PEACH BOTTOM ATOMIC POWER STATION, UNITS 1AND 2 (PEACH BOTTOM SUBSEQUENT LICENSE RENEWAL APPLICATION (SLRA) REQUESTS FOR ADDITIONAL INFORMATION (RAIS)

SAFETY - SET 1

1. GALL-SLR AMP XI.M41 Buried and Underground Piping and Tanks

Regulatory Basis

10 CFR 54.21(a)(3) requires an applicant to demonstrate that the effects of aging for structures and components will be adequately managed so that the intended function(s) will be maintained consistent with the current licensing basis for the subsequent period of extended operation. One of the findings that the staff must make to issue a renewed license (10 CFR 54.29(a)) is that actions have been identified and have been or will be taken with respect to managing the effects of aging during the subsequent period of extended operation on the functionality of structures and components that have been identified to require review under 10 CFR 54.21, such that there is reasonable assurance that the activities authorized by the renewed license will continue to be conducted in accordance with the current licensing basis. In order to complete its review and enable making a finding under 10 CFR 54.29(a), the staff requires additional information in regard to the matters described below.

RAI B.2.1.28-1

Background:

SLRA Section B.2.1.28, “Buried and Underground Piping and Tanks,” states the following:

a) The program will be consistent with the ten elements of GALL-SLR Report AMP XI.M41, "Buried and Underground Piping and Tanks."
b) Coating will be applied to buried portions of the 10-inch diameter stainless steel line from the torus dewatering tank to the condensate transfer pump suction line in accordance with approved station specifications, during the 10-year period prior to the subsequent period of extended operation (SPEO).
c) Visual inspections of buried piping within the scope of license renewal will be in accordance with GALL-SLR Report Table XI.M41-2, “Inspection of Buried and Underground Piping and Tanks.”

GALL-SLR Report AMP XI.M41 recommends the following:

a) One inspection for buried stainless steel in each 10-year inspection period beginning 10 years prior to the SPEO. This recommendation is based on all in-scope buried stainless steel being coated in accordance with the “preventive actions” program element of GALL-SLR Report AMP XI.M41 during the inspection period.

b) Additional inspections, beyond those in GALL-SLR Report Table XI.M41-2 may be appropriate if exceptions are taken to program element 2, “preventive actions.”

Issue:

The staff noted that the buried stainless-steel piping could be uncoated during portions of the 10-year period prior to the SPEO. Additionally, GALL-SLR Report AMP XI.M41 recommends that additional inspections may be appropriate if exceptions are taken to the “preventive actions” program element. SLRA Section B.2.1.28 does not provide a basis for not being consistent with

GALL-SLR Report AMP XI.M41 in regard to conducting only one inspection of uncoated buried stainless-steel piping during the 10-year period prior to the SPEO.

Request:

State the basis for why one inspection is appropriate for buried stainless steel piping during the 10-year period prior to the SPEO. Address relevant parameters such as the approximate length of buried uncoated stainless-steel piping, the approximate length of buried coated stainless-steel piping, results of soil corrosivity testing, etc.

RAI B.2.1.28-2

Background:

SLRA Section B.2.1.28 states "[t]he program uses the -850 mV relative to CSE (copper/copper sulfate reference electrode), instant off criterion specified in NACE SP0169 for acceptance criteria for steel piping and tanks."

GALL-SLR Report AMP XI.M41 recommends a polarized potential of -950 mV or more negative for steel piping when active microbiologically influenced corrosion (MIC) has been identified or is probable.

During the audit the staff noted that the results of twenty soil corrosivity samples showed that: (a) anaerobic sulfate reducing bacteria (SRB) were identified in thirteen of twenty tested samples; and (b) oxygen reduction potential values ranged from +263 to +390 mV in all samples.

The staff reviewed *Pipeline Integrity - Management and Risk Evaluation (2nd Edition)* and noted that for pipelines operating in anaerobic soils with known SRB, potentials more negative than -950 mV relative to CSE are used to control external corrosion.

The staff reviewed *Ductile-Iron Pipe and Fittings - Manual of Water Supply Practices, M41 (3rd Edition)* which states: "[a] redox potential greater than +100 mV shows the soil to be sufficiently aerated so that it will not support sulfate reducers. Potentials of 0 to +100 mV may or may not indicate anaerobic conditions; however, a negative redox potential definitely indicates anaerobic conditions under which sulfate reducers thrive."

Issue:

The GALL-SLR Report AMP XI.M41 recommendation to increase the cathodic protection polarization by -100 mV (i.e., from -850 mV to -950 mV) is based on: (a) active MIC being probable; or (b) operating experience identifying MIC on the external surfaces of buried piping or tanks. The staff noted that aerobic soil conditions support the conclusion that active MIC is not probable at Peach Bottom; however, the SLRA discussion of operating experience lacks sufficient detail to conclude whether or not instances of MIC on the external surfaces of buried steel piping or tanks have been identified.

Request:

State if MIC has been identified on the external surfaces of buried piping or tanks at Peach Bottom. If operating experience has identified one or more instances of MIC on the external surfaces of buried piping or tanks, state that basis for why the Buried and Underground Piping and Tanks program does not recommend a polarized potential of -950 mV or more negative for steel components.

References.

- NACE SP0169-2007, “Control of External Corrosion on Underground or Submerged Metallic Piping Systems”
- Singh, Ramesh. (2017). *Pipeline Integrity - Management and Risk Evaluation (2nd Edition) – Chapter 6. Corrosion and Corrosion Protection,* page 265
- *Ductile-Iron Pipe and Fittings - Manual of Water Supply Practices, M41 (3rd Edition).* American Water Works Association (AWWA), page 174

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2. GALL-SLR AMP XI.S8, “Protective Coating Monitoring and Maintenance

Regulatory Basis

10 CFR § 54.21(a)(3) requires an applicant to demonstrate that the effects of aging for structures and components will be adequately managed so that the intended function(s) will be maintained consistent with the current licensing basis for the subsequent period of extended operation. One of the findings that the staff must make to issue a renewed license (10 CFR Section 54.29(a)) is that actions have been identified and have been or will be taken with respect to managing the effects of aging during the subsequent period of extended operation on the functionality of structures and components that have been identified to require review under 10 CFR Section 54.21, such that there is reasonable assurance that the activities authorized by the renewed license will continue to be conducted in accordance with the current licensing basis (CLB). In order to complete its review and enable making a finding under 10 CFR Section 54.29(a), the staff requires additional information in regard to the matters described below.

RAI B.2.1.36-1

Background:

In its SLRA, Section B.2.1.36, “Protective Coating Monitoring and Maintenance,” the applicant claimed consistency with the GALL-SLR Report for the AMP XI.S8, “Protective Coating Monitoring and Maintenance.” The GALL-SLR Report “Detection of Aging Effects,” program element, states that ASTM D5163-08, “Standard Guide for Establishing a Program for Condition Assessment of Coating Service Level I Coating Systems in Nuclear Power Plants,” paragraph 9 contains the requirements for qualifications of coatings inspection personnel.

During the In-Office audit, the staff reviewed the program basis document PB-PBD-AMP-XI.S8, “Protective Coating Monitoring and Maintenance,” Revision 1, to evaluate whether the applicant is consistent with the GALL-SLR Report recommendations for the “Protective Coatings” AMP. In the document, the applicant states that coatings inspectors will be “certified,” but does not provide a description of the certification. This is also described as an enhancement to the “Protective Coating Monitoring and Maintenance” program in the SLRA.

Issue:

ASTM D5163-08, paragraph 9, states that coatings inspection personnel should be qualified to ASTM D7108, “Standard Guide for Establishing Qualifications for a Nuclear Coatings Specialist.” The applicant does not state what certification the coatings inspectors will attain.

Request:

State the certification that coatings inspectors will be required to attain when the proposed enhancement to the program is implemented.

RAI B.2.1.36-2

Background:

In its SLRA, Section B.2.1.36, "Protective Coating Monitoring and Maintenance," the applicant claimed consistency with the GALL-SLR Report for the AMP XI.S8, "Protective Coating Monitoring and Maintenance." The "Detection of Aging Effects," program element references ASTM D5163-08 paragraph 6 which states that Service Level I coatings should be inspected "…each refueling outage or during other major maintenance outages, as needed …."

