LICENSE RENEWAL INTERIM STAFF GUIDANCE

LR-ISG-2013-01

AGING MANAGEMENT OF LOSS OF COATING OR LINING INTEGRITY FOR INTERNAL COATINGS/LININGS ON IN-SCOPE PIPING, PIPING COMPONENTS, HEAT EXCHANGERS AND TANKS

INTRODUCTION

This license renewal interim staff guidance (LR-ISG) LR-ISG-2013-01, "Aging Management of Loss of Coating or Lining Integrity for Internal Coatings/Linings on In-Scope Piping, Piping Components, Heat Exchangers, and Tanks," provides changes to NUREG-1801, "Generic Aging Lessons Learned (GALL) Report," (GALL Report) and NUREG-1800, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants," (SRP-LR), as described below. These changes provide one acceptable approach for managing the associated aging effects for components within the scope of the License Renewal Rule (Title 10 of the *Code of Federal Regulations* (10 CFR) Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants"). A licensee may cite this LR-ISG in its license renewal application (LRA) until the guidance in this LR-ISG is incorporated into the license renewal guidance documents (i.e., GALL Report, SRP-LR).

DISCUSSION

Based on industry operating experience (OE) and the staff's review of several LRAs, the staff has determined that the GALL Report and SRP-LR should be revised to incorporate recommendations related to managing loss of coating or lining integrity (see Appendix B for the definition) due to blistering, cracking, flaking, peeling, delamination, rusting, or physical damage, and spalling for cementitious coatings/linings, of in-scope piping, piping component, heat exchanger, and tank internal coatings/linings. Loss of coating or lining integrity encompasses both the adhesion function of a coating/lining, in reference to the coating/lining potentially becoming debris, and the corrosion deterrence function of a coating/lining, in reference to loss of material for the base metal of coatings/linings (failed coatings). Loss of coating or lining integrity is also applicable to coatings exhibiting aging mechanisms such as blistering, cracking, flaking, peeling, etc. (degraded coating).

In developing these new recommendations, the staff developed:

- a new GALL Report aging management program (AMP) for internal coatings/linings for in-scope piping, piping components, heat exchangers, and tanks
- six new SRP-LR and GALL Report aging management review (AMR) line items
- changes to the existing loss of coating integrity line items associated with Service Level I coatings, and to GALL Report items AP-107, AP-108, and AP-194
- a final safety analysis report (FSAR) supplement description for the new AMP
- two new GALL Report definitions

I. Background

   a. OE indicates that failed and degraded coatings/linings have resulted in loss of material of the base metal and degraded performance of downstream equipment (e.g., heat exchangers). Based on OE examples, the staff revised the GALL Report

and the SRP-LR to include recommendations for managing the aging effects associated with internal coatings/linings for in-scope piping, piping components, heat exchangers, and tanks in which loss of the coating/lining could result in loss of material of the base metal or could prevent an in-scope component (e.g., a component that is in the scope of license renewal) from satisfactorily accomplishing any of its functions identified under 10 CFR 54.4(a)(1), (a)(2), or (a)(3) (e.g., reduction in flow, drop in pressure, reduction in heat transfer). For the purposes of this LR-ISG, the term "coating/lining" includes inorganic (e.g., zinc-based, cementitious) or organic (e.g., elastomeric or polymeric) coatings, linings (e.g., rubber, cementitious), paints, and concrete surfacers that are designed to adhere to a component to protect its surface.

b. The staff has noted that for steel pipe with elastomer-lined items (such as SRP-LR Table 3.3-1, "Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL Report," item 26), many applicants state that the elastomer lining is not credited for aging management. The staff recognizes that the corrosion allowance used for the design of a component could have incorporated a general corrosion rate that reflects 40 or 60 years of service. However, if a portion of the lining degraded and exposed the base material, more aggressive loss of material could occur than anticipated, particularly, for example, if the coated or lined steel pipe with a holiday (a skip, discontinuity, or void in a coating film) is in the vicinity of the transition to an uncoated copper or AL6XN line. As demonstrated by some of the following OE examples, loss of coating integrity has resulted in unplanned through-wall corrosion. In addition, loose lining can become debris that can result in degraded performance of downstream components. Therefore, when applied to the internal surfaces of in-scope components, coatings/linings are within the scope of license renewal, whether or not such coatings/linings are credited to prevent corrosion of the base material, and loss of coating or lining integrity is an applicable aging effect which should be managed if the coating/lining failure could prevent an in-scope component from performing its intended function identified under 10 CFR 54.4(a)(1), (a)(2), or (a)(3).

II. OE examples

Introduction: As described in Information Notice 85-24, "Failures of Protective Coatings in Pipes and Heat Exchangers," in 1982, a licensee experienced degradation of internal coatings in its spray pond piping and diesel generator heat exchangers that had been in-service for two years. Although this is not newly identified OE, the issue contains many key aspects related to coating degradation. The licensee observed severe blistering, moisture entrapment between layers of the coating, delamination, peeling, and widespread rusting. The degradation occurred as a result of improper practices during installation of the coatings, including 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 failure resulted in flow restrictions to the ultimate heat sink and blockage of the emergency diesel generator governor oil cooler.

Failure to install coatings with the correct installation prerequisites is not always immediately observable. There are three critical stages where prompt failures due to improper installation (e.g., installation techniques, coating not appropriate to application) typically become evident:

- Immediate failure. Coating failures occur as the system is being placed in or returned to service.
- First time thermal cycling. These failures become evident when a complete thermal cycle occurs resulting in the thermal movement of the substrate. Examples include a tank internal coating after it has been exposed to a winter-summer cycle, and heat-up and cool-down of a heat exchanger. If the coating was not installed properly, the substrate movement can result in a breakdown of the adhesion of the coating to the substrate.
- Two to three refueling outage intervals.

Although the root cause of the failure was related to installation practices, the failure occurred as time elapsed. Given that the effects might not always be immediately observable, the staff has concluded that subsequent inspections are necessary to ensure that coating failures are detected prior to an in-scope component's failure to satisfactorily accomplish its current licensing basis intended functions identified under 10 CFR 54.4.

Coating failures due to selection deficiencies during the planning and installation process for new coatings typically occur very early in the coating's life (less than 3 refueling cycles). However, loss of coating or lining integrity can occur later in coating life due to the effects of operating environment (e.g., erosion due to particles in the flow stream), physical damage (e.g., cavitation), or aging of the coating/lining material.

Loss of coating or lining integrity OE examples are as follows:

a. During an NRC 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 because of turbulent flow, resulted in the coating eroding away and leaving the base metal subject to wall thinning and leakage. The licensee's corrective actions included revisions to its monitoring program to include more frequent volumetric inspections of the piping system. This OE is described in an NRC Integrated Inspection Report, ADAMS Accession Number ML12045A544.

b. In 1994, a licensee replaced a portion of its cement-lined steel service water piping with piping lined with a common polyvinyl chloride (PVC) polymeric material. The manufacturer stated that the lining material had an expected life of 15 to 20 years. The licensee conducted multiple inspections from 1996 through 2003. An inspection in 1997 showed some bubbles and delamination in the coating material at a flange and an inspection in 2002 found some locations with impaired adhesion to the base metal. In 2011, diminished flow was observed downstream of one of the diesel generator heat exchangers. Inspections revealed that the lining in one piping spool piece was loose or missing in multiple locations. This spool piece had been previously inspected in 1999 with no deficiencies noted. The missing material had clogged a downstream orifice. The licensee sent a sample of the lining to a testing lab where it was determined that cracking was evident in the lining on both the metal and water side and there was a noticeable increase in the hardness of the in-service

sample as compared to an unused sample. This OE is described in Request for Additional Information (RAI) B.2.1.11-2, ADAMS Accession Number ML12041A054.

c. During an LRA AMP audit, the staff found that a licensee had experienced multiple instances of coating degradation of in-scope components, resulting in coating debris found in diesel generator intercoolers. As of March 2012, none of the debris had been large enough to result in reduced heat exchanger performance. This OE is described in RAI B2.1.9-3a, ADAMS Accession Number ML12097A064.

d. As described in Information Notice 2008-11, "Service Water System Degradation at Brunswick Steam Electric Plant Unit 1," and an NRC Special Inspection Report, ADAMS Accession Number ML073200779, a licensee experienced flow reduction over a 14-day period, resulting in the service water room cooler being declared inoperable. The flow reduction occurred because the rubber lining on a butterfly valve body became detached. The licensee had periodically experienced rubber lining and seat failures in upstream control valves. A corrective action document stated, "[t]his has been a historical problem at BNP [Brunswick Nuclear Plant] for the rubber liner in valves to fail due to aging and cracking of the rubber in a chlorinated water environment. This valve is original to the plant and the rubber lined valves in the Service Water system have been replaced with a non-rubber lined valve when the lining has failed."

e. At an international plant, cavitation in saltwater system piping downstream of a flow control valve eroded the pipe coating which resulted in unanticipated corrosion through the pipe wall. Inspection frequencies were increased. This OE is described in a report titled, "Highlights from the International Reporting System for Operating Experience (IRS) for Events in 2010 - 2011," ADAMS Accession Number ML13063A135.

f. A licensee experienced degradation of the protective concrete lining that 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 a valve located just upstream of the degraded area. This OE is described in a relief request for the temporary repair of a service water pipe, ADAMS Accession Number ML072890132.

g. 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. This OE demonstrates that unanticipated corrosion can occur when coatings are not present, ADAMS Accession Number ML14087A210.

h. A licensee experienced through-wall corrosion when a localized polymeric repair of a rubber-lined spool failed. This OE demonstrates that unanticipated corrosion can occur when coatings degrade and that localized polymeric repairs do not always remain functional, ADAMS Accession Number ML14073A059.

III. Industry guidance on degradation of coatings

a. The Electric Power Research Institute (EPRI) provided the following guidance on the effect of loss of coating or lining integrity in EPRI TR-103403, "Service Water System Corrosion and Deposition Sourcebook," which states:

> All of these barrier linings possess some degree of permeability to water and ions; hence their protective capabilities are not perfect. Further, coatings will almost always contain small flaws ("holidays") where local anodic conditions can occur. In some situations, corrosion at these holidays (small anodic areas supported by a large cathode) produces a more severe corrosion problem than if the material had never been coated at all. While the effect of such coating failures on the corrosion of the underlying metal would take time (possibly years), the failed coating itself can have an instant impact on the system. Coatings that fail as sheets or in large pieces can cause blockage of safety-related heat exchangers.

b. EPRI 1010059, "Service Water Piping Guideline," states:

> All coatings exhibit some degree of permeability to water, so they provide a barrier that is effective but less than 100% effective in keeping the environment away from the metallic pressure boundary. Permeability will be a function of the coating type and the coating thickness. Coating life, where life is defined as the time period during which the coating is nearly 100% effective at protecting the metal from corrosion, will typically be less than the life of the component (less than 40 years). These considerations require that the condition of the coating be examined periodically and that coating repairs or replacements be anticipated during the life of the service water piping.

As stated above, all coatings have some permeability, although immersion coatings are designed with very low permeability. There is evidence that for many immersion coatings, if properly applied and tested (e.g., holiday testing), the service life can extend well beyond 40 years. Even though some coatings can last beyond 40 years, this situation does not rule out the need for periodic assessment, with the frequency based on coating condition and performance.

IV. Industry use of the terms "coating" and "Service Level III coating"

a. Section 1.5.1.1, Common Terms Related to Coating Work, in EPRI 1019157, "Guideline on Nuclear Safety-Related Coatings," issued December 2009, defines paints/coatings/linings as, "[e]ssentially synonymous terms for liquid-applied materials consisting of pigments and fillers bound in a resin matrix that dry or cure to form a thin, continuous protective or decorative film. 'Linings' indicates an immersion environment." ASTM International (formerly known as American Society for Testing and Materials) Standard, ASTM D4538-05, "Standard Terminology Relating to Protective Coating and Lining Work for Power Generation Facilities," defines a coating system as "polymeric protective film consisting of one or more coats, applied in a predetermined order by prescribed methods."

The definition of the term "paints/coatings/linings" as stated in EPRI 1019157 is useful in understanding what is meant by a coating or lining; however, in order to succinctly communicate the scope of paints/coatings/linings covered by this LR-ISG, for purposes of the GALL Report, a new singular term, "coatings/linings," has been added to GALL Report Table IX.B, "Structures and Components," (see Appendix B of

this LR-ISG). The new definition of coatings/linings includes the following key aspects:

i. Coatings/linings include paints, coatings, linings, and other items such as concrete surfacers and rubber or cementitious linings.

ii. Coatings/linings can be constructed from inorganic (e.g., zinc-based, cementitious) or organic (e.g., elastomeric or polymeric) materials.

b. During the development of this LR-ISG, the staff reviewed EPRI 1019157, and Regulatory Guide (RG) 1.54, "Service Level I, II, and III Protective Coatings Applied to Nuclear Plants," Revision 2, issued October 2010, as well as several ASTM International (formerly known as American Society for Testing and Materials (ASTM)) Standards that are related to coatings and referenced in RG 1.54. In its review of these documents, the staff recognized that clarification is needed to ensure a common understanding of the scope of coatings/linings used in this LR-ISG.

EPRI 1019157 and RG 1.54 state that Service Level III "coatings are used in areas outside the reactor containment where failure could adversely affect the safety function of a safety-related SSC [systems, structures, and components]." Although this definition of Service Level III coatings sufficiently describes coatings with intended functions that meet the criterion of 10 CFR 54.4(a)(1) or 10 CFR 54.4(a)(2), it is not completely sufficient in the context of license renewal because it does not address the criterion of 10 CFR 54.4(a)(3) for coatings which, if they degrade, could impact a component's intended function(s) associated with regulated events such as station blackout or fire protection. In order to address this gap, the staff concluded that rather than creating additional "Service Level" definitions, use of the phrase "internal coatings/linings for in-scope piping, piping components, heat exchangers, and tanks" is adequate to define the scope of coatings and linings being addressed in this LR-ISG.

V. Basis for inclusion of internal coatings/linings for in-scope piping, piping components, heat exchangers, and tanks within the GALL Report

a. All coatings/linings applied to the internal surfaces of an in-scope component are in the scope of this LR-ISG if its degradation could prevent satisfactory accomplishment of any of the component's functions identified under 10 CFR 54.4(a)(1), (a)(2), or (a)(3).

b. The staff does not consider a coating/lining to be an SSC, with the exception of the example described below (i.e., GALL Report items CP-152 and TP-301). A coating/lining is applied to a component as part of its original design or later as a modification. In some instances, standard off-the-shelf components are installed with internal coatings/linings even though the licensee's specific environment does not require the protection provided by the coating/lining. However, in most cases, coatings/linings were applied with a function to prevent degradation of the base material. A coating/lining is an integral part of an in-scope component, providing it protection from corrosion whether credited for that protection or not. A coating/lining can be removed from the internal surfaces of a component; however, until such time as it is removed, it is an integral part of the component.

Although the addition of a coating/lining to a component can mitigate the potential effects of corrosion, coatings/linings can also introduce additional aging effects to

downstream components. The effects that a coating/lining can have on downstream components are similar to the impact uncoated base material can have on downstream components. For example, general corrosion of uncoated carbon steel piping can result in the release of corrosion products into the system. These corrosion products can have downstream effects such as flow blockage (see the discussion of fire water system flow blockage in LR-ISG-2012-02, "Aging Management of Internal Surfaces, Fire Water Systems, Atmospheric Storage Tanks, and Corrosion Under Insulation," where corrosion products led to complete blockage of fire water sprinkler piping) or loss of material due to fouling that leads to corrosion. Similarly, loss of coating or lining integrity can result in downstream flow blockage from debris and loss of material of the base metal.

The concept of coatings/linings being integral to the base material to which it is applied is consistent with current AMR line items in the GALL Report and SRP-LR, as follows:

- SRP-LR item 3.3.1-26, steel (with elastomer lining), steel (with elastomer lining or stainless steel cladding) piping, piping components, and piping elements exposed to treated water being managed for loss of material due to pitting and crevice corrosion (only for steel after lining/cladding degradation).
- SRP-LR item 3.3.1-37, steel (with coating or lining) piping, piping components, and piping elements exposed to raw water being managed for loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion (MIC); fouling that leads to corrosion; and lining/coating degradation.
- All of the GALL Report items for buried components include the coating or wrapping as integral to the component (i.e., EP-111, AP-198, and SP-145).

Because coatings/linings are an integral part of a component, the function(s) of the component dictates whether the component meets the scoping criteria of 10 CFR 54.4(a), and hence whether the coating/lining is considered to be in the scope of license renewal. More specifically, coatings/linings are not evaluated as stand-alone components to determine if 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 current licensing basis (CLB) because, the CLB intended function of the component dictates whether the component is in-scope. If the internally coated/lined component is in-scope, the aging effects of the coating/lining must be evaluated for potential impact associated with the component's and downstream component's intended function(s).

RG 1.54 states that, "[t]he maintenance rule requires the licensee to monitor the effectiveness of maintenance for protective coatings within its scope (as discrete systems or components or as part of any SSC) …." However, GALL Report items CP-152 and TP-301 are the only items in the GALL Report that identify a coating as a component (i.e., Service Level I coatings). RG 1.54 defines Service Level I coatings as, "[s]ervice Level I coatings are used in areas inside the reactor containment where coating failure could adversely affect the operation of post-accident fluid systems and thereby impair safe shutdown." There are many coated components within containment that are not in the scope of license renewal (e.g.,

floors, tanks, supports that do not have intended functions that meet the screening criteria of 10 CFR 54.4(a)). Therefore, in order to efficiently identify all of the applicable coated surfaces in containment, Service Level I coatings were identified as a component.

c. Components with a CLB intended function associated with 10 CFR 54.4(a)(1) include safety-related SSCs which are those relied upon to remain functional during and following design-basis events. The internal coatings/linings on components that are within the scope of license renewal because the component has a CLB intended function associated with 10 CFR 54.4(a)(1) could prevent satisfactory accomplishment of any of the functions identified under 10 CFR 54.4(a)(1) and therefore these coatings/linings are within the scope of this LR-ISG. Examples include a coating/lining applied to the inside of a diesel fuel oil storage tank, service water heat exchanger, or safety-related pipe.

d. Components with a CLB intended function associated with 10 CFR 54.4(a)(2) include all nonsafety-related SSCs whose failure could prevent satisfactory accomplishment of any of the functions identified in 10 CFR 54.4(a)(1). The internal coatings/linings on components within the scope of license renewal because the component has a CLB intended function associated with 10 CFR 54.4(a)(2) could cause a safety-related component to not meet its intended function in several ways:

    i. The internal coating/lining in an in-scope (10 CFR 54.4(a)(2)) pipe could degrade such that the base metal corrodes through-wall and sprays adjacent safety-related switchgear. This example is encompassed by the term leakage boundary (spatial) from SRP-LR Table 2.1-4(b), “Typical ‘Passive’ Component-Intended Functions,” which states, “[n]onsafety-related component that maintains mechanical and structural integrity to prevent spatial interactions that could cause failure of safety-related SSCs.”

    ii. An in-scope, internally coated/lined, nonsafety-related system that is connected to a safety-related system through a normally open isolation valve would be in the scope of this LR-ISG. The coating/lining could become detached because of aging and enter the safety-related system during routine operations, and subsequently clog the system during an accident response, or prevent the isolation valve from fully closing. An example could be a nonsafety-related water system that is used as a backup source of water for the auxiliary feedwater (AFW) system in the CLB.

    iii. The coating/lining installed inside a nonsafety-related piping segment which is in-scope because it has a structural integrity (attached) function as defined in SRP-LR Table 2.1-4(b), “[n]onsafety-related component that maintains mechanical and structural integrity to provide structural support to attached safety-related piping and components,” would be in the scope of this LR-ISG. If the coating/lining degraded, internal corrosion could occur and result in the piping segment failing during a seismic event.

e. Components with a CLB intended function associated with 10 CFR 54.4(a)(3) include all SSCs relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48), environmental qualification (10 CFR 50.49), pressurized thermal shock (10 CFR 50.61), anticipated transients without scram (10 CFR 50.62), and

station blackout (10 CFR 50.63). The internal coatings/linings on components that have a CLB intended function associated with 10 CFR 54.4(a)(3) would be in the scope of this LR-ISG. Components within the scope of license renewal under 10 CFR 54.4(a)(3) could be in the scope of this LR-ISG even though they are nonsafety-related and might not affect a safety-related function. As stated above, the coating/lining applied to the interior surface of an in-scope component becomes an integral part of the in-scope component, providing the component protection from corrosion whether credited for that protection or not. Two examples are as follows:

i. A coating/lining was installed to refurbish plant drains that drain water from a room during a fire event. If the coating/lining degrades and blocks flow in the line, a fire water sprinkler discharge could flood the room and result in an in-scope component's intended function(s) not being maintained. Many plants have designated portions of their plant drain systems as in-scope to ensure that the functions described in 10 CFR 54.4(a)(3) are successfully accomplished. For example, in relation to portions of its plant drain system, an applicant stated, "[i]t also meets 10 CFR 54.4(a)(3) because it is relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for Fire Protection (10 CFR 50.48)."

ii. A nonsafety-related demineralized water tank is used as a backup source in the CLB for the safety-related suction inventory of the AFW system. The tank is relied on during a station blackout. If the tank or its discharge piping is internally coated/lined, degradation of that coating/lining could result in a reduction of flow to the steam generators or reduction in suction pressure to the AFW pumps.

The staff recognizes that 10 CFR 54.4 does not address nonsafety-related components (e.g., those with an intended function under 10 CFR 54.4(a)(2)) whose failure could prevent satisfactory accomplishment of another nonsafety-related component's intended function. As such, to ensure that the staff's intent is clear, the following two examples are provided:

- For an in-scope piping system with a CLB intended function under 10 CFR 54.4(a)(2), if the only impact of loss of coating or lining integrity in a portion of the piping system would be to spray down an in-scope component with a CLB intended function under 10 CFR 54.4(a)(3), the aging effects for that portion of the coating/lining would not have to be managed.
- For in-scope components with a CLB intended function under 10 CFR 54.4(a)(2), flow blockage of a downstream component with a CLB intended function under 10 CFR 54.4(a)(3) would not have to be considered.

