OCONEE NUCLEAR STATION, UNITS 1, 2, AND 3 (ONS)
SUBSEQUENT LICENSE RENEWAL APPLICATION (SLRA)
REQUESTS FOR ADDITIONAL INFORMATION (RAIs)
SET #2

SAFETY REVIEW

RAI 3.3.2.2.2-1

Regulatory Basis:
Title 10 of the Code of Federal Regulations (CFR) Section 54.21(a)(1) requires a license renewal application to contain an integrated plant assessment (IPA) that identifies and lists structures and components that are within the scope of license renewal and subject to aging management review (AMR). Further, 10 CFR 54.21(a)(3) requires an applicant to demonstrate that the effects of aging for each structure and component identified in 10 CFR 54.21(a)(1) will be adequately managed such that their intended functions are maintained consistent with the current licensing basis (CLB) for the period of extended operation. To complete its review and enable the staff to make a reasonable assurance finding on functionality of reviewed structures and components for the period of extended operation consistent with 10 CFR 54.21, the staff requires under 10 CFR 54.29(a) additional information be provided regarding the matters described below.

Background:
With Supplement 1 of the Subsequent License Renewal Application (SLRA) for Oconee Nuclear Station (ONS), Units 1, 2, and 3, Duke Energy Carolinas, LLC (Duke Energy or the applicant), revised its SLRA (ADAMS Accession No. ML21302A208). The applicant's revision added the letdown cooler tubes to the scope of subsequent license renewal (SLR). However, the applicant also stated that the letdown cooler assemblies are replaced on a specified frequency, therefore they are not subject to AMR in accordance with 10 CFR 54.21 (a)(1)(ii). Accordingly, the applicant removed AMR line items related to the head and the shell of the letdown coolers from SLRA Tables 2.3.2-3 and 3.2.2-3. Additionally, the applicant revised SLRA Section 3.3.2.2.2, which is related to the further evaluation of the ONS letdown coolers due to cracking as a result of stress corrosion cracking (SCC) and cyclic loading. The revision states, in part, that the ONS "letdown coolers are replaced on a specified time period and are short-lived components not subject to aging management."

However, the NRC staff observed that the ONS letdown coolers have been subject to replacements, design changes, changes in operation, and repairs due to frequent tube failures. Additionally, during initial license renewal, Duke credited several programs for managing the aging effects of the ONS letdown coolers during the period of extended operations (PEO).

Issue:
Even though the applicant has now determined that the ONS letdown coolers are not subject to AMR due to periodic replacement, the replacement intervals should account for the history of multiple failures of the ONS letdown coolers to ensure the integrity of reactor coolant pressure boundary of the ONS letdown coolers during the subsequent period of extended operation (SPEO).

Specifically, during the audit, the staff became aware that laboratory examinations were performed on an ONS letdown cooler which had developed a reactor coolant pressure boundary leak during the PEO and was removed from service. These examinations revealed that the leakage was due to SCC.

Request:
1. Explain any actions taken to mitigate SCC of the letdown coolers for the SPEO and the methodology used to establish a reasonable replacement interval for the letdown coolers.
2. Clarify the ONS programs which will be used to monitor the performance of the replacement letdown coolers so that there is a reasonable assurance that pressure boundary failure due to SCC of the ONS letdown coolers will not occur prior to scheduled replacement during the SPEO.

Regulatory Basis:
Title 10 of the *Code of Federal Regulations* (CFR) Section 54.21(a)(3) requires an applicant to demonstrate that the effects of aging for each structure and component identified in 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 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 when evaluation of the matter in the GALL-SLR Report applies to the plant.

RAI B2.1.9-1

Background:
SLRA Section B2.1.9, "Bolting Integrity," states that the Oconee Bolting Integrity AMP, with the enhancements provided in the SLRA, will be consistent with the ten program elements of GALL-SLR Report AMP XI.M18, "Bolting Integrity." For the "preventive actions" program element, the GALL-SLR Report AMP states that the use of molybdenum disulfide (MoS_2) as a lubricant has been shown to be a potential contributor to stress corrosion cracking (SCC) and should not be used.

In the program description, the SLRA claims that the program already includes preventive measures to prohibit the use of lubricant containing MoS_2. To verify this claim, the staff audited the program's procedures and references (e.g., MP/0/A/1800/003, MP/0/A/1200/108, MP/0/A/1800/003A, Power Chemistry Material Guide (PCMG) Program) to better understand how the Oconee Bolting Integrity AMP is being consistent with the GALL-SLR Report AMP.

Issue:
Based on the review of the procedures associated with the bolting integrity program, it is not clear how the program is consistent with the GALL-SLR Report AMP XI.M18 recommendation for including preventive actions that would preclude the use of MoS_2 as a lubricant in closure bolting for pressure retaining components.

During the review, the staff noted some inconsistencies in the preventive measures used by each procedure to prohibit the use of lubricant containing MoS_2. Some procedures specified that lubricant material must be selected in accordance with the PCMG program, and other procedures directed the use of "N-5000 or equivalent" as a lubricant apparently without any

clear guidance on how the use of lubricant containing MoS_2 in closure bolting was restricted/limited.

It was also noted that Oconee follows the PCMG program to provide guidelines and limitations on materials that will be used in contact with safety related and non-safety related plant systems. However, this program was not described in the application for the bolting integrity program. Furthermore, it is not clear how this guidance will be sufficient to demonstrate consistency with the GALL-SLR Report since not all procedures clearly directed its use when selecting the lubricant for bolting material, nor is it clear those programs provided a clear action to prevent the use of lubricant material containing MoS_2.

Request:
Considering the issues identified above, clarify how procedures associated with the Bolting Integrity programs will be consistent with the GALL-SLR Report to demonstrate that clear preventive actions will be implemented to restrict the use of molybdenum disulfide (MoS_2) as a lubricant.

RAI B2.1.9-2

Background:
SLRA Section B2.1.9, "Bolting Integrity," states that the Oconee Bolting Integrity AMP, with the enhancements provided in the SLRA, will be consistent with the ten program elements of GALL-SLR Report AMP XI.M18, "Bolting Integrity." To ensure consistency with the "detection of aging effects" program element, the SLRA included enhancement no. 4 to demonstrate that the program will manage the inspections of closure bolting in locations where the detection of joint leakage is precluded or for which leakage is difficult to detect.

For the "detection of aging effects" program element, the GALL-SLR Report AMP provides, in part, inspection criteria and guidance to demonstrate that submerged closure bolting, closure bolting in systems containing air or gas, and closure bolting in components that are not normally pressurized will be adequately managed by the program. For submerged closure bolting, the GALL-SLR Report recommends the use of visual inspection to detect loss of material during opportunistic maintenance activities (e.g., when made accessible, and when joints are disassembled). The SLRA does not state how integrity of the bolted joints will be maintained (through alternate means of inspections or testing) when opportunistic maintenance activities will not provide access to at least 20 percent of the population, or the applicable sample size for the site, over a 10-year period. In a similar way, for closure bolting in systems containing air or gas, the GALL-SLR Report recommends that the SLRA states how integrity of the bolted joint will be demonstrated through the proposed inspection method, and for the closure bolting in components that are not normally pressurized, it recommends that the SLRA states how the aging effects associated with the closure bolting will be managed based on the proposed inspection method. In addition, for the "acceptance criteria" program element, the GALL-SLR Report AMP also states, in part, that plant-specific acceptance criteria are established when alternative inspections or testing is conducted for submerged closure bolting or closure bolting where the piping systems contains air or gas for which leakage is difficult to detect.

Issue:
During the staff review of the SLRA, the staff noted that the SLRA does not state how the aging effects associated with closure bolting for components that are not normally pressurized will be detected and managed so that the intended function(s) will be maintained consistent with the

current licensing basis. Specifically, the SLRA enhancement no. 4 seems to specifically address the detection of aging effects in submerged closure bolting and in closure bolting where the piping systems containing air or gas. Therefore, it is not clear how closure bolting from systems that are not normally pressurized will be adequately managed, and what alternate means of inspection and acceptance criteria will be implemented (e.g., checking the torque to the extent that the closure bolting is not loose) to ensure that the associated aging effects will be detected before a loss of function.

The staff also noted that SLRA enhancement no. 4 seeks to implement alternate means of inspection and testing when the minimum sample size is not met over a 10-year period. However, it is not clear what plant-specific acceptance criteria will be established for these alternative means of inspections and testing to demonstrate that these 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.

Request:

1. State how the aging effects associated with the closure bolting for components that are not normally pressurized will be detected and adequately managed by the Bolting Integrity program during the subsequent period of extended operation (i.e., inspection methods and acceptance criteria that will be used). Update the SLRA as necessary to include this information.

2. For the alternate inspection and testing methods specified in the SLRA for submerged closure bolting or closure bolting where leakage is difficult to detect, clarify what the plant-specific acceptance criteria are that will be established for the Bolting Integrity program to ensure that the intended function(s) will be maintained consistent with the current licensing basis for the subsequent period of extended operation. Update the SLRA as necessary.

RAI B2.1.9-3

Background:
SLRA Section B2.1.9, "Bolting Integrity," states that the Oconee Bolting Integrity AMP, with the enhancements provided in the SLRA, will be consistent with the ten program elements of GALLSLR Report AMP XI.M18, "Bolting Integrity." To ensure consistency with the "detection of aging effects" program element, the SLRA included enhancement no. 3 to demonstrate that the program will perform volumetric inspections of non-ASME high-strength bolting greater than two inches in diameter in accordance with the methods described in ASME Code Section XI, Table IWB 2500 1, Examination Category BG1.

For the "parameters monitored or inspected," and "detection of aging effects" program elements, the GALL-SLR Report states that high strength closure bolting with actual yield strength greater than or equal to 150 ksi, and bolting for which yield strength is unknown, maybe subject to stress corrosion cracking (SCC), and it should be monitored for surface and subsurface discontinuities indicative of cracking. The GALL-SLR Report also states that for all closure bolting greater than 2 inches in diameter (regardless of code classification) with actual yield strength greater than or equal to 150 ksi and closure bolting for which yield strength is unknown, volumetric examination in accordance with ASME Code Section XI, Table IWB-2500-1, Examination Category B-G-1, is performed.

Issue:
Regarding SLRA enhancement no. 3, it is not clear how this enhancement is consistent with the GALL-SLR Report recommendation to demonstrate that the aging effects of cracking due to SCC will be adequately managed for high-strength bolting. Specifically, the enhancement is not clear whether the proposed volumetric inspection applies to bolting with actual yield strength greater than or equal to 150 ksi and closure bolting for which yield strength is unknown.

Request:
Clarify how SLRA enhancement no. 3 to the Bolting Integrity program is consistent with the GALL-SLR Report recommendation to ensure that the aging effects of cracking due to SCC will be adequately manage for high-strength bolting with actual yield strength greater than or equal to 150 ksi and closure bolting for which yield strength is unknown.

RAI A2.9-1

Background:
SLRA Section A2.9, "Bolting Integrity," provides the program description that will be used to supplement the UFSAR for the Bolting Integrity AMP. As stated, in part, in 10 CFR 54.21(d), the "FSAR supplement for the facility must contain a summary description of the programs and activities for managing the effects of aging and the evaluation of time-limited aging analyses for the period of extended operation determined by paragraphs (a) and (c) of this section." Table XI-01 of the GALL-SLR Report provides a recommended description of the Bolting Integrity program.

During the audit, the staff noted that existing procedures do not appear to directly manage the inspections of closure bolting in locations that preclude detection of joint leakage or where the system contains air or gas for which leakage is difficult to detect (e.g., air or gas systems, not normally pressurized). Therefore, enhancement no. 4 in SLRA Section B2.1.9 seeks to implement new actions, either as a new procedure or as an enhancement to existing procedure(s), to ensure that closure bolting in locations that preclude detection of joint leakage or where the leakage is difficult to detect is adequately managed during the subsequent period of extended operations, consistent with the GALL-SLR Report recommendations. These actions include the use of alternate means of inspections to ensure that aging effects can be detected for these components.

Issue:
During the staff review of the UFSAR supplement, the staff noted that the program description does not appear to contain a summary description of the AMP that is consistent with the program and actions described in SRLA Section B2.1.9 and/or the GALL-SLR Report. Specifically, the program description does not include the alternate means of inspections (e.g., testing – soap bubble or thermography testing) that will be used by the Bolting Integrity program to ensure that the effects of aging for closure bolting for which leakage is difficult to detect can be detected and adequately managed before a loss of function.

Request:
Update the summary description of the Bolting Integrity program to provide a description that is consistent with the program and actions described in SRLA Section B2.1.9.

Regulatory Basis:

Section 54.21(a)(3) of 10 CFR requires the applicant to demonstrate that the effects of aging for each structure and component identified in 10 CFR 54.21(a)(1) will be adequately managed so that the intended function will be maintained consistent with the current licensing basis (CLB) for the 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 when evaluation of the matter in the GALL-SLR Report applies to the plant.

RAI 3.5.2.2.1.5-1

Background:
SLRA Table 3.5.1 claims that AMR item 3.5.1-027 is not applicable, and it further states, "Cracking due to cyclic loading of the Containment liner and penetrations is a time-limited aging analysis (TLAA), as defined in 10 CFR 54.3. The evaluation of this TLAA is addressed in Section 4.6. The associated NUREG-2191 aging items are not used."

SLRA Section 3.5.2.2.2.1.5 states that TLAAs for fatigue of the containment liner plate and main feedwater and main steam penetrations are addressed in SLRA Section 4.6. However, SLRA Section 3.5.2.2.2.1.5 does not address fatigue or fatigue waiver analyses of containment pressure-retaining boundary components other than those above, nor provides any further evaluation associated with AMR item 3.5.1-027 for managing cracking due to cyclic loading of containment pressure-retaining boundary components of steel, stainless steel or dissimilar metal weld (DMW) material that do not have a CLB fatigue analysis.

Issue:
The non-applicability claim of AMR item 3.5.1-027 appears to be not adequately justified and it is unclear how the other steel, stainless steel or DMW containment pressure-retaining boundary components subject to cyclic loading, but do not have a CLB fatigue analysis, covered by item 3.5.1-027 will be adequately managed for cracking due to cyclic loading.

Request:
1. List the steel, stainless steel or DMW containment-pressure-retaining boundary components at ONS covered by SLRA Table 3.5.1, item 027 (e.g., personnel airlock, equipment hatch, electrical penetration, mechanical penetration, penetration sleeves, penetration bellows, fuel transfer tube etc.) that are subject to cyclic loading but do not have a CLB fatigue analyses.
2. Justify the non-applicability claim of SLRA Table 3.5.1, item 3.5.1-027, for each of these components. Alternatively, describe how cracking due to cyclic loading (cumulative fatigue damage) will be adequately managed for each of these components pursuant to 10 CFR 54.21(a)(3), or justify why the aging effect does not require management pursuant to guidance in SRP-SLR Section 3.5.2.2.1.5, as modified by Interim Staff Guidance SLR-ISG-2021-03-Structures. Provide necessary conforming changes to the SLRA accordingly.