During the In-Office audit, the staff reviewed the PMID RQ 234247-01, "20S019: Torus Dewatering/Cleaning/Inspection," and PMID RQ 234248-01, "30S019: Torus Dewatering/Cleaning/Inspection," to evaluate whether the applicant is consistent with the recommendations for the Water Chemistry AMP in the GALL-SLR Report. Additionally, the staff reviewed the program basis document PB-PBD-AMP-XI.S8, "Protective Coating Monitoring and Maintenance," Revision 1.

Issue:

ASTM D5163-08 recommends inspection of Service Level 1 coatings during "…each refueling outage or during other major maintenance outages, as needed …." During its review of the applicant procedures the NRC staff noted that inspections of Service Level I coatings are conducted at a frequency of at least every 2 refueling outages, or 4 years.

Request:

State the basis for why an inspection frequency for Service Level I coatings of every 2 refueling outages, or 4 years, is consistent with the GALL-SLR.

RAI B.2.1.36-3

Background:

In its SLRA, Section B.2.1.36, "Protective Coating Monitoring and Maintenance," the applicant claimed consistency with the GALL-SLR Report for the AMP XI.S8, "Protective Coating Monitoring and Maintenance." The GALL-SLR report recommends logging the total amount of degraded coatings in containment in order to compare it to the total amount of permitted degraded coatings. This allows for a determination of reasonable assurance of post-accident operability of the ECCS.

During the In-Office audit, the staff reviewed AR 1192421, "MSSRV [Main Steam Safety Relief Valve] Disch. Piping Temp. > Torus Coating Qualified Temp," dated March 25, 2011, which stated that the discharge temperature for the MSSRVs is greater than the coatings qualified temperature. The AR also stated that the coatings in the area of the MSSRVs will be deemed qualified unless a MSSRV opens, at which point it will be deemed unqualified and added to the unqualified coatings log. Additionally, Chapter 14, "Plant Safety Analysis," of the Updated Final Safety Analysis Report (UFSAR) provides an analysis that shows during certain postulated LOCAs, the MSSRVs may open.

Issue:

The "Monitoring and Trending" program element of the GALL-SLR recommends logging the total amount of degraded coatings in containment in order to compare it to the total amount of permitted degraded coatings. However, it is possible that the coatings currently deemed qualified in the area of the MSSRVs will fail as the MSSRV discharge temperature is greater

than the coatings qualified temperature. This would result in more unqualified coatings than were accounted for in the unqualified coatings logs.

Request:

State the basis for determining that the coatings identified in AR 1192421 should remain 'qualified,' and how that is consistent with the "Monitoring and Trending" program element that recommends maintaining a log of all unqualified coatings.

RAI B.2.1.36-4

Background:

The GALL-SLR recommends the UFSAR supplement for the XI.S8, "Protective Coating Monitoring and Maintenance," program reference Regulatory Guide (RG) 1.54, "Service Level I, II, III, and In-Scope License Renewal Protective Coatings Applied to Nuclear Power Plants," as the basis for inspecting and maintaining Service Level I Coatings.

Issue:

The applicant's proposed UFSAR supplement in Section A.2.1.36 of the SLRA doesn't reference RG 1.54 as the basis for the "Protective Coating Monitoring and Maintenance" program. The proposed UFSAR supplement only references RG 1.54 to give the definition of Service Level I coatings. Therefore, it is not clear what standard the program will be based on.

Request:

State the basis for how the proposed UFSAR supplement is consistent with the recommended supplement provided in the GALL-SLR.

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3. GALL-SLR Report AMP XI.M42 Internal Coatings/linings for In-scope Piping, Piping Components, Heat Exchangers and Tanks

Regulatory Basis

10 CFR 54.21(a)(3) requires an applicant to demonstrate that the effects of aging for structures and components will be adequately managed so that the intended function(s) will be maintained consistent with the current licensing basis for the subsequent period of extended operation. One of the findings that the staff must make to issue a renewed license (10 CFR 54.29(a)) is that actions have been identified and have been or will be taken with respect to managing the effects of aging during the subsequent period of extended operation on the functionality of structures and components that have been identified to require review under 10 CFR 54.21, such that there is reasonable assurance that the activities authorized by the renewed license will continue to be conducted in accordance with the current licensing basis. In order to complete its review and enable making a finding under 10 CFR 54.29(a), the staff requires additional information in regard to the matters described below.

RAI B.2.1.29-1

Background:

SLRA Table 3.3.2-17, "High Pressure Service Water System," states that loss of coating integrity and loss of material is managed for internally coated carbon steel residual heat removal (RHR) heat exchanger tube side components exposed to raw water using the Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks program.

During the audit, the staff noted that during development of the Internal Coatings/Linings for in-Scope Piping, Piping Components, Heat Exchangers, and Tanks aging management program, it was identified that the high-pressure service water side of the RHR heat exchanger water box does not appear to be coated.

Issue:

Based on the staff's observation during the audit, it is unclear if the subject components are internally coated. If the subject components are not internally coated, it is unclear to the staff why the Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks program is appropriate to manage loss of material for the subject components.

Request:

State if the high-pressure service water carbon steel RHR heat exchanger tube side components are internally coated. If the subject components are not internally coated, state the basis for why the Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks program is appropriate to manage loss of material for the subject components.

RAI B.2.1.29-2

Background:

SLRA Tables 3.3.2-24, "Radwaste System," and 3.3.2-26, "Reactor Water Cleanup System," state that internally coated carbon steel tanks exposed to treated water are managed for loss of material and loss of coating or lining integrity using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program. As amended by letter dated January 23, 2019, the plant-specific note associated with the subject components states "[t]he environment is Treated Water that does not have the potential for microbiologically-induced corrosion."

GALL-SLR Report AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks," states that GALL-SLR Report AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," is an acceptable alternative to the inspections recommended in GALL-SLR Report AMP XI.M42 when six different condition exists. One of the conditions is that the internal environment would not promote microbiologically influenced corrosion (MIC) of the base metal.

NUREG–2221, "Technical Bases for Changes in the Subsequent License Renewal Guidance Documents NUREG–2191 and NUREG–2192," states the following:

> MIC is not likely in treated water systems where sulfates and chlorides are low (<150 ppb); however, contamination of treated water systems can lead to MIC. Treated water systems typically are low in the nutrients required to sustain microorganisms, but in stagnant or low flowing areas, corrosion products and contaminants can accumulate and settle. The same contamination source for the microorganism could also allow introduction of the nutrients required to sustain these microbes.

Issue:

A basis was not provided for why the internal surfaces of the internally coated carbon steel tanks in the radwaste and reactor water cleanup systems exposed to treated water are not susceptible to loss of material due to MIC.

Request:

State the basis for why internally coated carbon steel tanks exposed to treated water in the radwaste and reactor water cleanup systems are not susceptible to MIC.

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4. GALL-SLR AMP XI.M27 Fire Water System

Regulatory Basis:

10 CFR 54.21(a)(3) requires an applicant to demonstrate that the effects of aging for structures and components will be adequately managed so that the intended function(s) will be maintained consistent with the current licensing basis for the subsequent period of extended operation. One of the findings that the staff must make to issue a renewed license (10 CFR 54.29(a)) is that actions have been identified and have been or will be taken with respect to managing the effects of aging during the subsequent period of extended operation on the functionality of structures and components that have been identified to require review under 10 CFR 54.21, such that there is reasonable assurance that the activities authorized by the renewed license will continue to be conducted in accordance with the current licensing basis. In order to complete its review and enable making a finding under 10 CFR 54.29(a), the staff requires additional information in regard to the matters described below.

RAI B.2.1.17-1

Background

SLRA Section B.2.1.17, "Fire Water System" program, Enhancement No 1 states the following in relation to inspector tests flushes and main drain tests: "[I]f acceptance criteria are not met, at least two additional tests shall be performed. If acceptance criteria are not met during follow-up testing, the test shall be performed on the same system, on the other unit." SLRA Section B.2.1.17 also states that it will be consistent with GALL-SLR Report AMP XI.M27, "Fire Water System," with an exception. The exception is not related to inspector test flushes and main drain tests.

GALL-SLR Report AMP XI.M27, "Fire Water System," recommends the following additional corrective actions other than those cited in Enhancement No.1: (a) the additional tests are completed within the interval in which the original test was conducted; and (b) if subsequent tests do not meet acceptance criteria, an extent of condition and extent of cause analysis is conducted to determine the further extent of tests.

The Program Basis Document for the Fire Water System, reviewed during the audit, states that: (a) wet pipe sprinkler systems fed directly from the main supply header do not have alarm control valves or a main drain; and (b) inspector test flushes are performed that verify there are no flow blockages in the supply piping.