The basis for these positions is that, based on the license renewal rule, components with a CLB intended function under 10 CFR 54.4(a)(2) are only in-scope to the extent that they impact safety-related functions. The staff recognizes that for ease of documentation, the entire piping system might have been cited as meeting 10 CFR 54.4(a)(2) criteria.

VI. Summary of changes in this LR-ISG

To address the aging management of internal coatings/linings for in-scope piping, piping components, heat exchangers, and tanks, this LR-ISG implements a new GALL Report AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat

Exchangers, and Tanks." The staff used GALL Report AMP XI.S8; EPRI 1019157, RG 1.54; American Concrete Institute (ACI) Standard 201.1R-08, "Guide for Conducting a Visual Inspection of Concrete in Service," ACI Standard 349.3R-02, "Evaluation of Existing Nuclear Safety-Related Concrete Structures," and ASTM International Standards referenced in RG 1.54 to develop the recommendations contained in the new GALL Report AMP XI.M42. The staff included the new AMP in the mechanical series of AMPs instead of the structural series because the aging effects being managed by the program will be associated principally with piping, piping components, heat exchangers, and tanks, not structures. Therefore, the AMP is numbered XI.M42 and not XI.S9.

a. A summary of the key recommendations in GALL Report AMP XI.M42 is as follows:

    i. Visual inspections are conducted on internal coatings/linings. The periodicity of the visual inspections is based on an evaluation of the impact of a coating/lining failure (e.g., reduction of flow or drop in pressure, loss of material of the base metal, reduction in heat transfer) on the in-scope component's CLB intended function, potential problems identified during prior inspections, and known service life history. However, not-to-exceed inspection intervals have been established in the new AMP that are dependent on the results of previous inspections and other factors such as if the coating/lining is located in an erosive environment.

    The extent of inspections for all tanks and heat exchangers is all accessible internal surfaces. The extent of inspections for internally coated/lined piping is the lesser of either a representative sample of 73 1-foot axial length circumferential segments of piping or 50 percent of the total length of each coating/lining material and environment combination. The extent of inspections for piping is deliberately higher than for that of the GALL Report sampling-based AMPs.

    The staff recognizes that the sampling size recommended in several AMPs (e.g., XI.M32, "One-Time Inspection," XI.M33, "Selective Leaching") is based on a close approximation of a 90 percent confidence level that 90 percent of a given population is not experiencing degradation. However, the staff notes that components within the scope of these programs were generally procured, installed, and tested in accordance with industry consensus documents (e.g., ASTM Standards, American Society of Mechanical Engineers (ASME) Code Section III). However, some internal piping coatings/linings, even when installed in accordance with manufacturer's recommendations, did not have the benefit of being procured, installed, and tested in accordance with industry consensus documents that cover the same level of detail as covered in those associated with power piping or nuclear construction codes. Consequently, the staff considers that the representative sample size to manage loss of coating or lining integrity for piping internal coatings/linings that were not installed to manufacturer recommendations and industry consensus documents should be greater than the representative sample size for other GALL Report AMPs.

    Where documentation exists that manufacturer recommendations and industry consensus documents (i.e., those recommended in RG 1.54, or earlier accepted versions of those standards) were complied with during

installation, the extent of piping inspections may be reduced to the lesser of either 25 1-foot axial length circumferential segments of piping or 20 percent of the total length of each coating/lining material and environment combination.

Baseline inspections are conducted in the 10-year period prior to the period of extended operation in order to establish the condition of coatings/linings prior to entering the period of extended operation. In addition, these baseline inspections provide input to the interval of subsequent inspections.

ii. Fire water tanks are not included in the scope of the new AMP. LR-ISG-2012-02 revised GALL Report AMP XI.M27 to recommend that the internal surfaces of fire water tanks (e.g., storage tanks, foam water sprinkler system tanks) be inspected to the requirements of National Fire Protection Association (NFPA) 25, "Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems." Section 9.2.6, "Interior Inspections," of NFPA 25 covers inspections of coatings/linings for these tanks. The interior surfaces of coated/lined storage tanks are inspected every 5 years. The staff concluded that inspection of the internals of foam water sprinkler systems should occur every 10 years consistent with NFPA Table 11.1.1.2. When fire water system SSCs are internally coated/lined, the Fire Water System AMP should be enhanced with recommendations from AMP XI.M42 and its associated FSAR Description of the Program.

iii. A provision was included in the "scope of program" program element of GALL Report AMP XI.M42 to allow the use of alternative AMPs to manage the aging effects of coatings/linings installed in specific components or systems (e.g., GALL Report AMP XI.M20, "Open-Cycle Cooling Water System," for service water coatings/linings). In order to use this provision, the alternative AMP should include all the recommendations of GALL Report AMP XI.M42 and the FSAR supplement for GALL Report AMP XI.M42, as shown in SRP-LR Table 3.0-1, "FSAR Supplement for Aging Management of Applicable Systems." The "scope of program" program element for each GALL Report AMP that could be used as an alternative AMP was revised to include a discussion of this provision (See Appendix D, "Changes to the 'scope of program' Program Element of Potential Alternative AMPs").

iv. Visual inspections are intended to identify defects such as blistering, cracking, flaking, peeling, delamination, and rusting, as well as physical damage. The "parameters inspected/monitored" program element of AMP XI.M42 includes definitions for these terms. For areas not readily accessible for direct inspection, such as pipelines, heat exchangers, and other equipment, consideration is given to the use of remote or robotic inspection tools.

v. For coated/lined surfaces determined to not meet the acceptance criteria, testing or examination is conducted to ensure that the extent of repaired or replaced coatings/linings encompasses sound coating/lining material. The staff provided specific recommendations for coatings exhibiting indications of peeling and delamination that will remain in-service.

vi. The training and qualification of individuals involved in coating/lining inspections for all materials except cementitious coatings/linings, is conducted in accordance with ASTM International Standards endorsed in RG 1.54, including staff limitations. 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.

vii. The staff concluded that there are two acceptable alternatives to using GALL Report AMP XI.M42 to manage loss of coating or lining integrity. These alternatives are described in the AMP. The first is associated with components where the only CLB intended function is leakage boundary (spatial) or structural integrity (attached) as defined in SRP-LR Table 2.1-4(b) that satisfy other criteria related to the internal environment and whether the coating/lining was credited in the design analysis for the component. The second is associated with components where corrosion of the base material is the only potential aging effect related to coating/lining degradation.

b. New AMR items are included in SRP-LR Sections, Engineered Safety Features Systems (Section 3.2), Auxiliary Systems (Section 3.3), and Steam and Power Conversion Systems (Section 3.4), and in the corresponding GALL Report Tables. The staff did not revise SRP-LR Section 3.1, "Reactor Vessel, Internals, and Reactor Coolant System," because it is not aware of any instances where coatings/linings have been applied to the internal surfaces of reactor coolant pressure boundary SSCs. These new items address loss of coating integrity; loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion; fouling that leads to corrosion; and loss of material due to selective leaching for internally coated components.

   Existing SRP-LR Table 3.3-1 items 26 and 37 and GALL Report items AP-108 and AP-194 were revised to remove reference to elastomer linings. GALL Report item AP-107 was deleted because it was no longer required.

c. The new GALL Report AMP XI.M42 is included in Appendix C.

d. Details for the new SRP-LR and GALL Report items are included in Appendix A and Appendix B.

e. Corresponding changes to the FSAR supplement description are shown in Appendix A, Table 3.0-1.

f. A new material term, "coatings/linings," was added to GALL Report Section IX.C. A new aging effects term, "loss of coating or lining integrity," was added to GALL Report Section IX.E.

ACTIONS

Applicants should use Appendices A through D in preparing their LRA to be consistent with the GALL Report.

NEWLY IDENTIFIED SYSTEMS, STRUCTURES, AND COMPONENTS UNDER 10 CFR 54.37(b)

The NRC is not proposing to treat the revised recommendations for managing aging effects associated with internal coatings/linings for in-scope piping, piping components, heat exchangers, and tanks as "newly identified" SSCs under 10 CFR 54.37(b). Therefore, any additional action on such materials, which the NRC may impose upon current holders of renewed operating licenses under 10 CFR Part 54, would not fall within the scope of 10 CFR 54.37(b). The NRC would address compliance with the requirements of 10 CFR 50.109, "Backfitting," before imposing any new aging management requirements on current holders of renewed operating licenses (see discussion below).

BACKFITTING AND ISSUE FINALITY

This LR-ISG contains guidance on one acceptable approach for managing the associated aging effects occurring during the period of extended operation for internal coatings/linings for in-scope piping, piping components, heat exchangers, and tanks. The staff intends to use the guidance in this LR-ISG when reviewing current and future license renewal applications. Existing holders of renewed operating licenses may follow the guidance in this LR-ISG, but are not required to do so.

Backfitting

Issuance of this LR-ISG does not constitute backfitting as defined in the Backfit Rule for nuclear power plants, 10 CFR 50.109(a)(1), and the NRC staff did not prepare a backfit analysis for issuing this LR-ISG. There are several rationales for this conclusion, depending on the status of the nuclear power plant licensee under 10 CFR Parts 50, 52, and 54.

Licensees currently in the license renewal process - The backfitting provisions in 10 CFR 50.109 do not protect an applicant, as backfitting policy considerations are not applicable to an applicant for a renewed license. Therefore, issuance of this LR-ISG does not constitute backfitting as defined in 10 CFR 50.109(a)(1).

Licensees that already hold a renewed license - This guidance is nonbinding and the LR-ISG does not require current holders of renewed licenses to take any action (i.e., programmatic or plant hardware changes for managing the associated aging effects for components within the scope of this LR-ISG). Current holders of renewed licenses must treat the information presented in this LR-ISG as "operating experience" information, and consider the operating experience as required by their CLB to ensure that relevant AMPs are, and will remain, effective. If, in the future, the NRC decides to take additional action and impose requirements for managing the associated aging effects for components within the scope of this LR-ISG, then the NRC would follow the requirements of the Backfit Rule.

Current 10 CFR *Part 50 operating license holders that have not yet applied for renewed licenses* - The backfitting provisions in 10 CFR 50.109 do not protect any future applicant for license renewal. Therefore, issuance of this LR-ISG does not constitute backfitting as defined in 10 CFR 50.109(a)(1).

Issue Finality under 10 CFR *Part 52*

Issuance of this LR-ISG is not inconsistent with the issue finality provision applicable to standard design certifications, 10 CFR 52.63, or the specific issue finality provisions in each of the approved design certification rules within the appendices of 10 CFR Part 52. The design certification information for these rules does not address compliance with the license renewal

requirements in 10 CFR Part 54. Therefore, the issue finality provisions applicable to these design certifications do not extend to the nuclear safety issues of license renewal, and the NRC need not address these issue finality provisions when issuing this LR-ISG.

Issuance of this LR-ISG is not inconsistent with the issue finality provision, 10 CFR 52.98, which is applicable to the current combined licenses issued under 10 CFR Part 52. The NRC's issuance of those combined licenses was not based upon any consideration of compliance with the license renewal requirements in 10 CFR Part 54. Furthermore, the issue finality provisions of 10 CFR Part 52 do not extend to the aging management matters covered by 10 CFR Part 54, as evidenced by the requirement in 10 CFR 52.107, "Application for Renewal," stating that applications for renewal of a combined license must be in accordance with 10 CFR Part 54. Lastly, there are currently no combined licensees seeking license renewal under 10 CFR Part 54, and the issue finality provisions in 10 CFR Part 52 are not applicable to future applicants seeking a renewed license. Therefore, the changes and new positions presented in the LR-ISG may be made without consideration of the issue finality provisions in 10 CFR Part 52.

CONGRESSIONAL REVIEW ACT

This LR-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.

APPENDICES

Appendix A, Mark-up Showing Changes to the SRP-LR

Appendix B, Mark-up Showing Changes to the GALL Report AMR Items and Definitions

Appendix C, GALL Report AMP XI.M42, Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks

Appendix D, Changes to the "scope of program" Program Element of Potential Alternative AMPs

Appendix E, Resolution of Public Comments

For the most part, the appendices in this LR-ISG are not shown in crossed out for deleted text and underlined for added text format. The appendices were not annotated in this manner because, with the exception of the following, they consist entirely of new material. The GALL Report and associated SRP-LR AMR Tables for GALL Report items AP-107, AP-108, AP-194, CP-152, and TP-301, were shown with crossed out and underlined changes as they are existing AMR items.

REFERENCES

5 U.S.C. § 801, Congressional Review of Agency Rulemaking, Office of the Law Revision Counsel of the House of Representatives, 2012.

10 CFR Part 50, Domestic Licensing of Production and Utilization Facilities, Office of the Federal Register, National Archives and Records Administration, 2010.

10 CFR Part 54, Requirements for Renewal of Operating Licenses for Nuclear Power Plants, Office of the Federal Register, National Archives and Records Administration, 2011.

ACI Standard 201.1R-08, Guide for Conducting a Visual Inspection of Concrete in Service, 2008.

ACI Standard 349.3R-02, Evaluation of Existing Nuclear Safety-Related Concrete Structures, 2002.

ASTM D610-08, Standard Practice for Evaluating Degree of Rusting on Painted Steel Surfaces.

ASTM D714-02, Standard Test Method for Evaluating Degree of Blistering of Paints.

ASTM D722-86, Standard Test Method for Evaluating Degree of Flaking (Scaling) of Exterior Paints.

ASTM D4538-05, Standard Terminology Relating to Protective Coating and Lining Work for Power Generation Facilities.

ASTM D5163-91, Standard Guide for Establishing Procedures to Monitor the Performance of Safety Related Coatings in an Operating Nuclear Power Plant.

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.

EPRI 1019157, Plant Support Engineering: Guidelines on Nuclear Safety-Related Coatings, December 2009.

EPRI TR-103403, Service Water Corrosion and Deposition Sourcebook, December 1993.

EPRI 1010059, Service Water Piping Guideline, September 2005.

Nuclear Energy Institute, NEI 95-10, Industry Guidelines for Implementing The Requirements of 10 CFR 54 – The License Renewal Rule, Revision 6.

Regulatory Guide 1.54, Service Level I, II, and III Protective Coatings Applied to Nuclear Plants, Revision 2, October 2010.

U.S. Nuclear Regulatory Commission. NUREG-1801, Revision 2, Generic Aging Lessons Learned (GALL) Report, December 2010.

U.S. Nuclear Regulatory Commission. NUREG-1800, Revision 2, Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants, December 2010.

U.S. Nuclear Regulatory Commission, NRC Information Notice 85-24, Failures of Protective Coatings in Pipes and Heat Exchangers, March 26, 1985.

APPENDIX A

MARK-UP SHOWING CHANGES TO THE SRP-LR

Table 3.0-1 FSAR Supplement for Aging Management of Applicable Systems				
GALL Chapter	**GALL Program**	**Description of Program**	**Implementation Schedule***	**Applicable GALL Report and SRP-LR Chapter References**
XI.M42	Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks	The program consists of periodic visual inspections of all coatings/linings applied to the internal surfaces of in-scope components exposed to closed-cycle cooling water, raw water, treated water, treated borated water, waste water, lubricating oil or fuel oil where loss of coating or lining integrity could impact the component's and downstream component's current licensing basis intended function(s). 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. The training and qualification of individuals involved in coating/lining inspections of noncementitious 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.	Program is implemented no later than six months before the period of extended operation and inspections begin no later than the last refueling outage before the period of extended operation.	GALL V / SRP 3.2 GALL VII / SRP 3.3 GALL VIII / SRP 3.4

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

ID	Type	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Rev2 Item	Rev1 Item
72	BWR/PWR	Metallic piping, piping components, heat exchangers, tanks with internal coatings/linings exposed to closed-cycle cooling water, raw water, treated water, treated borated water, or lubricating oil	Loss of coating or lining integrity due to blistering, cracking, flaking, peeling, delamination, rusting, or physical damage, and spalling for cementitious coatings/linings	Chapter 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	N/A N/A N/A N/A N/A
73	BWR/PWR	Metallic piping, piping components, heat exchangers, tanks with internal coatings/linings exposed to closed-cycle cooling water, raw water, treated water, treated borated water, or lubricating oil	Loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion; fouling that leads to corrosion	Chapter 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	N/A N/A N/A N/A N/A
74	BWR/PWR	Gray cast iron piping components with internal coatings/linings exposed to closed-cycle cooling water, raw water, or treated water	Loss of material due to selective leaching	Chapter XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	No	V.A.E-415 V.B.E-415 V.C.E-415 V.D1.E-415 V.D2.E-415	N/A N/A N/A N/A N/A

APPENDIX A

MARK-UP SHOWING CHANGES TO THE SRP-LR

Table 3.2-2 Aging Management Programs Recommended for Aging Management of Engineered Safety Features	
GALL Report Chapter/AMP	**Program Name**
Chapter XI.M42	Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks

Table 3.3-2 Aging Management Programs Recommended for Aging Management of Auxiliary Systems	
GALL Report Chapter/AMP	**Program Name**
Chapter XI.M42	Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks

Table 3.4-2 Aging Management Programs Recommended for Aging Management of Steam and Power Conversion Systems	
GALL Report Chapter/AMP	**Program Name**
Chapter XI.M42	Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks

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

ID	Type	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Rev2 Item	Rev1 Item
26	BWR/PWR	~~Steel (with elastomer lining),~~ Steel ~~(~~with ~~elastomer lining or~~ stainless steel cladding~~)~~ Piping, piping components, and piping elements exposed to Treated water	Loss of material due to pitting and crevice corrosion (only ~~for steel~~ after ~~lining/~~cladding degradation)	Chapter XI.M2, “Water Chemistry,” and Chapter XI.M32, “One-Time Inspection”	No	~~VII.A3.AP-107~~ VII.A4.AP-108	~~VII.A3-9(A-39)~~ VII.A4-12(A-40)
37	BWR/PWR	Steel ~~(with coating or lining)~~ Piping, piping components, and piping elements exposed to Raw water	Loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion; fouling that leads to corrosion ~~lining/coating degradation~~	Chapter XI.M20, "Open-Cycle Cooling Water System"	No	VII.C1.AP-194 VII.C3.AP-194 VII.H2.AP-194	VII.C1-19(A-38) VII.C3-10(A-38) VII.H2-22(A-38)

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

ID	Type	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Rev2 Item	Rev1 Item
138	BWR/PWR	Metallic piping, piping components, heat exchangers, tanks with internal coatings/linings exposed to closed-cycle cooling water, raw water, treated water, treated borated water, waste water, lubricating oil, or fuel oil	Loss of coating or lining integrity due to blistering, cracking, flaking, peeling, delamination, rusting, or physical damage, and spalling for cementitious coatings/linings	Chapter XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	No	VII.A2.A-416 VII.A3.A-416 VII.A4.A-416 VII.C1.A-416 VII.C2.A-416 VII.C3.A-416 VII.D.A-416 VII.E1.A-416 VII.E2.A-416 VII.E3.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	N/A N/A N/A N/A N/A N/A N/A N/A N/A N/A N/A N/A N/A N/A N/A N/A N/A N/A N/A

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

ID	Type	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Rev2 Item	Rev1 Item
139	BWR/PWR	Metallic piping, piping components, heat exchangers, tanks with internal coatings/linings exposed to closed-cycle cooling water, raw water, treated water, treated borated water, or lubricating oil	Loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion; fouling that leads to corrosion	Chapter XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	No	VII.A2.A-414 VII.A3.A-414 VII.A4.A-414 VII.C1.A-414 VII.C2.A-414 VII.C3.A-414 VII.D.A-414 VII.E1.A-414 VII.E2.A-414 VII.E3.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	N/A N/A N/A N/A N/A N/A N/A N/A N/A N/A N/A N/A N/A N/A N/A N/A N/A N/A N/A

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

ID	Type	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Rev2 Item	Rev1 Item
140	BWR/PWR	Gray cast iron piping components with internal coatings/linings exposed to closed-cycle cooling water, raw water, or treated water	Loss of material due to selective leaching	Chapter 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.D.A-415 VII.E1.A-415 VII.E2.A-415 VII.E3.A-415 VII.E4.A-415 VII.E5.A-415 VII.F1.A-415 VII.F2.A-415 VII.F3.A-415 VII.F4.A-415 VII.G.A-415 VII.H1.A-415 VII.H2.A-415	N/A N/A N/A N/A N/A N/A N/A N/A N/A N/A N/A N/A N/A N/A N/A N/A

Table 3.4-1 Summary of Aging Management Programs for Steam and Power Conversion System Evaluated in Chapter VIII of the GALL Report

ID	Type	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Rev2 Item	Rev1 Item
66	BWR/PWR	Metallic piping, piping components, heat exchangers, tanks with internal coatings/linings exposed to closed-cycle cooling water, raw water, treated water, treated borated water, or lubricating oil	Loss of coating or lining integrity due to blistering, cracking, flaking, peeling, delamination, rusting, or physical damage, and spalling for cementitious coatings/linings	Chapter XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	No	VIII.A.S-401 VIII.B1.S-401 VIII.B2.S-401 VIII.C.S-401 VIII.D1.S-401 VIII.D2.S-401 VIII.E.S-401 VIII.F.S-401 VIII.G.S-401	N/A N/A N/A N/A N/A N/A N/A N/A N/A
67	BWR/PWR	Metallic piping, piping components, heat exchangers, tanks with internal coatings/linings exposed to closed-cycle cooling water, raw water, treated water, treated borated water, or lubricating oil	Loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion; fouling that leads to corrosion	Chapter XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	No	VIII.A.S-414 VIII.B1.S-414 VIII.B2.S-414 VIII.C.S-414 VIII.D1.S-414 VIII.D2.S-414 VIII.E.S-414 VIII.F.S-414 VIII.G.S-414	N/A N/A N/A N/A N/A N/A N/A N/A N/A
68	BWR/PWR	Gray cast iron piping components with internal coatings/linings exposed to closed-cycle cooling water, raw water, or treated water	Loss of material due to selective leaching	Chapter XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	No	VIII.A.S-415 VIII.B1.S-415 VIII.B2.S-415 VIII.C.S-415 VIII.D1.S-415 VIII.D2.S-415 VIII.E.S-415 VIII.F.S-415 VIII.G.S-415	N/A N/A N/A N/A N/A N/A N/A N/A N/A