RAI 3.5.2.2.1.6-1

Background:
SLRA Section 3.5.2.2.1.6, associated with AMR item 3.5.1-010 related to stress corrosion cracking (SCC), states that stainless steel high energy pipes that penetrate the containment are

connected to carbon steel penetration sleeves with dissimilar metal welds, and the ASME Section XI, Subsection IWE program and 10 CFR Part 50, Appendix J program manage the aging of these dissimilar metal welds. However, SLRA Section B2.1.28 states that Appendix J AMP manages the aging of these dissimilar metal welds.

SLRA Section A2.28 states, "The program includes supplemental surface or enhanced examinations to detect cracking for specific pressure-retaining components. Containment liners and penetrations were analyzed for cyclic fatigue and do not require surface examinations in addition to visual examinations to detect cracking in stainless steel and dissimilar metal welds of penetration sleeves and components that are subject to cyclic loading."

The above statements appear to imply that supplemental surface or enhanced examinations would apply to components with dissimilar metal welds for SCC since analysis for fatigue loading does not preclude cracking due to SCC. But the ASME Section XI, Subsection IWE program and the SLRA Section 3.5.2.2.1.6 do not appear to include any enhancements for the surface or enhanced examinations and do not identify the specific pressure-retaining components on which these examinations will be performed, as stated in SLRA Section A2.28. In addition, SRP-SLR Section 3.5.3.2.1.6 guidance states that containment inservice inspection (ISI) IWE and leak rate testing may not be sufficient to detect cracks, especially for dissimilar metal welds.

SLRA Table 3.5.1 claims AMR item 3.5.1-010 to be not applicable, and SLRA Section 3.5.2.2.1.6 states that ONS containment does not have stainless steel penetration sleeves, penetrations bellows, vent line bellows, or suppression chamber shell (interior face) as part of the containment pressure boundary. However, as stated in SLRA Section 3.5.2.2.1.6, ONS does have penetration sleeves with dissimilar metal welds that could be subject to SCC.

Issue:
It is unclear how the ASME Section XI, Subsection IWE program and 10 CFR Part 50, Appendix J program will be sufficient to manage aging effects of dissimilar metal welds without additional appropriate examinations capable of detecting cracking due to SCC. Also, there are no AMR line items in SLRA Table 3.5.2-2 to manage SCC for penetrations with dissimilar metal welds.

SLRA Section B2.1.28 ASME Section XI, Subsection IWE program and SLRA Section 3.5.2.2.1.6 do not appear to include an enhancement with regard to supplemental surface or enhanced examinations and do not identify the specific pressure-retaining components on which these examinations will be performed, as stated in SLRA Section A2.28.

AMR Item 3.5.1-010, with corresponding GALL-SLR Report AMR item II.A3.CP-38, also applies to dissimilar metal welds which do exist at ONS. It appears that the non-applicability claim in SLRA Table 3.5.1, for AMR item 3.5.1-010 is not sufficiently justified or addressed in SLRA Section 3.5.2.2.1.6.

Request:
1. Explain how the ASME Section XI, Subsection IWE program and 10 CFR Part 50, Appendix J program examination/testing methods will be sufficient to manage dissimilar metal welds without additional examinations capable of detecting cracking due to SCC.
2. Clarify the specific pressure-retaining components that will be subject to supplemental surface or enhanced examinations and the examination frequency to detect cracking and provide appropriate enhancement to the SLRA Section B2.1.28 AMP to perform

these examinations. Also, state the specific enhanced visual examination method (e.g., EVT-1) that may be performed in lieu of surface examinations.

3. Justify the non-applicability claim of SLRA Table 3.5.1, item 3.5.1-010 in SLRA Section 3.5.2.2.1.6. Alternatively, provide appropriate Table 2 AMR line items for the components and material that will be managed for SCC in accordance with GALL-SLR Table 3.5-1, item 3.5.1-010.
4. Clarify the discrepancy among SLRA Section 3.5.2.2.1.6, SLRA Section B2.1.28, and SLRA Section A2.28 regarding aging management of dissimilar metal welds, and supplemental surface or enhanced examinations to detect cracking for specific pressure-retaining components.
5. Revise SLRA as necessary to be consistent with responses to the above requests.

RAI B2.1.30-1

Regulatory Basis:
Title 10 of the *Code of Federal Regulations* (10 CFR) Section 54.21(a)(3) requires the applicant to demonstrate that the effects of aging for each structure and component identified in 10 CFR 54.21(a)(1) will be adequately managed so that the intended function will be maintained consistent with the current licensing basis for the 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 when evaluation of the matter in the GALL-SLR Report applies to the plant.

Background:
The "preventive actions" program element of GALL-SLR AMP XI.S3 states: "Operating experience and laboratory examinations show that the use of molybdenum disulfide (MoS_2) as a lubricant is a potential contributor to stress corrosion cracking (SCC), especially when applied to high-strength bolting. Thus, molybdenum disulfide and other lubricants containing sulfur should not be used."

The "parameters monitored or inspected" program element of GALL-SLR AMP XI.S3 recommends that high strength bolting (actual measured yield strength greater than or equal to 150 ksi) in sizes greater than 1 inch nominal diameter should be monitored for SCC.

SLRA Section B2.1.30 states that the ONS ASME Section XI, Subsection IWF AMP is an existing program with enhancements that will be consistent with the ten elements of the GALL-SLR AMP XI.S3, ASME Section XI, Subsection IWF. The SLRA AMP does not take exception to any program element including "preventive actions."

SRP-SLR Section 1.2.1 states, in part: "If a GALL-SLR Report AMP is selected to manage aging, the applicant may take one or more exceptions to specific GALL-SLR Report AMP program elements. Exceptions are portions of the GALL-SLR Report AMP that the applicant does not intend to implement, which the staff will review on a case-by-case basis. Any deviation or exception to the GALL-SLR Report AMP should be described and justified."

SLR-ONS-AMPR-XI.S3, "ASME Section XI, Subsection IWF AMP Evaluation Report, ONS Units 1, 2 and 3," Revision 2, paragraph 4.2.a under Preventive Actions, on page 10 of 41 states: "The use of molybdenum disulfide as a lubricant on bolting is prohibited at Oconee as specified in the Power Chemistry Materials Guide (PCMG). Station procedures specify the use of thread lubricants, such a Loctite N-5000, that have low levels of halogens and sulfur to

minimize the potential for stress corrosion cracking. (Reference: AD-EN-ALL-0045, PCMG Manual Section 1.10.7)."

Section 4.2.c of SLR-ONS-AMPR-XI.S3, Revision 2, on page 10/11 of 41 states in part:

> The ONS ASME Section XI, Subsection IWF AMP consists of ASTM A490 bolting for the reactor vessel anchor studs and the replacement steam generator anchor studs. Bolting material selection is governed through the design change procedures and design specifications for the plant. The use of lubricants and sealants is controlled by the Nuclear Chemical Control process through the PCMG and by station maintenance procedures. Station procedures specify the use of thread lubricants and sealants…

Section 1.10.7 of the Power Chemistry Material Guide (PCMG) Program, Revision 31, states in part: "The PCMG program controls chemical content of consumables to preclude initiation of stress corrosion cracking of austenitic stainless steel, and prescribes contaminant limits for thread lubricants and sealants, which are approved for use. NOTE: Molybdenum Disulfide containing materials are restricted from use on bolting materials."

Since high-strength bolting is used and may continue to be used at ONS, and molybdenum disulfide (MoS_2) or other lubricants containing sulfur may have been used at ONS, as recommended in the GALL-SLR, SLRA Section B2.1.30 includes enhancement 5 (SLR Commitment # 30(5) in SLRA Table A6.0-1) to the "detection of aging effects" program element to perform volumetric examinations, once in each 10-year period during the SPEO, on a representative sample of high-strength bolting greater than one inch nominal diameter to detect cracking for NSSS [Nuclear Steam Supply System] component supports.

Issue:

1. While the PCMG through a footnote (as above) appears to only restrict (and not prohibit as claimed in the AMP evaluation report SLR-ONS-AMPR-XI.S3) use of molybdenum disulfide (MoS_2) containing materials at ONS, the possibility appears to exist that MoS_2 lubricant may have been used at ONS in the past and may continue to be used in the future. Also, the PCMG does not mention or prohibit use of other lubricants containing sulfur. Further, during the audit, the staff noted that document ER-CHM-00005 "Nuclear Chemical [Approved] List" includes Molykote BR-2, Molykote 3452, Molykote (R) Z Powder as approved lubricants at ONS, which contain MoS_2 as an ingredient. The staff also noted that, in response to audit breakout question 5(a), the applicant stated that it cannot be confirmed whether molybdenum disulfide has been used on bolting within the IWF program at ONS in the past. Based on the above, the "preventive actions" element of the SLRA AMP does not appear to have adequately addressed the use at ONS of molybdenum disulfide and other lubricants using sulfur which are identified in the GALL-SLR Report as potential contributors to stress corrosion cracking (SCC) in high-strength bolting, and the staff could not verify the consistency claim.

   The "preventive actions" program element of the SLRA AMP does not include an enhancement corresponding to the GALL-SLR AMP XI.S3 recommendation that MoS_2 and other lubricants containing sulfur should not be used, and therefore it does not appear to be consistent with the corresponding program element of the GALL-SLR XI.S3 AMP in that regard. Further, the SLRA AMP does not appear to take or justify an exception to the "preventive actions" program element with regard to use of molybdenum disulfide and other lubricants containing sulfur.

2. The staff notes that VT-3 visual inspections of the currently implemented ASME Section XI, Subsection IWF program may not detect SCC aging effect, prior to loss of intended function, in high-strength bolting from the use of molybdenum disulfide or other lubricants containing sulfur. The staff also noted that adequate preventive measures may not be currently in place and, for the subsequent period of extended operation (SPEO), may not inhibit this aging effect. Hence, it is possible that this aging effect may be present prior to entering and during the SPEO due to possible past use and the possibility of continued use of high-strength bolts with lubricants containing sulfur, including molybdenum disulfide. Hence, it is possible that such an aging effect may remain undetected until SLRA AMP B2.1.30 volumetric examinations of a sample of susceptible high-strength are performed during the SPEO, which could be as much towards the end of the first 10-year interval in the SPEO. The SRP-SLR Branch Technical Position RLSB-1 Section A.1.2.3.4, however, states that "detection of aging effects" should occur before there is a loss of the SC-intended function(s). Therefore, for the period of time between the start of the SPEO and when the volumetric examinations are performed, which could be up to the end of the first 10-year interval in to the SPEO, it is not clear how the aging effect of cracking due to SCC will be detected and managed prior to a loss of intended function.

3. If ONS uses MoS_2 or other lubricants containing sulfur coated high-strength bolts susceptible to SCC into the SPEO, there is the potential to increase the population of installed high-strength bolts (i.e., install additional high-strength bolts as replacement bolting) susceptible to SCC. It is not clear how the sample for volumetric examination representing the entire population of high-strength bolts will be established. It is also not clear how the program will assess the sample size and scope to ensure that it continues to monitor suspect high-strength bolts coated with sulfur based lubricants, especially those that have used/are using MoS_2.

Request:

1. Provide an enhancement and corresponding SLR Commitment that would make the "preventive actions" program element consistent, as claimed in the SLRA, with the GALL-SLR AMP XI.S3 regarding the recommendation that molybdenum disulfide and other lubricants containing sulfur should not be used in order to prevent SCC in high strength bolting. Alternatively, describe and justify an exception taken to the "preventive actions" program element of the GALL-SLR AMP XI.S3 regarding the recommendation that molybdenum disulfide and other lubricants containing sulfur should not be used to prevent SCC in high-strength bolting.

2. Since the first volumetric examinations per enhancement 5 (SLRA Commitment 30(5)) to the SLRA B2.1.30 AMP are planned for some time into the SPEO (could be as much as towards the end of the first 10-year interval in the SPEO), provide information on whether and how the timing of implementation of enhancement 5 volumetric examinations would assure that cracking due to SCC will be detected for the population of existing high strength bolts in a manner such that this aging effect can be managed prior to loss of intended function, consistent with SRP-SLR Branch Technical Position RLSB-1 Section A.1.2.3.4, during the SPEO.

3. Discuss how the "parameters monitored or inspected" program element will identify and assess the adequacy of the representative high-strength bolting sample inspected for cracking due to SCC for existing and/or when additional susceptible high-strength bolts are installed.

4. Update applicable portions of the SLRA, as necessary, consistent with responses to the above requests.

RAI 3.5.2.2.1.2-1

Regulatory Basis:
Section 54.21(a)(3) of 10 CFR requires the applicant to demonstrate that the effects of aging for each structure and component identified in 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 (CLB) for the period of extended operation. As described in the SRP-SLR, an applicant may demonstrate compliance with 10 CFR 54.21(a)(3) by referencing the GALL-SLR Report when evaluation of the matter in the GALL-SLR Report applies to the plant.

Background:
SLRA Section 3.5.2.2.1.2 states that the only high temperature piping penetrating the reactor building shell are the main steam lines and feedwater lines. The main steam penetrations (shown in USFAR Figure 3-20) are designed with cooling fans and stacks. SLRA Section 3.5.2.2.1.2 also states that a review of ONS operating experience (OE) reflects that localized concrete temperatures at the main steam penetrations have marginally exceeded 200°F. Volumetric non-destructive concrete testing was performed to address the exposure to elevated temperature concern. This testing determined that there was no adverse impact to the concrete strength due to the marginally higher temperatures in these areas.

SLRA Section B 2.1.29, operating experience No. 3 states, “In December of 2012, while performing temperature readings at the Unit 1 main steam penetration inside of the enclosed penetration area, it was discovered that the maximum inner surface of the concrete around the piping at the penetration was 227°F.”

It appears that the main steam penetrations rely on cooling fans and stacks to maintain acceptable temperatures. However, the staff found that, in the SLRA, cooling fans and stacks are not in the scope of subsequent license renewal, and they are not subject to aging management review.

During the audit, the staff also found that the outside main steam penetrations of the Units 2 and 3 have experienced high concrete temperatures indicated in the document “Reactor Building Concrete Subject to Elevated Temperatures,” file no. OSC-10898, Revision 0, which concluded that the temperature history of the concrete around the Units 2 and 3 main steam penetrations has caused no significant reduction in concrete strength based on Olson Engineering, Inc.’s assessment of Unit 1 penetration #28.

Issue:
It is unclear how localized concrete temperatures at the main steam penetrations can be adequately maintained without aging management of the cooling fans and stacks and concrete temperature monitoring at the main steam penetrations to identify a problem with the cooling fans and stacks.

It is unclear what the elevated concrete temperatures at the Units 2 and 3 main steam penetrations were, and how it was determined that the conclusions from the Unit 1 assessment

were applicable to the elevated concrete temperatures at the Units 2 and 3 main steam penetrations.

Request:

1. Evaluate whether cooling fans and stacks should be in the scope of subsequent license renewal and subject to aging management review.
    a. If cooling fans and stacks are within the scope of subsequent license renewal, explain how aging management will be accomplished (i.e., identify an appropriate AMP and enhancements, provide acceptance criteria with basis, summarize plant-specific evaluations and corrective actions, and develop AMR line items etc.)
    b. If cooling fans and stacks are not within the scope of subsequent license renewal, explain how localized concrete temperatures at the main steam penetrations will be adequately maintained, and provide the technical basis (I.e., tests and/or calculations) to justify the higher temperatures if the localized concrete temperatures are exceeded.
2. Describe high concrete temperature OE at the Units 2 and 3 main steam penetrations. Explain how it was determined that the conclusions of the Unit 1 assessment apply to the elevated concrete temperatures at the Units 2 and 3 main steam penetrations.
3. Based on the responses to the above requests, update the SLRA accordingly.