GALL-SLR Report AMP XI.M27, Table XI.M27-1, "Fire Water System Inspection and Testing Recommendations," recommends that main drain tests be conducted.

Issue

SRP-SLR Section 1.2.1 states:

> Section 54.21(a)(3) to 10 CFR Part 54 requires the application to demonstrate, for SSCs within the scope of license renewal and subject to an AMR pursuant to 10 CFR 54.21(a)(1), that the effects of aging are adequately managed so that the intended function(s) are maintained consistent with the current licensing basis (CLB) for the subsequent period of extended operation.
>
> For the programs submitted in the SLRA that the applicant claims are consistent with the GALL-SLR Report, the NRC staff will verify that the applicant's programs are consistent with those described in the GALL-SLR Report and/or with plant conditions and OE during the performance of an AMP audit and review.

The SLRA lacks sufficient information to determine that the Fire Water System program is consistent with GALL-SLR Report AMP XI.M27; in particular: (a) the adequacy of additional inspections when test acceptance criteria are not met; and (b) the criteria that will be used to determine the number of further tests if any of the initial set of additional inspections do not meet acceptance criteria.

During the audit, it was conveyed to the staff that of the 29 wet pipe sprinkler systems that are fed directly from the main supply header, 20 have main drains and 9 do not.

The staff noted that the test procedure associated with inspector test flushes is conducted by starting a stop watch, opening a valve, and timing the duration until an alarm window actuates. Based on the potential variability of the time to taken to open the valve, it is not clear whether the results of the inspector test flushes can be accurately trended sufficient to detect potential flow blockage due to fouling.

In order to determine whether the Fire Water System program is consistent with GALL-SLR Report AMP XI.M27, the staff seeks clarification on: (a) whether main drain tests will be conducted on all of the wet pipe sprinkler systems that have main drains; and (b) whether the results of the inspector test flushes can be accurately trended sufficient to detect potential flow blockage due to fouling.

Request

a) State when the additional inspections will be conducted when test acceptance criteria are not met. State the criteria or method that will be used to determine the number of further tests if any of the initial set of additional inspections do not meet acceptance criteria. State the basis for the response if the provided information is not consistent with GALL-SLR Report AMP XI.M27.

b) Respond to the following: (a) confirm that of the 29 wet pipe sprinkler systems fed directly from the main supply header, 20 have main drains and 9 do not, or provide the correct quantities; (b) state whether main drain tests will be conducted on all of the wet pipe sprinkler systems that have main drains and provide the basis for the population size if they will not all be periodically tested consistent with GALL Report AMP XI.M27, Table XI.M27-1; and (c) if it is assumed that the results of the inspector test flushes can be trended sufficient to detect potential flow blockage due to fouling, state the basis for the consistency of the trend results.

RAI B.2.1.17-2

Background

GALL-SLR AMP XI.M27, Table XI.M27-1, recommends that hydrants be flushed in accordance with NFPA-25, "Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems," Section 7.3.2, which requires that: (a) "[e]ach hydrant shall be opened fully and water flowed until all foreign material has cleared;" and (b) "[f]low shall be maintained for not less than 1 minute." The Water-Based Fire Protection Systems Handbook, Fourth Edition, Testing Procedure for [NFPA 25 Section] 7.3.2 states, "[o]pen the hydrant fully and allow the flow to continue until all foreign material has cleared, with a minimum flow period of 1 minute." Page 196 of this document clarifies this requirement by stating, "[f]low test until all foreign material has cleared (not less than one minute)." The plant-specific procedures do not include a requirement that the hydrant flush be maintained for a minimum of one minute and the SLRA does not include an enhancement to address this, or an exception to justify the difference.

NFPA-25, Section 7.3.2, also requires that: (a) "[a]fter operation, dry barrel and wall hydrants shall be observed for proper drainage from the barrel" (b) "[f]ull drainage shall take no longer than 60 minute;" and (c) "[w]here soil conditions or other factors are such that the hydrant barrel does not drain within 60 minutes, or where the groundwater level is above that of the hydrant drain, the hydrant drain shall be plugged and the water in the barrel shall be pumped out." During the audit, the staff's review of plant-specific operating experience revealed that multiple hydrants were found full or a water level was detected within the hydrant. In addition, the plant specific procedure for flushing hydrants states that: (a) the hydrant should be, "drained to a level approximately 3 feet below ground level;" and (b) "[i]f the hydrant is still not drained, or directed by the sign on the fire hydrant, then manually pump it down to 3 feet below the ground." During the audit, it was conveyed to the staff that: (a) the frost line in the vicinity of Peach Bottom is 20 inches to 30 inches deep; and (b) there are some hydrants located in areas where the water table is higher and they might not remain drained following the flush. Table 7.2.2.4 of the NFPA 25 Handbook states that a barrel which contains water or ice could be indicative of a faulty drain, a leaky hydrant valve, or high groundwater table, The recommended corrective action is to "[r]epair and drain; for high groundwater it could be necessary to plug the drain and pump out the barrel after each use." The SLRA does not include an enhancement to address this, or an exception to justify the difference.

Issue

The staff has concluded that to be consistent with GALL-SLR Report AMP XI.M27, a hydrant must be fully open for at least one minute to ensure that an adequate flush was conducted. The staff's position is based on the fact that until the hydrant is fully open, the flow velocity might not be adequate to clear the fire water main of all debris. The SLRA lacks sufficient information to justify this staff-identified difference.

Although the plant-specific procedures require that a hydrant be drained below the frost line, the frost line is based on the soil overcharge. In the case of a hydrant, while soil surrounds the hydrant barrel, the barrel internal temperature could be below freezing for depths greater than the frost line. In addition, as conveyed to the staff during the audit, certain hydrants might refill with water due to the water table height. The SLRA lacks sufficient information to justify: (a) why hydrants are only pumped to 3 feet below the ground; and (b) why the hydrant drain is not plugged and the plant-specific procedures enhanced to state that water in the barrel shall be pumped out where the water table can result in leakage into a hydrant barrel.

Request

a) State the basis for why an adequate hydrant flush has been conducted when the plant-specific procedures do not include a requirement to fully open the hydrant for at least one minute.

b) Respond to the following: (a) confirm the depth of the frost line; (b) state the basis for why water in the hydrant barrel will not freeze even though it is only pumped down to 3 feet below the ground level; and (c) state why the hydrant drain is not plugged and the plant-specific procedures enhanced to state that water in the barrel shall be pumped out where the water table can result in leakage into a hydrant barrel.

RAI B.2.1.17-3

Background

SLRA Section B.2.1.17, Enhancement No. 4 states," [r]evise procedures to improve guidance for external visual inspections of the in-scope sprinkler systems piping and sprinklers at least every two years to inspect for excessive corrosion…"

NFPA 25 Section 5.2.1.1.2 states that, "[a]Ny sprinkler that shows signs of any of the following shall be replaced: (1) leakage; (2) corrosion..."

During its search of plant-specific operating experience, the staff noted four instances of leaking sprinklers.

GALL-SLR Report AMP XI.M27, Table XI.M27-1, footnote 10 states, "[w]here NFPA 25 or this table cite annual testing or inspections, testing and inspections can be conducted on a refueling outage interval if plant-specific OE has shown no loss of intended function of the in-scope SSC due to aging effects being managed for the specific component (e.g., loss of material, flow blockage due to fouling)."

Issue

As recommended by GALL-SLR Report AMP XI.M27, sprinklers exhibiting "corrosion" versus sprinklers exhibiting "excessive corrosion" are to be replaced. The SLRA does not describe the difference between "significant corrosion" and "corrosion" and as a result, the staff cannot conclude whether the changes described in Enhancement No. 4 will be consistent with GALL-SLR Report AMP XI.M27.

The SLRA lacks sufficient information for the staff to conclude whether the effects of the leakage identified in the plant-specific operating experience could have adversely affected the sprinkler such that its intended function would not have been met.

Request

a) State the criteria that differentiate between corrosion and significant corrosion and the basis for why using the criterion of significant corrosion will be effective at identifying sprinkler degradation prior to a loss of intended function.

b) State the percentage of wet pipe sprinklers that exhibited leakage in the past 10 years. State the basis for why the effects of the observed leakage did not result in a loss of intended function of the sprinkler. If the effects could have resulted in a loss of intended function, state the basis for the effectiveness of the proposed sprinkler visual inspections.

RAI B.2.1.1.17-4

Background

During its search of plant-specific operating experience, the staff noted a decreasing trend of fire water pump flow testing results. In tests conducted in 2015 and 2018, some of the flow tests did not meet acceptance criteria.