APPENDIX A

MARK-UP SHOWING CHANGES TO THE SRP-LR

Table 3.5-1 Summary of Aging Management Programs for Containments, Structures and Component Supports Evaluated in Chapters II and III of the GALL Report							
ID	Type	Component	Aging Effect/Mechanism	Aging Management Program	Further Evaluation Recommended	Rev2 Item	Rev1 Item
34	BWR/PWR	Service Level I coatings	Loss of coating or lining integrity due to blistering, cracking, flaking, peeling, delamination, rusting, or physical damage	Chapter XI.S8, "Protective Coating Monitoring and Maintenance"	No	II.A3.CP-152 II.B4.CP-152	N/A N/A
73	BWR/PWR	Service Level I coatings	Loss of coating or lining integrity due to blistering, cracking, flaking, peeling, delamination, rusting, or physical damage	Chapter XI.S8, "Protective Coating Monitoring and Maintenance"	No	III.A4.TP-301	N/A

APPENDIX B

MARK-UP SHOWING CHANGES TO THE GALL REPORT AMR ITEMS AND DEFINITIONS

II CONTAINMENT STRUCTURES A3 & B4 Common Components							
II.A3.CP-152 II.B4.CP-152		Service Level I coatings	Coatings	Air – indoor, uncontrolled	Loss of coating integrity due to blistering, cracking, flaking, peeling, delamination, rusting, or physical damage	Chapter XI.S8, "Protective Coating Monitoring and Maintenance"	No

III STRUCTURES AND COMPONENT SUPPORTS A4 Group 4 Structures (Containment Internal Structures, excluding Refueling Canal)							
III.A4.TP-301		Service Level I coatings	Coatings	Air – indoor, uncontrolled	Loss of coating integrity due to blistering, cracking, flaking, peeling, delamination, rusting, physical damage	Chapter XI.S8, "Protective Coating Monitoring and Maintenance"	No

V ENGINEERED SAFETY FEATURES							
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
V.A.E-401 V.B.E-401 V.C.E-401 V.D1.E-401 V.D2.E-401		Piping, piping components, heat exchangers, tanks with internal coatings/linings	Metallic with internal coating/lining	Closed-cycle cooling water, raw water, treated water, treated borated water, or lubricating oil	Loss of coating or lining integrity due to blistering, cracking, flaking, peeling, delamination, rusting, or physical damage, and spalling for cementitious coatings/linings	Chapter XI.M42, “Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks”	No

APPENDIX B

MARK-UP SHOWING CHANGES TO THE GALL REPORT AMR ITEMS AND DEFINITIONS

V ENGINEERED SAFETY FEATURES							
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
V.A.E-414 V.B.E-414 V.C.E-414 V.D1.E-414 V.D2.E-414		Piping, piping components, heat exchangers, tanks with internal coatings/linings	Metallic with internal coating/lining	Closed-cycle cooling water, raw water, treated water, treated borated water, or lubricating oil	Loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion; fouling that leads to corrosion	Chapter XI.M42, “Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks”	No
V.A.E-415 V.B.E-415 V.C.E-415 V.D1.E-415 V.D2.E-415		Piping components with internal coatings/linings	Gray cast iron with internal coating/lining	Closed-cycle cooling water, raw water, or treated water	Loss of material due to selective leaching	Chapter XI.M42, “Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks”	No

APPENDIX B

MARK-UP SHOWING CHANGES TO THE GALL REPORT AMR ITEMS AND DEFINITIONS

VII AUXILIARY SYSTEMS							
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
~~VII.A3.AP-107~~	~~VII.A3-9(A-39)~~	~~Piping, piping components, and piping elements~~	~~Steel (with elastomer lining)~~	~~Treated water~~	~~Loss of material due to pitting and crevice corrosion (only for steel after lining/cladding degradation)~~	~~Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"~~	~~No~~
VII.A4.AP-108	VII.A4-12(A-40)	Piping, piping components, and piping elements	Steel ~~(~~with ~~elastomer lining or~~ stainless steel cladding~~)~~	Treated water	Loss of material due to pitting and crevice corrosion (only ~~for steel~~ after ~~lining/~~cladding degradation)	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"	No
VII.C1.AP-194 VII.C3.AP-194 VII.H2.AP-194	VII.C1-19(A-38) VII.C3-10(A-38) VII.H2-22(A-38)	Piping, piping components, and piping elements	Steel ~~(with coating or lining)~~	Raw water	Loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion; fouling that leads to corrosion ~~lining/coating degradation~~	Chapter XI.M20, "Open-Cycle Cooling Water System"	No

APPENDIX B

MARK-UP SHOWING CHANGES TO THE GALL REPORT AMR ITEMS AND DEFINITIONS

VII AUXILIARY SYSTEMS							
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
VII.A2.A-416 VII.A3.A-416 VII.A4.A-416 VII.C1.A-416 VII.C2.A-416 VII.C3.A-416 VII.D.A-416 VII.E1.A-416 VII.E2.A-416 VII.E3.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		Piping, piping components, heat exchangers, tanks with internal coatings/linings	Metallic with internal coating/lining	Closed-cycle cooling water, raw water, treated water, treated borated water, waste water, lubricating oil, fuel oil	Loss of coating or lining integrity due to blistering, cracking, flaking, peeling, delamination, rusting, or physical damage, and spalling for cementitious coatings/linings	Chapter XI.M42, “Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks”	No

APPENDIX B

MARK-UP SHOWING CHANGES TO THE GALL REPORT AMR ITEMS AND DEFINITIONS

VII AUXILIARY SYSTEMS							
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
VII.A2.A-414 VII.A3.A-414 VII.A4.A-414 VII.C1.A-414 VII.C2.A-414 VII.C3.A-414 VII.D.A-414 VII.E1.A-414 VII.E2.A-414 VII.E3.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		Piping, piping components, heat exchangers, tanks with internal coatings/linings	Metallic with internal coating/lining	Closed-cycle cooling water, raw water, treated water, treated borated water, or lubricating oil	Loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion; fouling that leads to corrosion	Chapter XI.M42, “Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks”	No

APPENDIX B

MARK-UP SHOWING CHANGES TO THE GALL REPORT AMR ITEMS AND DEFINITIONS

VII AUXILIARY SYSTEMS							
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
VII.C1.A-415 VII.C2.A-415 VII.C3.A-415 VII.D.A-415 VII.E1.A-415 VII.E2.A-415 VII.E3.A-415 VII.E4.A-415 VII.E5.A-415 VII.F1.A-415 VII.F2.A-415 VII.F3.A-415 VII.F4.A-415 VII.G.A-415 VII.H1.A-415 VII.H2.A-415		Piping components with internal coatings/linings	Gray cast iron with internal coating/lining	Closed-cycle cooling water, raw water, or treated water	Loss of material due to selective leaching	Chapter XI.M42, “Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks”	No

APPENDIX B

MARK-UP SHOWING CHANGES TO THE GALL REPORT AMR ITEMS AND DEFINITIONS

VIII STEAM AND POWER CONVERSION SYSTEMS							
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
VIII.A.S-401 VIII.B1.S-401 VIII.B2.S-401 VIII.C.S-401 VIII.D1.S-401 VIII.D2.S-401 VIII.E.S-401 VIII.F.S-401 VIII.G.S-401		Piping, piping components, heat exchangers, tanks with internal coatings/linings	Metallic with internal coating/lining	Closed-cycle cooling water, raw water, treated water, treated borated water, or lubricating oil	Loss of coating or lining integrity due to blistering, cracking, flaking, peeling, delamination, rusting, or physical damage, and spalling for cementitious coatings/linings	Chapter XI.M42, “Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks”	No
VIII.A.S-414 VIII.B1.S-414 VIII.B2.S-414 VIII.C.S-414 VIII.D1.S-414 VIII.D2.S-414 VIII.E.S-414 VIII.F.S-414 VIII.G.S-414		Piping, piping components, heat exchangers, tanks with internal coatings/linings	Metallic with internal coating/lining	Closed-cycle cooling water, raw water, treated water, treated borated water, or lubricating oil	Loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion; fouling that leads to corrosion	Chapter XI.M42, “Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks”	No
VIII.A.S-415 VIII.B1.S-415 VIII.B2.S-415 VIII.C.S-415 VIII.D1.S-415 VIII.D2.S-415 VIII.E.S-415 VIII.F.S-415 VIII.G.S-415		Piping components with internal coatings/linings	Gray cast iron with internal coating/lining	Closed-cycle cooling water, raw water, or treated water	Loss of material due to selective leaching	Chapter XI.M42, “Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks”	No

APPENDIX B

MARK-UP SHOWING CHANGES TO THE GALL REPORT AMR ITEMS AND DEFINITIONS

GALL Report Section	Term	Definition as used in this document
IX.C	Coatings/Linings	Coatings/linings include inorganic (e.g., zinc-based, cementitious) or organic (e.g., elastomeric or polymeric) coatings, linings (e.g., rubber, cementitious), paints, and concrete surfacers designed to adhere to a component to protect its surface.
IX.E	Flow blockage	Flow blockage is the reduction of flow or pressure, or both, in a component due to fouling, which can occur from an accumulation of debris such as particulate fouling (e.g., eroded coatings, corrosion products), biofouling, or macro fouling. Flow blockage can result in a reduction of heat transfer or the inability of a system to meet its intended safety function, or both. This definition is consistent with the definition of the term “pressure boundary” as found in SRP-LR Table 2.1-4(b), “Typical ‘Passive’ Component-Intended Functions.”
The definition of the term “flow blockage” was added to the GALL Report by LR-ISG-2012-02, “Aging Management of Internal Surfaces, Fire Water Systems, Atmospheric Storage Tanks, and Corrosion Under Insulation.” It is included here only for information.		
IX.E	Loss of Coating or Lining Integrity	Loss of coating or lining integrity is the disbondment of a coating/lining from its substrate. Loss of coating or lining integrity can be due to a variety of aging mechanisms such as blistering, cracking, flaking, peeling, delamination, rusting, or physical damage, and spalling for cementitious coatings/linings. Where the aging mechanism results in exposure of the base material, loss of material of the base material can occur. Where the aging mechanism results in the coating/lining not remaining adhered to the substrate, the coating/lining can become debris that could prevent an in-scope component from satisfactorily accomplishing any of its functions identified under 10 CFR 54.4(a)(1) or (a)(3) (e.g., reduction in flow, drop in pressure, reduction in heat transfer).

APPENDIX B

MARK-UP SHOWING CHANGES TO THE GALL REPORT AMR ITEMS AND DEFINITIONS

GALL Report Section	Term	Definition as used in this document
IX.F	Fouling	Fouling is an accumulation of deposits on the surface of a component or structure. This term includes accumulation and growth of aquatic organisms on a submerged metal surface or the accumulation of deposits (usually inorganic). Biofouling, a subset of fouling, can be caused by either macro-organisms (e.g., barnacles, Asian clams, zebra mussels, or others found in fresh and salt water) or micro-organisms (e.g., algae, microfouling tubercles). Fouling also can be categorized as particulate fouling (e.g., sediment, silt, dust, eroded coatings, and corrosion products), biofouling, or macrofouling (e.g., delaminated coatings, debris). Fouling in a raw water system can occur on the piping, valves, and heat exchangers. Fouling can result in a reduction of heat transfer, flow or pressure, or a loss of material.
The definition of “fouling” was revised by LR-ISG-2012-02. It is included here only for information.		

APPENDIX C

NEW PROGRAM: GALL REPORT AMP XI.M42 INTERNAL COATINGS/LININGS FOR IN-SCOPE PIPING, PIPING COMPONENTS, HEAT EXCHANGERS, AND TANKS

XI.M42 Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks

Program Description

Proper maintenance of internal coatings/linings is essential to ensure that the intended functions of in-scope components are met.

Degradation of coatings/linings can lead to loss of material, of base materials and downstream effects such as reduction in flow, reduction in pressure or reduction in heat transfer when coatings/linings become debris. The program consists of periodic visual inspections of internal coatings/linings exposed to closed-cycle cooling water, raw water, treated water, treated borated water, waste water, fuel oil, and lubricating oil. 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. EPRI Report 1019157, "Guideline on Safety-Related Coatings," provides information on the ASTM standard guidelines and coatings. American Concrete Institute (ACI) Standard 201.1R-08, "Guide for Conducting a Visual Inspection of Concrete in Service," provides guidelines for inspecting concrete.

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 closed-cycle cooling water, raw water, treated water, treated borated water, waste water, fuel oil, and lubricating oil where loss of coating or lining integrity could prevent satisfactory accomplishment of any of the component's or downstream component's CLB intended functions identified under 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 GALL Report 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 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 stand-alone 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 current licensing basis (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 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 SRP-LR Table 3.0-1, "FSAR Supplement for Aging Management of Applicable Systems," 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 and loss of material due to selective leaching need not be managed for these components by another program. Reference GALL Report Chapter VII items A-414 and A-415 as examples.

2. ***Preventive Actions:*** The program is a condition monitoring program and does not recommend any preventive actions.

3. ***Parameters Monitored/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
   - Spalling – a fragment, usually in the shape of a flake, detached from a concrete member.

   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:*** Baseline coating/lining inspections occur in the 10-year period prior to the 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.

APPENDIX C

NEW PROGRAM: GALL REPORT AMP XI.M42 INTERNAL COATINGS/LININGS FOR IN-SCOPE PIPING, PIPING COMPONENTS, HEAT EXCHANGERS, AND TANKS

Subsequent inspection intervals are established by a coating specialist qualified in accordance with an ASTM International standard endorsed in RG 1.54. However, inspection intervals should not exceed those in Table 4a, "Inspection Intervals for Internal Coatings/Linings for Tanks, Piping, Piping Components, and Heat Exchangers."

Table 4a. 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 spalling in cementitious coatings/linings.
   B. Prior inspection results do not meet category A; however, a coating specialist determined that no remediation is required.
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 mechanical damage to the coating/lining (e.g., certain heat exchanger end bells, piping downstream of certain control valves).
4. Subsequent inspections for Inspection Category B are re-inspections at the original location(s) as well as inspections of new locations.
5. When conducting inspections to 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 4a, or if the inspection results meet Inspection Category A, GALL Report AMP XI.M30.

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.

- Tanks – all accessible internal surfaces
- Heat exchangers – all accessible internal surfaces
- Piping – either inspect a representative sample of 73 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. The inspection surface includes the entire inside 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 73 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.

  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 25 1-foot axial length circumferential segments of piping or 20 percent of the total length of each coating/lining material and environment combination.

The coating/lining environment includes both the environment inside 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 (i.e., item (a) or (b)) is an acceptable alternative to the inspections recommended in this AMP when:

- loss of coating or lining integrity cannot result in downstream effects such as reduction in flow, drop in pressure, or reduction in 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-LR 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 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. The grid dimensions for the representative sample should be consistent with those for inspections for flow-accelerated corrosion.

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

In addition, where loss of coating or lining integrity cannot result in downstream effects such as reduction in flow, drop in pressure, or reduction in 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 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. A representative sample size is described above with grid dimensions being those consistent with inspections for flow-accelerated corrosion.

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.

5. ***Monitoring and Trending:*** A pre-inspection 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. When corrosion of the base material is the only issue related to coating/lining degradation of the component and external wall thickness measurements are used in lieu of internal visual inspections of the coating/lining, the corrosion rate of the base metal is trended.

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

   a. Indications of peeling and delamination are not acceptable.

   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 and frequency should not be increasing between inspections (e.g., reference 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: Coatings/linings that do not meet acceptance criteria are repaired, replaced, or removed. Testing or examination is conducted to ensure that the extent of repaired or replaced coatings/linings encompasses sound coating/lining material.

As an alternative, 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 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 of the coated component; and (e) followup visual inspections of the degraded coating are conducted within 2 years from detection of the degraded condition, with a re-inspection 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 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.

If a blister 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 in-service should be based both on the potential effects of flow blockage and degradation of the base material beneath the blister.

The site corrective actions program is implemented in accordance with the requirements of 10 CFR Part 50, Appendix B.

8. ***Confirmation Process:*** As discussed in the Appendix for GALL, the staff finds the requirements of 10 CFR Part 50, Appendix B, acceptable to address the confirmation process.

9. ***Administrative Controls:*** As discussed in the Appendix for GALL, the staff finds the requirements of 10 CFR Part 50, Appendix B, acceptable to address the administrative controls.

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 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 NRC 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. (ADAMS Accession Number 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 Number 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 Number 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 Number 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 Number 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 Number 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 Number ML14087A210).

i. A licensee experienced through-wall corrosion when a localized polymeric repair of a rubber-lined spool failed. (ADAMS Accession Number ML14073A059).

References

10 CFR Part 50, Appendix B, *Quality Assurance Criteria for Nuclear Power Plants*, Office of the Federal Register, National Archives and Records Administration, 2009.

ACI Standard 201.1R-08, Guide for Conducting a Visual Inspection of Concrete in Service, 2008.

ACI Standard 349.3R-02, Evaluation of Existing Nuclear Safety-Related Concrete Structures, 2002.

ASTM D714-02, Standard Test Method for Evaluating Degree of Blistering of Paints

ASTM D4538-05, Standard Terminology Relating to Protective Coating and Lining Work for Power Generation Facilities.

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.

EPRI Report 1019157, *Guideline on Nuclear Safety-Related Coatings*, Revision 2, (Formerly TR-109937 and 1003102), Electric Power Research Institute, December 2009.

NRC Regulatory Guide 1.54, Rev. 2, *Service Level I, II, and III Protective Coatings Applied to Nuclear Power Plants,* U.S. Nuclear Regulatory Commission, October 2010.

U.S. Nuclear Regulatory Commission, NRC Information Notice 85-24, Failures of Protective Coatings in Pipes and Heat Exchangers, March 26, 1985.

APPENDIX D

CHANGES TO THE "SCOPE OF PROGRAM" PROGRAM ELEMENT OF POTENTIAL ALTERNATIVE AMPS

The text below will be added to Program Element 1, "scope of program," for the following AMPs as a new paragraph following the existing paragraph(s):

- GALL Report AMP XI.M20, "Open-Cycle Cooling Water System"
- GALL Report AMP XI.M21A, "Closed Treated Water Systems"
- GALL Report AMP XI.M24, "Compressed Air Monitoring"
- GALL Report AMP XI.M27, "Fire Water System"
- GALL Report AMP XI.M29, "Aboveground Metallic Tanks"
- GALL Report AMP XI.M30, "Fuel Oil Chemistry"
- GALL Report AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"

This program may be used to manage the aging effects for coatings/linings that are applied to the internal surfaces of components included in the scope of this program as long as the following are met:

- The recommendations of GALL Report AMP XI.M42 are incorporated into this AMP.
- Exceptions or enhancements associated with the recommendations in GALL Report AMP XI.M42 are included in this AMP.
- The FSAR supplement for GALL Report AMP XI.M42, as shown in SRP-LR Table 3.0-1, "FSAR Supplement for Aging Management of Applicable Systems," is included in the application with a reference to this AMP.

In addition, for GALL Report AMP XI.M27, the text below will be added to Program Element 1, "scope of program," as a new paragraph following the existing paragraph(s):

The aging effects associated with fire water tank internal coatings/linings are managed by this AMP in lieu of AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks." However, where the fire water storage tank internals, are coated, the Fire Water System Program and 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 of AMP XI.M42. The Fire Water System Program should also be enhanced to include the recommendations from the "acceptance criteria" program element of AMP XI.M42.

APPENDIX E

RESOLUTION OF PUBLIC COMMENTS

Note: The Nuclear Energy Institute (NEI) submitted comments related to LR-ISG-2012-02 by letter dated June 14, 2013 (ADAMS Accession No. ML13168A397), which integrated multiple industry comments on the subject LR-ISG. NEI provided three attachments in its letter:

- Attachment 1, "LR-ISG-2012-02 Significant Industry Comments and Considerations"
- Attachment 2, "Detailed Industry Comments"
- Attachment 3, "Supplemental Details"

The text of Attachments 1 and 3 are not included in this Appendix as the specific details and NRC resolution of comments is covered below in the table.

As requested by the staff, NEI provided input related to the potential to split the LR-ISG into multiple parts. The industry requested that the portion of the LR-ISG addressing Service Level III (augmented) coatings be removed from LR-ISG-2012-02, "Aging Management of Internal Surfaces, Fire Water Systems, Atmospheric Storage Tanks, and Corrosion Under Insulation," and addressed in a new LR-ISG. The industry request stated that this would allow for further discussion on the recommendations associated with Service Level III (augmented) coatings, while progressing with issuance of LR-ISG-2012-02. The staff agreed with this change. Industry comments as originally submitted for the review of draft LR-ISG-2012-02 (i.e., numbered 5, 6, and 74 through 81) related to Service Level III (augmented) coatings are therefore addressed below. Note that in LR-ISG-2012-02, the term "Other" was used in place of Service Level III (augmented).