Regulatory Basis:
Title 10 of the *Code of Federal Regulations* (CFR) Section 54.21(a)(3) requires an applicant to demonstrate that the effects of aging for each structure and component identified in 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 period of extended operation.

RAI B4.1-1

Background:
Section B4.1, “Secondary Shield Wall (SSW) Tendon Surveillance,” of the SLRA starts, “the program manages for loss of material, cracking, and loss of tendon prestress by conducting visual inspections and tendon liftoff tests in accordance with station procedures (MP/A1400/021, Reference 017, “Tendon - SSW – Surveillance”). These are performed on three randomly selected horizontal tendons every other outage.” The SLRA further states, “the primary strength of the removable sections of the wall is provided by horizontal tendons as well as conventional reinforcing bars in each panel.”

Based on its review of drawings during the audit, the staff noted that there are three types of tendon groups in the SSW, namely: vertical, horizontal (lower, middle, and upper) and diagonal ties. These tendon groups help resist the pressure and jet loads resulting from postulated pipe ruptures. In addition, the diagonal tie tendons provide a critical boundary support function for the entire SSW structure to the permanent shield wall as shown in ONS Plant Drawing, No. O-0070-A, Revision 14, “Reactor Building SSWs North Elevation Unit 1, South Elevation Units 2 & 3.”

Issue:
It is not clear why the SSW tendon inspections are limited to the horizontal tendons only.

Request:
Provide justification for why vertical and diagonal tie tendons are not considered for visual inspections and tendon liftoff tests in accordance with station procedures. Include an explanation of how aging management is conducted on the vertical and diagonal tendons or explain why aging management is not necessary for these tendons.

RAI B4.1-2

Background:
SRP-SLR Section A.1.2.3.5 provides the branch technical position for reviewing element 5, "monitoring and trending," for plant-specific AMPs. Section A.1.2.3.5 notes that "results of inspections in the prior period of extended operation are used to provide input to trending results," and that "trending is a comparison of the current monitoring results with previous results in order to make predictions for the future." The SRP-SLR further notes that where practical, degradation should be projected to the next scheduled inspection.

Issue:
SLRA Section B4.1, Element 5, discusses monitoring and trending of the prestress in the SSW tendons. The SLRA notes that prestress is monitored by comparing the measured lift-off forces to the established minimum required force for each tendon group. The SLRA also notes that plant procedures will be enhanced to include a review of previous lift-off data results for the tendons selected for inspection; however, no discussion is provided regarding predicting future results or projecting the prestressing losses to the next scheduled inspection.

Request:
Explain how prestressing losses are projected for the SSW tendons or provide justification for not performing trending assessments of the SSW tendon losses to make projections to the next inspection.

Regulatory Basis:
Title 10 of the *Code of Federal Regulations* (CFR) Section 54.21(c) requires the applicant to evaluate time-limited aging analyses (TLAA) and disposition them in accordance with (c)(1)(i), (c)(1)(ii), or (c)(1)(iii). 10 CFR 54.21(d) requires that the FSAR supplement for the facility must contain a summary description of the programs and activities for managing the effects of aging and evaluation of the TLAA for the period of extended operation determined by 54.21(a) and 54.21(c), respectively.

Section 54.21(a)(3) of 10 CFR requires the applicant to demonstrate that the effects of aging for each structure and component identified in 10 CFR 54.21(a)(1) will be adequately managed so that the intended function will be maintained consistent with the current licensing basis (CLB) for the period of extended operation.

RAI 4.6.1-1

Background:
SLRA Section 4.6.1, "Containment Liner Plate" under TLAA disposition for the containment liner plate states, in part: "As described in UFSAR Section 3.8.1.5.3, the only portions of the liner

plate that contain fatigue analysis are those thickened portions at the penetrations." A similar statement is made in UFSAR supplement for the TLAA in SLRA Section A4.6.1.

SLRA Section 4.6.1 and its UFSAR supplement description in SLRA Section A4.6.1 concluded that thermal fatigue of the containment liner plate would be acceptable for the subsequent period of extended operation (SPEO), and further states that the effects of fatigue of the containment liner plate will be adequately managed by the Fatigue Monitoring AMP (B3.1) for the SPEO in accordance with 10 CFR 54.21(c)(1)(iii).

SLRA Section 4.6.1 states, in part: "The Fatigue Monitoring AMP will track cycles for significant fatigue transients listed in Table 4.3.1-1 and ensure corrective action is taken prior to potentially exceeding design limits."

The acceptance criteria for FSAR Supplement in SRP-SLR Section 4.6.2.2 states:

> The specific criterion for meeting 10 CFR 54.21(d) is that the summary description of the evaluation of TLAAs for the subsequent period of operation in the FSAR Supplement is sufficiently comprehensive, such that later changes can be controlled by 10 CFR 50.59. The description contains information associated with the TLAAs regarding the basis for determining that the applicant has made the demonstration required by 10 CFR 54.21(c)(1).

Issue:

1. The staff understands that the liner plate is thickened at the penetrations to address stress concentrations at discontinuities. However, the staff notes from review of UFSAR Section 3.8.1.5.3 (p 3.8.1-30 and -31) and the SLRA Section 4.6.1 under the title "TLAA description" that the fatigue loads stated therein apply to and were considered in the design of the entire liner plate (not only the thickened liner plate), which appear inconsistent with the above referenced statement from the SLRA.
2. From the SLRA Section 4.6.1 and A4.6.1 descriptions, it is not clear what fatigue parameter (e.g., cumulative fatigue damage, cracking due to cyclic loading, fatigue waiver analyses parameter(s)) is managed by the Fatigue Monitoring Program, the relevant transients that are monitored and how monitoring those parameters assure adequate fatigue management of the containment liner plate consistent with the disposition of 10 CFR 54.21(c)(1)(iii).
3. The staff is unable to make its determination that the UFSAR supplement provides an adequate summary description for the TLAA equivalent to that in SRP-SLR Table 4.6-1 for the TLAA disposition in accordance with 10 CFR 54.21(c)(1)(iii).

Request:

1. Clarify or correct the referenced statements from SLRA 4.6.1 disposition and A4.6.1 in Issue 1, regarding that fatigue analysis are only for thickened portions of the liner, which appears inconsistent with the description in the UFSAR and SLRA 4.6.1 TLAA description. Clearly state whether or not the TLAA evaluation described in SLRA Section 4.6.1 and A4.6.1 applies to the containment liner plate (i.e., portions backed by concrete) in its entirety.
2. Identify the fatigue parameter (e.g., cumulative fatigue damage, cracking due to cyclic loading) that is managed by the Fatigue Monitoring Program in accordance with the TLAA disposition for the containment liner plate, the relevant transients that are

monitored by the program and how monitoring those transients assure adequate fatigue management of the containment liner plate.

3. Provide a revised SLRA Section A4.6.1 UFSAR supplement summary description, consistent with the disposition of the containment liner plate fatigue TLAA in SLRA Section 4.6.1, with sufficient information that includes the specific fatigue evaluation parameter that is managed by the Fatigue Monitoring Program, the specific relevant transients monitored by the program, and how monitoring those transients assures adequate management of cumulative fatigue damage of the containment liner plate.

4. If a TLAA, as defined in 10 CFR 54.3, does not exist in the current licensing basis (CLB) for the containment liner plate information presented in SLRA Section 4.6.1, state so and describe how the aging effect of cumulative fatigue damage or cracking due to cyclic loading will be adequately managed for the subsequent period of extended operation pursuant to 10 CFR 54.21(a)(3) and the guidance for SRP-SLR Table 3.5-1, item 027 and its associated further evaluation in SRP-SLR Section 3.5.2.2.1.5, as modified in Interim Staff Guidance (ISG) SLR-ISG-2021-03-Structures (ADAMS Accession No. ML20181A381).

5. Provide applicable and necessary updates to the SLRA consistent with the responses to the requests above.

RAI 4.6.3-1

Background:
SLRA Section 4.6.3 states that the effects of fatigue on the intended functions of the containment main steam penetrations and main feedwater penetrations will be adequately managed by the Fatigue Monitoring AMP (B.3.1) for the subsequent period of extended operation in accordance with 10 CFR 54.21(c)(1)(iii).

The UFSAR Supplement in SLRA Section A4.6.3 “Containment Penetrations Fatigue Analysis,” as amended by Supplement 2 dated November 11, 2021 (ADAMS Accession No. ML21315A012), states in part:

> The transient cycles considered in the main steam and feedwater penetrations analyses were projected for 80 years of operation and the count found to be adequate for the SPEO. The *Fatigue Monitoring* (A3.1) aging management program will monitor and track the relevant transients to manage fatigue of the main steam and feedwater penetrations during the SPEO in accordance with 10 CFR 54.21(c)(1)(iii).

The acceptance criteria for FSAR Supplement in SRP-SLR Section 4.6.2.2 states:

> The specific criterion for meeting 10 CFR 54.21(d) is that the summary description of the evaluation of TLAAs for the subsequent period of operation in the FSAR Supplement is sufficiently comprehensive, such that later changes can be controlled by 10 CFR 50.59. The description contains information associated with the TLAAs regarding the basis for determining that the applicant has made the demonstration required by 10 CFR 54.21(c)(1).

The staff verifies that the applicant has provided an FSAR Supplement with information equivalent to that in SRP-SLR Table 4.6-1 for disposition under 10 CFR 54.21(c)(1)(iii).

Issue:
The fatigue TLAA evaluation in SLRA Section 4.6.3, and its UFSAR supplement description in SLRA Section A4.6.3 (as amended) do not state what specific fatigue evaluation parameter (e.g., cumulative fatigue damage (cumulative usage factor or CUF), cracking due to cyclic loading, etc.) is adequately managed by the Fatigue Monitoring Program by monitoring the relevant transient cycles. Further, the UFSAR Supplement summary description does not state, to assure program effectiveness, the specific relevant transients that will be monitored and what fatigue evaluation parameter is maintained within what acceptance criteria (e.g., CUF maintained less than or equal to 1, or require corrective actions prior to that limit) by monitoring those transients against the stated allowable cycle counts or require corrective actions when cycle count limits are approached.

The staff needs additional information to make its determination that the UFSAR supplement provides an adequate summary description for the TLAA equivalent to that in SRP-SLR Table 4.6-1.

Request:

1. State the specific fatigue evaluation parameter that will be adequately managed by the Fatigue Monitoring Program (SLRA B3.1) and by monitoring what specific transient cycles for the fatigue TLAA evaluation for containment penetrations in SLRA Section 4.6.3.

2. Provide a revised SLRA Section A4.6.3 UFSAR supplement summary description consistent with the disposition of the main steam and main feedwater piping penetrations fatigue TLAA in SLRA Section 4.6.3, with sufficiently comprehensive information that includes the specific fatigue evaluation parameter (with limit) that is managed by the Fatigue Monitoring Program, the specific relevant transients monitored by the program and how monitoring those parameters assures adequate management of cumulative fatigue damage including triggering corrective action.

Regulatory Basis:
Title 10 of the *Code of Federal Regulations* (CFR) Section 54.3 defines the criteria to qualify a certain analysis as a Time-Limiting Aging Analysis (TLAA). For each analysis that is determined to meet the definition of a TLAA, 10 CFR 54.21(c) requires the applicant to evaluate the TLAA in the Subsequent License Renewal Application (SLRA) to demonstrate that the TLAA either: (i) will remain valid for period of extended operation; (ii) has been projected to the end of the period of extended operation; or (iii) the effects of aging on the intended function(s) of the component(s) assessed in the TLAA will be adequately managed during the period of extended operation.

RAI 4.2.3-1

Background:
The applicant dispositioned the Pressurized Thermal Shock (PTS) TLAA in accordance with 10 CFR 54.21(c)(ii). Applicable to extended beltline locations, Section 3.4.1 of ANP-3898P, Revision 0, discusses how the Cu wt% content was determined for ONS Unit 1 and Unit 2 RPV inlet (INF) and outlet (ONF) nozzle forgings and transition forgings, and Unit 3 RVP INF. The staff notes that Section 3.4.1 of ANP-3898P does not include a discussion regarding the Cu wt% value for the RPV ONF and transition forging for Unit 3.

Issue:
The staff lacks clarity regarding how the applicant determined a generic Cu wt% value for the Unit 3 RPV ONF and transition forging. These forgings show a different Cu wt% value in Table 5-12 of ANP-3898P, Revision 0, compared to the generic value determined in Section 3.4.1 for extended beltline materials. During its review of ANP-3898P and supporting documents, the staff was not able to identify how the applicant determined the applicable Cu wt% value for the Unit 3 RPV ONF and transition forging.

Request:
Describe how the generic Cu wt% value for Unit 3 RPV ONF and transition forging was determined and provide a justification for using this value.

RAI 4.2.3-2

Background:
Section 5.4.1 of ANP-3898P, Revision 0, establishes the initial RT_{NDT} (generic mean) and σ_I (standard deviation) values for ONS Unit 3 RPV ONF and transition forging. The applicant states that these forgings were fabricated by a non-US supplier (Klockner-Werke), and the generic mean and standard deviation values were determined from the material data set in Table 5-2 of ANP-3898P, Revision 0. ANP-3898P, Revision 0, states that the actual suppliers of the forgings to Rotterdam Dockyards for the plants listed in Table 5-2 are not known but likely included Klockner-Werke, Fried-Krupp Huttenwerke AG, and Rheinstahl Huttenwerke AG based on a review of Table 2 of PWROG-17090 (ADAMS Accession Number ML20023E238).

Issue:
The staff lacks clarity regarding how the forgings in Table 5-2 of ANP-3898P, Revision 0, are applicable or representative of the ONS Unit 3 RPV ONF and transition forging. In addition, the applicant states that it reviewed PWROG-17090 as part of determining the data set in Table 5-2 of ANP-3898P, Revision 0, but it is not clear to the staff how the applicant's review yielded the dataset provided in Table 5-2. Specifically, the staff performed a search of the applicable materials in Table 5-2 within PWROG-17090 and was not able to reference them within the document.

Request:
Justify how the forgings in Table 5-2 of ANP-3898P, Revision 0, are applicable or representative to ONS Unit 3 RPV ONF and transition forging. As part of your response, include a discussion of the source information for these forgings and why their selection is conservative, applicable, or representative for ONS Unit 3.

Regulatory Basis:
Section 54.21(a)(3) of Title 10 of the *Code of Federal Regulations* (10 CFR) requires an applicant to demonstrate that the effects of aging for each structure and component identified in 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 period of extended operation. One of the findings that the U.S. Nuclear Regulatory Commission (NRC) 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 the matters identified in 10 CFR 54.21(a)(1) and 10 CFR 54.21(a)(2), 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 B2.1.15-1

Background:
Oconee Subsequent License Renewal Application (SLRA) Tables 3.5.2-1 (Auxiliary Building) and 3.5.2-3 (Turbine Building) list a "masonry wall" component type, with a fire protection intended function and include two materials: "masonry walls" and "concrete block." For masonry walls materials, the tables credit both the Fire Protection and the Masonry Walls programs to manage cracking. However, for concrete block materials these tables only credit the Masonry Walls program to manage cracking of the concrete block masonry walls with a fire barrier intended function and do not include the Fire Protection program.