Issue

The existing testing results could be indicative of potential degradation of the underground fire water system, leakage past isolation valves, or instrument accuracy issues. Given that potential degradation of the underground fire water system cannot be eliminated as a cause for the adverse results, the SLRA does not include sufficient information to justify conducting underground flow tests every 5 years as recommended by GALL-SLR Report AMP XI.M27. The staff recognizes that if corrective actions and subsequent inspections establish a trend of meeting the acceptance criteria and the trend results support it; a return to a 5-year interval of testing could be acceptable.

Request

State the periodicity of conducting underground flow tests and the basis for why this periodicity will demonstrate that the intended function of the fire water system will be met throughout the subsequent period of extended operation.

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5. GALL-SLR Report for the AMP XI.M30, "Fuel Oil Chemistry

Regulatory Basis:

Regulatory Basis: 10 CFR § 54.21(a)(3) requires an applicant to demonstrate that the effects of aging for structures and components will be adequately managed so that the intended function(s) will be maintained consistent with the current licensing basis for the subsequent period of extended operation. One of the findings that the staff must make to issue a renewed license (10 CFR Section 54.29(a)) is that actions have been identified and have been or will be taken with respect to the managing the effects of aging during the subsequent period of extended operation on the functionality of structures and components that have been identified to require review under 10 CFR Section 54.21, such that there is reasonable assurance that the activities authorized by the renewed license will continue to be conducted in accordance with the current licensing basis (CLB). In order to complete its review and enable making a finding under 10 CFR Section 54.29(a), the staff requires additional information in regard to the matters described below.

RAI B.2.1.19-1

Background:

In its SLRA, Section B.2.1.19, "Fuel Oil Chemistry," the applicant claimed consistency with the GALL-SLR Report for the AMP XI.M30, "Fuel Oil Chemistry." The GALL-SLR Report AMP XI.M30, "detection of aging effects" program element states, "[p]eriodic multilevel sampling provides assurance that fuel oil contaminants are below unacceptable levels. If tank design features do not allow for multilevel sampling, a sampling methodology that includes a representative sample from the lowest point in the tank may be used."

During the In-Office audit, the staff reviewed the program basis document PB-PBD-AMP-XI.M30, "Fuel Oil Chemistry," Revision 1, to evaluate whether the applicant is consistent with the GALL-SLR Report recommendations for the "Fuel Oil Chemistry" AMP. The program basis document for Fuel Oil Chemistry program states, "[d]iesel generator fuel oil storage tank 0A(B,C,D)T038 samples are withdrawn from the fuel oil transfer pump suction piping while the transfer pump is in service. The transfer pump suction is located 4" off the tank bottom."

Additionally, the design basis document states, that the Peach Bottom site sampling methodology is more conservative than what is recommended in ASTM D4057. ASTM D4057

Table 1, “Typical Sampling Procedures and Applicability,” states that bottom or thief sampling of liquid is used for storage tanks.

Issue:

1. It is not clear to the staff that samples taken from the fuel oil transfer pump while the pump is running, meets the recommendations of the GALL-SLR program element “detection of aging effects” for multi-level sampling or a representative sample from the lowest point of the tank. If the pump has been running for some period of time prior to taking the sample, the sample will not be representative of the fuel oil that is normally at the bottom of the stagnant tank. Any water, sediment, and microbiological organisms in the fuel oil that may have been present at the bottom of the tank will have already been pumped out, thus preconditioning the sampled fluid.
2. It is not clear to the staff whether a sample point that is 4 inches above the tank bottom is truly considered a bottom sample.

Request:

1. State the basis for the deviation from the GALL-SLR Report AMP XI.M30 “detection of aging effects” program element which recommends taking either a multi-level sample, or a representative sample from the lowest point in the tank. Additionally, provide a basis on why pre-conditioning is not being considered when taking samples while the transfer pump is in operation, which could possibly be pumping out any standing water or sediment that would be present in the bottom of the tank during stagnant conditions.
2. State the basis for why the pump intake level of 4 inches above tank bottom provides a representative sample of the fluid on the tank bottom.

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6. SLRA Sections B.2.1.39, B.2.1.40, and B.2.1.41 Electrical Insulation for Inaccessible Medium-Voltage Power Cables Not Subject to Title 10, Code of Federal Regulations (CFR) 50.49 Environmental Qualification Requirements, Electrical Insulation for Inaccessible Instrumentation and Control Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements, Electrical Insulation for Inaccessible Low-Voltage Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements

Regulatory Basis:

Section 54.21(a)(1) of 10 CFR requires the applicant to identify and list those structures and components subject to an aging management review. Section 54.21(a)(3) of 10 CFR requires the applicant to demonstrate that the effects of aging for structures and components within the scope of license renewal and subject to an AMR pursuant to 10 CFR 54.21(a)(1) will be adequately managed so that the intended function(s) will be maintained consistent with the current licensing basis for the subsequent period of extended operation. As described in SRP-SLR, an applicant may demonstrate compliance with 10 CFR 54.21(a)(3) by referencing the GALL-SLR Report, and when evaluation of the matter in the GALL-SLR Report applies to the plant. SRP-SLR Section 3.6.3.4 states that if the applicant identifies, in the SLRA AMP, an

exception to any of the program elements of the GALL-SLR Report AMP, the reviewer is to confirm that the SLRA AMP with the exception will satisfy the criteria of 10 CFR 54.21(a)(3).

RAI B.2.1.39-1, B.2.1.40-1, B.2.1.41-1 [1]

Background:

SLRA Sections B.2.1.39, B.2.1.40, and B.2.1.41 describe electrical insulation for inaccessible medium-voltage, instrumentation and control, and low-voltage power cables not subject to 10 CFR 50.49 environmental qualification requirements AMPs as consistent with GALL-SLR XI.E3A, XI.E3B, and XI.E3C with exceptions. The "preventive actions" element of the GALL-SLR Report AMPs XI.E3A, XI.E3B, and XI.E3C states in part "…The inspection frequency for water accumulation in manholes/vaults is established and performed based on plant-specific OE with cable wetting or submergence. The periodic inspections occur at least once annually." This element also states in part " … Inspection for water accumulation are also performed after event-driven occurrences, such as heavy rain, rapid thawing of ice and snow, or flooding." Exelon proposed exceptions to "preventive actions" program element as follows:

- Manholes with level monitoring and alarms that result in consistent, subsequent pump out of accumulated water prior to wetting or submergence of cables, will be inspected at least once every five years, as supported by plant operating experience.

- Manholes with level monitoring and alarms that result in consistent, subsequent pump out of accumulated water prior to wetting or submergence of cables, will be inspected following event-driven occurrences such as heavy rain, rapid thawing of ice and snow, or flooding, when level monitoring indicates water is accumulating.

Issue:

1. It is not clear to the NRC staff that reliance on level monitoring system to inspect water accumulation every 5 years will prevent inaccessible cables from significant moisture.
2. Exelon did not address industry operating experience with the installed level monitoring system.

Request:

1. Describe the level monitoring systems and provide industry operating experience with these systems.

2. If inspections are carried out every 5 years due to reliance on the level monitoring system, describe how the level monitoring systems are monitored for proper functioning and reliability

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7. SLRA 4.3.6.3, Core Shroud Support Fatigue Analysis Reevaluation

Regulatory Basis

In accordance with 10 CFR 54.21(c)(1), a list of time-limited aging analyses, as defined in 10 CFR 54.3, must be provided. The applicant shall demonstrate that: (i) The analyses remain

[1] This is one RAI that applies to three Peach Bottom aging management programs.

valid for the period of extended operation; (ii) The analyses have been projected to the end of the period of extended operation; or (iii) The effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

RAI 4.3.6.3-1

Background

SLRA Section 4.3.6.3 addresses the reevaluation of the core shroud support fatigue analysis as a time-limited aging analysis (TLAA). In the section, the applicant indicated that the Fatigue Monitoring program is used to manage the aging effect associated with the fatigue analysis for the core shroud support through the subsequent period of extended operation in accordance with 10 CFR 54.21(c)(1)(iii).

SLRA Section 4.3.6.3 also provides the following information: (1) as described in the first license renewal application of the applicant (July 2, 2001) the core shroud support fatigue analysis was reevaluated in 1998 to consider the effects of the recirculation pump start transient; and (2) the reevaluation described in the first license renewal application conservatively computed a 40-year non-environmental cumulative usage factor (CUF) of 0.834 for the core shroud support.