Original Comments from the Public Review of Draft LR-ISG-2012-02 Comment Nos. 5 - 6 and 74 - 81		
#	Comment	Staff Resolution

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Original Comments from the Public Review of Draft LR-ISG-2012-02 Comment Nos. 5 - 6 and 74 - 81		
#	Comment	Staff Resolution
5	If coatings are treated as a non-safety related SSC, it would seem that inclusion of Service Level III coatings or other coatings on the basis that the loss of the coating could "prevent an in-scope component from satisfactorily accomplishing any of its functions identified under 10 CFR 54.4(a)(1), (a)(2), or (a)(3)" would appear to be an expansion of the non-safety affecting safety license renewal scoping criterion. However, if coatings are treated as a part of a "piping component," does this ISG imply all coatings that could prevent satisfactorily accomplishing a 10 CFR 54.4(a)(1), (a)(2), or (a)(3) function are in-scope or only those coatings associated with in-scope piping? For example, if a backup demineralized water tank is not the credited source in a plant's CLB for SBO event, then is the tank in-scope simply because a coating failure could prevent the SBO intended function from being performed? 10 CFR 54.4(a)(2) states that all non-safety related SSCs whose failure could prevent satisfactory accomplishment of any of the functions identified in Section 54.4(a)(1) should be included within the scope of the Rule. It does not include subject non-safety related (NSR) components that could prevent satisfactorily accomplishment of functions identified under 54.4(a)(2) or (a)(3). As an analogy, a NSR pipe which is located in the same room or space as a functional (a)(2) or (a)(3) equipment failure has a potential to cause spatial interaction that could prevent their accomplishment of an intended function; however, such NSR piping, if located in a space or room that only contains functional (a)(2) or (a)(3) equipment, is not required to be in the scope of license renewal following the guidance in NEI 95-10 Appendix F, while coatings as proposed under this ISG would be in-scope.	The LR-ISG was revised to clarify the staff's intent. The staff does not consider a coating/lining to be an SSC. A coating/lining is an integral part of an in-scope component, providing it protection from corrosion, whether credited for that protection or not. The basis for this statement has been included in LR-ISG Section V.b. The function(s) of the component determines whether it has an intended function(s) that meets the scoping criteria of 10 CFR 54.4(a). Internal coatings/linings are not evaluated as stand-alone components to determine whether they meet the scoping criteria of 10 CFR 54.4(a). The staff has clarified the LR-ISG wording to more clearly communicate that the subject coatings/linings are those applied to the internal surfaces of in-scope components. Therefore, in response to the example in the first paragraph of the comment, if the backup demineralized water tank is not the credited source in a plant's CLB for a station blackout (SBO) event, the coatings/linings installed inside that tank would not be in-scope.
6	ISG states "Visual inspection will be conducted on all coatings that could affect a license renewal function". Delete the word "all" or revise the statement as follows. "Visual inspection will be conducted on ~~all~~ coatings <u>as noted in the AMP</u> that could affect a license renewal function". This is a significant burden on the plant if 100% visual inspection is required as opposed to sampling methodology that takes into account worst case locations, highest flow, highest risk consequence, etc. Revise this bullet consistent with proposed changes to AMP XI.M42.	The staff agrees with this comment in part. For tanks and heat exchangers, the staff has concluded that all accessible surfaces should be inspected, and therefore the staff has not proposed a change to the LR-ISG for these components. However, for piping, GALL Report AMP XI.M42 was revised to recommend a sample size sufficient to establish reasonable assurance that the CLB intended function(s) of internally coated/lined in-scope components would be met during the period of extended operation.
74	AMP XI.M42 Program Description In the 11th line of the program description, the comma should go after the word "degraded" and not "deficient".	The Program Description was editorially corrected as recommended.

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75	AMP XI.M42 Exclude fuel oil tank coatings from the scope of AMP XI.M42. Coatings used in fuel oil tanks (such as epoxies) are inspected during the tank cleaning and inspection recommended by AMP XI.M30. These coatings are not exposed to high fluid velocities, and a search of recent industry OE did not identify any recent fuel oil tank coating/lining degradation that resulted in downstream effects such as reduction of flow, reduction in pressure or reduction of heat transfer. EPRI 1019157 (Guideline on Nuclear Safety Related Coatings) recommends assessment of fuel oil tank coatings every ten years due to the reliability of these coatings. In addition ten years is also the frequency of the diesel fuel oil tank cleaning cycle noted in Regulatory Guide 1.137.	The staff does not agree with this comment, although a new footnote was added to Table 4a as described below. The staff noted the following: • Regulatory Guide 1.137, "Fuel-Oil Systems for Standby Diesel Generators," states, "[a]s a minimum, the fuel oil stored in the supply tanks should be removed, the accumulated sediment removed, the tanks cleaned, and the interior inspected at 10-year intervals." • EPRI 1019157, Table 8-1, "Condition assessment applications and frequency," recommends that the coatings on each diesel fuel oil storage tank be inspected every ten years. • GALL Report AMP XI.M30, "Fuel Oil Chemistry," recommends that tank internal inspections be conducted at least once during the 10-year period prior to the period of extended operation and once during each 10-year period of the period of extended operation. AMP XI.M30 does not have recommendations related to coating/lining inspections and therefore the staff concludes that fuel oil tank coatings/linings should not be removed from the scope of AMP XI.M42. During AMP audits, the staff has noted degraded internal fuel oil storage tank coatings/linings during its search of plant-specific operating experience. These degraded coatings/linings could continue to degrade to the point where an intended function could be lost. In conjunction with other changes, AMP XI.M42, Table 4a states that for inspection Category A (i.e., "[n]o peeling, delamination, blisters, or rusting are observed. Any cracking and flaking has been found acceptable in accordance with the 'acceptance criteria' program element of this AMP)" inspections can occur on 6-year intervals. These inspection intervals can be extended to 12 years if inspection Category A is met and if 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, as long as at least one of the trains is inspected every 6 years. Therefore, if the tank's internal coatings/linings are not degraded and there is a redundant fuel oil storage tank, the LR-ISG recommends an inspection interval that exceeds the 10 years recommended in the Regulatory Guide and EPRI document. However, if degraded coatings/linings are observed, more frequent inspections are warranted. In order to address plants with only one fuel oil storage tank, a new footnote to Table 4a was added to align the internal inspection interval to AMP XI.M30 and Regulatory Guide 1.137 frequency as long as the inspection results meet Inspection Category A criteria.

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76	AMP XI.M42 Element 2 In element 2, delete "However, for plants that credit coatings to minimize loss of material, this program is a preventive action." For such cases, the coating is a preventive measure, but the program does not include preventing actions… it remains a condition monitoring program.	The staff agrees with this comment. The statement was deleted.
77	AMP XI.M42 Element 4 Delete the third and fourth paragraph after the notes in element 4. Revise the acceptance criteria to state that peeling or delaminations are repaired or replaced. Additional measures for coatings not meeting acceptance criteria need to be identified in element 6 or 7. Adhesion tests referenced in RG 1.54 are potentially destructive and provide no compensatory considerations/allowances for wetted surface coatings that are in service.	The staff agrees in part with this comment. The paragraph on peeling and laminations was relocated to the “acceptance criteria” program element and integrated into the paragraphs related to peeling or delamination and blistering. The staff does not agree with the comment on adhesion testing; however, the reference to adhesion testing was changed to be an example of physical testing. The staff has concluded that it is appropriate to perform testing to demonstrate that as-left coatings are sound (e.g. blister surrounded by sound material) because peeling, delamination, and blistering can result in the release of large portions of coating/lining that could significantly impact flow, pressure, and heat transfer in downstream components.
78	AMP XI.M42 Element 4 “Other” coatings do not meet the scoping criteria as defined in 10 CFR 54.4 and should be deleted from this ISG. Due to its size, the discussion for deletion of "other" coatings is available in Attachment 3 Section 1.0.	See the response to Comment No. 5.

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#	Comment	Staff Resolution
79	AMP XI.M42 Element 4 Recommend the following changes to AMP XI.42:1. In the program description delete the following parenthetical expression in the first sentence of the program description. (as defined in RG 1.54, "Service Level I, II, III Protective Coatings Applied to Nuclear Plants," Revision 2 or latest version). 2. Insert the definition of Service Level III (SL3) coatings as the second sentence of the program description. 3. In element 4 in the second paragraph after Table 4a notes, delete the reference to RG 1.54 and list the applicable ASTM International Standards. The intent of the reference to RG 1.54 in the program description was to point to a definition for SL3 coatings. Including the definition of SL3 coatings would be more appropriate. As written, the program description could be interpreted to mean that maintenance of SL3 coatings that is described in this AMP and that maintenance is consistent with RG 1.54. To avoid misunderstanding or possible AMP exceptions, the ASTM standards that are endorsed for adhesion testing should be identified in the AMP without reference to RG 1.54.	The staff agrees with the first part of this comment. The staff has concluded that rather than creating additional "Service Level" definitions, use of the phrase "internal coatings/linings for in-scope piping, piping components, heat exchangers, and tanks" is adequate to define the scope of coatings/linings being addressed in this LR-ISG. The staff also deleted the reference to Regulatory Guide 1.54 from the Program Description. The staff does not agree with the change to Program Element 4. Referring to the Regulatory Guide for appropriate ASTM standards related to adhesion testing allows the adoption of future ASTM standards to be used in the program when the Regulatory Guide is updated.
80	AMP XI.M42 Element 4 Provide a sample population for coating inspections. A 100% inspection of all internally coated piping on a two year frequency for plants with a large population of coated components can be a large undertaking. In addition, remote technology might not be readily available for long lengths of internally coated buried pipe or drain piping embedded in concrete. A 100% inspection is neither warranted (at least for some coatings) nor practical. Some buried fire protection piping is cement lined, and performs very well over very long time frames. However, inspection is extraordinarily onerous, unlikely to identify degradation, but may actually increase the potential for degradation, where excavation is necessary to gain access to the piping internal surfaces.	The staff agrees with this comment. The "detection of aging effects" program element was revised to include inspection intervals based on inspection results. In addition, the program element extent of inspection was revised for piping segments to be sampling based. See the response to Comment No. 6.

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Original Comments from the Public Review of Draft LR-ISG-2012-02 Comment Nos. 5 - 6 and 74 - 81		
#	Comment	Staff Resolution
81	App. H Element 4 Delete the fourth paragraph after the notes in element 4 about determining corrosion rates and performing external wall thickness measurements. External wall thickness measurements should not be required by the coatings program. Loss of material on the internal surfaces of mechanical fluid systems within the scope of license renewal is managed by other AMPs noted in GALL. Unless identified by the CLB, corrosion rates and inspection intervals for loss of material should not be included in a coatings AMP.	The staff does not agree with this comment. The provision addresses alternatives to coating/lining inspections. In some cases, as defined by the alternative, wall thickness measurements are appropriate. The applicant does not have to implement the wall thickness measurements if it conducts the coatings/linings inspections.

The following comments were received subsequent to the issuance of LR-ISG-2013-01 for public comment on January 10, 2014. Comment numbers 5 and 6, and 74 - 81 were not used to avoid overlap with comments received related to LR-ISG-2012-02.

- Comment Nos. 1 – 4 and 7 – 10 were received from Daniel L Cox, P.E., (ADAMS Accession No. ML14055A250)
- Comment Nos. 11 – 73 and 82 - 119 were received from the Nuclear Energy Institute (NEI). (ADAMS Accession No. ML14058A181)

The comment number in brackets corresponds to the NEI comment number when applicable.

#	Comment	Staff Resolution
1	Discussion, page 1: "...GALL Report and SRP-LR should be revised to incorporate recommendations related to managing *loss of coating integrity* due to blistering, cracking, flaking, peeling, or physical damage of Service Level III (augmented) coatings." Comment: *loss of coating integrity* should be consistently used Suggested change: *loss of coating integrity* has two parts, failed coating and degraded coating: Use *failed coating* when referring to detachment or disbondment. This is consistent with the concern in Coatings Service Level I, where debris generation is the major concern. Use *degraded coating* when referring to all other related coating anomalies, such as blistering, cracking, flaking, peeling, or physical damage.	The staff agrees with this comment in part. The staff has concluded that the term "loss of coating integrity" as currently used in the GALL Report for Service Level I coatings is appropriate. The purpose of declaring an aging effect is to associate it with a material, environment, aging mechanism and recommended aging management program (MEAP) in the GALL Report. The aging effect/mechanism for Service Level I coatings is loss of coating integrity due to blistering, cracking, flaking, peeling, delamination, rusting, or physical damage. This aging effect/mechanism is equally applicable to other coatings/linings. For GALL Report purposes (i.e., selecting the correct MEAP combination), it is immaterial whether the coating/lining is failed or degraded. However, the staff agrees that clarification as described in the comment would be beneficial. A description of failed and degraded coatings was added to the beginning of the LR-ISG in the Discussion portion.
2	Background, page 1, 1.a: OE indicates that *degraded coatings* have resulted in unanticipated or accelerated corrosion of the base metal and degraded performance of downstream equipment (e.g., heat exchangers). Comment: *loss of coating integrity* should be consistently used Suggested change: see comment 1	The staff agrees with this comment. Using the term "failed coating" in this case provides clarity. The change was incorporated as recommended in the comment.

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#	Comment	Staff Resolution
3	OE examples, II.a., pages 2 and 3 Coating degradation leading to failure to generate debris or result in loss of corrosion protection can take much longer. It can state with a crack, allowing localized corrosion, resulting in blistering, pealing and delamination. The subsequent paragraphs address failures and degradation that occurred in time frames well beyond 3 refueling cycles. This can result to unnecessary confusion. Suggested change: In order to ensure a clear understanding of *the issue this needs to be addressed in a new sub-paragraph iv. I suggest something to the effect:* *iv. Coating failures due to selection or installation deficiencies typically occur very early in the coatings life (< 3 refueling cycles). However, loss of coating integrity can occur later in coating life due to the effects of operating environment (e.g., turbulence and erosion), physical damage, or ultimately aging.*	The staff agrees with this comment. It provides an appropriate perspective that coating/lining failures can also occur due to improper selection. The change was incorporated as recommended in the comment with the exception of deleting the words “or installation” because installation errors were already addressed earlier in this section of the LR-ISG.
4	Industry Guidance on Degraded Coatings, III.a..and III.b., pages 4 and 5. Comment: Though it is true all coatings have some permeability, immersion coatings are designed with very low permeability. There is evidence that many immersion coatings, if properly applied and tested (holiday), the service life can extend well beyond 40 years. Suggested Change: For clarity, I suggest a statement be made that even though some coatings can last beyond 40 years, this still does not rule out the need for periodic assessment and the frequency should be based on coating condition and performance.	The staff agrees with this comment. The change reinforces the need to conduct condition assessments of coatings/linings. The change was incorporated as recommended in the comment.
Comment Nos. 5 & 6 were associated with comments on Draft LR-ISG-2012-02		

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#	Comment	Staff Resolution
7	Definition of Service Level III (augmented) Coatings Definition of Service Levels need to be different between *Safety Related* and *Non-Safety Related* coatings. SSCs identified under 10 CFR 54.4(a)(1) and (a)(2) are classified as *Safety Related.* SSCs identified under 10 CFR 54.4(a)(3) are classified as *Non- Safety Related.* *It should be noted that the original definitions of Coatings Service Level I, II, and III were developed to address the COATING, and what affect the COATING would have if it failed, NOT what effect the LACK OF COATING would have, i.e., corrosion.* Suggested Change: Leave the current definition of Coatings Service Level III as defined in ASTM D4538 as is, and use ASTM definition proposed new definition of Coatings Service Level LR. My proposed revision to that definition is: *Coating Service Level LR -- coatings include those applied to the internal surfaces of structures, systems, and components (SSC) identified in 10 CFR 54.4(a)(3) whose loss of coating integrity through failure (debris generation) or degradation (blistering, cracking, flaking, peeling, holidays, or physical damage) could prevent satisfactory accomplishment of any of the SSC intended functions. These coatings are not considered nuclear safety-related.*	The staff agrees with this comment; however the staff concluded that rather than creating additional "Service Level" definitions, use of the phrase "internal coatings/linings for in-scope piping, piping components, heat exchangers, and tanks" is better than the term "Coating Service Level LR" to define the scope of coatings/linings being addressed in this LR-ISG.
8	V.e.i, page 8 Floor drains can clog by other than coating failure. If the drains are other than stainless steel, such as normal ductile iron, corrosion products can clog, as well as other debris. In addition, this type of event could conceivably impact 10CFR54.4(a)(1) and (a)(2) components as well, if the drains were, for example, in the Auxiliary Feedwater Pump Room. Suggested Change: Having the floor drains in the scope of this ISG can overlook the other clogging mechanisms. This should be in the scope of the structures ISG.	The staff does not agree with this comment. Aging effects associated with floor drains have been appropriately addressed in LRAs; and mechanical system AMPs (e.g., XI.M38) have been cited to manage the aging effects. Loss of material in floor drains exposed to waste water or raw water is typically managed by GALL Report AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components." See GALL Report item SP-136. The staff recognizes that there are many ways floor drains can clog. However, if the drain lines are in-scope and coated or lined, loss of coating or lining integrity could result in flow blockage. The staff has provided alternatives to the use of AMP XI.M42, for which drain piping might be applicable, in certain instances. See the response to Comment No. 28.

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9	Appendix B, Definition of Coating Comment: linings (e.g., rubber, cementitious) are not contained within the ASTM D33 committee Standard D4538 for Coating System or Lining definition: *coating system, n*—polymeric protective film consisting of one or more coats, applied in a predetermined order by prescribed methods. *lining, n*—particular type of coating intended for protection of substrates from corrosion as a result of continuous or intermittent fluid immersion. Suggested Change: Rubber linings are covered by ASTM D7602-11. There is, however, no ASTM D33 standard for Cementitious lining materials. To minimize confusion of terms, (e.g., coatings and linings), *rubber and cementitious lining materials should have their own definition separate from coatings and linings.* These materials are typically NOT part of the coatings program, and may take special training and qualifications for proper assessment of performance.	The staff agrees with this comment in part. As stated in Section IV.c. of this LR-ISG, EPRI 1019157 defines paints/coatings/linings as, "[e]ssentially synonymous terms for liquid-applied materials consisting of pigments and fillers bound in a resin matrix that dry or cure to form a thin, continuous protective or decorative film. 'Linings' indicates an immersion environment." ASTM D4538 defines the term "lining" as [a] "particular type of coating intended for protection of substrates from corrosion as a result of continuous or intermittent fluid immersion." RG 1.54 states "ASTM D 3912-10, 'Standard Test Method for Chemical Resistance of Coatings and Linings for Use in Nuclear Power Plants' (Ref. 17), provides guidance that the NRC staff finds acceptable for evaluating the chemical resistance of coatings applied to light-water NPPs." However, while RG 1.54 includes definitions for Service Level I, II, and III coatings, the definitions do not include the term "lining." RG 1.54 also references ASTM D 7167 and ASTM D 4538 which include the term "lining." The staff is not aware of any widespread confusion in the industry in relation to the intermixing of the terms "coating" and "lining." Including separate definitions for coatings and linings would unnecessarily complicate the LR-ISG. However, in order to more clearly present the scope of this LR-ISG and the new AMP XI.M42, the staff has replaced the term "coating" with "coating/lining," and the term "loss of coating integrity" with "loss of coating or lining integrity." The term "loss of coating integrity" associated with Service Level I coatings was not changed because the term is currently used in the GALL Report and there does not appear to be any industry misunderstanding of its use. In addition, the term "Service Level III" is no longer used in the LR-ISG and AMP XI.M42 and, therefore, ambiguity in relation to rubber and cementitious materials being in-scope has been minimized. The staff evaluated the training programs referenced in AMP XI.M42 and concluded that with the acceptance criteria recommended in the program, a coatings specialist should be able to evaluate linings (i.e., rubber, polymeric). The staff incorporated training requirements for cementitious coatings/linings based on ACI 349.3R-02.

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#	Comment	Staff Resolution
10	Appendix B, Definition of Loss of Coating Integrity Comment: This term is not defined in any industry standard, and is inconsistent with the intent of *failed coating* used in the definition of Coatings Service Level I, where disbondment results in debris generation is the major concern. *Loss of coating integrity* is NOT only the disbondment of a coating from its substrate. It IS also the loss of film integrity, such as blisters, cracks, holidays, etc. It may be the appropriate term for Coatings Service Level III, where both debris generation and pressure boundary corrosion is a concern. Suggested Change: *loss of coating integrity* has two parts, failed coating and degraded coating: Use *failed coating* when referring to detachment or disbondment. This is consistent with the concern in Coatings Service Level I, where debris generation is the major concern. Use *degraded coating* when referring to all other related coating anomalies, such as blistering, cracking, flaking, peeling, or physical damage. *The term may better be defined as: Loss of coating integrity - The failure of a coating where disbondment results in debris generation, or coating degradation where blistering, cracking, flaking, peeling, holidays or physical damage has compromised the corrosion protection properties.*	The staff agrees with this comment in part. Loss of coating integrity is not a new aging effect. The GALL Report currently cites loss of coating integrity in association with Service Level I coatings. However, the LR-ISG was revised to reference the definition (contained in Appendix B) in the opening paragraph of the Discussion Section of this LR-ISG. The definition clearly covers the safety function (adhesion) in reference to the coating/lining potentially becoming debris, and operational function (corrosion deterrence), in reference to loss of material of the base metal, including accelerated corrosion. These functions were also introduced in general terms in the opening paragraph of the Discussion Section of this LR-ISG.