Issue:
It is not clear whether: a) the different treatment of masonry walls and concrete block materials noted above was an oversight, b) the listed masonry walls constructed of concrete block do not have a fire barrier intended function and, consequently, do not need to be included in the Fire Protection program, or c) inspections done by the Masonry Walls program can ensure the fire barrier intended function of the concrete block masonry walls is being maintained.

Request:
Clarify which of the issues discussed above is applicable to this situation and if appropriate provide a discussion and any changes to the SLRA. If the inspections done by the Masonry Walls program are being credited for ensuring the fire barrier intended function of the concrete block masonry walls is maintained during the subsequent period of extended operation, then include additional information (e.g., inspections, acceptance criteria, and corrective actions are equivalent to those in the Fire Protection program; inspections are performed on the same frequency as required by the Fire Protection program; and the credited program procedures have been updated, if necessary, to address the fire barrier intended function).

RAI B2.1.15-2

Background:
SLRA Section 2.4.8.2 states, "Armaflex is a flexible insulation material which is installed in penetrations in the floor and ceiling of east and west penetration rooms (of each unit) for pressure boundary conditions. The NRC has accepted Armaflex as a fire barrier and has exempted it from testing and rating requirements normally required for fire barriers."

The table in Section 4.4 of Enclosure 9.5, "Fire Barrier Penetration Configuration Identification," in implementing procedures MP/1/A/1705/018, MP/2/A/1705/018, and MP/3/A/1705/018, "Fire Protection – Penetration – Fire and Flood Barrier – Inspection and Minor Repair," state that Armaflex is approved for "Flood only in East Penetration room floors."

Issue:
SLRA Section 2.4.8.2 states that Armaflex is a credited fire barrier material; however, the implementing procedures state it is only approved for flood barriers. The NRC staff notes that neither SLRA Table 2.4.8-2 nor SLRA Table 3.5.2-23 identify Flood Barrier as an intended function for component type "Fire Barriers – Penetration Seals." In addition, the staff notes that

the implementing procedures referenced above include other sealant types that are approved for both fire and flood.

Based on the implementing procedures referenced above, it appears that flood barriers are inspected at the same frequency as fire barriers; however, it is unclear to the NRC staff whether the "detection of aging effects," "acceptance criteria," and "corrective actions" program elements for fire barriers are bounded by the comparable program element associated with flood barriers. The staff notes that SLRA Table 3.5.2-23 lists the aging effects requiring management for elastomeric fire barriers as "hardening, loss of strength, or shrinkage," using the Fire Protection program, whereas the corresponding aging effects for flood barriers is only "loss of sealing," using the Structures Monitoring program.

Request:

1. Discuss and address the apparent disparity between the SLRA statement and the implementing procedures relative to the approved function(s) of Armaflex (e.g., fire barrier, flood barrier, or both).

2. If the inspections done by the Structures Monitoring program are being credited for ensuring the fire barrier intended function of the elastomeric penetration seals is maintained during the subsequent period of extended operation, then include additional information (e.g., "detection of aging effects," "acceptance criteria," and "corrective actions" program elements for elastomeric fire barriers in the Fire Protection program are bounded by the corresponding program elements in the Structures Monitoring program associated with flood barriers).

Regulatory Basis:
Section 54.21(a)(3) of Title 10 of the *Code of Federal Regulations* (10 CFR) requires an applicant to demonstrate that the effects of aging for each structure and component identified in 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 period of extended operation. One of the findings that the U.S. Nuclear Regulatory Commission (NRC) 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 the matters identified in 10 CFR 54.21(a)(1) and 10 CFR 54.21(a)(2), 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 B2.1.10-1

Background:
Oconee Subsequent License Renewal Application (SLRA) Section 2.3.1.4 states that the evaluation boundary for the steam generator (SG) components includes "mechanical sleeves."

In addition, SLRA Supplement 1, dated October 28, 2021 (ADAMS Accession No. ML21302A208), revised SLRA Section B2.1.10, "Steam Generators," to clarify that continued acceptability evaluations will be performed during the subsequent period of extended operation for "steam generator components such as tubes, plugs, secondary side components, sleeves, tube supports, primary side cladding of heads (interior surfaces), tubesheets and tube-to-tubesheet welds."

Issue:
Sleeving is not an NRC-approved repair method at Oconee, therefore, it is unclear to the NRC staff why the SLRA refers to “mechanical sleeves” and “sleeves.”

Request:
Discuss why the SLRA refers to “mechanical sleeves” and “sleeves,” in relation to steam generator components or alternatively revise SLRA Sections 2.3.1.4 and B2.1.10 to remove reference to “mechanical sleeves” and “sleeves,” respectively.

RAI B2.1.10-2

Background:
SLRA Supplement 1, dated October 28, 2021 (ADAMS Accession No. ML21302A208), revised SLRA Table 3.1.2-4 by adding two different items under Plant Specific Note 1, which state: “The environment of Treated Water is equal to the environment of Secondary Feedwater for the Tube Support Plate Assembly (support rods),” and “The Auxiliary Feedwater Nozzle Flanges are insulated with stainless steel metal reflective insulation (Reference: Drawing OM 241-37 Sheet 1 and OSS-0241.00-00-0005).” In addition, SLRA Supplement 3, dated December 15, 2021 (ADAMS Accession No. ML21349A005), revised SLRA Table 3.1.2-4 by adding another Plant Specific Note 1, which states, “The environment of Secondary Feedwater is considered the same as Treated Water for the Steam Generator components.”

The NRC staff notes that SLRA Supplement 1 also included a Plant Specific Note 2.

Issue:
Based on SLRA Supplements 1 and 3, there will be three different items identified as Plant Specific Note 1.

Request:
Revise SLRA Table 3.1.2-4 to correct the numbering of the plant specific notes and, if necessary, revise the language where they are referenced in the SLRA Table 3.1.2-4.

RAI B2.1.10-3

Background:
The NRC staff has questions regarding the use of the Industry Standard Notes in SLRA Table 3.1.2-4 for the following:

- Aging Management Review (AMR) item 3.1.1-005 for managing cumulative fatigue damage of the steel auxiliary feedwater nozzle inlet header exposed internally to treated water (Note A).
- AMR item 3.1.1-083 for managing loss of material of the steel secondary manway and handhole opening covers exposed internally to secondary feedwater (Note A).
- Cracking of stainless steel tube support plate assembly (support rods) exposed externally to secondary feedwater (Note E).
- Loss of material of the stainless steel tube support plate assembly (support rods) and tube support plate assembly (tube support plates) exposed externally and internally, respectively, to treated water (Note J).

- Cracking of stainless steel tube support plate assembly (tube support plates) exposed externally to secondary feedwater (Note E).
- AMR item 3.1.1-072 for managing loss of material of the steel tubesheet exposed externally to secondary feedwater (Note A).

Issue:
AMR item 3.1.1-005 in Volume 1 of NUREG-2191, "Generic Aging Lessons Learned for subsequent License Renewal (GALL-SLR) Report" (ADAMS Accession No. ML17187A031), manages cumulative fatigue damage of steel steam generator components exposed to secondary feedwater or steam. However, as noted above, the environment for the steel auxiliary feedwater nozzle inlet header is treated water (internal). It is unclear to the NRC staff that Industry Standard Note A is correct since its use means, in part, that the environment is consistent with the GALL-SLR. The staff notes that SLRA Supplement 3, dated December 15, 2021 (ADAMS Accession No. ML21349A005), revised SLRA Table 3.1.2-4 by adding a Plant Specific Note 1, which states, "The environment of Secondary Feedwater is considered the same as Treated Water for the Steam Generator components."

AMR item 3.1.1-083 in the GALL-SLR manages loss of material of steel steam generator components: shell assembly exposed to secondary feedwater or steam. However, as noted above, the component is steel secondary manway and handhole opening covers exposed internally to secondary feedwater. It is unclear to the NRC staff that Industry Standard Note A is correct since its use means, in part, that the component is consistent with the GALL-SLR.

SLRA Supplement 3 revised SLRA Table 3.1.2-4 to cite AMR item 3.1.1-071 to manage cracking of stainless steel tube support plate assembly (support rods) exposed externally to secondary feedwater by the Steam Generators program and changed the Industry Standard Note from E to C. AMR item 3.1.1-071 in the GALL-SLR manages cracking by the Steam Generators and Water Chemistry programs. However, SLRA Table 3.1.2-4 was not revised to make similar changes to the aging management evaluation item for managing cracking of stainless steel tube support plate assembly (support rods) exposed externally to secondary feedwater by the Water Chemistry program, which also cites Industry Standard Note E.

SLRA Table 3.1.2-4 cites Industry Standard Note J for managing loss of material of the tube support plate assembly (support rods) and tube support plate assembly (tube support plates) exposed externally and internally, respectively, to treated water by the Steam Generators and Water Chemistry programs. Industry Standard Note J is defined in the SLRA as "Neither the component nor the material and environment combination is evaluated in NUREG-2191." However, the use of Industry Standard Note J is unclear because the NRC staff notes that AMR item 3.1.1-071 (IV.D1.RP-226) manages loss of material of stainless steam generator structural: U-bend supports including anti-vibration bars exposed to secondary feedwater or steam by the Steam Generators and Water Chemistry programs. The staff notes that Supplement 1, dated October 28, 2021 (ADAMS Accession No. ML21302A208), revised SLRA Table 3.1.2-4 by adding plant specific notes that indicate that the environment of treated water is equal to the environment of secondary feedwater for these components. In addition, the staff notes, citing AMR item 3.1.1-071 with an Industry Standard Note C for managing cracking would be similar to citing ARM item 3.1.1-071 for managing loss of material as discussed above.

SLRA Table 3.1.2-4 cites the Steam Generators and Water Chemistry programs to manage cracking of stainless steel tube support plate assembly (tube support plates) exposed externally to secondary feedwater and cites Industry Standard Note E. The NRC staff notes that SLRA Supplement 3 revised SLRA Table 3.1.2-4 to cite AMR item 3.1.1-071 to manage cracking of

stainless steel tube support plate assembly (support rods) exposed externally to secondary feedwater by the Steam Generators program and changed the Industry Standard Note from E to C. Therefore, it is unclear to the NRC staff why no AMR item was cited for managing cracking of the stainless steel tube support plate assembly (tube support plates) and why Industry Standard Note E is cited.

AMR item 3.1.1-072 in GALL-SLR manages loss of material of steel steam generator: tube bundle wrapper and associated supports and mounting hardware exposed to secondary feedwater or steam by the Steam Generators and Water Chemistry programs. SLRA Supplement 3 revised SLRA Table 3.1.2-4 to change Industry Standard Note A to C for the steel tubesheet since it is a different component than the component for AMR item 3.1.1-072. However, SLRA Supplement 3 only made this change for the Steam Generators program.

Request:

1. Given that the environment for the steel auxiliary feedwater nozzle inlet header is different than the environments for AMR item 3.1.1-005, please discuss the use of Industry Standard Note A, or alternatively, revise SLRA Table 3.1.2-4 to cite an industry standard note that indicates differences with the GALL-SLR or reference Plant Specific Note 1 that was added in Supplement 3.

2. Given that steel secondary manway and handhole opening covers is different than the component for AMR item 3.1.1-083, please discuss the use of Industry Standard Note A or alternatively revise SLRA Table 3.1.2-4 to use Industry Standard Note C.

3. Discuss why AMR item 3.1.1-071 was not cited for managing cracking of stainless steel tube support plate assembly (support rods) exposed externally to secondary feedwater by the Water Chemistry program, and discuss the use of Industry Standard Note E. Alternatively, revise SLRA Table 3.1.2-4 to cite AMR item 3.1.1-071 and Industry Standard Note C.

4. Discuss the use of Industry Standard Note J for loss of material of the stainless steel tube support plate assembly (support rods) and tube support plate assembly (tube support plates) exposed externally and internally, respectively, to treated water. Alternatively, revise SLRA Table 3.1.2-4 to cite AMR item 3.1.1-071 (IV.D1.RP-226) and Industry Standard Note C.

5. Discuss why no AMR item is cited for managing cracking of the stainless steel tube support plate assembly (tube support plates) and why Industry Standard Note E is cited. Alternatively, revise SLRA Table 3.1.2-4 to cite AMR item 3.1.1-071 (IV.D1.RP-384) and Industry Standard Note C.

6. Discuss the use of Industry Standard Note A for AMR item 3.1.1-072 cited for managing loss of material of the steel tubesheet exposed externally to secondary feedwater by the Water Chemistry program. Alternatively, revise SLRA Table 3.1.2-4 to use Industry Standard Note C.

RAI B2.1.10-4

Background:
SLRA Table 3.1.2-4 includes an aging management evaluation for nickel alloy and steel primary manway and inspection opening covers and backing plates. During the audit of the SG

program, Duke Energy Carolinas, LLC, clarified that the primary manway and inspection opening covers and backing plates are steel with nickel alloy cladding.

Issue:
The AMR items cited for the nickel alloy primary manway and inspection opening covers and backing plates are for steel (with stainless steel or nickel alloy cladding) primary side components: upper and lower heads, and tubesheet welds. While SLRA Supplement 2, dated November 11, 2021 (ADAMS Accession No. ML21315A012), revised SLRA Table 3.1.2-4 to cite Industry Standard Note C for the AMR items cited for the nickel alloy primary manway and inspection opening covers and backing plates, the material does not appear to be accurately reflected for these components or to be consistent with the GALL-SLR.

AMR items 3.1.1-124 and 3.1.1-049 cited for the steel primary manway and inspection opening covers and backing plates are for steel piping and piping components and for external surfaces of steel once-through SG components, respectively. While SLRA Supplement 2 also revised SLRA Table 3.1.2-4 to cite Industry Standard Note C for AMR item 3.1.1-124, the material does not appear to be accurately reflected for these components or to be consistent with the GALL-SLR. No changes were included in any supplements for AMR item 3.1.1-049. The NRC staff notes that Table 3.1.2-4 states that other components are clad.

Request:
Revise SLRA Table 3.1.2-4 to indicate that the material of the primary manway and inspection opening covers and backing plates is “steel (with nickel alloy cladding)” or explain why this revision is not appropriate.

Regulatory Basis:
Title 10 of the *Code of Federal Regulations,* Part 54, “Requirements for renewal of operating licenses for nuclear power plants,” is designed to elicit application information that will enable the NRC staff to perform an adequate safety review and the Commission to make the necessary findings. Reliability of application information is important and advanced by requirements that license applications be submitted in writing under oath or affirmation and that information provided to the NRC by a license renewal applicant or requirement to be maintained by NRC regulations be complete and accurate in all material respects. Information that must be submitted in writing under oath or affirmation includes the technical information required under 10 CFR 54.21(a) related to assessment of the aging effects on structures, systems, and components subject to an aging management review. Thus, both the general submission requirements for license renewal applications and the specific technical application information requirements require that submission of information material to NRC’s safety findings (see 10 CFR 54.29, “Standards for issuance of a renewed license”) be submitted by an applicant as part of the application.

