of pipe, and typically do not include terminal ends, which are areas of interest. Revise/eliminate this recommendation for CFRP piping.
  - Delete the steel host pipe from the scope.
  - Allow for leakage tests in lieu of other inspections and testing.
- Preliminary Response Summary: Staff agrees in part.
  - see following slide.

XI.M43, Tests and Inspections for HDPE and CFRP (cont.)

Comment 32-078 continued.

- Agree. Staff confirms that frequency and scope in Table XI.M43-2 for HDPE and CFRP materials apply to “Parameters Monitored or Inspected,” tests and inspections, paragraphs (a) and (b).
- Agree. For metal host pipe (i.e., any segment of metal pipe not repaired by CFRP and the metal substrate of CFRP terminal ends that has the CFRP installed on the interior surface of the pipe), Staff to revise Table XI.M43-2 to state that metal host pipe will be managed by GALL-SLR Report AMP XI.M41.
- Agree. Staff to revise “Scope of Program,” to state that the buried and/or underground pipes not repaired by CFRP including the metal substrate of CFRP terminal ends are managed by GALL-SLR Report AMP XI.M41, “Buried and Underground Piping and Tanks.”
- Disagree. Staff disagrees with using leakage testing (ex. IWA-5000) in lieu of all other inspections and testing specified in AMP.
  - Leakage testing by itself cannot monitor incipient degradation of the structural integrity of CFRP-repaired and HDPE piping. Leakage test is useful only when a pipe has a through wall leak.
  - Prescribed inspection and testing in the AMP, in addition to leakage testing, will provide reasonable assurance of the structural integrity of the subject piping.

XI.M43: Eliminate Prescriptive Corrective Actions/Inspections

- Comment 32-089 Summary: XI.M43, "HDPE Piping and CFRP Repaired Piping," eliminate prescriptive corrective actions (PCA)
  - PCA may not be warranted dependent on the specific findings from inspections.
  - Projecting through end of subsequent PEO as basis for expanded sample inspections is overly conservative and unclear how to implement.
- Preliminary Response Summary: Staff disagrees.
  - These are recommendations that may be used for corrective actions. Element 7 of AMP XI.M43 describes corrective actions in more detail and are similar guidelines to other AMPS.
  - Staff provided guidance for these prescriptive corrective actions to ensure structural integrity of CFRP-repaired and HDPE piping.

Long-term Loss of Material Due to General Corrosion

- Comment 32-101 Summary: Deletion of “Long-term loss of material due to general corrosion” from GALL-SLR AMR lines, associated SRP-SLR lines, and applicable AMPs.
  - General corrosion is a slow-acting long-term aging effect that is adequately addressed through the normal “loss of material” AMR lines and adequately managed through existing AMPs without any specific guidance.
  - Distinction between “Long-term loss of material due to general corrosion” and “Loss of material due to general corrosion,” not clear.
- Preliminary Response Summary: Staff Disagrees
  - Technical basis and definition of long-term loss of material provided in NUREG-2221, Rev. 0, in Table 2-29 (page 2-333).

Further Evaluation on Recurring Internal Corrosion

- Comment 32-102 Summary: Elimination of SRP further evaluation sections 3.2.2.2.7, 3.3.2.2.7, and 3.4.2.2.6 on recurring internal corrosion.
  - OE Report (NUREG-1275) documents this issue and well-understood aging issues.
  - Unnecessary since GALL-SLR and the SRP-SLR already address these issues; "recurring" is a misnomer; guidance is overly conservative.
- Preliminary Response Summary: Staff disagrees.
  - Criteria for "recurring" corrosion are given in the SRP-SLR, including one criterion for multiple incidents of a component either not meeting acceptance criteria or experiencing a reduction in wall thickness greater than 50%. For a component to meet this criterion would indicate either fast progressing corrosion or a component not meeting its intended function.
  - Eliminating further evaluations in cases of fast progressing corrosion or a component not meeting its intended function would not provide for timely identification and mitigation of degradation.
  - Further evaluations by SLR applicants complying with the SRP-SLR have resulted in component repair and replacements, mitigation of corrosive environments, and augmented inspections. This OE demonstrates the positive value of the SRP-SLR further evaluations.

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Summary of Notable Comment Responses (Structural)

XI.S6: Structures Monitoring, Change Insp. Frequency

- Comment 19 Summary: For structures in scope for 10 CFR 54.4(a)(2) only, change inspection frequency from not to exceed 5 years, to not to exceed 10 years.
  - 10 year insp. interval would be commensurate with structures safety significance.
  - OE and CAP adequate to detect and resolve any issues between inspections.
- Preliminary Response Summary: Staff disagrees.
  - NUREG 2191, AMP XI.S6, Element "Detection of Aging Effects," is general guidance for structures and components, and it states, "The inspection frequency depends on safety significance and the condition of the structure as specified in NRC RG 1.160."
  - The condition/OE of the structures and components described in 10 CFR 54.4(a)(2) are plant-specific. If structures and components described in 10 CFR 54.4(a)(2) are in scope for the purpose of aging management, their structural monitoring frequency should follow the guidance in NUREG 2191, AMP XI.S6.