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#	Comment	Staff Resolution
11 [1]	The ISG should be revised to focus on age-related degradation of coating systems that remain in service beyond their qualified service life. The ISG addresses degradation of coatings which are generally not long-lived (i.e., coatings have a qualified life as specified by the manufacturer). This ISG should only address age-related coatings issues. However, the ISG primarily addresses non-age-related installation and design issues that are not pertinent to License Renewal. In addition to the non-age-related issues, the ISG addresses operating experience of age-related degradation that has occurred when a coating system has remained in operation beyond its qualified design life. If an applicant chooses to keep a coating system in service beyond its qualified life and replace based on condition, then the condition monitoring of the coating needs to be evaluated as an AMP and, therefore, the recommendations of this ISG may apply. The first principle of the license renewal rule (10 CFR 54) is that the existing regulatory process is adequate to ensure that the licensing bases of all currently operating plants provide and maintain an acceptable level of safety for operation such that operation will not be inimical to public health and safety or common defense and security with the exception of detrimental effects of aging on the functionality of certain SSCs during the PEO and other issues related to safety only during the period extended of operation. As stated in the ISG, internal coatings are generally not expected to last more than 15-20 years and OE of coating failures is normally due to the mis-application of the coating or the use of the wrong type of coating and, as such, occur in the first few years after installation (see ISG section II.a). Therefore, since these types of coating failures are not due to age-related degradation, the existing regulatory process is sufficient (i.e., 10 CFR Part 50). Furthermore, since the degradation and failure of coatings is not unique to the period of extended operation, any significant additions to safety obtained through the performance of the recommendations made in this ISG would also be applicable during the current operating term. That is, if the recommendations made in this ISG significantly add to safety then there is no basis for waiting until the period of extended operation before implementing the program. This issue should be and has been addressed for the initial operating term (i.e., through the issuance of IN 85-24, Reg Guide 1.54). The existing regulatory process (i.e., 10 CFR Part 50), as continued during the period of extended operation, provides reasonable assurance that non-age-related degradation and failure of internal coatings are managed such that an acceptable level of safety for operation will be maintained.	The staff does not agree with this comment, although changes to clarify the staff's position are as noted below. The staff noted the following in regard to the 8 themes discussed in this comment: • 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. To provide clarity, the staff revised the "scope of program" element of AMP XI.M42 to state this. • The LR-ISG does not "primarily address non-age-related installation and design issues that are not pertinent to License Renewal." With the changes incorporated as a result of these comments (e.g., elimination of Inspection Category C in Table 4a of AMP XI.M42), the LR-ISG focuses on inspections of coatings/linings to ensure that loss of coating or lining integrity will be detected prior to degradation of the coating/lining causing the loss of a CLB intended function. • The statement that implies that managing the aging effects of a coating/lining is only appropriate if it is kept in-service beyond its qualified life is not consistent with the GALL Report. The GALL Report recommends inspections of myriads of component types (e.g., piping, pump casings) that would not be anticipated to reach the end of their qualified lives prior to the end of the period of extended operation. • The staff agrees with the first principle of license renewal. However, the staff has concluded that coatings/linings can degrade as they age and this degradation can result in detrimental effects on the functionality of certain SSCs during the period of extended operation. • The staff agrees that application errors or misapplication of a coating/lining can result in degradation of coatings. However, coating/lining degradation has occurred as a result of aging and therefore during the period of extended operation it is appropriate to manage the associated aging effects, and further, some application errors take time to become evident. An analogy that disproves the comment is that corrosion of piping occurs during the period prior to the period of extended operation; however, loss of material is an applicable aging effect during the period of extended operation. • Whether or not the staff elects to pursue changes to the regulations for the current operating term is not material to the consideration of issuing revised recommendations through an LR-ISG for the period of extended operation. • RG 1.54 provides guidance on various aspects of coatings such as personnel qualifications of inspectors, coating testing, etc. However, it does not contain the same level of specificity as the recommendations in a GALL Report aging management program.

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12 [2]	Given the significant amount of confusion resulting from the release of this ISG for public comment, the NUCC believes that it would be wise to delay/rewrite this ISG and proceed with research in the area of immersion service life, blistering, adhesion, historical data collection, etc. Pursuant to this, there are currently EPRI projects which are already underway. Additionally, this ISG presents a fundamental change in licensing basis. Currently, most plants are licensed with required structural integrity being based on corrosion and not with required structural integrity being based on coatings used to provide protection.	The staff does not agree with this comment. The staff has conducted four public meetings to discuss this LR-ISG. Industry and consensus standards personnel attended these meetings. All aspects of the LR-ISG were discussed including topics such as extent of inspection, inspection methods, the role of the coatings specialist, etc. In addition, this LR-ISG has been issued twice for public comment. The staff will be pleased to review the results of future testing; however, it has concluded that there is sufficient information available to produce an effective aging management program for loss of coating integrity. As discussed in Section V.a. of this LR-ISG, only coatings/linings (a) that are applied to the internal surfaces of an in-scope component, and (b) whose degradation could prevent satisfactory accomplishment of any of the functions identified under 10 CFR 54.4(a)(1), (a)(2), or (a)(3) are in the scope of this LR-ISG. The coating/lining is not determined to be in-scope based on its corrosion mitigative features. The discussion in this LR-ISG reinforces that coatings/linings are only in-scope because of the intended function of the component in which they are installed and not that of the coating/lining. Therefore there is no change in the licensing basis as a result of issuance of this LR-ISG.
13 [3]	The wording used by the ISG Title and throughout of "….Loss of Coating Integrity…" should be changed. This is too nebulous in spite of the definition provided in Appendix B, page B-5. The term could mean far more than simply disbondment. It further leads to confusion as to the scope of this ISG. Suggested Change: “Aging Management of Coating Disbondment for Internal Service Level III Coatings". This term should be used consistently and exhaustively. Or define the term clearly in the introduction / discussion and fully explain the deviation from past understanding of a coatings safety function (adhesion) and a coating's operational function (corrosion deterrence). This ISG is now blending these two functions which is causing confusion. During these early paragraphs it would be good to reference the appendix with the amended and improved definition of "Loss of Integrity."	See the response to Comment No. 10. The staff has concluded that the applicable aging mechanisms include more than disbondment. Citing disbondment would exclude aging mechanisms such as cracking or physical damage, which could result in an SSC not meeting its CLB intended function(s).

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14 [4]	The term "…Service Level III (Augmented) Coatings" has caused confusion. The use of CSL III [Coating Service Level III] (Augmented) has caused confusion among industry. This term should be abandoned, because it implies that these coatings referenced within this ISG are subsets of regular CSL III applications. Coating Service Level III coatings are, by definition, safety-related (See ASTM D4538-05). A number of coatings that fall under 10CFR54.4(a)(3) are NOT safety-related and, as such, do not fall under the established definition of Coating Service Level III. A new definition is needed to cover coatings which are NOT safety-related and which fall under 10CFR54.4(a)(3). This will avoid confusion of Licensees which currently use the established definition of Coating Service Level III in their licensing basis documents. Suggested Change: Use the term Coating Service Level - Aging Management. Stay consistent with industry/ASTM. This term should be used throughout the ISG.	See the response to Comment No. 7.
15 [5]	Add a section to the ISG that characterizes the applicable environments (i.e., raw water, treated water, treated borated water, waste water, fuel oil and lube oil). Although the marked up SRP and GALL address environment, the ISG itself does not have any focus on environments. For example a Fire System CO2 tank or piping may be internally coated, but this condition is not addressed within the scope of this ISG.	The staff does not agree with this comment. The "scope of program" program element of AMP XI.M42 and the new GALL Report and SRP-LR items state the applicable internal environments. The internals of a fire system CO_2 tank would be exposed to a dry gas. It is not within the scope of this ISG. The "scope of program" program element specifically addresses fire water storage tanks, "[t]he aging effects associated with fire water storage tank internal coatings/linings are managed by GALL Report AMP XI.M27, 'Fire Water System,' instead of this AMP." To provide clarity, the term "storage" was removed from in front of the word tank.

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#	Comment	Staff Resolution
16 [6]	Page #1, Discussion In reference to "…due to blistering, cracking..", the term blistering should be removed. A blister in an immersion protective coating is an area of no adhesion. There are multiple causes which include lack of proper surface preparation leaving contaminants at the substrate; improper curing times which can leave solvents in the primer that were not removed through evaporation; cold wall and cathodic disbondment. All of these failures have been seen in safety-related level III tanks and piping. Stable blisters in areas of low or no flow provide no credible risk for clogging of downstream components. Stability of blisters can easily be determined by inspection. An example would be a reactor water storage tank which has not been open for 30 years and the inspector observes blisters (quarter to dime size) at multiple locations with no anomalies such as cracking or peeling within the blister. These blisters can easily be considered stable. These blisters can be opened to determine corrosion rate; however, typically when blisters are stable the corrosion rate is very low. The chemical composition of the constituencies within the blister has reached equilibrium and, therefore, is considered stable. Acceptable adhesion for immersion coatings cannot be judged by the manufacturer's original newly applied coatings laboratory adhesion data. The type, cure, uptake of moisture, surface preparation, aging mechanisms, immersion solutions, etc. of the coatings factor into adhesion values. Manufacturers cannot supply valid adhesion values for coatings that have been in immersion for many years. Adhesion values do not represent the functionality of the coating which can only be determined by the visual inspection. Holiday testing cannot be used due to the uptake of moisture and could severely damage the coating. If the coating has no peeling, flaking, or cracking then no additional actions should be required. If blistering is detected then a few sample blisters should be opened to determine if active corrosion is present. No actions are required if the as-found corrosion rate does not present a minimum-wall risk for the required service life. The safety-related function of both Service Level I and III coatings is for the coating to remain on the substrate. This is verified by visual inspection and has been accepted by the NRC. Level III coatings are not subject to severe environmental changes such as a LOCA.	The staff does not agree with the specific request of this comment. The specific wording, "loss of coating or lining integrity due to blistering, cracking, flaking, peeling, or physical damage," currently exists in the GALL Report as the aging effect and mechanism for coatings. However, portions of the comment do bear consideration of the staff as follows. The staff has concluded that extensive cause analysis and repair/replacement of coating/lining blisters that are small and not growing is not warranted. The LR-ISG recommends a baseline inspection of coatings/linings in the 10-year period prior to the period of extended operation with followup inspections in 4 years if coating/lining degradation such as blistering is detected. The staff has concluded that the baseline and followup inspections provide sufficient trending for small blisters. The "acceptance criteria" program element was revised to state that: • Blisters should be limited to a few intact small blisters that are completely surrounded by sound coating/lining bonded to the substrate. • Blister size and frequency should not be increasing between inspections (e.g., reference ASTM D714-02, "Standard Test Method for Evaluating Degree of Blistering of Paints"). The "corrective actions" program element was revised to address physical testing and evaluation associated with blisters that will remain in-service without repair. The above changes are consistent with EPRI 1019157 and the staff's review of ASTM standards associated with coatings (e.g., D 5163, D 7167). The staff does not agree with the statements in the comment associated with: • Adhesion values: adhesion values could provide a means to demonstrate that the coating/lining is effectively attached to the base metal. The staff recognizes that there is no industry-wide adhesion acceptance criterion for in-service Service Level III coatings. However, the staff has concluded that these values could be obtained. • The staff recognizes that high-voltage holiday testing should not be conducted on previously immersed coatings/linings. This is consistent with ASTM D 5162. However, a low voltage wet sponge test method could be used. Nevertheless, at this time, the staff is not incorporating recommendations that include specificity in regard to conducting adhesion and holiday testing.

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#	Comment	Staff Resolution
17 [7]	Section I. Background [Comment A]: Entire paragraphs should be reviewed with consideration made to reword significantly. Similar to the note in the comment about the title above, the word “degraded” is used with apparent association with “loss of coating or lining integrity.” Both terms do not seem to adequately convey the intent of the purpose relative to the definition found on page B-5 of the ISG. One term should be picked, it should not be picked capriciously, that term should be clear, and it should be used consistently. Additionally, there is lack of clarity of whether the question of integrity is related to the coatings operational function (prevent/deter corrosion) versus its safety function (stay adhered). Also, the ISG references and does not seem to fully distinguish degraded coatings (operational function) with disbonded coatings (safety function). This should be carefully discriminated. **Suggested Change:** Choose the applicable term (such as coating disbondment) and be consistent. [Comment B]: For the purpose of this ISG, it was declared that “[c]oating” includes linings consisting of rubber and cementitious materials. These materials appear to be outside the typical purview of a coatings program and ASTM D33; and, therefore, should not be included within this scope. According to ASTM D4538, coatings consist of a single or multiple coats of polymeric protective film and linings which are subset of coatings. It would not include these additional materials. **Suggested Change:** Remove this reference. [Comment C]: At the top of page 2 (and in other places) the term SL III (augmented) is used. This should change as proposed above. **Suggested Change**: The recent proposed change was to Coating Service Level - Aging Management. Please stay consistent with ASTM terminology to avoid confusion.	The staff has concluded the following: • Comment A: The staff does not agree with this portion of the comment. See the response to Comment No. 10. However, as described in the response to Comment No. 10, the staff incorporated a change to the Discussion Section of the LR-ISG to point to the duality of the term “loss of coating or lining integrity.” • Comment B: The staff does not agree with this portion of the comment. See the response Comment No. 9. It was not the staff’s intent to develop an LR-ISG limited to coatings within the scope of ASTM D33. • Comment C: The staff agrees with this portion of the comment. See the response to Comment No. 7.
18 [8]	I. Background (and throughout) Remove reference to “accelerated corrosion.” The ISG is in part designed to address "accelerated" corrosion of the base metal of the coated components if the coating fails. The existing AMPs already adequately address accelerated corrosion of the base metal. Accelerated aging of the base metal due to localized coating failures manifests as localized pitting. Existing AMPs address pitting of the base metal regardless of whether the component is coated or not.	The staff does not agree with this comment. The term “accelerated corrosion” is applicable where a coating defect exposes base material in the vicinity of dissimilar metals. The purpose of AMP XI.M42 is to manage aging effects associated with the coatings such that the base metal is not exposed.

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#	Comment	Staff Resolution
19 [9]	I. Background Eliminate zinc-based coatings (e.g., galvanized piping) from the scope of the ISG. As stated in the fourth paragraph of section V.b of this ISG, monitoring of coatings is required by the maintenance rule. The license renewal process is intended to address issues that are not sufficiently addressed by the maintenance rule. Since this issue is addressed by the maintenance rule there is no need for it to be addressed as part of the license renewal process.	The staff does not agree with this comment. A case in point is documented in Information Notice 2013-06, "Corrosion in Fire Protection Piping Due to Air and Water Interaction." Unanticipated corrosion occurred as a result of the loss of internal galvanized coating on fire water sprinkler piping. While the maintenance rule adequately addresses active functions of in-scope components, the purpose of aging management programs is to manage the detrimental effects of aging on long-lived passive SSCs.
20 [10]	I. Background Suggest deleting this "background" discussion. The intended functions suggested for coatings in these "background" sections are outside the current design basis for these Service Level III coatings. Per 10CFR54, license renewal is not an appropriate method for expanding the design basis of a licensed facility.	The staff does not agree with this comment. This LR-ISG is not changing the design basis of any licensed facility. The scope of coatings/linings are those that are applied to the internal surfaces of in-scope components in which loss of the coating/lining could result in loss of material in the base metal or could prevent an in-scope component from satisfactorily accomplishing any of its functions identified under 10 CFR 54.4(a)(1), (a)(2), or (a)(3). The LR-ISG does not add any components to the scope of license renewal. The scope of components in the LRA would continue to be consistent with the design basis (i.e., CLB intended functions) of the licensed facility.

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#	Comment	Staff Resolution
21 [11]	I. Background (and throughout) Remove reference to "unanticipated" corrosion The ISG is in part designed to address "unanticipated" corrosion of the base metal of the coated components if the coating fails. By current license renewal methodology, aging of the base metal is anticipated since credit is not taken for the coatings when determining aging effects (i.e., credit is not taken for the coating to conclude that the aging of the component will not occur). In other words, it is assumed that the component will age even if it has an internal coating and the AMPs are designed to manage the aging. Therefore, aging of the base metal is not "unanticipated." Furthermore, as stated in section V.b of this ISG the existing LR guidance documents and AMPs address age-related degradation of coated components when/if the coating fails (e.g., SRP-LR item 3.3.1-26 and 3.3.1-37). Therefore, the potential for aging of the base metal was anticipated during the development of existing LR guidance documents (GALL, SRP).	The staff does not agree with this comment. Unanticipated corrosion is meant to convey that corrosion occurred (due to loss of coating or lining integrity) prior to a planned inspection that would have detected the degraded base material before through-wall corrosion or loss of material below minimum wall thickness requirements occurred. While there are AMPs that manage aging effects associated with the base material, AMP XI.M42 manages aging effects associated with the coating/lining. Several OE examples point clearly to unanticipated corrosion due to loss of coating or lining integrity. The staff discussed SRP-LR items 3.3.1-26 and 3.3.1-37 in light of demonstrating that the concept of coatings/linings being integral to the base material to which it is applied is consistent with current AMR line items in the GALL Report and SRP-LR. This LR-ISG was written in part because the staff concluded that these items were not adequate to fully address internal coatings/linings. • Item 3.3.1-26 cites GALL Report AMPs XI.M2, “Water Chemistry,” and XI.M32. • Item 3.3.1-37 cites GALL Report AMP XI.M20. The staff has concluded that the inspection frequencies and number of inspections of internal surfaces associated with AMPs XI.M20 and XI.M38 may not be sufficient to detect loss of coating or lining integrity prior to a potential loss of a CLB intended function. The one-time inspections of XI.M32 are not adequate to manage loss of coating or lining integrity. It should be noted that based on the staff’s review of five recent LRAs, in all five cases the applicant stated that item 3.3.1-26 was not applicable. One of these LRAs also stated that item 3.3.1-37 was not applicable. However, given the potential for misinterpreting the term, the use of unanticipated corrosion has been minimized. The potential misinterpretation is that if corrosion is anticipated, there is no need to manage loss of coating or lining integrity.

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#	Comment	Staff Resolution
22 [12]	I. Background Remove reference to (a)(2) functions in the last sentence of section I.b. The ISG states that loss of coating integrity must be managed if the coating failure could prevent the accomplishment of 10 CFR 54.4(a)(2) intended functions. License renewal guidance documents (e.g., NEI 95-10) state that cascading hypothetical failures need not be considered if they are not part of the station's CLB and have not previously been experienced. For a coating failure to cause loss of an (a)(2) function the following cascading failures would have to occur: (1) the age-related failure of a coating, (2) the subsequent failure of the base metal, (3) interaction with a component performing an (a)(1) function (e.g., leakage or spray), and (4) the subsequent failure of the component performing the (a)(1) function. This series of cascading failures has not been experienced nor is it likely postulated in a station's CLB. It is not credible that this series of cascading failures would occur and go unidentified and, therefore, it need not be considered for license renewal.	The staff does not agree with this comment. The cascading sequence described in the comment is not consistent with NEI 95-10 Section 5.2.1.4 which states, "[t]he cascading issue applies to 10 CFR 54.4(a)(2) components and involves the consideration of subsequent levels of support systems that are necessary to ensure that a safety-related SSC performs it's intended function." The sequence does not demonstrate cascading because first, it is not associated with cascading support systems and second: • age-related failure of a coating/lining is the initiator, • subsequent failure of the base metal is a direct consequence of the failure of the coating/lining, • interaction with a component performing an (a)(1) function would be assumed to happen based on the coated/lined component's (a)(2) intended function, and • subsequent failure of the component performing the (a)(1) function would also be an expected outcome based on the coated/lined component's (a)(2) intended function. In other words, if the coated/lined component could not cause the failure of a component with an (a)(1) intended function, the coated/lined component would not have an (a)(2) intended function. The staff recognizes that the leak would probably be identified. However, SRP-LR Section A.1.2.3.4, item 2 states that, "[a] program based solely on detecting structure and component failure [i.e., the leaking pipe] should not be considered as an effective AMP for license renewal." In the vast majority of cases, the internal surfaces of the coated/lined component would have been inspected using GALL Report AMPs XI.M20, XI.M21A, XI.M32, or XI.M38. The staff has concluded that the inspection frequencies and number of these programs may not or will not be sufficient to detect loss of coating or lining integrity prior to a potential loss of a CLB intended function.
23 [13]	I.a, V – Summary The descriptions of the definition of SL3 coatings in the two locations noted is redundant to Section V.a. Recommend deleting the redundant text and leaving needed text in V.a.	The staff concluded that rather than creating additional "Service Level" definitions, use of the phrase "internal coatings/linings for in-scope piping, piping components, heat exchangers, and tanks" is adequate to define the scope of coatings/linings being addressed in this LR-ISG. Therefore this comment is no longer applicable.
24 [14]	I.b. First sentence begins with "The staff has noted that for AMR steel pipe with…". The phrase "AMR steel pipe" is not clear. The meaning of "AMR steel pipe" is unclear. Perhaps delete "AMR."	The staff agrees with this comment, the recommended change was incorporated.

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#	Comment	Staff Resolution
25 [15]	I.b. First sentence appears incorrect in stating that "many applicants state that the elastomer lining is not credited for aging." Consider aging management as the proper term.	The staff agrees with this comment, the recommended change was incorporated.
26 [16]	1.b. Delete "The staff recognizes that the corrosion allowance used for the design of a component could have incorporated a general corrosion rate that reflects 40 or 60 years of service" and delete "However" from the beginning of the next sentence. The sentence is not relevant. An applicant typically performs periodic inspections on a system with internal coating on the same frequency as for a system that is not coated. It is not a function of whether there is a corrosion allowance.	The staff's response to Comment Nos. 26, 27, and 28 is merged because the three comments cover essentially the same concept. The staff considers the existing GALL AMPs adequate to manage loss of material for uncoated components. The statement, "[i]f the existing GALL AMPs are sufficient for pitting why are they not for accelerated corrosion at the locations of coating holidays?" begs the question. The GALL AMPs could also be equally effective for coated/lined components. However, the terms "typically" and "generally" in the comments are part of the issue. During its review of LRAs, the staff does not typically know that an applicant will perform periodic inspections on a system with internal coating/lining on the same frequency as for a system that is not coated/lined. None of the GALL AMPs used to manage the aging effects associated with internal surfaces (i.e., AMP XI.M20, AMP M21A, AMP XI.M38) specifically state that internally coated and uncoated components should be inspected on the same frequency. For example, the "detection of aging effects" program element for AMP XI.M21A states, "[a]dditionally, a representative sample of piping and components is selected based on likelihood of corrosion or cracking and inspected at an interval not to exceed once in 10 years." Unless stated in the LRA, it is not clear whether coated and uncoated components would be considered as two different representative sample populations. AMP XI.M38, as modified by LR-ISG-2012-02 states that "[a]t a minimum, in each 10-year period during the period of extended operation, a representative sample of 20 percent of the population (defined as components having the same material, environment, and aging effect combination) or a maximum of 25 components per population is inspected." It is not clear that an applicant would identify steel exposed to raw water and steel exposed to a coating/lining in a raw water system as two separate populations. The following provide examples where the coated/lined pipe should be inspected more frequently if there were no inspections of the coating/lining: • Accelerated corrosion could occur in some instances. An example would be a coated/lined steel pipe with a holiday in the vicinity of the transition to an uncoated copper or AL6XN line (see the revised wording in Section I.b.). • If no corrosion allowance was used for coated/lined pipe, whereas uncoated pipe had an appropriate corrosion allowance. Based on the above, the staff has concluded that no broad changes should be incorporated into GALL AMP XI.M42. However, the staff revised the "detection of aging effects "program element to allow the use of AMP XI.M36 and AMP XI.M38 or other appropriate internal surfaces inspection program (e.g., AMP XI.M20, XI.M21A) in lieu of the inspections recommended in AMP XI.M42 when certain conditions are met. See Section VI.a., "Summary of changes in this LR-ISG." The staff did not include components with intended functions within the scope of 10 CFR 54.4 (a)(1) and (a)(3), because with the exception of plant-specific configurations, the staff concluded that flow blockage would be applicable for these components.
27 [17]	I.b. Clarify how accelerated corrosion that could occur at the location of a coating holiday is different from pitting corrosion that is adequately managed by existing programs. The ISG is partially to address accelerated aging at coating holidays. Existing GALL AMPs provide guidance for managing pitting corrosion which is an accelerated localized corrosion effect. If the existing GALL AMPs are sufficient for pitting why are they not for accelerated corrosion at the locations of coating holidays? What is unique about the corrosion at coating holidays that makes the existing GALL AMPs inadequate?	
28 [18]	1.b. Clarify the first sentence of I.b. with respect to applicants not crediting a lining for aging. Generally applicants do not credit an internal lining or coating when determining which aging effects are applicable for the base metal of the coated component. For example, applicants do not claim that a coated carbon steel component is not subject to Loss of Material due to General, Pitting, and Crevice Corrosion in a water environment simply because of the coating. Instead, it is assumed the component will age (i.e., no credit is taken for the coating) and the AMP is designed to ensure that the aging will not prevent the accomplishment of an intended function. In other words, aging of the base metal, including accelerated aging (e.g., pitting) is not unanticipated and is adequately addressed by existing GALL AMPs. Note: there is no Adams ML#.	