Background:
By letter dated June 7, 2021, Duke Energy Carolinas, LLC (Duke Energy) submitted to the U.S. Nuclear Regulatory Commission (NRC or staff) an application to renew the Renewed Facility Operating License for the Oconee Power Station, Units 1, 2 and 3 licenses pursuant to Section 104b of the Atomic Energy Act of 1954, as amended, and Part 54 of Title 10 of the *Code of Federal Regulations,* Part 54, “Requirements for renewal of operating licenses for nuclear power plants.”

RAI 2.3.1.3-1

Issue:
In SLRA Section 2.3.1.3, Reactor Coolant System: SLRA Table 2.3.1-3 – Reactor Coolant System – Pressurizer, the intended function for the listed components is to form part of the pressure boundary. However, thermal cycling is not included as an intended function for following components:

- Pressurizer; Surge Line Nozzle.
- Pressurizer; Surge Line Nozzle Safe End.
- Pressurizer; Surge Line Nozzle Safe End Weld.

Request:
Explain whether thermal cycling should be included as an intended function for these components. If not, provide justification.

RAI 2.3.1.3-2

Issue:
Regarding SLRA Section 2.3.1.3, Reactor Coolant System: SLRA Table 2.3.1-3 - Reactor Coolant System – Pressurizer, if the spray head meets any one of the situations as described below, it may require the inclusion of the pressurizer spray head in the scope of license renewal:

a. During fire events as required by 10 CFR 50 Appendix R evaluation, the pressurizer spray head is used to achieve the reactor cooldown to meet the Technical Specifications LCO 3.4.3.
b. If the spray head is failed, it will damage the surrounding safety-related components.

Request:
Explain if the pressurizer spray head is excluded from the scope of license renewal and provide justification by specifically addressing the related concerns presented in Table 2.3-1 of the Standard Review Plan (NUREG-2192).

RAI B2.1.11-1

Regulatory Basis

Title 10 of the *Code of Federal Regulations* Section 54.21(a)(3) requires an applicant to demonstrate that the effects of aging for each structure and component identified in 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 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 the matters identified in 10 CFR 54.21(a)(1) and 10 CFR 54.21(a)(2), 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. Title 10 of the *Code of Federal Regulations* Section 54.21(d) requires that the FSAR supplement for the facility contain a summary description of the programs and activities for managing the effects of aging and the evaluation of time-limited aging analyses for the

period of extended operation determined by 10 CFR 54.21(a) and (c), respectively. 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.

Background:

SRP-SLR:

The SRP-SLR discusses how applicants meet the 10 aging management program elements in Appendix A.1.2.3, “Aging Management Program Elements.”

SRP-SLR Appendix A.1.2.3.9, “Administrative Controls” states:

> 2. Administrative controls are addressed through the QA program that is used to meet the requirements of 10 CFR Part 50, Appendix B, associated with managing the effects of aging (e.g., document control, special processes, and test control). Appendix A.2 describes how an applicant may apply its 10 CFR Part 50, Appendix B, QA program to fulfill the administrative controls element of this AMP for both safety-related and nonsafety-related SCs within the scope of this program.

SRP-SLR Appendix A.2:

Quality Assurance for Aging Management Programs (Branch Technical Position IQMB-1) BTP (IQMB-1) describes an acceptable process for implementing the corrective actions, the confirmation process, and administrative controls of aging management programs for SLR.

SRP-SLR A.2.2 Branch Technical Position:

> 2. For nonsafety-related SCs that are subject to an AMR for SLR, an applicant has the option to expand the scope of its 10 CFR Part 50 Appendix B program to include these SCs and to address corrective actions, the confirmation process, and administrative controls for aging management during the subsequent period of extended operation. The reviewer verifies that the applicant has documented such a commitment in the Final Safety Analysis Report supplement in accordance with 10 CFR 54.21(d).
>
> 3. If an applicant chooses an alternative means to address corrective actions, the confirmation process, and administrative controls for managing aging of nonsafety-related SCs that are subject to an AMR for SLR, the applicant's proposal is reviewed on a case-by-case basis following the guidance in BTP RLSB-1 (Appendix A.1 of this SRP-SLR).

GALL-SLR:
An example summary program description of the QA program for the FSAR supplement is shown in Table A-01 below.

Table A-01. FSAR Supplement Summary for Quality Assurance Programs for Aging Management Programs			
GALL-SLR AMP	**GALL-SLR Program**	**Description of Program**	**Implementation Schedule**
GALL-SLR Appendix A	Quality Assurance	The QA program, developed in accordance withthe requirements of 10 CFR Part 50, Appendix B, provides the basis for the corrective actions, confirmation process, and administrative controls elements of AMPs. The scope of this existing QA program is expanded to also include nonsafety-related SCs subject to AMPs.	Existing program

Oconee SLRA:

B2.1.11 Open-Cycle Cooling Water System:
Enhancement 7 to the Oconee *Open-Cycle Cooling Water System* AMP states that, "The *Open-Cycle Cooling Water System* AMP is an existing program that will be consistent with NUREG-2191 Section XI.M20, *Open-Cycle Cooling Water System* with enhancements and exceptions, as described below":

> 7. Incorporate programmatic guidance contained in engineering support documents into controlled plant procedures subject to administrative controls in accordance with the Duke Energy QA Program. (Element 9)

Appendix A1.0:

Quality Assurance for Aging Management Programs

The Quality Assurance (QA) Program is described in Topical Report DUKE-QAPD-001-A, "Quality Assurance Program Description, Operating Fleet" which implements the requirements of 10 CFR 50, Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants." The QA Program is consistent with the summary in Appendix A.2, "Quality Assurance for AMPs (Branch Technical Position IQMB-1)" of NUREG-2192. The QA Program provides the basis for the corrective actions, confirmation process, and administrative controls elements of AMPs. The scope of the existing QA Program is expanded to include non-safety related structures and components that are subject to an AMR for LR. The QA Program is applicable to the safety related and non-safety related structures, components, and commodity groups that are subject to AMR.

Issue:

Although the SLRA states that the existing QA Program is expanded to include non-safety related structures and components that are subject to an AMR for LR, the statement only addresses license renewal (LR) and does not appear to be expanded to include subsequent license renewal (SLR) and, in addition, there is no such commitment listed in Table A6.0-1 of the Oconee SLRA.

Request:

1. Revise the description of the expanded QA Program in the SLRA to be applicable to SLR and include the commitment in Table A6.0-1 of the SLRA, or provide an alternative

means to address corrective actions, the confirmation process, and administrative controls for managing aging of non-safety-related SCs that are subject to an AMR for SLR.

2. It is unclear to the staff why an enhancement to element 9 is needed for only the Open-Cycle Cooling Water System aging management program. Clarify the extent to which this enhancement is needed in the Oconee SLRA.

Regulatory Basis:
Title 10 of the *Code of Federal Regulations* (10 CFR) Section 54.21(a)(1) requires that a license renewal application contains an integrated plant assessment (IPA) that identifies and lists those structures and components that are within the scope of license renewal and subject to aging management review (AMR). Further, 10 CFR 54.21(a)(3) requires that the applicant demonstrates that the effects of aging for each structure and component identified in 10 CFR 54.21(a)(1) will be adequately managed such that their intended function(s) are maintained consistent with the current licensing basis (CLB) for the period of extended operation.

RAI 3.5.2.2.2.6-1

Background:
SLRA Section 4.2, "Reactor Vessel Neutron Embrittlement Analyses," indicate that the RV for Unit 1 is built with bent rolled ASTM A302B modified steel plates, while those for Units 2 and 3 are made from forged ASTM A 508 Class 2 steel plates. The report ANP-3898NP, Revision 0 (page 9-6 of enclosure 4 of the SLRA) states that the Class 1 RV steel support skirt is made of a SA-516 Grade 70 carbon-manganese steel. Figure 9-1, "Reactor Pressure Vessel Support Assembly," of ANP-3898NP, Revision 0, shows that the skirt is attached to the RV transition forging dutchman by a circumferential full penetration weld.

It is apparent that the method of construction of ONS Unit 1 RV differs with those of Units 2 and 3. Casting methods of parent material, microstructural heterogeneities produced during manufacturing (e.g., rolled steel plates have microstructural changes in one direction, while those that are forged have it in two) and welding processes used could affect the performance (including fracture toughness) of support skirt to dutchman circumferential weldments. The NRC by letter dated January 7, 2016 (ADAMS Accession No. ML16004A262), granted a relief to ONS from performing a 100 percent VT-3 visual examination required by ASME Code, Section XI, Subsection IWF (Examination Category F-A in Table IWF-2500-1) for the Class 1 RV steel support skirt assembly that excludes from inspection the circumferential welds attaching the skirt to the RV dutchman for weld numbers 1-RPV-WR36, 2-RPV-WR36, and 3-RPV-WR36 as noted in the ONS relief request (ADAMS Accession No. ML15201A573). The weldments are identified to be within the scope of license renewal and subject to AMR. In accordance with 10 CFR 54.21(a)(3) an applicant must 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.

Literature indicates that there is no distinct advantage or disadvantage in the serviceability of fabricated components from rolled or forged steel plates provided these have nearly identical chemistry, casting methods, and similar microstructure. Literature also indicates that loss of material due to corrosion can also contribute to reduction in fracture toughness by allowing intrusion of corrosive agents (e.g., boric acid) to ingress into metals and welds and altering constrains conditions at the tip of preexisting flaws or cracks.

Issue:
The mechanical performance of fabricated steel components and their weldments depend on a variety of parameters such as mode of construction, preexisting flaws, inservice aggressive environments (e.g., radiation exposure, boric acid exposure, pitting, crevice corrosion) that could affect their ductility, fatigue, and fracture toughness. It is not clear what steps were taken during manufacturing to ensure that no detectable flaws and/or residual stresses existed on the RV dutchman to skirt weldments (HAZs and welds) that could lead to their loss of structural integrity for each of the three ONS RV Units.

The staff notes that there are no SLRA Table 3.5.2 AMR line items specific to the RV skirt to dutchman welds to manage the effects of aging for the subsequent period of extended operation. The staff is not aware of any operating experience (OE) and ASME Code Section XI inspection results attesting their condition prior to entering the period of subsequent license operation. It is not clear when weldments of skirt to dutchman were last physically inspected to ASME Code Section XI. Since the aforementioned relief from the ASME Code Section XI mandated inspection of the circumferential weld of the skirt assembly to the RV dutchman was limited to the Fourth Ten-Year Inservice Inspection (ISI) Interval for all three of the ONS RV Units, it is not clear how the applicant plans to establish a baseline for the condition of the aforementioned welds prior to entering the subsequent period of extended operation and what steps it plans to take to ensure their intended function is maintained to the end of the subsequent period of extended operation and confirm the validity of the fracture toughness evaluation in SLRA Section 3.5.2.2.2.6.

Request:

1. Discuss what steps were taken to rule out detectable flaws and/or residual stresses on the dutchman to support skirt weldments (HAZs and welds) during manufacturing of ONS Unit 1, 2, and 3 RVs that could contribute to weldments' loss of strength, loss of fracture toughness due to aggressive environments in the RV annulus cavity.
2. Describe steps to be taken (e.g., ongoing OE review, implementation of maintenance rule) to establish a baseline reflective of the condition of the RV dutchman to steel support skirt weldments and confirm that their intended function is maintained for each of the ONS RV Units prior to entering the subsequent period of extended operation.
3. Outline how aging effects such as loss of material and irradiation on RV dutchman to steel support skirt weldments will be adequately managed such that their intended function will be maintained to the end of the subsequent period of extended operation and provide or point to the applicable Table 3.5.2 AMR line items.
4. Update applicable SLRA sections, as applicable and necessary, consistent with the responses to the requests above.

References:

Dale R. Clark, Brian Flinn, Robert A. Clark, "Roll Plate vs Roll-Forged Ring Comparison of Metallurgical Properties." GT Engineering, October 2012, (http://www.public.tnb.com/pubint/docs/Forged_Base_Plates_White_Paper.pdf)

Yingbo Hou, Deqing Lei, Shujin Li, Wei Yang,1 and Chun-Qing Li, "Experimental Investigation on Corrosion Effect on Mechanical Properties of Buried Metal Pipes," International Journal of Corrosion, Volume 2016, Article ID 5808372, https://doi.org/10.1155/2016/5808372.

RAI 3.5.2.2.2.6-2

Background:
SLRA Section 3.5.2.2.2.6 defines the RV support assembly to be the RV steel "support skirt and the reactor vessel support flange, which were attached to the reactor vessel during fabrication of the reactor vessel." SLRA Table 3.1.2-1, "Reactor Vessel, Reactor Internals, and Reactor Coolant System - Reactor Vessel - Aging Management Evaluation," includes an AMR line item for loss of material aging effect associated with the RV steel support skirt. The AMR cites SLRA AMP B2.1.1 "ASME Code Section XI, Inservice Inspection, Subsections IWB, IWC, and IWD," with generic note J that states: "[n]either the component nor the material and environment combination is evaluated in NUREG-2191."

The SLRA Section B2.1.1 defers to "ASME [Code Section] XI, Subsection IWF" (SLRA AMP B2.1.30) to which the applicant claims consistency with enhancement and no exceptions to GALL-SLR XI.S3 for management of aging effects for loss of material, cracking, loss of preload, and loss of mechanical function for ASME Class 1, 2, and 3 and MC component supports. The RV skirt is classified as an ASME Class 1 support.

Issue:
ASME Code Section XI, Subsection IWB, Table IWB-"2500-1 (B-K) Examination Category B-K, Welded Attachments for Vessels, Piping, Pumps, and Valves," references Figure IWB-2500-14 which outlines the extent of the IWB boundary. From information provided in ONS relief request submittal (ADAMS Accession No. ML15201A573) it is apparent that the skirt to dutchman weldment are outside the ASME Code Section XI IWB inspection boundaries but included in ASME Code Section XI IWF inspections. It is not clear how ONS plans to use the SLRA AMP B2.1.1 to manage the effects of aging for loss of material through the SLRA Table 3.1.2-1 AMR line item when the jurisdiction of ASME Section IWB is well above the RV steel support skirt. It is also not clear how generic note J is justified for the ASME Class 1 RV steel support skirt component that is required to be managed for aging consistent with the guidance provided in AMP XI.S3 of NUREG-2191.

Request:

1. Justify the conclusion made in SLRA Table 3.1.2-1 AMR line item, that for the ASME Class 1 RV steel support skirt "[n]either the component nor the material and environment combination is evaluated in NUREG-2191."
2. Discuss how all applicable aging effects for the ASME Class 1 RV steel support skirt will be managed during the subsequent period of extended operation. If SLRA AMP B2.1.30 will be used, state so and provide the relevant SLRA Table 3.5.2 AMR line items.

RAI 3.5.2.2.2.2-3

Background:
SLRA Section 3.5.2.2.2.2 states that the operating experience (OE) "identified no issues related to elevated temperatures affecting concrete structures. Additionally, analysis performed to determine the maximum concrete temperature of the primary shield wall [PSW] illustrates that the concrete will not exceed 200 °F for local loads." The SLRA concludes that a "plant-specific aging management program to manage the effects of reduction of strength and modulus due to elevated temperature is not required."