Clarification on GALL Vol. 1, Item II.A1.CP- 32

- Comment 31-002 Summary: Item II.A1.CP- 32, clarification or confirmation of aging effect/mechanism for this item indicates, "Increase in porosity and permeability; loss of strength due to leaching of calcium hydroxide **and** carbonation." Focus on the significance of "and.“
- Preliminary Response Summary: Staff Disagrees.
  - Staff acknowledges that leaching of calcium hydroxide and carbonation are different aging mechanisms that can cause a loss of strength. However, staff disagrees with comment that “and” should be revised to “or” because the loss of strength could be caused by either leaching of calcium hydroxide, or due to carbonation, or a combination of both (as connoted by use of “and,” for the aging effect/mechanism description).

Clarification on GALL Vol. 1, Item II.A1.CP- 32

- Comment 31-003 Summary: [Item II.A1.CP- 32] Clarification or confirmation of the aging effect/mechanism for this item indicates, "Increase in porosity and permeability; loss of strength due to leaching of calcium hydroxide and carbonation." Focus on the significance of "carbonation." Based on this description, please indicate why carbonation is listed as an applicable aging mechanism for the identified environment of water– flowing for this item.
- Preliminary Response Summary: Staff Disagrees.
  - This environment/aging combination is dependent on the env. (water-flowing) for this line item. It is up to the licensee to evaluate whether this item is applicable to their site.

Clarification of GALL Vol. 1, Item III.A4.TP- 305

- Comment 31-006 Summary: AMR Item III.A4.TP-305, request clarification of AMR on containment internal structures considered as exterior above and below-grade inaccessible areas, which containment internal structures are exposed to water flowing env., and why containment foundation is included when it appears to be addressed by other items/tables.
- Preliminary Response Summary: Staff disagrees.
  - It depends on the plant configuration. It is up to the applicant to determine whether the component, material, environment, and aging effect combination in the AMR line item exist in their specific plant.

Clarification of GALL Vol. 1, Item III.A4.T- 36

- Comment 31-007 Summary: AMR Item III.A4.T-36, clarification of why the environment for this item listed as Air – indoor uncontrolled instead of Air-indoor uncontrolled, neutron flux.
- Preliminary Response Summary: Staff disagrees
  - The environment can be attributed in general as originally listed. Restricting the environment to neutrons will mask potential cumulative/combined aging effects on reactor vessel steel structural supports due to other environments, e.g., thermal, boric acid, etc.

XI.M18, XI.S1, XI.S3, XI.S6, Cracking of High-Strength Bolting

- Comment 32-018 Summary: Remove guidance related to cracking of high-strength bolting from various AMPs (XI.M18, XI.S1, XI.S3, XI.S6).
  - No OE on this issue since resolution of issue (NUREG-1339)
  - Issue due to installation issues, use of improper lubricants, exposure to high temperature leakage, prevalent in early plant life, not aging issues.
- Preliminary Response Summary: Staff disagrees.
  - High strength bolting is known to have greater susceptibility to stress corrosion cracking; the use of lower strength bolts remains a widely-held good practice
  - GALL-SLR AMPs include provisions for the use of higher strength bolting, with a commensurate increase in recommended inspection
    - Refer to NUREG 2191 GALL XI.S3. Element 3, “Parameters monitored or inspected,” states, “high strength bolting (actual measured yield strength greater than or equal to 150 ksi (1,034 MPa) in sizes greater than 1 inch nominal diameter (including ASTM A490 bolts and ASTM F2280 bolts), should be monitored for SCC.”

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Summary of Notable Comment Responses (Electrical)

“Potentially,” unknown Env. Exposure of Inaccessible Cables

- Comment 29-010, 32-095, 32-096, 32-097 Summary: remove “potentially” (related to unknowns in environmental exposure of inaccessible cables) from XI.E3A, XI.E3B, and XI.E3C,
  - “Potentially” not explained in the Tech. Bases Doc. or GALL-SLR, could cause confusion
- Preliminary Response Summary: Staff agrees in part.
  - Staff disagrees with deleting the word "potentially" but will clarify use of this word in XI.E3A, XI.E3B, and XI.E3C to ensure that inaccessible cables are conservatively scoped into the AMP and adequately monitored.

XI.E3A, XI.E3B, and XI.E3C Remove Requirement for Level Control Alarm at Central Location or Control Room

- Comment 32-093 Summary: Remove requirement for level control alarm at central location or control room in XI.E3A, XI.E3B, and XI.E3C.
- Preliminary Response Summary: Staff Agrees in part.
  - Staff disagreed with removing “central location or the control room;” however, staff agrees to modify the AMPs XI.E3A, XI.E3B, XI.E3C to provide general requirements for level control alarms to ensure that the causes of level alarms are expeditiously identified and addressed.
  - Credit for water level monitoring equipment can be taken if such devices have continuous self-monitoring features and generate failure alarms in a location easily identifiable and observable to ensure that the cause of the alarm is appropriately and expeditiously identified and addressed (e.g., a central location, control room, etc.).

Questions and Discussion