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#	Comment	Staff Resolution
29 [19]	II.a. Entire sub-paragraph II.a should be reviewed with consideration made to rewording. • Paragraph "IIa" is not an OE example; it is a background/introduction to the other six OE examples found in sections b through g. Suggested Change: Change or delete subsection II.a as an OE example. • Sections IIb through IIg appear to be examples of OE for applications that are older than what would expected to be within "two to three refueling outage intervals." There does not appear to be adequate connection between subsection IIa and the six OE examples. Suggested Change: Please provide clear justification and connection based on OE. • See last sentence. Suggested Change: Change the last portion of the last sentence to read, "…repaired or replaced to be inspected within the period of the next two refueling outages."	The staff's evaluation of each of the bulleted items in this comment are as follows: • The staff agrees with this portion of the comment. The material in II.a. associated with IN 85-24 was reformatted as not being a bulleted OE example and relabeled as introductory material. • The staff does not agree with this portion of the comment. The six examples were not intended to be associated exclusively with degradation occurring within "two to three refueling outage intervals." The new paragraph added as a result of Comment No. 3 provides a better transition from the introductory material and the loss of coating or lining integrity OE examples. • This change is not required because the last sentence was deleted as a result of the changes implemented to address Comment No. 33.
30 [20]	II.a. This OE example is not relevant to license renewal and should be removed. The issue identified in this example has been addressed by an Information Notice (IN 85-24) and has been adequately considered by the 10 CFR Part 50 regulatory process. The example describes an event in which a misapplied coating failed after it had been in service for two years. Failure due to misapplication of a coating is not age-related and generally occurs after no more than a few years after installation. Since the effects of misapplication of coatings are realized after only a few years it is inappropriate to postpone any significant enhancements to safety until the period of extended operation. As such, any significant enhancements to safety that can be made to address this OE should be performed during the current operating term and, therefore, should be regulated under 10 CFR Part 50. This is not related to long term aging and is not unique to operation beyond the initial 40-year term and, as such, it is inappropriate to address this issue through the license renewal process.	The staff agrees in part with this comment. Table 4a was revised to eliminate Inspection Category C (newly installed or repaired coatings/linings) to address Comment No. 33. The staff acknowledges that inspections during the subsequent two refueling outage intervals for newly installed or repaired coatings/linings, although a good practice, would be associated with confirming that selection or installation deficiencies had not occurred. The inspections would not be associated with managing loss of coating or lining integrity associated with license renewal. The staff does not agree with removing the introductory material (see Comment No. 29) associated with IN 85-24 because it provides background on coating degradation aging mechanisms and a transition to the need to conduct future inspections to detect loss of coating or lining integrity.
31 [21]	II.a. In the second sentence of the last paragraph in this section, change the word "satisfactory" to satisfactorily". Editorial	The word was editorially corrected.

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#	Comment	Staff Resolution
32 [22]	II.a. This is not an example of a coating failure that occurred as a result of aging. In the top full paragraph it states "Although the root cause of the failure was related to installation practices the failure occurred as time elapsed." Failures occur as time elapses. The fact that a failure occurred after a period of time, does not mean that it was due to the effects of aging, even though one may call it age-related. The cause in this example was poor installation; not aging.	The staff does not agree with this comment. The staff never intended that the material extracted from IN 85-24 be perceived as being solely associated with age-related degradation of coatings/linings. The material was used to demonstrate that installation deficiencies can lead to subsequent failure. In fact, proper selection and installation of coating/lining materials can mitigate the potential impact of subsequent aging of coatings/linings. The purpose of several AMPs is to address degradation that is due to: (a) aging of the component, or (b) defects that grow in magnitude as "time elapses." In other words, stating that a failure was due to a prior action (e.g., poor welding controls, improper selection of materials) does not exempt the aging effect from being managed by an AMP. For example, poor welding quality could lead to incorporation of a defect into a weld. It may take years for the defect to grow to a detectable size or result in through-wall penetration. GALL Report AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," was developed to detect both aging of an in-scope component that was appropriately procured, designed, installed, and tested to consensus standards; and the defect that was incorporated as a result of poor welding controls. This concept is further reinforced by GALL Report AMP XI.M10, "Boric Acid Corrosion," which addresses loss of material that occurs as a result of a leaking component in the vicinity of an in-scope component. SRP-LR Section A.1.2.1 item 7 (unchanged since SRP-LR Revision 0) states, "[a]lthough bolted connections are not supposed to leak, experience shows that leaks do occur, and the leakage could cause corrosion. Thus, the aging effects from leakage of bolted connections should be evaluated for license renewal." Just as a bolted flange leak is the originating cause that leads to the need to manage loss of material in a nearby in-scope component, improper selection or installation deficiencies for a coating/lining can lead to the need to manage loss of coating or lining integrity. Loss of coating or lining integrity could occur because of: (a) age-related degradation of the coating/lining that was appropriately procured, designed, installed, and tested; or (b) selection or installation deficiencies that do not manifest themselves until many years past what would be considered the normal period of time to detect such errors.

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#	Comment	Staff Resolution
33 [23]	II OE Examples and Appendix C Table 4a New coating degradation associated with installation practices is not an aging effect. Recommendations to inspect newly installed coatings should not be in the GALL. The inspection may be a good practice and perhaps another Information Notice should be issued with the recommendation, but the GALL is for aging management and license renewal. Other good maintenance practices do not belong in it. This could dilute its use and allow for the GALL to be revised for other items that are not associated with aging management in the future.	The staff's response to Comment Nos. 33 and 34 is merged because the comments cover essentially the same concept. The staff agrees with these comments. Table 4a was revised to eliminate Inspection Category C (newly installed or repaired coatings/linings) to address Comment No. 33. The staff acknowledges that inspections during the subsequent two refueling outage intervals for newly installed or repaired coatings/linings, although a good practice would be associated with confirming that selection or installation deficiencies had not occurred. The inspections would not be associated with managing loss of coating or lining integrity associated with license renewal.
34 [24]	II.a Table 4a Delete the recommendation in Table 4a, "Inspection Intervals for Service Level III (augmented) Coatings for Tanks, Piping, and Heat Exchangers," of the new GALL Report AMP XI.M42, "Service Level III (augmented) Coatings Monitoring and Maintenance Program," for inspection during the next two refueling outage intervals of newly installed coatings or coatings that have been repaired or replaced. Recommending inspections within two operating cycle intervals is addressing installation deficiencies; not the effects of aging. This violates the letter and the spirit of the statements of consideration for the license renewal rule, which state "The Commission still believes that mitigation of the detrimental effects of aging resulting from operation beyond the initial license term should be the focus for license renewal." Clearly addressing the results of inadequate installation or maintenance within two operating cycles of installation is not addressing the detrimental effects of aging resulting from operation beyond the initial license term. Additionally, OE doesn't appear to support the proposed requirement to re-inspect two more times after initial installation/repairs/replacements. Installation/repairs of coatings will be applied by certified specialists which should count for some consideration from the proposed requirement.	
35 [25]	II.a.,d. "…Number ML 12097A064." Please verify Accession number; it appears to be in error.	The ADAMS Accession Number is correct. The referenced RAI appears on pages 3 to 5 of Enclosure 1.

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36 [26]	II. b Note – in the final LR-ISG, OE example II.b was renumbered as II.a. as a result of changes implemented to address Comment No. 32. This OE example does not support the establishment of a new AMP to manage internal coatings. As demonstrated by this OE example, the failure of the coating itself is irrelevant to the intended function of the component. The intended function is performed as long as the pressure boundary of the component is maintained and, therefore, the appropriate corrective action is to monitor for wall loss of the base metal and not inspect the coating. Furthermore, it is unlikely that coatings subject to erosion would fail as a sheet but instead would wear away locally due to the abrasive nature of water with entrained solids at high velocities. In addition, if a coating subject to erosion were to fail in a sheet it is likely that the coating would break apart in the flow prior to causing flow blockage.	The staff does not agree with this comment. The OE examples were not provided to justify the establishment of a new AMP, but rather to provide examples of loss of coating or lining integrity that resulted in degraded in-scope components. The staff agrees that even with the through-wall leakage the component might be able to perform its CLB intended function (i.e., pressure boundary - "[p]rovide pressure-retaining boundary so that sufficient flow at adequate pressure is delivered," reference, SRP-LR, Table 2.1-4(b) Typical "Passive" Component-Intended Functions). However the purpose of a c*ondition monitoring program is to* inspect for the presence and extent of aging effects. SRP-LR Section A.1.2.1, item 1 states, "[t]he determination of applicable aging effects is based on degradation mechanisms that have occurred and those that potentially could cause structure and component degradation." This OE provides an example where component degradation occurred as a result of loss of coating or lining integrity. This is consistent with NEI 95-10, "Industry Guideline For Implementing-The Requirements of 10 CFR Part 54-The License Renewal Rule," Table 4.3-1, "Aging Management Activity 10 Program Elements," which describes the "detection of aging effects" program element as, "[d]etection of aging effects should occur before there is a loss of structure or component intended function(s)." For the "monitoring and trending" program element it states, "[m]onitoring and trending should provide predictability trending of the extent of degradation and provide timely corrective or mitigating actions." In regard to the statement, "the appropriate corrective action is to monitor for wall loss of the base metal and not inspect the coating," the staff recognized that there are effective inspection methods other than conducting visual inspections of the internal coatings/linings. Where loss of coating or lining integrity cannot result in downstream effects, the "detection of aging effects" program element of AMP XI.M42 allows a representative sample of external wall thickness measurements in lieu of visual inspections of the coatings/linings.

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37 [27]	II.c Note – in the final LR-ISG, OE example II.c was renumbered as II.b. as a result of changes implemented to address Comment No. 32. This OE example demonstrates that it is inappropriate to address this issue through license renewal. The OE describes the failure of a coating system that is designed to last 15-20 years per the manufacturer. Evidence of coating degradation was identified as early as three years after installation. Failure of the coating occurred 19 years before the station entered the period of extended operation. The recommendations made in this program would not go into effect until the period of extended operation and, as such, would not have prevented the event. This time period was exceeded and the material started to fail by migration of plasticizers resulting in embrittlement and cracking which would be expected. This should be considered a historical design issue. Rather than addressing this issue through the license renewal process, it should be addressed for the initial operating term since the failure was not due to long term aging unique to the extended period of operation.	The staff does not agree with this comment. Given that there are a limited number of plants that have entered the period of extended operation, the availability of OE examples is also limited. The example is valid because it demonstrates loss of coating or lining integrity occurring near the end of the manufacturer's recommended service life. When coatings/linings are kept in-service beyond their recommended life, visual inspections should be conducted to determine if degradation, as occurred in this case, is not occurring. This is the basis for the "detection of aging effects" program element of AMP XI.M42 recommending that service life history is a factor in determining inspection locations.
38 [28]	II.d Note – in the final LR-ISG, OE example II.d was renumbered as II.c. as a result of changes implemented to address Comment No. 32. This OE example demonstrates that it is unlikely that failure of properly designed and installed coating systems will not cause degradation of downstream components and should be removed Modern coating systems designed for immersion are designed such that they do not fail as a sheet. If the coating is properly installed the coating will become brittle prior to loss of adhesion and therefore flake off in small pieces. This OE example does not provide any indication that the coating system used would fail as a sheet in the future. The referenced RAI postulates that the coating debris could block individual heat exchanger tubes. Blocking or plugging of individual heat exchanger tubes does not prevent the heat exchanger from performing its design function since heat exchangers are designed such that there are excess tubes for the required heat transfer. The intended function of a downstream heat exchanger is not challenged unless an upstream coating fails as a large enough sheet to block multiple heat exchanger tubes (generally 10%-15% for heat exchangers important to safety). This OE example does not provide any evidence that coating failures capable of causing flow blockage of downstream heat exchangers are likely to occur.	The staff does not agree with this comment. • Many of the coating/lining systems installed in plants are not "modern coating systems." • Sheet-like failure is not a prerequisite for causing flow blockage of downstream components. If enough "small pieces" are detached from the coating/lining, reduction of heat transfer can occur. In addition, blockage of strainers can occur with multiple small pieces.

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#	Comment	Staff Resolution
39 [29]	II.e Note – in the final LR-ISG, OE example II.e was renumbered as II.d. as a result of changes implemented to address Comment No. 32. Please remove the lining reference found in "...flow reduction occurred because rubber lining on butterfly valve body became detached..." Rubber lining in valve bodies is not the responsibility of the coating program. Valves are procured with these type linings installed as part of the manufacturing process and aging management of these linings should reside in the AMPs associated with valve components.	The staff does not agree with this comment. It is the responsibility of the applicant to determine which plant-specific procedures include the requirements for inspections of coatings and linings. The "scope of program" program element of AMP XI.M42 allows an applicant to manage the aging effects of coatings/linings in an alternative AMP that is specific to the component or system in which the coatings/linings are installed as long as the recommendations and FSAR supplement details of AMP XI.M42 are incorporated into the alternative program.
40 [30]	II.e Note – in the final LR-ISG, OE example II.e was renumbered as II.d. as a result of changes implemented to address Comment No. 32. This OE example is due to the use of an improper coating system for the service environment and therefore, is not age-related As demonstrated by the corrective actions taken, the cause of the OE was the use of a rubber lining in a chlorinated water environment. Replacement with a proper coating system (i.e., non-rubber) has corrected the issue. Based on this it can be concluded that the issue is due to a design deficiency rather than long-term aging. In addition, this OE demonstrates that coating failures are self-revealing via normal system monitoring and, therefore, additional inspections are not necessary. Finally, this issue demonstrates that coating failures are adequately regulated through the 10 CFR Part 50 process. This process continues through the period of extended operation and, therefore, a 10 CFR 54 AMP is not required to ensure that an acceptable level of safety for operation is maintained.	The staff does not agree with this comment. In regard to "use of an improper coating system," see the response to Comment No. 32. Although in this instance the loss of coating or lining integrity was self-revealing, failure of the rubber lining could have occurred coincident with an accident or transient where full system flow was required. The inspections recommended by AMP XI.M42 could have detected precursor degradation of the lining.
41 [31]	II.f Note – in the final LR-ISG, OE example II.f was renumbered as II.e. as a result of changes implemented to address Comment No. 32. This OE example is not relevant unless the license renewal applicant credits the internal coating to preclude aging and, therefore, does not have an aging management program that anticipates aging. The contention in this OE example is that aging of coated components is not anticipated and, thus, the coating has to be managed for aging so that this assumption remains valid. However, as stated earlier in this ISG, applicants for license renewal generally do not credit internal coatings to preclude aging and, therefore, the aging is anticipated. As such, the AMPs are designed to manage the aging of the base metal, including accelerated aging (e.g., pitting corrosion).	The staff does not agree with this comment. This OE is a clear example of unanticipated through-wall corrosion that occurred as a result of loss of coating or lining integrity. It is immaterial whether the license credited the coating/lining. The licensee's inspection methods and/or frequency of inspections were inadequate to detect the degrading coatings/linings.

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#	Comment	Staff Resolution
42 [32]	II.f Note – in the final LR-ISG, OE example II.f was renumbered as II.e. as a result of changes implemented to address Comment No. 32. Qualify, reword, or delete the text "cavitation in piping downstream of flow control valve eroded the pipe coating resulting in unanticipated corrosion through the pipe wall." There are no known coatings that will withstand cavitation issues in a piping system. Aging management issues due to cavitation in piping systems should reside in the AMP for the piping system and not the AMP for coatings.	The staff does not agree with this comment. If there are no known coatings/linings that will withstand cavitation in a piping system, periodic inspections of the coatings/linings should be conducted. As addressed in the response to Comment No. 39, it is the responsibility of the applicant to determine which AMP or plant-specific procedures include the requirements for inspections of coatings and linings.
43 [33]	II.g Note – in the final LR-ISG, OE example II.g was renumbered as II.f. as a result of changes implemented to address Comment No. 32. This OE example does not support the establishment of a new AMP to manage internal coatings. As demonstrated by this OE example, the failure of the coating itself is irrelevant to the intended function of the component. The intended function is performed as long as the pressure boundary of the component is maintained. Had an appropriate aging management program been in place to manage the degradation of the base metal, the event would not have occurred. In addition, the failure of the concrete lining appears to be due to a design deficiency rather than age-related degradation. The concrete lining is not designed to withstand the high flow velocities and turbulence caused by the valve located just upstream of the degraded area. Use of an appropriate, erosion resistant lining would have prevented this event.	The staff does not agree with this comment. The OE examples were not provided to justify the establishment of a new AMP, but rather to provide examples of loss of coating or lining integrity that resulted in degraded in-scope components. In regard to the intended function of the component portion of the comment, see the staff's response to Comment No. 36. In regard to the design deficiency portion of this comment, see the staff's response to Comment No. 32.
44 [34]	III.a. The quoted paragraph refers to small flaws where anodic conditions can occur and then it states, "small anodic areas supported by a large cathode." What is the large cathode? Provide clarity on what the large cathode is. The substrate or the fluid?	The comment is directed to an extensive quote from EPRI TR-103403. The purpose of the quote was to point to existing industry guidance on degradation of coatings/linings. As a result of the response to Comment No. 28, a portion of section I.b. was revised to state, "However, if a small portion of the lining degraded and exposed the base material, accelerated corrosion could occur (e.g., coated/lined steel pipe with a holiday in the vicinity of the transition to an uncoated copper or AL6XN line)."

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#	Comment	Staff Resolution
45 [35]	V. Entire section should be reviewed. Please note that this section appears to treat 10 CFR 54.4 (a) (1), (a)(2), and (a)(3) as having equivalent safety-related applications. They are not. The subsection noted as (a)(3) is not safety-related and to include them as a part of the scope of this ISG is simply an impetus for further confusion. This overlap is leading to confusion by industry. This was evident during the recent ASTM D33 meeting where confusion continued even after extensive discussion between industry and NRC representatives. This confusion is compounded when the CSL III term is used whether it utilizes the term "augmented" or not. Additionally, during previous public meetings the NRC noted that this ISG was to affect change to "Commission Regulated Event[s"] which included Fire Protection and Safety Blackout. These were noted as part of 10 CFR Part 50 criteria. 10 CFR Part 50 is no longer being referenced but the ISG does contain components/systems that are found within Part 50. This is leading to continued confusion. Suggested Change: Extensive clarification through re-writing several of these sections to segregate safety-related versus nonsafety-related components is warranted due to the extensive confusion which has occurred.	The staff does not agree with the comment associated with (a)(3) components. See the response to Comment No. 5. However, in order to avoid potential confusion, the staff concluded that rather than creating additional "Service Level" definitions, use of the phrase "internal coatings/linings for in-scope piping, piping components, heat exchangers, and tanks" is adequate to define the scope of coatings/linings being addressed in this LR-ISG.
46 [36]	V. The definition of Service Level III (augmented) coating is too broad because it includes in-scope components not subject to AMR. There are many active components that are in-scope for license renewal. Strictly reading, this definition could apply to motor operated valve actuators housing internal coatings. I believe this is not the intent of the definition. Recommend the definition should read: …coatings applied to the internal surfaces of an in-scope component subject to AMR (passive and long-lived)……. .	The staff agrees with this comment in part. The staff has concluded that rather than creating additional "Service Level" definitions, use of the phrase "internal coatings/linings for in-scope piping, piping components, heat exchangers, and tanks" is adequate to define the scope of coatings/linings being addressed in this LR-ISG.
47 [37]	V.a. Delete the first sentence of this section. It is inserted before the definition and it is confusing whether it is part of the definition. A statement of what coatings are in the scope of the license renewal rule should not be inserted in the definition of SL III coating. If the intent is to say that SL III coating is within the scope of license renewal, then such statement should follow the definition of SL III coating.	This comment was resolved with the changes to use the phrase "internal coatings/linings for in-scope piping, piping components, heat exchangers, and tanks," in lieu of revising the Service Level III definition.