Section 3.8.3.5 of the UFSAR states that the "maximum allowable concrete temperature at penetrations in the Primary Shield Wall [(PSW)] shall not exceed 400 °F."

Section 3.5.2.2.2.2 of the SRP-SLR states concrete temperatures under normal operation or any other long-term period to 66 °C (150 °F) except for local areas, which are allowed to have increased temperatures not to exceed 93 °C (200°F) and recommends a further evaluation and a plant-specific program if any portion of the safety-related and other concrete structures exceeds the specified temperature limits. It concludes that higher temperatures may be allowed if tests and/or calculations are provided to evaluate the reduction in strength and modulus of elasticity and these reductions are applied to the design calculations.

Issue:

SLRA Section 3.5.2.2.2.2 states that based on analysis performed the maximum concrete temperature of the PSW concrete will not exceed 200 °F for local loads. UFSAR Section 3.8.3.5 states that maximum allowable concrete temperature at penetrations in PSW shall not exceed 400 °F. It is not clear what analysis was performed that the SLRA references that led to the conclusion that the maximum PSW concrete temperature is 200 °F instead of the 400 °F.

Request:

1. Describe the SLRA Section 3.5.2.2.2.2 referenced analysis for the PSW concrete temperature.
2. Summarize the analysis results that justify the conclusion that the maximum PSW concrete temperature will not exceed 200 °F for local loads.

RAI 3.5.2.2.2.6-4

Background:
Section 9.4.4.1 of ANP-3898NP/P Revision 0, "Framatome Reactor Vessel and RCP TLAA and Aging Management Review Input to the ONS SLRA," (Enclosure 4, Attachment 1 to the SLRA, ADAMS Accession No. ML21158A200 for the non-proprietary version and Enclosure 5 to the SLRA for the proprietary version) states that:

> "Neutron fluence and gamma dose at 80-years (72 EFPY) are calculated using source terms that bound all Oconee units to provide bounding estimates for RPV [reactor pressure vessel] support and the biological shield wall."

Issue:

Although the description provided in the ANP-3898 would lead to conservative neutron fluence and gamma dose estimates at 80-years (72 EFPY), the degree of conservatism in the calculations that results from employing the bounding source is not clear. In order for the NRC staff to evaluate the degree of conservatism in the source term and determine whether those source terms provide adequately bounding fluence and gamma dose estimates, comparative information relative to the actual plant operating condition is necessary. Such a determination will enable the staff to determine whether the downstream aging effects are based on valid estimates of radiation exposure.

Request:

Provide the radial Relative Power Distribution (RPD) of a recent cycle that is representative of typical operating conditions at ONS Units 1, 2, and 3.

RAI 3.5.2.2.2.6-5

Background:

In Section 9.4.4.1 of ANP-3898NP/P, Revision 0 (Enclosure 4, Attachment 1 to the SLRA, ADAMS Accession No. ML21158A200), the applicant stated that the exposure level of 5.53E-04 displacements per atom (dpa) is conservatively assumed to be applicable to all the components of the RPV steel support assembly of each ONS unit.

Issue:

Even though the applicant stated that the exposure level of 5.53E-04 dpa is conservatively assumed to be applicable to all the components of the RPV steel support assembly, the staff is not clear how conservative the value of 5.53E-04 dpa is compared to the actual exposure level at the location where the RPV steel support assembly is anchored to the concrete pedestal embedment, i.e., at the components of the RPV steel support assembly at the RPV steel support flange elevation and below. The staff needs this clarification in order to evaluate the margin in exposure level at the RPV steel support flange elevation and below since the applicant determined that the RPV steel support flanges of the three ONS units (and the associated welds at ONS Units 1 and 2) are potentially susceptible to reduction of fracture toughness by irradiation embrittlement (Section 9.4.5 of ANP-3898NP/P, Revision 0). The staff needs this information as part of its overall evaluation of reasonable assurance that the RPV steel support assembly of each ONS unit will perform its intended function through the subsequent period of operation.

Request:

Describe the conservatism included in using the value of 5.53E-04 dpa at the RPV steel support flange elevation and below.

RAI 3.5.2.2.2.6-6

Background:

Section 9.4.1 of ANP-3898NP/P, Revision 0, discusses the applicant's assessment of the current condition of the RPV steel support skirt assemblies of ONS Units 1, 2, and 3. The staff noted the discussion of the visual examinations performed on the RPV steel support skirt assemblies during inservice inspections, but also noted that there is no information on preservice examinations.

Issue:

Since visual examinations are performed to look for evidence of gross deformation or misalignment that could result from cracks/indications rather than to detect the cracks/indications themselves, the staff needs information on the preservice examinations performed on the RPV steel support assemblies of ONS Units 1, 2, and 3 in order to clarify that any unacceptable cracks/indications in the RPV steel support assemblies would have been detected (through surface or volumetric examinations), and that, therefore, the specific component of the assemblies would have been replaced or repaired, or have not been used if preservice examinations in the material procurement specifications did not allow materials with preservice cracks/indications.

Request:

Describe either the preservice examinations (include all results) performed for the RPV steel support skirt assemblies of ONS Units 1, 2, and 3 or the material procurement specifications for the components of the RPV steel support skirt assemblies with regard to prohibiting preservice cracks/indications in the components used in the assemblies.

RAI 3.5.2.2.2.6-7

Background:

Section 9.3 of ANP-3898NP/P, Revision 0 states that the vertical bearing plate and nelson studs "do not support the RPV [steel] support assembly intended function" and that the intended function of the RPV steel support assembly is to provide structural support for the RPV.

Issue:

Based on its audit and the review of SLRA Section 3.5.2.2.2.6 and Sections 9.3 and 9.4.5 of ANP-3898NP/P, Revision 0, the staff is not clear how the vertical bearing plate and nelson studs do not have an RPV steel support assembly intended function of providing structural support for the RPV of ONS Units 1, 2, and 3.

If the vertical bearing plate and nelson studs have an intended function of providing structural support for the RPV, these two components need to be evaluated for loss of fracture toughness due to irradiation embrittlement consistent with the evaluations in Section 9.4 of ANP-3898NP/P, Revision 0. Also, if the vertical bearing plate and nelson studs do have the aforementioned intended function, the staff would need clarification whether the calculation of the stress intensities in Section 9.3 of ANP-3898NP/P, Revision 0 and the stresses in the evaluation of the RPV support flange and associated welds discussed in Section 9.4.5 of ANP-3898NP/P, Revision 0 included the effect of the vertical bearing plate and nelson studs.

Request:

1. Clarify whether the vertical bearing plate and nelson studs described in Section 9.3 of ANP-3898NP/P, Revision 0 have an intended function of providing structural support for the RPV of ONS Units 1, 2, and 3.

2. If the vertical bearing plate and nelson studs have an intended function of providing structural support for the RPV, evaluate the vertical bearing plate and nelson studs for loss of fracture toughness due to irradiation embrittlement consistent with the evaluations in Section 9.4 of ANP-3898NP/P, Revision 0. In this evaluation, include the following aspects of the vertical bearing plate and nelson studs: material specifications, initial NDT and associated margins, cited source documents of initial NDT and associated margins, and preservice examinations (including results) or material procurement specifications with regard to prohibiting preservice cracks/indications.

3. Clarify whether the calculation of the stresses in Section 9.4.2 of ANP-3898NP/P, Revision 0 and in the evaluation of the RPV support flange and associated welds discussed in Section 9.4.5 of ANP-3898NP/P, Revision 0, included the effect of the vertical bearing plate and nelson studs. If the effect of the vertical bearing plate and nelson studs was not included, explain how the stresses determined in Sections 9.4.2 and 9.4.5 of ANP-3898NP/P, Revision 0 are conservative with respect to stresses had

the effect of the vertical bearing plate and nelson studs been included.

RAI 3.5.2.2.2.6-8

Background:

In Section 9.4.5 of ANP-3898NP/P, Revision 0, the applicant evaluated the RPV support flanges of ONS, Units 1, 2, and 3, and the RPV support flange welds of ONS Units 1 and 2 because they were determined to be potentially susceptible to reduction of fracture toughness by irradiation embrittlement at 72 EFPY of operation. In this evaluation, the applicant stated that:

> "the RPV support flange was not explicitly addressed for faulted loads as the [anchor] bolts were determined to be the weak link and the [anchor] bolts were shown acceptable with margin."

In SLRA Section 3.5.2.2.2.6, the applicant also stated that this evaluation concluded that:

> "…the potential for irradiation embrittlement of the support flange is acceptable considering: (1) configuration of the reactor vessel support skirt welded to the flange plate and the numerous bolts connecting the flange plate to the concrete, and (2) stresses in the flange plate are bounded by the stresses in the RPV [steel] support skirt, which is considered the most vulnerable part of the fracture-critical member."

Issue:

SLRA Section 3.5.2.2.2.6 and ANP-3898NP/P, Revision 0 do not appear to provide sufficient details of the evaluation performed for reduction of fracture toughness by irradiation embrittlement for the RPV support flanges of ONS, Units 1, 2, and 3 and the RPV support flange welds of ONS Units 1 and 2. Specifically, there is insufficient detail of (a) how it was determined that for faulted loads, the weakest link were the 96 bolts that anchor the RPV steel support skirt assembly onto the concrete pedestal (48 bolts equally spaced outside of the RPV support flange and 48 bolts equally spaced inside) as depicted in Figure 9-2 of ANP-3898NP/P, Revision 0; (b) what the margins are in the anchor bolts for faulted loads; and (c) how it was determined that the RPV steel support skirt was considered the most vulnerable part of the fracture-critical member.

Request:

Provide details on:

1. The determination that for faulted loads, the weakest link were the 96 bolts that anchor the RPV steel support skirt assembly onto the concrete pedestal.
2. The margins in the anchor bolts for faulted loads.
3. The determination that the RPV steel support skirt was considered the most vulnerable part of the fracture-critical member.

Details should include methodology, major assumptions and conservatisms, and type of current licensing basis documents, such as stress reports or analyses of records from which the details are obtained.

Regulatory Basis:
Section 54.21(a)(3) of Title 10 of the *Code of Federal Regulations* (10 CFR) requires an applicant to demonstrate that the effects of aging for each structure and component identified in 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 period of extended operation. One of the findings that the U.S. Nuclear Regulatory Commission (NRC) 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 the matters identified in 10 CFR 54.21(a)(1) and 10 CFR 54.21(a)(2), 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 B2.1.8-1

Background:
Subsequent License Renewal Application (SLRA) Supplement 1, dated October 28, 2021 (ADAMS Accession No. ML21302A208), revised SLRA Tables 3.3.2-48 and 3.3.2-49 to add Aging Management Review (AMR) item 3.3.1-126 to manage wall thinning due to erosion for the steel piping and piping components exposed internally to raw water in the condenser circulating water (CCW) system and the low pressure service (LPS) water system, respectively.

SLRA Supplement 1 also added plant specific notes to SLRA Tables 3.4.2-1, 3.4.2-3, 3.4.2-7, 3.4.2-10 that state, “Steel ‘Piping and Piping Components’ that are susceptible to wall thinning (due to erosion or flow accelerated corrosion) includes components constructed of carbon steel and gray cast iron.”

Issue:
SLRA Table 3.3.2-48 includes gray cast iron pump casings, strainer bodies, and valve bodies exposed internally to raw water. In addition, SLRA Table 3.3.2-48 includes ductile iron valve bodies exposed internally to raw water.

SLRA Table 3.3.2-49 includes gray cast iron filter bodies and pump casings and ductile iron valve bodies exposed internally to raw water. In addition, SLRA Table 3.3.2-49 includes copper alloy and copper alloy greater than 15 percent zinc components that are exposed internally to raw water.

A plant-specific note was not added to SLRA Tables 3.3.2-48 and 3.3.2-49, like the plant-specific note added in SLRA Supplement 1 stated above, to indicate whether “Steel Piping and Piping Components” includes components constructed of materials other than steel in the CCW or LPS systems.

Request:
Discuss whether “Steel Piping and Piping Components” includes the gray cast iron, ductile iron, copper alloy, and copper alloy greater than 15 percent zinc components in the CCW and LPS systems. If it does, then revise SLRA Tables 3.3.2-48 and 3.3.2-49 to include a plant specific note that clearly describes what materials are represented by “Steel Piping and Piping Components.”

RAI B2.1.8-2

Background:
The Aging Management Program XI.M17, "Flow-Accelerated Corrosion," "detection of aging effects" program element discussion in Volume 2 of NUREG-2191, "Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report," states that identification of erosion susceptible locations is based on corrective actions in response to plant-specific operating experience and that the associated components can be treated similar to other "susceptible-not-modeled" lines. Section 4.4 of SLR-ONS-AMPR-XI.M17, "Flow-Accelerated Corrosion AMP Evaluation Report," states, "An erosion susceptibility analysis has been performed to identify locations within FAC susceptible systems where the potential for erosion damage may exist." In addition, Section 4 of Technical Report BP-2017-0041-TR-01, "Duke Energy - Oconee Nuclear Station Unit 1 Erosion Susceptibility Analysis (ESA)," states, "The scope of the Erosion Susceptibility Analysis is all plant piping within the Unit 1 FAC [flow-accelerated corrosion] Susceptible Systems." During the audit of the FAC program, the applicant clarified that the ESAs are limited to FAC susceptible systems (only evaluates systems susceptible to FAC) and identification of erosion in non-FAC susceptible systems is only based on operating experience.

The NRC staff notes that, based on additional operating experience reviews performed during the FAC program audit, SLRA Supplement 1, dated October 28, 2021, and SLRA Supplement 2, dated November 11, 2021 (ADAMS Accession Nos. ML21302A208 and ML21315A012, respectively), added wall thinning due to erosion as an aging effect for several non-FAC susceptible systems (e.g., CCW, LPS, and recirculating cooling water system). In addition, Section 4.7 of SLR-ONS-AMPR-XI.M17 states, "Replacement with an alternate material does not remove the component from the list of erosion-susceptible locations since a material that is completely resistant to erosion is not available." However, the NRC staff notes that neither the SLRA nor documents reviewed during the FAC program audit include discussion about adding locations to the FAC program for non-FAC susceptible systems based on operating experience.

Operating experience example No. 2 in SLRA Section B2.1.8 relates to Action Request (AR) 01822156 and AR 01823513 for cavitation damage downstream of a valve in the 3B motor driven emergency feedwater (EFW) pump test recirculation line. The NRC staff notes that the ESA may exclude the downstream portion of the EFW recirculation lines (LB-130), using the infrequent-operation exclusion criteria with a statement "Interfacing system usage represent less than 2% of plant operating time." The staff also notes that AR 01822156 includes a search of other potentially applicable operating experience that identified PIP 09-3675, relating to leaks in the turbine driven EFW recirculation lines. The associated discussion states that the PIP added locations along the turbine driven EFW recirculation lines to the FAC program.