In its review related to the core shroud support fatigue analysis, the staff noted that the following reference discusses the CUF (non-environmental) for the core shroud support as part of the extended power uprate (EPU) project for the Peach Bottom Atomic Power Station (PBAPS): NEDC-33566P, Revision 0, "Peach Bottom Atomic Power Station Units 2 and 3 Constant Pressure Power Uprate," September 2012. Table 2.2-12 of the reference document indicates that the 60-year non-environmental CUF for the core shroud support is 0.26 under the EPU conditions.

Issue

SLRA Section 4.3.6.3 and Table 4.3.1-3 (80-year CUF table) do not provide the projected 80-year CUF for the core shroud support in comparison with the existing CUF values for the component. Such comparison with the existing CUF calculations is needed to confirm that the 80-year CUF is a reasonable projection. In addition, the 40-year CUF (0.834) discussed in SLRA 4.3.6.3 is significantly greater than the 60-year CUF (0.26) in the EPU submittal.

Request

1. Please compare the projected 80-year CUF and CUF_{en} (environmental CUF) values for the core shroud support with the 40-year CUF (0.834) in SLRA Section 4.3.6.3 and the 60-year CUF (0.26) in the 2012, EPU submittal. As part of the response, confirm that the 80-year CUF is a reasonable projection in comparison with the existing estimates of CUF values (40-year and 60-year).

RAI 4.3.6.3-2

Background

SLRA Section 4.3.6.3 indicates that the fatigue reevaluation performed in 1998 for the core shroud support considers the "sudden start of pump in cold recirculation loop" transient. In comparison, SLRA Table 4.3.1-1 addresses plant design transients for fatigue TLAAs, including

another recirculation pump start transient, that is, “improper start of cold recirculation loop” transient. SLRA Section 4.3.6.3 indicates that the Fatigue Monitoring program will be used to monitor the plant transients in the aging management of fatigue cracking for the core shroud support.

Issue

SLRA Section 4.3.6.3 does not clearly discuss whether the fatigue monitoring for the core shroud support includes the “improper start of cold recirculation loop” transient, which is another recirculation pump restart transient and may be similar to the “sudden start of pump in cold recirculation loop” transient.

Request

1. Please clarify whether the fatigue monitoring for the core shroud support includes the “improper start of cold recirculation loop” transient, which is another recirculation pump restart transient and may be similar to the “sudden start of pump in cold recirculation loop” transient. As part of the response, describe the differences between the two transients related to the recirculation pump start.

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8. GALL-SLR AMP XI.M17, “Flow-Accelerated Corrosion

Regulatory Basis.

10 CFR 54.21(a)(3) requires an applicant to demonstrate that the effects of aging for structures and components will be adequately managed so that the intended function(s) will be maintained consistent with the current licensing basis for the subsequent period of extended operation. As provided in 10 CFR 54.29(a), a renewed license may be issued if the staff finds that actions have been identified, which either have been or will be taken, with respect to managing the effects of aging during the subsequent period of extended operation. As described in SRP-SLR, an applicant may reference the GALL-SLR Report in an SLRA to designate which programs will be used and how those programs correspond to the AMPs in the GALL-SLR Report. If an applicant takes credit for a program in the GALL-SLR Report, it is incumbent on the applicant to ensure the conditions and operating experience at the plant are bounded by those for which the GALL-SLR Report program was evaluated. To complete its review and enable the formulation of a finding under 10 CFR 54.29(a), the staff requires additional information regarding the matters described below.

RAI B.2.1.9-1

Background.

Peach Bottom SLRA Section B.2.1.9, Flow Accelerated Corrosion, states that the program is consistent with GALL-SLR AMP XI.M17, “Flow-Accelerated Corrosion” program and that it relies on implementation of EPRI’s NSAC-202L, Revision 4, “Recommendations for an Effective Flow-Accelerated Corrosion Program.” GALL-SLR AMP XI.M17 states the program includes the use of predictive software, such as CHECWORKS, that uses the implementation guidance of NSAC-202L. SLRA Section B.2.1.9 states that the program uses CHECWORKS to predict component wear rates and remaining service life.

The Flow-Accelerated Corrosion program is implemented at all Exelon sites through the governing procedure ER-AA-430, "Conduct of Flow-Accelerated Corrosion Activities." During discussions with the staff, Exelon stated that an enhancement to its FAC program governing procedure, similar to what was documented during the staff's previous reviews for the Byron and Braidwood license renewal (Ref response to RAI B.2.1.8-2 (ML14135A179)), was not needed for the FAC program in Peach Bottom's subsequent license renewal. According to Exelon, the statement in the governing procedure: "Ultrasonic inspection data should be evaluated using an approved (i.e., validated and verified) software program," fulfills the enhancement from the Byron and Braidwood review: "to revise program procedures to require the documentation of the validation and verification of updated vendor supplied FAC program software."

As discussed during the license renewal reviews for Byron and Braidwood, the software associated with the FAC program is categorized as Class DD, "Screened" in accordance with Exelon's IT-AA-101, "Digital Technology Software Quality Assurance (DTSQA) Procedure." According to the DTSQA, Class DD software requires minimal documentation and does not require validation and verification. In response to the staff's question for Byron and Braidwood, Exelon chose to enhance program procedures to address the validation and verification issue in lieu of changing the software classification through the DTSQA. The staff found Exelon's approach for the Byron and Braidwood review acceptable because the program procedures were to require documentation of the validation and verification for any updated versions of the FAC-related software prior to its use.

Issue.

Although the governing procedure states that the software is validated and verified, it is not clear to the staff how confirmation of this aspect will be implemented, because Class DD software does not require validation or verification in accordance with Exelon's DTSQA. In addition, there are no steps within ER-AA-430 to check if the software has been revised or to verify that the documentation of the software validation and verification is available for the current revision of the software. Consequently, it is unclear to the staff how the FAC program will ensure that the predictive software used to predict component wear rates will be consistent with the guidelines in NSAC-202L.

Request.

Provide information to show how the program will ensure that updated versions of any software used in the FAC program, which predicts component wear rates and remaining life, has been validated and verified prior to use to confirm that the predictions are done consistent with the guidelines in NSAC-202L.

RAI B.2.1.9-2

Background

Peach Bottom SLRA Section B.2.1.9, Flow Accelerated Corrosion, states that the program is consistent with GALL-SLR AMP XI.M17, "Flow-Accelerated Corrosion" program and that it relies on implementation of EPRI's NSAC-202L, Revision 4, "Recommendations for an Effective Flow-Accelerated Corrosion Program." GALL-SLR AMP XI.M17 states the program includes the development of FAC predictive models to reflect component geometries, materials, and

operating parameters. NSAC-202L, Section 3.3, "Other Documentation" recommends, in part, that the predictive plant model and all revisions be documented and independently checked by a qualified individual.

Exelon corrective action document AR02573389 addresses industry-operating experience from Davis-Besse (see LER 346/2015-002, "Improper Flow Accelerated Corrosion Model Results in 4-Inch Steam Line Failure and Manual Reactor Trip") regarding CHECWORKS modeling discrepancies that resulted in a failure of an elbow. Exelon's associated operating experience review (AR02530386-09) found flow orifice size discrepancies in several FAC predictive models, but unlike Davis-Besse, the discrepancies were conservative because the orifice diameters were modeled as a smaller size resulting in higher velocities than actual. In answering the question "Why the condition happened," the AR states "Legacy issues with CHECWORKS modeling." More recently, industry-operating experience from Indian Point (see LER 286/2018-003, "Manual Reactor Trip Due to a Steam Leak on a High-Pressure Feedwater Heater") discussed weaknesses in the initial setup of the CHECWORKS model for the affected system.

During follow-up discussions with the staff, Exelon stated its operating experience reviews in AR02530386-09 had only looked at orifice diameter modeling. Exelon added that it had previously performed a comprehensive update of CHECWORKS models in 2012 to support the extended power uprate, and had identified errors in CHECWORKS modeling where several elbows had been modeled as tees. The modeling errors were corrected to reflect the actual geometries; however, Exelon clarified that only those models affected by the extended power uprate were reviewed as part of the comprehensive update in 2012.

Issue. Industry operating experience shows that legacy errors in CHECWORKS models have resulted in FAC program failures. Although Exelon's FAC program ensures that changes made to CHECWORKS models are performed by and independently reviewed and verified by qualified FAC engineers, it appears that the accuracy of the initial models has not been verified in all cases. Based on the identification of legacy modeling errors during selected reviews of some Peach Bottom FAC models, it is not clear to the staff whether the FAC program will continue to provide reasonable assurance that structural integrity will be maintained between inspections.