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#	Comment	Staff Resolution
48 [38]	V.a. Term for SL III (augmented) should be changed to SL III-augmented if previous comments are not incorporated. Clarification. Implies augmented = SLIII	The staff has concluded that rather than creating additional “Service Level” definitions, use of the phrase “internal coatings/linings for in-scope piping, piping components, heat exchangers, and tanks” is adequate to define the scope of coatings/linings being addressed in this LR-ISG.
49 [39]	V.a Revise (delete i and revise ii) to read: "V. Definition of Coating Service Level - Aging Management a. All coatings applied to the internal surfaces of an in-scope component, that are not covered by the existing definition of Coating Service Level III (see ASTM D4538-05), are in the scope of this LR-ISG if its degradation could prevent satisfactory accomplishment of any of the functions identified under 10CFR54.4(a)(3). Coating Service Level Aging Management are those: i. Applied to the internal surfaces of in-scope components and whose failure could prevent satisfactory accomplishment of any of the functions identified under 10CFR54.4 (a)(3) (e.g.., fire protection, station blackout)." Clarification.	The staff has concluded that rather than creating additional “Service Level” definitions, use of the phrase “internal coatings/linings for in-scope piping, piping components, heat exchangers, and tanks” is adequate to define the scope of coatings/linings being addressed in this LR-ISG.
50 [40]	V.a This section of the report really does not address the case of material that is used to repair a 0.25 inch pit in a tank. It is hard to characterize this as a coating and as such should be stated that coating does not include these types of very limited pit repairs. The dictionary definition of a coating is "a layer of any substance spread over a surface." EPRI 1019157 defines paints/coatings/linings as "essentially synonymous terms for liquid-applied materials consisting of pigments and fillers bound in a resin matrix that dry or cure to form a thin, continuous protective or decorated film." This is different than a substance used to fill-in a pit because it is not a continuous thin film. In addition one of the justifications for stating coatings can be a concern is large areas could come off and significantly impact flow, pressure, and heat transfer downstream. Clarifying the definition of a coating should address this concern.	The staff does not agree with the comment. The comment is internally inconsistent in that the dictionary definition does not contain a limit on the size of the coating, nor does the EPRI definition. A .25 inch piece of detached coating/lining could impact the function of an in-scope component (e.g., an emergency diesel fuel injector). It would be appropriate for applicants to address small repairs as an exception. The exception should address plant-specific operating experience, potential for further loss of material in the specific environment, factors associated with transportability of loose coatings (e.g., specific gravity, flow, location relative to suction piping), and the presence of downstream strainers with appropriate indications/alarms.
51 [41]	V.a Clarify if the SLIII (augmented) definition (and therefore the ISG) only applies for SSCs located outside the containment The current definition seems to imply that the internal coating of a safety-related component located inside containment is not a SLIII (augmented) coating. Is this the intent?	The staff agrees with the concern raised in this comment; however, it has been addressed by not using “Service Level” terms to define the scope of the LR-ISG. See the response to Comment No. 49.

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#	Comment	Staff Resolution
52 [42]	V.a.i V.e.i Clarify if the SLIII (augmented) definition (and therefore the ISG) only applies for internal coatings The existing SLIII coating (in RG 1.54) includes external coatings if their failure could impact a safety function (see RG 1.54 section C.1.c, "coating on the external surface of a reactor containment may be designated Service Level III"). Failure of an external coating could potentially leave the exposed base metal vulnerable to "unanticipated" external degradation. Is the intent to include both internal and external coatings within the scope of this ISG? Furthermore, the example provided in section V.e.i of this ISG seems to be just as applicable to external coatings. If an external coating in the area of drains credited for Fire Protection were to fail, they could also cause flow blockage in the drain line. Would these coatings be considered SLIII (augmented)?	The LR-ISG only applies to internal coatings/linings. This has been clarified by the change described in Comment No. 49, and others. The staff has not chosen to address external coatings/linings (other than Service Level I) at this time because, unlike internal coatings/linings, they are visible by the plant staff on a routine basis. Degradation of external coatings/linings that could lead to the loss of a CLB intended function would be expected to be entered into the corrective action system and corrected.
53 [43]	V.a.i Revise the definition to read "used in areas outside the reactor containment whose age-related failure could adversely affect the safety-function of a safety-related SSC…" Failure mechanisms that are not age-related are not relevant to license renewal. This comment is also applicable throughout the ISG. References to coating failures should be limited to age-related coating failures since this is the purview of license renewal.	The staff does not agree that a change is appropriate in relation to this comment. The proposed change could result in a licensee inferring that as long as it could conclude that the degradation was a result of an original installation error (despite the number of years in service), no license renewal followup actions would be required (e.g., transitioning from Table 4a Inspection Category A to B). This is not the case. If a coating/lining has been performing its intended functions for multiple cycles and then exhibits degradation, aging is involved in the degradation. As described in Comment No. 30, the staff has eliminated the proposed Inspection Category C that recommended inspections of newly installed or repaired/replace coatings/linings during the next two refueling outage intervals. The staff acknowledges that it is unlikely that failures of these coatings/linings would be due to aging. In addition, the staff would not regard coating degradation caused by inspection activities (e.g., damage due to scaffolding) to be considered age-related. Outside of these examples, licensees should address coating/lining degradation as recommended in the LR-ISG and develop an exception and corresponding justification for the exception.
54 [44]	Revise the definition to read "...applied to the internal surfaces of in-scope components and whose age-related failure could prevent satisfactory accomplishment of any of the functions identified under 10 CFR 54.4(a)(3) (e.g., fire protection, station blackout)." Failure mechanisms that are not age-related are not relevant to license renewal.	The staff does not agree with this comment. See the response to Comment No. 53.

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#	Comment	Staff Resolution
55 [45]	Clarify whether an in-scope coated component located near a component performing a 10 CFR 54.4(a)(3) component is to be included in scope under 10 CFR 54.4(a)(3). Although it is clear that, based on the guidance in this ISG, internal coatings for components within the scope of license renewal in accordance with 10 CFR 54.4(a)(2) would be considered SLIII (augmented), it is unclear what intended function they perform if there failure could potentially impact the performance of a 10 CFR 54.4(a)(3) function. For example, theoretically, an internal coating for a component that is in-scope under 10 CFR 54.4(a)(2) and is located near nonsafety-related switchgear that is required to perform an (a)(3) function could fail and cause the base metal to corrode through and spray the switchgear. This could potentially prevent the switchgear from performing its (a)(3) function. Per the definition in the ISG, this coating would be classified as a SLIII (augmented) since (1) it is applied to the internal coating of an in-scope component and (2) its failure could prevent the accomplishment of an (a)(3) function. Per NUREG-1800, each function of a component within the scope of license renewal must be identified. This spatial interaction is beyond the scope of 10 CFR 54.4(a)(2). Would the coated component be in-scope under 10 CFR 54.4(a)(3)? If so, this is inconsistent with the Statements of Consideration which takes care to limit the unnecessary expansion of the scope of review for (a)(3). If not, the SLIII (augmented) definition should be modified to make this clear. Note that this concern is also applicable to (a)(2) components with internal coatings located upstream of components performing an (a)(3) function (i.e., would the internal coating for the (a)(2) component perform an (a)(3) function). Suggested rewording: "...applied to the internal surfaces of components within the scope of license renewal in accordance with 10 CFR 54.4(a)(3) and whose failure could prevent satisfactory accomplishment of any of the functions identified under 10 CFR 54.4(a)(3) (e.g., fire protection, station blackout)."	The staff agrees with this comment. Several statements in this LR-ISG were revised to clarify the staff's intent related to the scope of coatings/linings and the intended function of the component in which it is applied. For example in Section V.a. the underlined word (below) was added to clarify that it is the component's function that dictates whether the associated loss of coating or lining integrity aging effects need to be addressed. "[a]ll coatings/linings applied to the internal surfaces of an in-scope component are in the scope of this LR-ISG if its degradation could prevent satisfactory accomplishment of any of the component's functions identified under 10 CFR 54.4(a)(1), (a)(2), or (a)(3)." These changes clarify the staff's intent. In response to the examples cited in the comment: • For a piping system that is in-scope under 10 CFR 54.4(a)(2), if the only impact of loss of coating or lining integrity in a portion of the piping system would be to spray down a component in-scope under 10 CFR 54.4(a)(3), the aging effects for that portion of the coating/lining would not have to be managed. • For components that are in-scope under 10 CFR 54.4(a)(2), flow blockage of a downstream component that is in-scope under 10 CFR 54.4(a)(3) would not have to be considered. Given the deletion of the use of the term "Service Level III (augmented)," no further changes to the LR-ISG are required.
56 [46]	V.a.ii The ii definition creates a condition that is outside the scope of 10CFR54. If the coated component is non safety-related and in scope for (a)(2) but its failure impacts an (a)(3) component, doesn't this create a new function of NSR whose failure could affect a nonsafety-related (a)(3) component function, i.e. (a)(4)? For example, what if a coating on (a)(2) component failed and piping leaked on (a)(3) component, in accordance with 54.4, does that make the coated component in scope?	The staff responded to this comment in Comment No. 55.

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#	Comment	Staff Resolution
57 [47]	V.b. It is not clear, in the first sentence, what/where the example is of a coating being considered an SSC. Add some clarification that the description is located in the last paragraph under V.b. Clarification	The staff agrees with this comment. The sentence was clarified by adding a reference to GALL Report items CP-152 and TP-301.
58 [48]	V.b. In the 5th sentence add the word "offers" as follows: "A coating is an integral part of an in-scope component, providing it offers protection from…." Editorial	The staff does not agree with this editorial change because it could change the intent of the statement. The full statement is, "[a] coating/lining is an integral part of an in-scope component, providing it protection from corrosion whether credited for that protection or not." It is immaterial whether an internal coating/lining provides protection or not. Once it is applied to the internal surfaces of a component, it can be impactful if it degrades.
59 [49]	V.b. In the first sentence of the paragraph it states the coating is an integral part of the component. If the coating is an integral part of the in scope component then the only aging effect required to be identified for the coated portion of the component is loss of coating integrity managed by this program. As a result no other programs are required to manage the coated surface. This should be stated somewhere such that it is clear. To add clarity on aging management of coated components.	The staff agrees with this comment. The "scope of program" program element of AMP XI.M42 was revised to state, "[f]or components where the aging effects of internally coated/lined surfaces are managed by this program, loss of material and changes in material properties due to aggressive chemical attack need not be managed for these components by another program."
60 [50]	V.b. Edit the last sentence of the section. Within the last sentence, replace the word "unique" with the words "integral part of."	The staff agrees with this comment in part. The term "unique" was deleted. The phrase "integral part of" was not added because Service Level I coatings are defined as a component in the GALL Report.
61 [51]	V.b. The second paragraph of section V.b addresses reduction of flow due to coating debris. Maintaining adequate flow rates is an active function of the system, not passive, and therefore, is beyond the scope of license renewal. Other than for stagnant systems (e.g., Fire Protection), reduction in flow due to coating debris, or any other mechanism, is self revealing during normal system monitoring and as such, internal visual inspections are not required. OE examples II.c and II.e in this ISG demonstrate that normal system monitoring is effective at detecting reduction in flow due to coating debris prior to loss of function. Maintaining active functions of systems is adequately addressed by system performance monitoring in accordance with the maintenance rule and need not be addressed for license renewal.	The staff does not agree with the statement that "[m]aintaining adequate flow rates is an active function of the system, not passive, and therefore, is beyond the scope of license renewal." SRP-LR Table 2.1-4(b), Typical "Passive" Component-Intended Functions, defines the pressure boundary function as "[p]rovide pressure-retaining boundary so that sufficient flow at adequate pressure is delivered…" If an applicant desires to credit system performance monitoring, it should be stated as an exception and justified in the LRA.

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#	Comment	Staff Resolution
62 [52]	V.b. The third paragraph of section V.b is inconsistent with the definition of SLIII (augmented). This section of the ISG states that the function of the coated component drives the function of the coating (i.e., if a component has an (a)(3) function then the coating has an (a)(3) function). This is not consistent with the SLIII (augmented) definition. A component with an internal coating that is connected to safety-related equipment through a normally open isolation valve but is beyond the first seismic anchor and physically separated from safety-related equipment such that spatial interaction (e.g., leakage or spray) is not possible would meet the definition of SLIII (augmented) but the coated component would not meet any scoping criterion. In addition, the coated component does not have an intended function related to flow blockage of downstream components in contrast to the function of the coating itself (in other words the coating has an additional function that is not driven by the function of the coated component). Clarification of the definition is needed to address this inconsistency.	The staff does not agree with this comment. The definition of Service Level III (augmented) was deleted from the LR-ISG. As stated in the response to Comment No. 55, the LR-ISG was revised to clarify the staff's intent related to the scope of coatings/linings and the intended function of the component in which it is applied. Specifically, the "scope of program" program element of AMP XI.M42 states, "[t]he scope of the program is internal coatings/linings for in-scope piping, piping components, heat exchangers, and tanks exposed to closed-cycle cooling water, raw water, treated water, treated borated water, waste water, fuel oil, and lubricating oil where loss of coating or lining integrity could prevent satisfactory accomplishment of any of the component's functions identified under 10 CFR 54.4(a)(1), (a)(2), or (a)(3)." The staff does not agree with the statement, "[i]n addition, the coated component does not have an intended function related to flow blockage of downstream components in contrast to the function of the coating/lining itself (in other words the coating/lining has an additional function that is not driven by the function of the coated component)." The staff recognizes that an uncoated component would not have an intended function related to flow blockage. For example, the CLB intended function for a coated or uncoated component in a PWR auxiliary feed water pump discharge line would state in part, deliver 350 gpm to the steam generators. However, this does not preclude the fact that there is a potential failure mode of flow blockage during the current licensing period. One of the purposes of the integrated plant assessment is to identify the effects of aging. 10 CFR 54.21(a)(3) states, "[f]or each structure and component identified in paragraph (a)(1) of this section, demonstrate that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation." Therefore, the staff has concluded that the following examples provide insight into its position: • If a coated/lined component has a CLB intended function identified under 10 CFR 54.4(a)(1) to deliver 350 gpm to the steam generators, then loss of coating or lining integrity is an applicable aging effect because it could prevent that intended function from occurring. • If a coated/lined component has a CLB intended function identified under 10 CFR 54.4(a)(2) to not leak and spray a safety-related panel, then loss of coating or lining integrity is an applicable aging effect because it could prevent that intended function from occurring. • If a coated/lined component has a CLB intended function identified under 10 CFR 54.4(a)(3) to remove 100 gpm of fire sprinkler discharge water to prevent flooding in a room, then loss of coating or lining integrity is an applicable aging effect because it could prevent that intended function from occurring.

#	Comment	Staff Resolution
63 [53]	V.d.i & iii It is not clear why these two sections are needed. Consider deletion. The concerns of these two sections are managed by other programs regardless if they are coated or not. Hypothetical cascading failures that have not been experienced and are not part of the station's CLB need not be addressed when scoping for license renewal. If there is operating experience that is generically applicable (i.e., to many different coating systems in many different service environments) that indicate that failure of a coating that in turn causes failure of the base metal leading to spray on safety-related equipment where the safety-function is lost (or could have been lost) then this OE should be provided. If this is just a theoretical, hypothetical concern then it need not be addressed for license renewal. In addition, failure of the coating itself is irrelevant to the function of the component. The leakage boundary function of the component is maintained as long as through-wall leakage of the base metal is prevented. The existing license renewal guidance (e.g., GALL/SRP, Rev 2) provides AMPs that ensure that aging of the base metal is adequately managed to prevent through-wall leakage. Therefore, managing any potential aging of the coating is not required.	The staff does not agree with this comment in relation to the concept of cascading failures as stated by the commenter. The staff responded to a comment on cascading failures in Comment No. 22. The staff has concluded that none of the existing GALL Report AMPs completely address loss of coating or lining integrity. However, as stated in the response to Comment No. 28, the staff did revise the “detection of aging effects” program element to allow the use of AMP XI.M36, and AMP XI.M38 or other appropriate internal surfaces inspection program (e.g., AMP XI.M20, XI.M21A) when certain conditions are met in lieu of the inspections recommended in AMP XI.M42.

#	Comment	Staff Resolution
64 [54]	V.d.iii The internal coatings on nonsafety-related pipe that maintains mechanical and structural integrity to provide structural support to SR piping and components should not be in scope unless credit was specifically taken for the coating in designing the system. Delete or revise this section. Typically credit is not taken for pipe coatings for the pipe to perform its function. The coating is more like an added provision. Therefore, the coating should not need to be age-managed. The system can perform its function without the coating. As stated in NEI 95-10 appendix F even aged pipe does not fail in a seismic event and only the supports are in scope. As written this would require you to include coatings in air systems if there were any that were in for structural support only. Hypothetical cascading failures that have not been experienced and are not part of the station's CLB need not be addressed when scoping for license renewal. Internal coating failures generally lead to localized pitting of the base metal. It is not credible that localized pitting would render the component unable to perform its structural support function. If there is operating experience that is generically applicable (i.e., too many different coating systems in many different service environments) that indicate that failure of a coating that in turn causes failure of the base metal leading to loss of the component's structural support function then this OE should be provided. If this is just a theoretical, hypothetical concern then it need not be addressed for license renewal. In addition, failure of the coating itself is irrelevant to the function of the component. The structural support function of the component is maintained as long significant loss of material (in both depth and area) is not allowed to occur. The existing license renewal guidance (e.g., GALL/SRP, Rev 2+G64) provides AMPs that ensure that aging of the base metal is adequately managed to prevent significant loss of material. Therefore, managing any potential aging of the coating is not required.	The staff does not agree with the cascading failures portion of this comment, which was addressed in Comment No. 22. NEI 95-10, Section 5.2.2.3, “Non-seismic and Seismic II/I Piping and Supports,” states, “[n]o experience data exists of welded steel pipe segments falling due to a strong motion earthquake,” “[f]alling of piping segment is extremely rare and only occurs when there is a failure or unzipping of the supports,” and “[t]hese observations hold for new and aged pipe.” However, the data in the referenced document, NUREG CR-6239, "Survey of Strong Motion Earthquake Effects on Thermal Power Plants in California with Emphasis on Piping Systems," does not support the conclusion related to aged pipe. The staff reviewed NUREG CR-6239 Table 4.5, “Summary Description of Behavior, Damage, and Failures of California Above Ground Power Plant Piping and Supports Due to Strong Motion Earthquakes.” Based on a review of Table 4.5, the age of the majority of the first plants installed at each site at the time of the various earthquakes ranged from 5 years to 30 years, with one site aged to 38 years and another aged to 46 years. The data does not necessarily support plants aged to 60 years. Nevertheless, based on Comment No. 28, the staff revised the “detection of aging effects” program element to allow the use of AMP XI.M36, and AMP XI.M38 or other appropriate internal surfaces inspection program (e.g., AMP XI.M20, XI.M21A) when certain conditions are met in lieu of the inspections recommended in AMP XI.M42. This alternative includes piping with an intended function of structural integrity (attached) as defined in SRP-LR Table 2.1-4(b).
65 [55]	V.e.ii General references to tanks should be reviewed and reworded. As noted above, blisters have been observed to remain stable due to equilibrium of the conditions which initiated the blistering. In low flow conditions, these blisters do not typically generate debris for down-the-line concerns.	The staff does not agree with this comment. The staff has concluded that blistering is not the only failure mechanism that impacts tank coatings/linings. In addition, depending on the specific gravity of degraded coatings/linings which could become loose debris and the fluid velocity within the tank, this debris could transport and cause flow blockage.

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#	Comment	Staff Resolution
66 [56]	VI This section is inconsistent with the definition of SLII coatings provided in RG 1.54. Many of the coatings that are included in the definition of SLIII (augmented) and by extension included in the scope of this ISG are SLII coatings. Therefore, many (if not most) SLII coatings are included within the scope of this ISG.	The staff agrees with this comment. The definition of SLIII (augmented) has been removed from the LR-ISG. In addition, Section VI, “Basis for not including Service Level II coatings within the scope of this LR-ISG,” has been deleted from the LR-ISG.
67 [57]	VII The next to last sentence includes piping, piping components, heat exchangers and tanks. According to Chapter IX, piping components includes a lot of specific components. "Examples include fittings, tubing, flow elements/indicators, demineralizers, nozzles, orifices, flex hoses, pump casings and bowls, safe ends sight glasses, spray heads, strainers, thermowells, and valve bodies and bonnets." Is it the intent of this ISG to address piping, tanks and heat exchangers, or all of the above listed components? Delete "piping components" from the subject sentence.	It is the staff’s intent that all piping segments, tanks, and heat exchangers, as well as any of the types of components included in the definition of piping components in GALL Report Chapter IX be included within the scope of the LR-ISG. The staff is not revising the LR-ISG based on this comment.
68 [58]	VII Suggest rewording this sentence: "The staff included the Service Level III (augmented) coatings AMP in the mechanical series of AMPs instead of the structural series because the components being age-managed by the program will principally be piping, piping components, heat exchangers, and tanks." To this: "The staff included the Service Level III (augmented) coatings AMP in the mechanical series of AMPs instead of the structural series because the aging effects being managed by the program will be associated principally with piping, piping components, heat exchangers, and tanks." "Age-managed" is a term that does not appear in NUREG-1800 or NUREG-1801.	The staff agrees with this comment. It is incorporated into the LR-ISG.
69 [59]	VII.a.i It is not clear how periodicity of visual inspections is based on impact of coating failure. There is nothing in Table 4a based on impact of coating failure. An explanation of how impact of coating failure affects periodicity of visual inspection seems warranted. An explanation of how impact of coating failure affects periodicity of visual inspection is needed to allow determination of periodicity of inspections.	The staff does not agree with this comment. Table 4a establishes an upper limit on the frequency of inspections regardless of the results of inspections, coating/lining history, etc. The statement, “[s]ubsequent 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” is intended to provide the recommended inputs that a coatings specialist should use in determining whether more frequent inspections are required.