Issue:
Based on the above discussion, the following issues are not clear:

1. Based on the discussion in AR 1822156, additional locations for non-FAC susceptible systems have been added to the FAC program based on operating experience. However, the SLR-ONS-AMPR-XI.M17 does not provide any discussion regarding this aspect. The guidance in GALL-SLR AMP XI.M17 states that components in this category may be treated similar to other "susceptible-not-modeled" lines. Although CSD-FAC-ALL-1610.005, Revision 0, "Susceptible Non-Modeled Program," states FAC susceptible systems are susceptible to non-FAC mechanisms (i.e., cavitation, impingement, or flashing), the procedure does not address the addition of non-FAC

susceptible systems to the program. The portion of the "detection of aging effects" program element in SLR-ONS-AMPR-XI.M17, pertaining to the identification of erosion locations, only addresses FAC susceptible systems. Although Revision 5 of AD-EG-ALL-1610, "Flow Accelerated Corrosion Implementation," states, "Erosion degradation mechanisms and how they are addressed are further discussed in CSD-FAC-ALL-1610.007," the cited document states that it only applies to FAC susceptible systems. In addition, the portion of the "corrective actions" program element discussion in SLR-ONS-AMPR-XI.M17 states there is a list of erosion-susceptible locations, but there is no discussion about adding non-FAC susceptible components to the list based on operating experience. It is unclear what drives the inspections that manage wall thinning due to erosion for non-FAC susceptible locations.

2. Section 4.6 of SLR-ONS-AMPR-XI.M17 states, "Additionally, a safety factor of 2 is used when calculating the next scheduled inspection for components suspected to be wearing from an erosive mechanism." Sections 5.5 and 5.8 of AD-EG-ALL-1610 were referenced, however, additional information regarding where the requirement to use a safety-factor of 2 by manually changing the FAC Manager software for erosion mechanism evaluation on non-FAC susceptible components is not specified.

3. The ESAs use an infrequent-operation exclusion criteria, based on less than 2 percent of plant operating time for the EFW recirculation system. However, operating experience for upstream components in the motor driven and turbine driven EFW recirculation lines demonstrate that lines meeting infrequent-operation exclusion criteria have experienced cavitation erosion. The NRC staff notes that the comparable infrequent-operation exclusion criteria is also used in the FAC system susceptibility analysis, but the SLRA includes an enhancement to reassess this FAC exclusion to ensure adequate bases exist to justify this exclusion. The staff also notes that alternate industry guidance related to cavitation erosion (*see* Section 4.6 of EPRI 112657, Revision B-A, "Revised Risk-Informed Inservice Inspection Evaluation Procedure") uses a value significantly less than 2 percent of operating time for susceptibility to this aging mechanism. Therefore, the validity of the infrequent-operation exclusion criteria used in the ESA for erosion mechanisms is unclear.

4. CSD-FAC-ALL-1610.001, "Outage Inspection Planning," notes that if significant wear is not found on components with trace chromium (measured greater than 0.10 percent), then no re-inspection is needed, unless the components are subject to erosion mechanisms. SLR-ONS-AMPR-XI.M17 does not discuss how the results of the ESA for FAC susceptible components will be integrated into the existing Unit Specific Databases to ensure that components subject to erosion mechanisms will continue to be re-inspected if the measured chromium content is greater than 0.10 percent and significant wear has not been found.

Request:

1. Discuss how and where erosion susceptible locations for non-FAC susceptible systems are documented, and what drives the inspections that manage wall thinning due to erosion.

2. Show where the safety-factor of 2 (which requires manually changing the FAC Manager software) is specified for erosion mechanism evaluations on non-FAC susceptible components.

3. Discuss the basis for using an infrequent-operation exclusion criteria based on less than 2 percent of plant operating time given the operating experience discussed above. Include a discussion about the current enhancement to verify this exclusion criteria for FAC, but not needing to verify this exclusion criteria for erosion mechanisms.

4. Discuss how results from the ESA for FAC susceptible systems are accounted for in components meeting the trace chromium exemption within the program.

Regulatory Basis:
Section 54.21(a)(3) of Title 10 of the *Code of Federal Regulations* (10 CFR) requires an applicant to demonstrate that the effects of aging for each structure and component identified in 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 period of extended operation. One of the findings that the U.S. Nuclear Regulatory Commission (NRC) 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 the matters identified in 10 CFR 54.21(a)(1) and 10 CFR 54.21(a)(2), 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 B2.1.16-1

Background:
Table XI.M27-1 of NUREG-2191, Volume 2, "Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report" (ADAMS Accession No. ML17187A204), recommends that main drain tests follow Section 13.2.5 of NFPA 25. Section 13.2.5 of NFPA 25 requires "main drain tests to be conducted annually at each water-based fire protection system riser to determine whether there has been a change in the condition of the water supply piping and control valves." It also states, "When there is a 10 percent reduction in full flow pressure when compared to the original acceptance test or previously performed tests, the cause of the reduction shall be identified and corrected if necessary."

Subsequent License Renewal Application (SLRA) Supplement 2, dated November 11, 2021 (ADAMS Accession No. ML21315A012), revised Enhancement 9 in SLRA Sections A2.16 and B2.1.16 and SLRA Table A6.0-1 to state, in part, "When there is a ten percent reduction in full flow pressure when compared to an established baseline value, the cause of the reduction shall be identified and corrected if necessary."

Issue:
It is unclear whether "an established baseline value" is referring to an original acceptance test (or comparable test result). If it is not referring to an original acceptance test (or comparable test result), it is unclear how the baseline value will be established. The test-to-test pressure monitoring should be capable of identifying significant degradation of the fire water system supply over several years.

Request:
1. Clarify whether "an established baseline value" is referring to an original acceptance test (or comparable test result).

2. If “an established baseline value” is not referring to an original acceptance test (or comparable test result), then discuss how the baseline value will be established and how it will result in identifying significant degradation of the fire water system supply over several years.

RAI B2.1.16-2

Background:
Enhancement 5 to the Fire Water System program in SLRA Sections A2.16 and B2.1.16 and SLRA Table A6.0-1 states, “Revise inspection procedures to provide additional inspection guidance regarding age-related degradation and to include inspection parameters for items such as lighting, distance, offset, presence of protective coatings, and cleaning processes.” Revision 1 of SLR-ONS-AMPR-XI.M27, “Fire Water System AMP [Aging Management Program] Evaluation Report,” notes that this enhancement affects the “detection of aging effects” program element and notes that the program will be enhanced to include periodic internal visual inspections of sprinkler and deluge system branch line piping for flow blockage due to fouling. In addition, follow-up volumetric wall thickness examinations will be performed when internal visual inspections identify surface irregularities indicative of unacceptable degradation.

Issue:
Although Revision 1 of SLR-ONS-AMPR-XI.M27 provides examples of inspection parameters that will be added as part of Enhancement 5, the SLRA does not provide any description of the additional inspection guidance for age-related degradation to be added to the inspection procedures. The vagueness of the procedure change described in the SLRA does not seem to provide for future verification activities by the NRC or confirmation that commitments have been completed. In addition, controls for future changes to the program through the 10 CFR 50.59 process may not be able to be assured without a sufficiently comprehensive description of the enhancement.

Request:
Clarify what additional inspection guidance for age-related degradation is being added to the Fire Water System inspection procedures.

RAI B2.1.16-3

Background:
Table XI.M27-1 in Volume 2 of NUREG-2191 recommends internal inspections of piping consistent with Section 14.2 of NFPA 25, which requires piping and branch lines be inspected internally for foreign organic and inorganic material.

Exception 3 to the “detection of aging effects” program element in SLRA Section B2.1.16 states, “Periodic internal inspections of the sprinkler system branch lines within the scope of the Oconee Fire Water System AMP will not be performed.” The justification for the exception states that the only in scope sprinkler systems are the manually actuated dry pipe sprinkler systems for the cable room, cable shaft level 3, and cable shaft level 4 & 5; and that they are “not subject to significant internal corrosion or flow blockage due to fouling since they are maintained dry and are not subject to periodic wetting during testing.” In addition, the

justification states that plant operating experience did not show instances where these systems were actuated.

Section 4.4 of SLR-ONS-AMPR-XI.M27 states, “The sprinkler systems for the cable room, cable shaft level 3, and cable shaft level 4 & 5 are not subject to internal corrosion nor flow blockage due to fouling since they are maintained dry and are not subject to periodic wetting during testing. Internal inspections of these systems will not be performed.”

Issue:
Given that the internal inspections in Section 14.2 of NFPA 25 apply to both the piping and branch lines it is unclear whether Exception 3 applies to both the piping and branch lines because the Exception states “sprinkler system branch lines” and the Fire Water System AMP Evaluation Report states “Internal inspections of these systems will not be performed.” In addition, if Exception 3 only applies to the branch lines, it is unclear, based on information in the SLRA and documents reviewed during the Fire Water System program audit if the program currently includes internal inspections of the piping.

Request:
1. Discuss whether Exception 3 applies to both the piping and branch lines of the manually actuated dry pipe sprinkler systems for the cable room, cable shaft level 3, and cable shaft level 4 & 5, or if it only applies to the branch lines.

2. If Exception 3 only applies to the branch lines, does the Fire Water System program currently include internal inspections of the piping of the manually actuated dry pipe sprinkler systems for the cable room, cable shaft level 3, and cable shaft level 4 & 5, consistent with Section 14.2 of NFPA 25?

RAI B.2.3.2-1

Regulatory Basis:
Title 10 of the *Code of Federal Regulations* (10 CFR) Section 54.21(a)(3) requires an applicant to demonstrate that the effects of aging for each structure and component identified in 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 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 the matters identified in 10 CFR 54.21(a)(1) and 10 CFR 54.21(a)(2), 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. 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.

Background:
SLRA Table 3.1.2-4 has the AMR items for steam generator (SG) components. During the in-office audit, the staff asked about the environments assigned to the SG tube-to-tubesheet welds. In response to the breakout questions, SLRA Supplement 1 (ML21302A208), Attachment 8, proposed SLRA revisions that changed the description of the environment for these welds. SLRA Supplement 3 (ML21349A005), Attachments 6 and 8, also made changes to AMR line items for the SG tube-to-tubesheet welds in SLRA Table 3.1.2-4. Following is a summary of the changes in Supplements 1 and 3:

Supplement 1, Attachment 8:

- Changed the environment from “Reactor Coolant (Internal)” to “Secondary Feedwater (Internal)”. This change applies to the line items for “Cracking,” “Cumulative Fatigue Damage,” and “Loss of Material.”
- Changed the environment from “Secondary Feedwater (External)” to “Reactor Coolant (External).” This change applies to the line items for “Cracking” and “Loss of Material.”

Supplement 3:

- In Attachment 8, a new AMR item was added for “Cumulative Fatigue Damage,” to be managed by TLAA, for “Secondary Feedwater (Internal).” This AMR line uses the SLRA Table 3.1.2-4 original environment rather than the environment as modified by Supplement 1, Attachment 8.
- In Attachment 6, four of the “Notes” were changed from “A” to “C” for “Cumulative Fatigue Damage” for the “Reactor Coolant (Internal)” environment, and for “Cracking” and “Loss of Material” for the “Secondary Feedwater (External)” environment. These AMR lines use the SLRA Table 3.1.2-4 original environments rather than the environment as modified by Supplement 1, Attachment 8.

Issue:
For the “Environment” changes proposed to SLRA Table 3.1.2-4 in Supplement 1, Attachment 8, corresponding changes were not made to other items in SLRA Table 3.1.2-4, creating what appears to be inconsistencies between those items and the revised environments proposed in the supplement. In addition, changes proposed to SLRA Table 3.1.2-4 in Supplement 3 do not appear to be fully consistent with the Supplement 1 changes. The specific issues are:

a. The changes to “Environment” entries in SLRA Table 3.1.2-4 for the SG “Tube-To-Tube Sheet Welds” in Supplement 1, Attachment 8, were not accompanied by corresponding changes to the “NUREG-2191 Item,” “NUREG-2192 Table 1,” and “Notes.” As a result, the proposed environment changes appear to be inconsistent with the NUREG-2191 and NUREG-2192 items, and the corresponding Notes A.
b. The revisions to SLRA Table 3.1.2-4 for the SG “Tube-to-Tube Sheet Welds,” in Supplement 1, Attachment 8, results in two separate items for cracking in “Reactor Coolant (External),” with different “Aging Management Program,” NUREG-2191, NUREG-2192, and “Notes” entries.
c. The “Environment” changes to SLRA Table 3.1.2-4 proposed for the SG “Tube-to-Tube Sheet Welds” in Supplement 1, Attachment 8, are not included in the changes to SLRA Table 3.1.2-4 proposed in Supplement 3, Attachments 6 and 8. This includes the following:

    - The AMR item added for “Cumulative Fatigue Damage” in Attachment 8 of Supplement 3
    - The change of four of the AMR “Notes” from “A” to “C” in Attachment 6 of Supplement 3

Request:
Provide a single markup showing all proposed revisions to the steam generator “Tube-to Tube Sheet Welds” AMR lines in SLRA Table 3.1.2-4, and a summary description of the aging management for these welds relative to the original SLRA Table 3.1.2-4.

RAI 3.4.2.2.2-1

Regulatory Basis:
Section 54.21(a)(3) of Title 10 of the *Code of Federal Regulations* (10 CFR) requires an applicant to demonstrate that the effects of aging for each structure and component identified in 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 period of extended operation. One of the findings that the U.S. Nuclear Regulatory Commission (NRC) 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 the matters identified in 10 CFR 54.21(a)(1) and 10 CFR 54.21(a)(2), 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.

Background:
Oconee SLRA Table 3.4.1 is the summary of aging management programs for steam and power conversion systems, and it includes GALL-SLR Items 3.4.1-002 and 3.4.1-003. Item 3.4.1-002 addresses cracking due to stress corrosion cracking (SCC) for stainless steel piping, piping components, and tanks exposed to air or condensation. Table 3.4.1 states that this item requires further evaluation in SLRA Section 3.4.2.2.2. The discussions in Table 3.4.1 and SLRA Section 3.4.2.2.2 state that this item is not applicable because Oconee has no stainless steel piping, piping components, or tanks exposed to air or condensation in the scope of SLR in steam and power conversion systems, and that components in the steam and power conversion systems are insulated and aligned to GALL-SLR Item 3.4.1-104. For Item 3.4.1-104, the SLRA proposes to use the One-Time Inspection program to confirm SCC of insulated stainless steel piping, piping components, and tanks exposed to air or condensation is not occurring.

Item 3.4.1-003 addresses loss of material due to pitting or crevice corrosion for stainless steel and nickel alloy piping, piping components, and tanks exposed to air or condensation. Table 3.4.1 states that this item requires further evaluation in SLRA Section 3.4.2.2.3. The discussions in Table 3.4.1 and SLRA Section 3.4.2.2.3 state that the One-Time Inspection program will be implemented to confirm pitting and crevice corrosion of stainless steel piping, piping components, and tanks exposed to air or condensation are not occurring.

Issue:
GALL-SLR Items 3.4.1-002 and 3.4.1-003 address two different aging mechanisms for stainless steel piping, piping components, and tanks exposed to air or condensation. The discussions for these items in SLRA Table 3.4.1, SLRA Section 3.4.2.2.2, and SLRA Section 3.4.2.2.3, appear to be inconsistent with respect to the applicability of these items to Oconee SLR. For cracking due to SCC, the SLRA states that all of the components are insulated and Item 3.4.1-002 is not applicable. For crevice and pitting corrosion, the SLRA states that aging management for these components is consistent with the GALL-SLR, suggesting not all components are insulated. Because of this apparent inconsistency, it is not clear to the staff that the SLR aging management evaluation addresses SCC for all stainless steel piping, piping components, and tanks exposed to air or condensation in the steam and power conversion systems.