Request.

Based on the identification of legacy modeling errors during selected reviews of some Peach Bottom FAC models, provide information about the need for additional verification activities of FAC model parameters that have not been previously independently checked.

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9. GALL-SLR Report AMP XI.M33, "Selective Leaching"

Regulatory Basis

10 CFR 54.21(a)(3) requires an applicant to demonstrate that the effects of aging for structures and components will be adequately managed so that the intended function(s) will be maintained consistent with the current licensing basis for the period of extended operation. One of the findings that the staff must make to issue a renewed license (10 CFR 54.29(a)) is that actions have been identified and have been or will be taken with

respect to managing the effects of aging during the period of extended operation on the functionality of structures and components that have been identified to require review under 10 CFR 54.21, such that there is reasonable assurance that the activities authorized by the renewed license will continue to be conducted in accordance with the current licensing basis. In order to complete its review and enable making a finding under 10 CFR 54.29(a), the staff requires additional information in regard to the matters described below.

RAI B.2.1.22-1

Background:

SLRA Section B.2.1.22, "Selective Leaching," states that the program will be consistent with the ten elements of aging management program GALL-SLR Report AMP XI.M33, "Selective Leaching."

GALL-SLR Report AMP XI.M33 recommends (a) using visual inspections, mechanical examinations, and destructive examinations to detect selective leaching; and (b) that the program includes a process to evaluate difficult-to-access surfaces (e.g., heat exchanger shell interiors, exterior of heat exchanger tubes) if unacceptable inspection findings occur within the same material and environment population.

During the audit, the staff noted that for expanded inspections on difficult-to-access surfaces, such as heat exchanger tubes, industry proven technologies found capable of detecting degradation may be used as an initial indicator of the existence of imperfections. The staff also noted that if imperfections are identified, then direct visual inspection or destructive examination should be performed to fully assess the material condition.

Uhlig's Corrosion Handbook, 3rd Edition, page 148, states "[i]nspection for dealloying has been very difficult because this form of corrosion usually leaves a surface profile similar to uncorroded metal. The only way of finding dealloying has been by visual inspection for color changes or by mechanical probing to identify a loss of integrity. Several researchers have reported on attempts to develop methods of in situ nondestructive inspection for dealloying, but they have not achieved widespread acceptance."

Issue:

1. It is unclear to the staff which industry proven technologies will be used to screen for the existence of selective leaching on difficult-to-access surfaces.
2. Based on the staff's review of Uhlig's Corrosion Handbook and GALL-SLR Report AMP XI.M33, which recommend visual and mechanical examination techniques to detect selective leaching, it is unclear to the staff if industry proven technologies will be capable of screening for the existence of selective leaching on difficult-to-access surfaces.

Request:

1. State which industry proven technologies will be used to screen for the existence of selective leaching on difficult-to-access surfaces.
2. State the basis for how these industry proven technologies will be capable of screening for the existence of selective leaching on difficult-to-access surfaces.

References.

Revie, R. Winston. (2011). Uhlig's Corrosion Handbook (3rd Edition) - References. John Wiley & Sons. Retrieved from https://app.knovel.com/hotlink/pdf/id:kt008TZBV1/uhlig-s-cor

10. SLRA Section 3.5.2.2.2.4 Loss of Material and Cracking Due to Stress Corrosion Cracking (SCC) For Aluminum and Stainless-Steel Support Members, Welds, Bolted Connections and Support Anchorage to Building Structure

Regulatory Basis:

10 CFR § 54.21(a)(3) requires an applicant to demonstrate that the effects of aging for structures and components will be adequately managed so that the intended function(s) will be maintained consistent with the current licensing basis for the period of extended operation.

RAI 3.5.2.2.2.4-1

Background

SRP-SLR Table 3.5-1 item 099, recommends that Class 1, Class 2, Class 3, and Class MC aluminum and stainless steel support members, welds, bolted connections and support anchorage to building structures be managed for loss of material and cracking due to stress corrosion cracking (SCC) by either the AMP XI.M32, "One Time Inspection," AMP XI.S3, "ASME Section XI, Subsection IWF," or AMP XI.M36, "External Surfaces Monitoring of Mechanical Components" program. SRP-SLR Table 3.5-1 item 100, also recommends that other aluminum and stainless steel support members, welds, bolted connections and support anchorage to building structures be managed for the same aging effects by either the AMP XI.M32, "One Time Inspection;" AMP XI.S6, "Structures Monitoring," or AMP XI.M36, "External Surfaces Monitoring of Mechanical Components" program. These Table 1 line items are associated with a further evaluation, SRP-SLR Section 3.5.2.2.2.4, which describes the acceptance criteria, and recommends actions (including AMP enhancements) to address these aging effects when loss of material or cracking has occurred and is sufficient to potentially affect the intended function of these components.

SLRA Table 3.5.1, items 99 and 100, state that the One-Time Inspection Program will be used to addresses the aging effect of cracking (due to SCC) and loss of material for these components. SLRA Section 3.5.2.2.2.4 further states that visual inspections conducted in accordance with the One-Time Inspection Program will be performed to confirm that loss of material due to pitting and crevice corrosion or cracking due to SCC are not occurring at a rate that affects the intended function of the components.

The staff notes that NUREG-2221, "Technical Bases for Changes in the Subsequent License Renewal Guidance Documents NUREG-2191 and NUREG-2192," finds the use of visual inspection for these AMR line items, as acceptable when performing periodic inspections to manage the aging effects, and when it can easily be demonstrated that, for these type of structural supports, minor loss of material or cracking that might not be visually detectable during a walkdown inspection will likely not impact the intended function of the support.

Issue

Since cracking due to SCC cannot be reliably identified through visual examination, the proposed visual inspection under the One-Time Inspection Program is not sufficient to detect cracking due to SCC in stainless steel and/or aluminum components associated with SLRA Table 3.5.1 items 99 and 100. The staff notes that a method that has been determined to be

capable of detecting cracking due to SCC must be used to confirm that this aging effect is not occurring or that is occurring at a rate that affects the intended function of the components during for the subsequent period of extended operations.

Request

Provide adequate technical justification to demonstrate that the proposed inspection method will be capable of detecting cracking due to SCC, and that it will be sufficient to adequately demonstrate that the aging effect is not occurring or is not occurring at a rate that affects the intended function of the components. Also clarify what type of visual inspections will be used and if supplemental examination will be performed during the One-Time Inspection.

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11. GALL-SLR AMP Xi.M39, Lubricating Oil Analysis

Regulatory Basis

10 CFR § 54.21(a)(3) of 10 CFR requires an applicant to demonstrate that the effects of aging for structures and components will be adequately managed so that the intended function(s) will be maintained consistent with the current licensing basis for the subsequent period of extended operation. One of the findings that the staff must make to issue a renewed license (10 CFR § 54.29(a)) is that actions have been identified and have been or will be taken with respect to managing the effects of aging during the period of extended operation on the functionality of structures and components that have been identified to require review under § 54.21, such that there is reasonable assurance that the activities authorized by the renewed license will continue to be conducted in accordance with the current licensing basis (CLB). As described in SRP-SLR, an applicant may demonstrate compliance with 10 CFR 54.21(a)(3) by referencing the GALL-SLR Report. In order to complete its review and enable making a finding under 10 CFR § 54.29(a), the staff requires additional information in regard to the matters described below.

RAI B.2.1.26-1

Background:

SRP-SLR Report Table 3.3-1, “Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report,” items 3.3.1-99, and 3.3.1-100, recommends managing copper alloy, aluminum piping, stainless steel piping, and piping components exposed to lubricating oil for loss of material due to pitting, crevice corrosion, and microbiologically influenced corrosion (MIC) using GALL-SLR Report AMP XI.M39, "Lubricating Oil Analysis," and AMP XI.M32, "One-Time Inspection."

SLRA Table 3.3.2-35, “Turbine Building Closed Cooling Water System,” states that copper alloy with 15% zinc or less, and stainless-steel piping, piping components, and valve bodies exposed to lubricating oil will be managed for loss of material using GALL-SLR Report AMP XI.M38, “Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components.”