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#	Comment	Staff Resolution
70 [60]	VII.a.i The inspection criteria indicated by "extent of inspections for internally coated piping" should be qualified. Coating inspection sampling size for internally coated piping should not be more stringent than sampling sizes recommended in other AMPs. Commercial Grade Dedication of coatings which identify ASTM standards as critical characteristics for acceptance provide reasonable assurance those coatings are procured and tested in accordance with industry consensus documents (ASTM). Qualification of coatings applicators and inspectors are also typically performed in accordance with industry consensus documents (ASTM).	The staff agrees in part, with conditions. The staff is aware, as well as the industry, that some coatings/linings installed in the early years, particularly in nonsafety-related applications, may lack traceable documentation to demonstrate that manufacturer recommendations and industry consensus documents were used during installation. However, the staff recognizes that, in cases where documentation that manufacturer recommendations and industry consensus documents were used during application of the coating/lining is available, reasonable assurance that loss of coating or lining integrity will not impact the CLB intended function(s) of in-scope components can be established with a smaller sample size. The AMP was revised accordingly.
71 [61]	VII.a.i "Visual inspections are conducted on all coatings applied to …" should be reworded. It is incorrectly stated. Visual inspections are not performed on all internal coatings of in-scope components. Suggested Change: Replace the word "all" with the word "accessible." The first paragraph at the top of page 10 provides an example of inspection requirements for all tanks and heat exchangers. This example is unclear. Suggested Change: Rewrite and redefine this example for the sake of clarity.	The staff agrees in part with this comment. The term "all" was removed. The extent of inspections for tanks, heat exchangers, and piping is described in LR-ISG Section VI.a.i. Further guidance is provided in AMP XI.M42 (e.g., surface coverage).
72 [62]	VII.a.i App C, Section 4 The 73 1-foot lengths of pipe or 50% of total length of material and environment combination seems excessive. Is 95/95 confidence level needed for this ISG? For service level I coatings, requirement is to do walkdown of accessible locations. For service level III internal coatings, piping will need to be opened up, so it goes beyond looking at accessible areas. There should be a balance between the cost (resources, industrial safety, rad safety), feasibility and the benefit, to have the amount of inspections be more cost-beneficial.	The staff agrees in part with conditions. The LR-ISG includes an explanation of the basis for the higher number of inspections. However, consistent with the response to Comment No. 70, the staff revised AMP XI.M42 to recommend a lower number of inspections in cases where documentation that manufacturer recommendations and industry consensus documents were used during application of the coating/lining is available.
73 [63]	VII.a.i Element 4 Change to read as follows: "The extent of inspections for internally coated piping is either (remove 'a') 73 representative 1-foot axial length circumferential segments…." Editorial	The staff agrees that an editorial change is appropriate; however, the statement was revised as follows: "either a representative <u>sample of</u> 73…"
Comment Nos. 74 through 81 were associated with comments on Draft LR-ISG-2012-02		
82 [64]	VII.a.iv Element 3 Stating the specific ASTM standard in Element 3 seems to contradict NRC response to Resolution of Public Comments, Item 79. Consider revising the subject paragraphs to point to the Reg Guide or to the EPRI document. Consistency	The staff agrees with this comment; however, in lieu of referencing RG 1.54, the staff adopted definitions for blistering, cracking, flaking, peeling, delamination, and rusting from ASTM D610, ASTM D772, ASTM D4538, and EPRI 1019157. The "parameters monitored/inspected" program element of AMP XI.M42 was revised to include these definitions.

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#	Comment	Staff Resolution
83 [65]	VII.a.vii The in-scope indication of the installed coating upstream of the cooling pond is incorrect. Example (a) “coating installed upstream of a cooling pond with no piping obstructions between coating and cooling pond with flow circulation such that coating debris would not transport to an inlet pipe” was given as basis to perform external wall thickness measurements in lieu of coating inspections. This piping would not be an in scope component because loss of coating could not prevent it from satisfactorily accomplishing any of its functions identified under 10 CFR 54.4 as written and should be removed as an example.	The staff accepts this comment by deleting the example because the cooling pond example was encompassed by the second example, “a coating/lining installed on the internal surfaces of piping system that only has a leakage boundary (spatial) function.”
84 [66]	VII.c Change from "Attachment C" to "Appendix C". Editorial	The editorial change was incorporated.
85 [67]	Table 3.0-1 Description of Program Provide detail in the main body of the ISG (maybe in Section II OE examples) as to the environments applicable to this AMP, in addition to naming them in Table 3.0-1. Clarification	The staff does not agree with this comment. The environments described in Table 3.0-1 include closed-cycle cooling water, raw water, treated water, treated borated water, waste water, lubricating oil or fuel oil. These same environments are identified, as applicable in the AMR Tables changes associated with the GALL Report and SRP-LR, as well as the newly developed AMP XI.M42. The OE examples are related to raw water; however, loss of coating or lining integrity can result in loss of material and/or flow blockage in any of the environments cited in this LR-ISG.
86 [68]	Table 3.2-1 Remove "physical damage" from aging effect/mechanism column. Physical damage is not an aging effect or aging mechanism. License renewal aging management programs should not be relied on to manage physical damage or other conditions that are not related to operation beyond the initial license term.	The staff does not agree with this comment. Physical damage can be the result of aging mechanisms. The staff clarified its intent by adding the following wording to the “parameters monitored/inspected” program element of AMP XI.M41: “[p]hysical 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.”
87 [69]	Appendices A and B Throughout the body of the ISG, and in Elements 4 and 6 of AMP XI.M42, aging mechanisms of "rusting" and "delamination(s)" are typically listed yet the appendices do not include these terms consistently. Recommend adding these two terms where listings of aging mechanisms are given, e.g. Tables in the Appendices, and Definitions GALL Report Section IX.E. Clarification	The staff agrees with this comment. In addition to incorporating delamination and rusting into the LR-ISG, GALL Report items CP-152 and TP-301, and SRP-LR items 3.5.1-34 and 3.5.1-73 were revised accordingly. GALL Report AMP XI.S8 did not require changes because these two aging mechanism were already addressed. Spalling of cementitious materials was added to the GALL Report and AMR items citing XI.M42 but not XI.S8.

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#	Comment	Staff Resolution
88 [70]	Appendix B There is nothing that addresses the extent of material installed and it qualifying as being a coating. Provide provision to exclude inspection if a small pit is filled in with a ceramic metal based material or change the definition of a coating to clearly define small repairs don't qualify. Small pits filled in with a ceramic metal-based material are not coatings as defined in EPRI or ASTM guidance.	The staff does not agree with this comment. It is immaterial whether EPRI document or ASTM standard would define a small repair as a coating/lining. If the replacement coating/lining were to degrade, loss of material could recommence beneath the degraded coating/lining and the degraded coating/lining material could cause flow blockage. Applicants who desire to exclude small coating/lining repairs should identify them as an exception with accompanying justification in the LRA.
89 [71]	Appendix B Please clarify and reword the definitions of "Coatings" and "Loss of Coating Integrity". (See the definition of Coating as shown on page B-4) As noted above, the materials described as a part of coating linings includes materials which are not typically within the purview of a coatings system owner or ASTM D33. Suggested Change: Suggest removing "...linings (e.g., rubber, cementitious)..." (Please see definition of Loss of Coating Integrity as shown on page B-5) As previously noted, this term is very unclear it leads to continued confusion between whether this ISG relates to the safety function of coatings (adhesion) or the operational function of coatings (deterrence of corrosion of the substrate). Suggested Change: Suggest removing third paragraph entirely - "Where the...can occur"	See the response to Comment No. 9 for clarification of the LR-ISG in relation to use of the terms “coating” and lining.” See the response to Comment No. 10 for clarification of the function of coatings.
90 [72]	Appendix B IX.F Tanks can become fouled in the sense that sediment can build up and lead to corrosion. The definition of fouling in the GALL should be more inclusive. Include tanks in the list of components that can become fouled in the sense that sediment can build up and lead to corrosion. The other option is to remove the detail about raw water. OE has documented that the cause of the pitting corrosion in fuel oil tanks was fouling/sediment that occurred on the bottom of the tank.	The definition for fouling was included in the LR-ISG for information only. GALL Report item AP-105 addresses fouling that leads to corrosion in steel tanks exposed to fuel oil.
91 [73]	Program Description The EPRI document is listed and NOT the Reg Guide. Revise program description as needed for consistency.	The staff does not agree with this comment. The EPRI document is included, and ACI 210.1R-08 was added to the Program Description as guidance documents that contain additional detail on coatings and cement linings than that contained in the LR-ISG. RG 1.54 is referenced within the appropriate program elements (i.e., “detection of aging effects,” “acceptance criteria”) because it forms the basis of some of the recommendations contained in those program elements.

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#	Comment	Staff Resolution
92 [74]	Various Appendix C of the ISG is intended to provide guidance for managing age-related degradation of coatings but is written to address any degradation of coatings. Revise the wording to specify that the focus is age-related coating failure and degradation. As an example, the first sentence of the last paragraph at the bottom of page C-3 should be revised to say "The above recommendations for inspection of coatings may be omitted if the age-related degradation of coatings cannot result in downstream effects..." Since this is an aging management program there is no need to address degradation due to non age-related mechanisms.	See the response to Comment No. 11.
93 [75]	Various Revise the program to exclude components where the corrosion of the base metal is the only issue related to coating degradation. This program is designed to manage age-related degradation of internal coatings. The age-related degradation of the base metal is managed by other AMPs (e.g., Open Cycle Cooling Water System). If it can be shown that the only issue related to coating degradation is the corrosion of the base metal then the coating should be excluded from this AMP. The other AMPs assume age-related degradation, including accelerated degradation (e.g., pitting), and as such, provide sufficient aging management activities to ensure that the aging of the base metal is adequately managed. It is inefficient for one program to track corrosion rates for coated components (as required by element 5) and a different program to track corrosion rates for non-coated components in the same system.	See the response to Comment No. 28.
94 [76]	Appendix C Include use of other programs to manage coatings such as Diesel Fuel Monitoring. EDG Tanks sampling aspect of the Diesel Fuel Monitoring Program could be used to detect coating degradation rather than performing a visual inspection.	See the response to Comment Nos. 28 and 75.
95 [77]	Appendix C The new GALL program description is much more detailed for Service Level III coatings than the existing program for Service Level I coatings. This doesn't seem appropriate. Clarification	The staff has concluded that no changes are necessary as a result of this comment. AMP XI.M42 is larger in some aspects because more detail was required. For example: the “scope of program” program element is larger because more details were required to define coatings/linings that are in–scope. The industry has a standardized definition for Service Level I coatings and therefore the scope is more easily defined for AMP XI.S8. The “detection of aging effects” is more detailed in order to provide flexibility for inspection intervals and use of alternative AMPs. In contrast, AMP XI.S8 recommends that inspections be conducted every refueling outage interval.

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#	Comment	Staff Resolution
96 [78]	Element 2 Revise the preventive actions element to read as follows: "The use of the appropriate coating system for the service environment and the proper installation practices ensure that coating systems will perform as designed during the period of extended operation. Coating systems should be chosen using applicable industry guidance documents (e.g., NACE TPC 2, “Coatings and Linings for Immersion Service”). The installation and repairs of coating systems should be performed in accordance with manufacturer's guidance to ensure proper adhesion of the coating (e.g., proper cleaning of the surface to be coated). If these preventive measures are taken then the newly installed or repaired coating can be considered an Inspection Category A coating rather than an Inspection Category C coating (see Table 4A)." The inspection frequency for Inspection Category C coatings is intended to address misapplied coatings or the use of the wrong coating system. If the coating is properly applied and the correct coating system is chosen then there is no reason to believe that a coating will fail in the first few years of service. In addition, the way Table 4A is currently structured provides motivation to allow continued operation with degraded coatings as long as minimum requirements for the coating system are met rather than proactively repairing minor instances of coating degradation. If a coating has a blister that has been deemed acceptable by a coating specialist there is a disincentive to perform a repair of the blister since additional inspections would be required as a result. This is counterproductive to the goal of ensuring that coating systems are properly maintained.	This comment has been resolved by elimination of inspection Category C. See the response to Comment No. 30.
97 [79]	Element 3 The draft ISG identifies in several places (e.g. on PDF page 1 of 36) the aging effect to be managed as “loss of coating integrity due to blistering, cracking, flaking, peeling, or physical damage…”. However in Appendix C of the draft ISG, the Parameters Monitored/Inspected (Element 3) in GALL AMP XI.M42 states “Visual inspections are intended to identify coatings that do not meet acceptance criteria, such as peeling and delamination.” Recommend consistency in the identified parameters monitored with aging mechanisms that are being managed by the AMP. Section 10.2 of ASTM D7167-12 identifies (for parameters to be monitored) conditions other than peeling and delamination (e.g., such as blistering, cracking, and rusting).	The staff agrees with this comment. See the response to Comment No. 87.

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#	Comment	Staff Resolution
98 [80]	Element 4 The inspection frequency for diesel oil storage tanks should be set at 10 years, consistent with internal tank inspections recommended in GALL program XI.M30. The OE examples provided in this ISG do not provide any basis for why a ten year inspection frequency for the internal coatings for diesel oil storage tanks is insufficient. If generically applicable OE exists to warrant more frequent inspections, that OE should be provided. If not, the ten year frequency recommended in XI.M30 is appropriate.	See the response to Comment No. 75.
99 [81]	Element 4 The baseline inspection is only discussed in Element 4. Revise the body of the ISG to provide the basis for the Baseline Inspection. Clarification	The staff agrees with his comment. The basis for the baseline inspections was added to Section VI, "Summary of changes in this LR-ISG."
100 [82]	Element 4 Category C inspection requirement should be deleted for newly installed, repaired or replace coatings. One re-inspection within six years (similar to Category A) is recommended for newly installed or replaced coatings. One re-inspection within four years (similar to Category B) is recommended for repaired coatings. AMP Table 4(a), inspection category C coatings for newly installed coatings or coatings that have been repaired or replaced should not be more stringent than repair or replacement inspection requirements of other AMPs of ASME Code for pressure boundary or structural integrity intended functions of the base metal components. Newly installed, repaired, or replacement coatings are procured, installed, and tested to ASTM standards and/or Industry consensus documents and should not require re-inspection during the next two refueling cycles. In addition, qualification of coatings applicators and inspectors are also typically performed in accordance with industry consensus documents (ASTM).	The staff agrees with this comment. Category C has been deleted.

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#	Comment	Staff Resolution
101 [83]	Element 4 In Appendix C of the Draft ISG, the Detection of Aging Effects (Element 4) in GALL AMP XI.M42 states “Subsequent inspection intervals are established by a coating specialist qualified in accordance with an ASTM International standard endorsed in RG 1.54 (hereinafter Revision 2 or later).” Later in the same element it states: “The training and qualification of individuals involved in coating inspections and evaluating degraded conditions is conducted in accordance with an ASTM International standard endorsed in RG 1.54 including staff guidance associated with a particular standard.” Recommend allowing use of a later year editions of the ASTM International standard endorsed in RG 1.54 for qualification of coatings specialist and coating inspectors. RG 1.54, Revision 2, currently endorses ASTM D 7108-05 for qualification of Nuclear Coatings Specialist and ASTM D 4537-04a for qualification of coating inspection personnel. These standards have been superseded by ASTM D 7108-12 and ASTM D 4537-12, respectively.	The staff does not agree with this comment. The staff will not endorse revisions to standards that it has not reviewed.
102 [84]	Element 4 In 2nd paragraph below Table 4a, change "(e.g., flanges" to "(e.g., flange faces)" Clarification	The staff agrees with this comment. The change was incorporated as requested.
103 [85]	Element 4 In the last paragraph on page C-3, clarify what is meant by the following two sentences and consider a revision: "However, the recommendations for inspections are met if corrosion rates or inspection intervals have been based on the integrity of the coatings. In this case, loss of coating integrity could result in unanticipated or accelerated corrosion rates of the base metal." Clarification	The staff agrees with his comment. The wording of the alternative has been expanded and clarified.
104 [86]	Element 4 In the 2nd to last paragraph on p. C-3, do not understand what is meant by "For areas not readily accessible for direct inspection, such as small pipelines, heat exchangers, other equipment, consideration is given to the use of remote or robotic inspection tools." Does this mean that we have to use the tools? Above it already requires inspection of all accessible internal surface areas of heat exchangers. Clarification	The staff does not agree with his comment. The staff acknowledges that the “detection of aging effects” program element does state that all accessible internal surfaces should be inspected. However, the sentence related to the use of remote or robotic inspection tools is included to clarify the staff’s intent on the level of effort that should be used to gain access to all accessible surfaces.
105 [87]	Last paragraph on p. C-3 - First sentence is clear. The rest of the paragraph should be split out and clarified. The second sentence can be read multiple ways. It needs clarification. Also, the 2nd through 4th sentences are unrelated to the 1st sentence and should be separate	See the response to Comment No. 103.

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#	Comment	Staff Resolution
106 [88]	Element 4 Allow the use of normal system monitoring rather than intrusive internal visual inspections for detection of flow blockage in non-stagnant systems. Flow blockage in non-stagnant systems is self-revealing through system monitoring. As demonstrated by the OE presented in this ISG flow blockage is detectable through normal system monitoring prior to loss of system intended function.	The staff does not agree with this comment. The staff recognizes that flow blockage can be revealed in non-stagnant systems with normal flow rates. However, visual inspections are necessary to provide reasonable assurance that coatings have not degraded (e.g., peeling, delamination) such that there is the potential that they could become detached during post-accident conditions.
107 [89]	Element 4 Revise to recommend 20% of coated piping be inspected with a maximum of 25 1-foot sections. The internal coating for components performs a secondary function in that the coating may (1) protect the base metal which performs a primary function and/or (2) cause flow blockage of a component performing a primary function if it fails. Given that 90-90 confidence is acceptable for components with a primary function it is not justifiable to require 95-95 confidence for coatings with a secondary function even considering the fact that procurement, installation, and testing industry guidance may not be as rigorous.	See the response to Comment No. 70.
108 [90]	Element 4 Last paragraph needs to include guidance on the numbers of UT inspections on the pipe per foot such as in accordance with FAC guidance documents. Guidance is presently left open to interpretation. FAC is well established inspection criteria.	The staff agrees with this comment. A recommended representative sample size and grid spacing (consistent with those for flow-accelerated corrosion) were added.
109 [91]	Table 4a Category C inspection frequency is not justified and should be reduced to one outage interval for coating - new, repairs, or replacements. Inspection interval should require inspection only during the next refueling outage after installation and not the next two. Historically, OE has shown if a newly installed coating is going to fail it will fail, or show signs of failing, within the first 1½ - 2 years (typical refueling outage interval). A determination of subsequent inspection intervals (longer or shorter) can reliably be made after the first refueling outage inspection. Additionally, this is not reasonable for minor coating repairs. One follow-up inspection to determine if there is continuing degradation should be adequate to move to category A or B. Going two cycles will not expose coating to any new stresses from loads or temperatures that would not have occurred in one cycle. Note: this comment is applicable only if the above comment for Cat C inspection deletions is not accepted by NRC.	The staff agrees with this comment. Category C has been deleted.

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#	Comment	Staff Resolution
110 [92]	Table 4a Item 3b Change turbulence to erosion Erosion is the issue if there are concerns about high velocities and change of direction wearing away the coating. Most fluid flow in nuclear plants is turbulent to some extent.	The staff agrees with this comment. The term “erosion” eliminates the potential ambiguity associated with the term “turbulent,” while still maintaining the staff’s intent associated with damage to coatings due to fluid mechanical forces. The change was incorporated as requested.
111 [93]	Table 4a Item 4 For clarity, change first sentence to read "Subsequent inspections being conducted to Inspection Category B or C are re-inspected at the original as well as new locations." Editorial	The staff agrees with this comment. The editorial change was incorporated as requested.
112 [94]	Table 4a Item 5 Change sentence to read "If two sequential subsequent inspections demonstrate no change in coating condition, subsequent Category B inspections may be conducted at six-year intervals." Editorial	The staff agrees that a change is appropriate to add clarity. The sentence was revised to state that if two sequential subsequent inspections demonstrate no change in coating/lining condition, subsequent inspections at those locations may be conducted to inspection Category A.
113 [95]	Element 5 Revise the first sentence to read as follows: "A review of the previous two inspection results, when available, is conducted…" Editorial	The staff agrees with this comment; however, a clarification was added that the “when available” only applies to the baseline and first subsequent inspection. Two sets of inspection results should be available to review prior to the second subsequent inspection.
114 [96]	Element 6.a Revise the first sentence to read as follows: "…and coatings are repaired, replaced, or removed." The current text doesn't allow for another option, to remove the coating altogether.	The staff agrees with this comment. The change was incorporated as requested.
115 [97]	Element 6.a Why is the criteria peeling and delamination more stringent than required by GALL XI.S8 for service level I coating? That program refers to ASTM D 5163-08, which requires measuring size of degraded area, noting pattern and seeing carefully if lifting can easily be achieved beyond obvious peeled area. The standard also states that physical tests may be performed for deficient coating when directed by the nuclear coating specialist. In this new Coating program, it directly goes to the testing as the acceptance criteria. Using existing standards seems appropriate, when available.	The staff agrees with this comment in part. The criterion for peeling and delamination is more stringent than that required for AMP XI.S8 because the coatings within the scope of AMP XI.M42 are immersion coatings whereas most of the coatings within the scope of AMP XI.S8 are not. In addition, all readily accessible Service Level I coatings are inspected every refueling outage interval, whereas the coatings within the scope of AMP XI.M42 are not inspected as frequently, and in the case of piping, a much smaller extent of the coatings are inspected. Nevertheless, the staff has concluded that coatings exhibiting peeling and delamination could remain in service if certain actions are taken. The “corrective actions” program element of AMP XI.M42 was revised to reflect this option.
116 [98]	Element 6.b & 6.c Delete or clarify what is meant by the following citations: "…including staff guidance associated with use of a particular standard." Clarification	The staff agrees with this comment. The LR-ISG wording was changed to “limitations.” An example is that in RG 1.54 for the use of ASTM D 3911-08.
117 [99]	Element 6.f This needs to be included in 6a. Also define engineering documents. It is the acceptance criteria that is part of the requirement for adhesion testing specified in 6a.	The staff agrees with this comment in part. The term “engineering documents” was revised to “plant-specific design requirements.” The staff did not relocate the acceptance criteria for adhesion testing to 6.a because it could apply to both 6.a and to 6.b.

APPENDIX E

RESOLUTION OF PUBLIC COMMENTS

#	Comment	Staff Resolution
118 [100]	Element 10.a This paragraph identifies blistering, delamination, etc, as "aging effects" which is contrary to other ISG locations, which lists them as "aging mechanisms". Revise locations of this text as appropriate to be consistent. Clarification and consistency	The staff agrees with this comment. The change was incorporated as requested.
119 [101]	Remove the word "Draft" prior to issuance. Editorial	The editorial change was incorporated as requested.