Issue:

It is unclear how the GALL-SLR Report AMP XI.M38, “Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components,” program will be effective in managing the loss of material due to pitting, crevice corrosion, and MIC for copper alloy with 15% zinc or less, and stainless-steel components in an environment of lubricating oil. The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program is an inspection program

that is based on 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 at each unit. The GALL-SLR Report AMP XI.M39, "Lubricating Oil Analysis," program is a sampling program which maintains oil system (lubricating and hydraulic) contaminants (primarily water and particulates) within acceptable limits, thereby preserving an environment that is not conducive to loss of material. Additionally, the effectiveness of the Lubricating Oil Analysis program is verified by the use of GALL-SLR Report AMP XI.M32, "One-Time Inspection." The One-Time Inspection program is an inspection-based program with a representative sample size is 20 percent of the population or a maximum of 25 components at each unit.

Request:

State the basis for how the GALL-SLR Report AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," program will be effective in managing the loss of material due to pitting, crevice corrosion, MIC for the copper alloy with 15% zinc or less, and stainless-steel components in an environment of lubricating oil.

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12 Recurring Internal Corrosion, Cracking Due to SCC, and Various AMR Items

Regulatory Basis:

10 CFR 54.21(a)(3) requires an applicant to demonstrate that the effects of aging for structures and components will be adequately managed so that the intended function(s) will be maintained consistent with the current licensing basis for the period of extended operation. One of the findings that the staff must make to issue a renewed license (10 CFR 54.29(a)) is that actions have been identified and have been or will be taken with respect to managing the effects of aging during the subsequent period of extended operation on the functionality of structures and components that have been identified to require review under 10 CFR 54.21, such that there is reasonable assurance that the activities authorized by the renewed license will continue to be conducted in accordance with the current licensing basis. In order to complete its review and enable making a finding under 10 CFR 54.29(a), the staff requires additional information in regard to the matters described below.

RAI 3.3.2.2.7-1

Background

Consistent with the "operating experience" program elements of GALL AMP XI.M20, "Open Cycle Cooling Water System," and XI.M27, "Fire Water System," the potential for loss of material due to recurring internal corrosion was evaluated in accordance with SRP SLR Section 3.3.2.2.7. Section 3.3.2.2.7 recommends that a basis be provided for the adequacy of augmented inspections (e.g., periodicity, quantity) if loss of material due to recurring internal corrosion is an applicable aging effect. SLRA Section 3.3.2.2.7 states that loss of material due to recurring internal corrosion is an applicable aging effect for the open cycle cooling water and fire water systems.

SLRA Section 3.3.2.2.7 states that:

a. The Open-Cycle Cooling Water System program will be used to manage recurring internal corrosion (RIC) in the emergency service water system, high pressure service

water system, and service water system. The program utilizes quantitative volumetric examination methods for the detection of aging effects. Screening methods (e.g., guided wave) are used to screen for locations that are followed up using conventional nondestructive examination techniques. The program includes methodology for choosing piping inspection locations based on the risk associated with specific pipe locations balanced by other factors to investigate and address potential piping integrity concerns. The risk is determined by the combination of piping corrosion susceptibility and the consequences of pipe leaks or other integrity issues. The size of the inspection scope may include: inspections required for extent of condition, inspections required based on the risk factor, re-inspection locations based on the next scheduled inspection calculations, new inspection locations based on operating experience, and follow-up inspections on repairs. From 2013 through 2017, 150 raw water inspections were performed, for an average of 30 per year.

The program includes guidance for the determination of the next scheduled inspection, which is the calculated time frame at which an inspection will be performed based on current measured corrosion rate trending.

The program will require no fewer than five additional inspections for each inspection that did not meet acceptance criteria, or 20 percent of each applicable material, environment, and aging effect combination, whichever is less.

b. The Fire Water System program will be used to manage RIC in the fire water system. Periodic ultrasonic inspections were established when RIC was identified to trend pipe wall thickness. The ultrasonic inspections provide representative data for fire water system pipe wall thickness trending and indicates the type of corrosion occurring, which is localized microbiologically influenced corrosion (MIC).

Plant specific operating experience demonstrates that the currently performed flow testing and ultrasonic testing have provided sufficient data for trending fire water system pipe wall conditions prior to loss of intended function. Degraded pipe due to corrosion has been evaluated and replaced when necessary prior to loss of intended function. Additional augmented testing to detect RIC is not required.

Engineering evaluations are performed when degraded conditions are identified in order to determine the cause. When corrosion is identified as the cause of the degraded condition, the frequency of inspections is based on the projected corrosion rate, extent of condition for other areas in the system, and necessary repairs if required.

Issue

The SLRA lacks sufficient detail for the staff to conclude that RIC will be adequately managed during the subsequent period of extended operation. Specifically:

a. For the Open-Cycle Cooling Water System program, although 150 inspections have been conducted between 2014 and 2017, the SLRA does not state a minimum number of inspections that will occur in a set periodicity or the extent of piping that will be examined by screening techniques. Past performance is not reflective of the minimum number of inspections that will occur in the future.

b. For the Fire Water System program, although flushes and flow tests can demonstrate that portions of the system are capable of meeting their intended pressure boundary function at the time of the evolution, they do not provide data that can be trended in regard to the extent of and wall loss associated with MIC. The Fire Water System program lacks sufficient detail on the minimum number of inspections, how inspection locations will be selected, the periodicity of inspections, and the criteria used to expand the scope of inspections when inspection results do not meet acceptance criteria.

c. Both programs cite evaluations being conducted to determine the need for future inspections. During its review of plant-specific documents, the staff noted that the raw water corrosion program guide procedure allows a default to use nominal wall thickness when previous wall thick examinations have not been conducted at the piping location or other applicable locations. The procedure suggests conservatism that can be used (e.g., adding 12.5 percent to the nominal wall thickness), but does not require the use of conservative factors. The SLRA does not state a basis for why the use of nominal wall thickness will provide appropriate reinspection intervals.

Request

a. For the Open-Cycle Cooling Water System program, state the minimum number of inspections that will occur and periodicity of inspections and their basis.

b. For the Fire Water System program, state: (a) the minimum number of inspections; (b) the periodicity of inspections; (c) how inspection locations will be selected; and (d) the criteria used to expand the scope of inspections when inspection results do not meet acceptance criteria and their basis.

c. For both programs, state the basis for why the use of nominal wall thickness will provide appropriate reinspection intervals.

RAI 3.3.2.1.1-1

Background

SLRA Tables 3.1.23, 3.2.22, 3.2.33, 3.2.24, 3.2.25, 3.2.26, 3.2.28, 3.3.21, 3.3.22, 3.3.23, 3.3.27, 3.3.29, 3.3.210, 3.3.211, 3.3.212, 3.3.214, 3.3.220, 3.3.221, 3.3.222, 3.3.224, 3.3.225, 3.3.228, 3.3.229, and 3.3.235 state that for copper alloy with greater than 15 percent zinc piping, piping components, heat exchanger components, heat exchanger tubes, spray nozzles, fire hydrant, and sprinklers exposed to air indoor uncontrolled, airdry, air outdoor, condensation, treated water, raw water, or waste water, there are either no aging effects requiring management or the aging management review (AMR) item cites loss of material.

Issue

Various GALL SLR Report AMR items (e.g., A-473b, A473c, S455) state that cracking due to stress corrosion cracking (SCC) should be managed for copper alloy with greater than 15 percent components exposed to air, condensation, raw water, and waste water.

NUREG-2221, “Technical Bases for Changes in the Subsequent License Renewal Guidance Documents NUREG–2191 and NUREG–2192,” states:

The staff has concluded that copper alloy (>15% Zn or >8% Al) exposed to closed-cycle cooling water, raw water, and waste water can be susceptible to cracking due to stress corrosion cracking. EPRI 1010639 states, "[t]he necessary chemical substance to cause SCC in copper and copper alloys is ammonia or other ammonium compounds. These chemical substances are sometimes used in treated water systems to control the fluid pH or can be present because of an ammonium-based cleaning solvent. Ammonia can also be present in the atmosphere as a result of organic decay. In addition to ammonia or ammonium compounds, oxygen and moisture are also required to promote SCC in the copper alloys while other contaminants such as carbon dioxide may act as catalysts to increase the rate of cracking." Likewise, for raw water and waste water, these deleterious compounds can be present.

Based on a review of ASM Handbook, Volume 13B, "Corrosion: Materials, Corrosion of Copper and Copper Alloys," ASM International, 2006, pages 129–133, the staff concluded that copper alloy (>15% Zn) is susceptible to cracking due to SCC in air or condensation environments depending on the presence of ammonia-based compounds. In addition to being present in the outdoor air environment, they could be conveyed to the surface of a copper alloy (>15% Zn or >8% Al) component via leakage through the insulation from bolted connections (e.g., flange joints, valve packing).

The staff noted that several Table 2 items include cracking as an aging effect in addition to other aging effects such as loss of material. However, there are many AMR items in the above cited Table 2s where cracking is not addressed.

Request

State the basis for why cracking due to SCC is not cited as an aging effect requiring management for copper alloy with greater than 15 percent zinc components exposed to air indoor uncontrolled, airdry, air outdoor, condensation, treated water, raw water, or waste water.

RAI 3.3.2.2.8-1

Background

SLRA Section 3.3.2.2.8 and plant specific note No. 3 to SLRA Table 3.3.230 state that 6063T6 aluminum alloys are not susceptible to cracking due to stress corrosion cracking.

SRPSLR Section 3.3.2.2.8 provides a list of aluminum alloys that are not susceptible to cracking; however, 6063T6 is not on the list. When a specific alloy is not on the list, the basis used to determine that the alloy is not susceptible and technical information substantiating the basis should be provided in the SLRA.

Issue

The SLRA does not provide a basis for why 6063-T6 aluminum alloys are not susceptible to cracking due to stress corrosion cracking.

Request

State the basis for why 6063-T6 aluminum alloys are not susceptible to cracking due to stress corrosion cracking.

13. SLRA TLAA 4.2.13 Replacement Core Plate Extended Life Plug Irradiation –Enhanced Stress Relaxation Analysis

Regulatory Basis:

10 CFR 54.21(a)(3) requires an applicant to demonstrate that the effects of aging for structures and components will be adequately managed so that the intended function(s) will be maintained consistent with the current licensing basis for the period of extended operation. One of the findings that the staff must make to issue a renewed license (10 CFR 54.29(a)) is that actions have been identified and have been or will be taken with respect to managing the effects of aging during the period of extended operation on the functionality of structures and components that have been identified to require review under 10 CFR 54.21, such that there is reasonable assurance that the activities authorized by the renewed license will continue to be conducted in accordance with the current licensing basis. In order to complete its review and enable making a finding under 10 CFR 54.29(a), the staff requires additional information in regard to the matters described below.

RAI-4.2.13-1

Background:

SLRA Section 4.2.13, "Replacement Core Plate Extended Life Plug Irradiation –Enhanced Stress Relaxation Analysis," describes Exelon's TLAA for the irradiation induced stress relaxation of the extended life core support plugs (ELCSPs). Exelon dispositioned the TLAA for the ELCSPs in accordance with 10 CFR 54.21(c)(1)(ii). SLRA Section 4.2.13 states that the reevaluation predicted an end-of-life preload of 111 pounds which exceeds the differential pressure of 46.7 pounds acting on the ELCSPs.

Issue:

The staff does not have sufficient information to verify that the evaluation of the stress relaxation (loss of preload) for the ELCSPs is valid for the subsequent period of extended operation. The staff does not have sufficient information regarding the as-installed (beginning-of-life) preload or description of the method used to calculate the stress relaxation.

Request:

Provide information describing the as-installed preload for the ELCSPs and the methodology used to calculate the stress relaxation.

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14. SLRA TLAA 4.3.5 Environmental Fatigue Analyses for RVP and Class 1 Piping

RAI 4.3.5-1

Background

During the audit, the staff noted that the following onsite document discusses the applicant's plant transients related to fatigue monitoring and analyses (Reference: SIR-99-091, Revision 0,

Report on System Review and Recommendations for a Transient and Fatigue Monitoring System at Peach Bottom Atomic Power Station, September 1999). The plant transients and associated cycle numbers are used as input for fatigue analyses including the environmental fatigue analysis described in SLRA Section 4.3.5.

Specifically, Tables 2.1 and 2.2 of SIR-99-091, Revision 0 indicates that some cycles will not be included in the automatic counting by the fatigue monitoring system (SI:FatiguePro software) because they are difficult to track or have insufficient impact on fatigue (e.g., transients related to weekly reduction power cycles and control rod drive scrams). The reference document also indicates that these unaccounted cycles are preloaded in the fatigue monitoring system and therefore there is a need for users to ensure that the actual cycle numbers are reasonable in comparison with the preloaded cycle numbers.

Issue

SLRA Tables 4.3.1-1 and 4.3.1-2 describe the design transients used in the applicant's fatigue analyses including the environmentally assisted fatigue (EAF) analysis. These tables do not identify or discuss the uncounted, preloaded transients that are addressed in the above reference (SIR-99-091, Revision 0). In addition, SLRA Section 4.3.5 does not discuss the applicant's monitoring activities or evaluations to confirm that the actual cycle numbers for the preloaded transients are below the design basis cycles in the fatigue analyses.

Request

Please discuss how the applicant's monitoring activities or evaluations confirm that the preloaded transient cycles are in the reasonable ranges below the design basis cycles.

RAI 4.3.5-2

Background

SLRA Section 4.3.5 indicates that in 2015 the applicant's fatigue monitoring software was modified to include the calculation and tracking of CUF_{en} at the locations identified in NUREG/CR-6260 for the older-vintage BWR plant, as well as at other locations in contact with reactor water that were monitored by the fatigue monitoring software.

NUREG/CR-6260 identifies the following Class 1 locations for CUF_{en} calculations for the older-vintage BWR plants (1) reactor vessel shell and lower head; (2) reactor vessel feedwater nozzle; (3) reactor recirculation piping (including inlet and outlet nozzles); (4) core spray line reactor vessel nozzle and associated piping; (5) residual heat removal (RHR) return line piping; and (6) feedwater line piping.

Issue

SLRA Table 4.3.1-3 provides the 80-year CUF_{en} values for the applicant's limiting Class 1 locations. In comparison with the NUREG/CR-6260 locations, the table does not provide the EAF analyses results for the core spray line piping locations that are evaluated in NUREG/CR-6260. In addition, the SLRA does not clearly provide justification for the omission of the core spray line locations in the 80-year environmental fatigue projections.

Request

Provide justification for why SLRA Table 4.3.1-3 does not address the EAF results for the core spray line piping locations that are evaluated in NUREG/CR-6260.

RAI 4.3.5-3

Background

SLRA Section 4.3.5 (on pages 4-88 and 4-89) describes the applicant's methodology for environmental fatigue screening to determine the component locations for environmental fatigue monitoring. Specifically, step 8 indicates that all the selected locations with screening 80-year CUF_{en} (environmental fatigue usage factor) greater than 0.25 were identified and more detailed analysis for EAF was performed on these locations in accordance with NUREG-6909, Rev. 1.

Issue

SLRA Section 4.3.5 does not describe the difference between the EAF analysis performed during the screening process and the more detailed EAF analysis performed after the screening process (i.e., screening-in of the bounding locations).

Request

Please describe the difference between the EAF analysis performed during the screening process and the more detailed EAF analysis performed after the screening process. As part of the response, provide the justification for the difference.

RAI 4.3.5-4

Background

SLRA Section 4.3.5 describes the applicant's methodology for EAF screening to determine the component locations for EAF monitoring. Specifically, steps 6 and 7 address the screening process for the components that have not been monitored for environmental fatigue. In these screening steps, the component locations are screened based on 80-year CUF values (without consideration of environmental effect) and subsequently the selected locations are evaluated in consideration of environmental correction factor (F_{en}) to determine whether the projected CUF_{en} values exceed the screening threshold (0.25).

For example, in step 6 the location with the greatest estimated screening 80-year CUF value is selected. In addition, the top two locations with the greatest two estimated screening 80-year CUF values were selected, if the estimated screening 80-year CUF values of these locations are within a factor of two.

Issue

For the locations not included in the existing environmental fatigue monitoring, the applicant's method described above may omit the EAF locations that have a relatively low non-environmental CUF value but have a very high F_{en} value even though such location may result in the CUF_{en} value greater than the screening threshold (0.25).

In addition, SLRA Section 4.3.5 does not clearly discuss how the applicant confirms that the screened-out locations during the screening process are bounded by the screened-in locations in the EAF analysis (i.e., screened-out 9 component locations out of the 32 component locations

that have an identified CUF value in a PBAPS current licensing basis stress report or evaluation and for which EAF applies, as addressed in SLRA Section 4.3.5).

Request

1. Please describe how the applicant confirms that the EAF screening does not omit the locations that may have a relatively low CUF value but have a very high F_{en} value resulting in the CUF_{en} value greater than the screening threshold.

2. Please describe how the applicant confirms that the screened-out locations during the screening process are bounded by the screened-in locations for the EAF analysis and monitoring.