Request:
Clarify the apparent discrepancy in the aging management discussions for GALL-SLR Items 3.4.1-002 and 3.4.1-003 with respect to whether Oconee has uninsulated stainless steel piping, piping components, or tanks in the scope of SLR exposed to air or condensation in steam and

power conversion systems. In addition, revise SLRA Table 3.4.1, SLRA Sections 3.4.2.2.2 and 3.4.2.2.3, and SLRA Tables 3.4.2-1 through 3.4.2-12, as appropriate, for consistency in the use of GALL-SLR Items 3.4.1-002 and 3.4.1-003.

Regulatory Basis:
Title 10 of the *Code of Federal Regulations* (CFR) Section 54.21(a)(3) requires that the effects of aging for the SSCs identified therein will be adequately managed such that their intended functions are maintained consistent with the CLB for the subsequent period of extended operation. To complete its review and enable the staff to make a reasonable assurance finding in accordance with 10 CFR 54.29(a) on functionality of reviewed SSCs, the staff requires additional information for the subsequent period of extended operation be provided regarding the matters described below.

RAI B2.1.7-1

Background:
In the gap analysis evaluation of SLRA AMP B2.1.7, the applicant states that the primary-expansion relationship between the Primary-category upper core barrel (UCB), lower core barrel (LCB), and flow-distributor (FD) bolts and the linked Expansion-category upper thermal shield (UTS) and lower thermal shield (LTS) bolts/studs is for the aging mechanism of stress corrosion cracking (SCC) only. In the MRP-227, Rev. 1-A report (ADAMS Accession No. ML20175A112), the EPRI MRP's sampling-based methodology for increasing (i.e., expanding) a set of Primary-component inspections to a set of defined Expansion-category components is defined in Chapter 5 of the report. For expansion-based relationships between Primary-category UCB, LCB, and FD bolts and Expansion-category UTS and LTS bolts, the specific criteria for expanding the ultrasonic test (UT) inspections to the UTS and LTS bolts (i.e., expansion-link criteria for the UTS and LTS bolts) are defined in Line Items B7, B8 and B12 of Table 5-1 in the MRP-227, Rev. 1-A report. For the revised expansion-link basis of UTS and LTS bolts under the AMP's gap analysis methodology, the applicant would no longer need to expand the UT inspections to the UTS and LTS bolts if the cause of any crack-like indications in the Primary UCB, LCB, or FD bolting was confirmed to be caused (i.e., initiated or grown) by a fatigue mechanism.

Issue:
The proposed expansion-link basis for the Expansion-category LTS bolts and UTS bolts adds in a new expansion-link methodology criterion that is currently outside the scope of the current EPRI MRP methodology for component-specific examinations and expansions in Chapter 5 and Table 5-1 of MRP-227, Rev. 1-A. More specifically, the expansion bases in Line Items B7, B8 and B12 of Table 5-1 to the MRP-227, Rev. 1-A report only apply if noted conditions of cracking are detected in either the UCB bolts, LCB bolts or FD bolts and the number of UCB, LCB, or FD bolts with detected crack-like conditions (including previously failed/removed bolts) are determined to exceed 10% of the total population of the Primary bolting type; aging mechanism determinations are not specified or included in these Table 5-1 items as additional bases for establishing whether expansion activities for the LTS and UTS bolts are necessary.

In addition, the UT inspections applied to the Primary-category UCB, LCB, and FD bolts may not be capable of generating UT signals that can distinguish cracking induced by SCC from cracking induced by a fatigue mechanism. Thus, the change in the referenced expansion-link basis deviates from EPRI MRP assumptions and methodology for the MRP-227-based program.

The staff needs additional information to justify the proposed expansion-link basis for the LTS and UTS bolts.

Request:

1. Provide the justification for using the proposed expansion-link methodology for the LTS bolts and UTS bolts given that Line Items B7, B8, and B12 in Table 5-1 of MRP-227, Rev. 1-A (or in Table 5-1 of MRP-227, Rev. 2) do not establish the need for expansion for the LTS bolts and UTS bolts based on confirmation of a specific cause (i.e., mechanism) of crack-like conditions that may be detected in any of the referenced Primary bolting types. As part of this justification, discuss why the proposed change in the expansion-link criterion would not need to be identified as an exception to the "detection of aging effects," "monitoring and trending," and "acceptance criteria" program element criteria in GALL-SLR AMP XI.M16A, PWR Vessel Internals," as updated in NRC Interim Staff Guidance No. SLR-ISG-2021-01-PWRVI (ADAMS Accession No. ML20217L203).

2. Clarify how the UT inspection methods applied to the Primary-category UCB, LCB, and FD bolts are capable of generating UT signal results that can distinguish cracking caused by an SCC mechanism from cracking caused by a metal fatigue or cyclical loading mechanism. Otherwise, if it is determined that the UT inspection methods cannot generate UT signal results that are capable of distinguishing SCC from fatigue-induced cracking, define the additional activities that would need to be performed under SLRA AMP B2.1.7 to confirm the cause of crack-like indications that may be detected in the UCB, LCB, or FD bolts, and justify why these activities would not need to be included as an enhancement of the "detection of aging effects," "monitoring and trending," and "acceptance criteria" program elements of the AMP.

RAI B2.1.7-2

Background:
SLRA AMP B2.1.7 maintains the lower thermal shield (LTS) bolts as "Expansion" category components that are linked to UT inspections that will be performed on the Primary-category upper core barrel (UCB) bolts, lower core barrel (LCB) bolts, and flow distributor (FD) bolts, which are made for A-286 stainless steel (SS) materials. During its audit of SLRA AMP B2.1.7, the staff noted that in 1981, the applicant reported past incidents of cracking in the original A-286 stainless steel grade LTS bolts of ONS Unit 1 where the cracking was confirmed to be predominantly initiated by stress corrosion cracking (SCC). One of the corrective actions that resulted from the applicant's evaluation of this operating experience (OpE) was to replace the LTS bolts with LTS bolts fabricated from X-750 nickel-based alloy material.

Issue:
In MRP-227, Rev. 1-A, the EPRI Materials Reliability Program (MRP) identifies that LTS bolts made from either A-286 SS materials or X-750 Nickel-based alloy materials are susceptible to SCC. The staff noted that the risk-informed gap analysis basis for maintaining the LTS bolts as designated Expansion-category components presumes that any SCC conditions found in the A-286 SS materials of the UCB, LCB, and FD bolts going forward will still be representative and predictive of SCC conditions that may be postulated to occur in LTS bolts made from another SCC-susceptible material (i.e., X-750). Given the susceptibility of X-750 Nickel-based alloy to SCC, the staff needs the following additional information: (1) a justification for why the replacement LTS bolts made from X-750 would not be expected to develop SCC in the manner

or to the degree or extent that the original LTS bolts made from A-286 SS had developed SCC; and (2) justification for why the UCB, LCB, and FD bolts made from the same A-286 SS materials would still be considered as lead Primary component indicators for any SCC that is postulated to occur in LTS bolts made from the different X-750 material (such that the replacement LTS bolts could still remain as Expansion-category components for the referenced Primary bolting types).

Request:
Justify why the replacement X-750 LTS bolts would not be expected to develop SCC in the manner or nearly to the extent that the original LTS bolts made from A-286 SS had developed SCC in the past or to the extent that the Primary UCB, LCB, and FD bolts made from A-286 SS (i.e., as the leading Primary components) might be expected or postulated to develop SCC in the future. Clarify how this information supports maintaining the replacement LTS bolts as the "Expansion" category components for SLRA AMP B2.1.7.

RAI B2.1.7-3

Background:
In SLRA Section B2.1.7, "PWR Vessel Internals," the applicant states that it "removed visual VT-3 examination of high strength bolt locking devices." During its audit, the staff noted that the removal of the VT-3 examinations of high strength bolt locking devices will result in downgrading these bolt locking devices into the "No Additional Measures" (NAM) category of the MRP-227-based AMP.

Issue:
The applicant does not identify in the SLRA which of the specific RVI bolt locking devices are made from high-strength materials, such that the referenced locking device types can be placed in the NAM category of the program and no longer be subject to VT-3 visual inspection criteria. In addition, the applicant's basis for placing the high-strength RVI bolt locking devices in the NAM category is that the referenced high-strength bolt locking devices no longer screen in for irradiation embrittlement (IE) and that there are no other aging effect/mechanism combinations that would need to be managed during the subsequent period of extended operation. However, in the "*operating experience*" element of SLRA AMP B2.1.7, the applicant identified ONS-specific operating experience (OpE) with fully or partially missing bolt locking device welds in at least one of the high-strength RVI bolt locking device types. Thus, the staff needs further justification regarding the relevant OpE and its impact to the high-strength bolt locking device types being placed into the NAM category.

Request:
Identify which of the RVI high-strength bolt locking devices will no longer receive a VT-3 examination commensurate with the general statement made to remove these inspections. Discuss how the ONS OpE associated with the fully and partially missing bolt locking device welds (as applicable to one of the referenced high-strength bolt locking device types) does not impact the applicant's conclusion that there are no aging effect and mechanism combinations that need to be managed during the subsequent period of extended operation and that the referenced high-strength bolt locking devices can be placed into the NAM category of the program.

RAI B2.1.7-4

Background:
In SLRA AMP B2.1.7 and its supporting documentation, the applicant has downgraded the following CB cylinder components into the "No Additional Measures" (NAM) category of the program: (1) Unit 1, 2, and 3 CB cylinder plates and flange, (2) circumferential seam welds associated with the Unit 1 and 3 CB cylinder top flange components, (3) CB upper cylinder-to-lower cylinder circumferential seam welds in Units 1 and 3, (4) CB cylinder axial seam welds in Units 1, 2, and 3. For this basis, applicant is using component-specific fabrication practices to justify: (1) that there are no longer any aging mechanisms that screen in for these CB cylinder components, and (2) that the specified CB cylinder components can be placed into the NAM category.

(Note: The RAI does not apply to the Unit 2 CB cylinder top flange circumferential seam welds and the Unit 2 CB upper cylinder-to-lower cylinder circumferential seam weld being elevated to "Primary" category status as of the third revision of the formal Framatome gap analysis (Ref. 4)).

Issue:
The staff noted that the applicant's conclusion that "no aging effects/mechanisms of management" and placing these CB cylinder components into the NAM category is not consistent with the conclusions in MRP-189, Rev. 3. For example, the staff confirmed that the neutron fluence for 80 years of operation for the stainless steel CB cylinder and cylinder seam welds referenced in ANP-3899P, Revision 0, are projected to exceed the thresholds for IE in MRP-189, Revision 3. Thus, further justifications will be necessary for placing these referenced CB cylinder component into the NAM category of the program.

Request:
For those ONS CB cylinder top flange circumferential seam welds, CB cylinder axial seam welds, and CB upper cylinder-to-lower cylinder circumferential seam welds that are being placed into the NAM category of the program, justify how the fabrication practices support the placement of these welds into the NAM category, considering that these practices are associated with weld configurations in non-irradiated, pre-service component conditions.

As part of this clarification, the staff requests that the applicant identify the projected irradiation exposures (i.e., projected neutron fluence [E> 1.0 MeV] and disintegrations per atom (*dpa)* exposure) and applicable stress loadings for these CB cylinder weld components through 72 EFPY so that the staff can assess them to the corresponding susceptibility thresholds in Table 3-1 of MRP-189, Rev. 3 for the following aging mechanisms: (1) stress corrosion cracking (SCC); (2) irradiation-assisted stress corrosion cracking (IASCC); (3) fatigue, and (4) irradiation embrittlement (IE).

If the 72 EFPY projected irradiation values or loading values (or needed combination of the values) for the CB cylinder welds exceed the criteria in MRP-189, Rev. 3, justify that cited pre-service fabrication practice remains valid to support the conclusion that specific aging mechanism(s) do not need to be age-managed in the applicable ONS CB cylinder seam weld types that are being placed into the NAM category (i.e., for the version of the AMP that will be implemented during the subsequent period of extended operation).

References for the RAIs (Reference 4 Was Only Provided in the Audit Portal)

1. EPRI Non-Proprietary Report No. 3002017168, “Materials Reliability Program: Pressurized Water Reactor Internals Inspection and Evaluation Guidelines (MRP-227, Revision 1-A),” June 2020 (ADAMS Accession No. ML20175A112).

2. EPRI Proprietary Report No. 3002013218, “Materials Reliability Program: Screening, Categorization, and Ranking of Babcock & Wilcox-Designed Pressurized Water Reactor Internals Component Items and Welds (MRP-189, Revision 3),” December 2019 (ADAMS Accession No. ML20019K284).

3. Framatome Proprietary Report No. ANP-3899P, Revision 0, “Framatome Reactor Vessel Internals TLAA Input to the ONS SLRA,” May 2021. (ADAMS Accession No. ML21158A200).

4. Framatome Proprietary Report No. 51-9312330-003, “Oconee-Specific RV Internals Aging Management Strategy Development and Inspection Categorization for SLR,” November 11, 2021.

RAI B2.1.7-5

Background:
During the audit breakout session of October 6, 2021, the staff discussed aging management review (AMR) information issues for reactor vessel internal (RVI) components with the applicant. The AMR issues are documented and summarized in Duke Energy document entitled “TRP 15, PWR Vessel Internals, Oconee SLRA, Response to NRC Breakout Questions 15 – 31 and Follow-up from 10-1-2021 Breakout,” as placed on the audit portal for the SLRA.

Issue:
In Duke Energy document entitled “TRP 15, PWR Vessel Internals, Oconee SLRA, Response to NRC Breakout Questions 15 – 31 and Follow-up from 10-1-2021 Breakout,” the applicant identifies those AMR item changes that they applicant would be making to the AMR items for RVI components in SLRA Table 3.1.1 or SLRA Table 3.1.2-2.

Request:
Indicate whether Duke Energy will be making any changes to the AMR items for RVI components in SLRA Table 3.1.1 or Table 3.1.2-2 consistent those issue response statements calling for AMR item adjustments in the Duke Energy document entitled “TRP 15, PWR Vessel Internals, Oconee SLRA, Response to NRC Breakout Questions 15 – 31 and Follow-up from 10-1-2021 Breakout.” Justify the basis for deciding on whether changes to the AMR items will be made.

Regulatory Basis:
Title 10 of the *Code of Federal Regulations* (CFR) Section 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. As described in SRP-SLR, an applicant may demonstrate compliance with 10 CFR 54.21(a)(3) by referencing the GALL-SLR Report when evaluation of the matter in the GALL-SLR Report applies to the plant.

RAI B2.1.33-1

Background:
SLRA Section B2.1.33, "Structures Monitoring," states that the Oconee Structures Monitoring AMP, with the enhancements provided in the SLRA, will be consistent with the ten program elements of GALL-SLR Report AMP XI.S6, "Structures Monitoring." For the "scope of program" program element, the GALL-SLR Report AMP states that the program should include all SCs, component supports, and structural commodities in the scope of license renewal that are not covered by other structural aging management programs. Additionally, for the "parameters monitored or inspected" program element, the GALL-SLR Report states that steel bracing and edge supports associated with masonry walls should be inspected for deflection or distortion, loose bolts, and loss of material due to corrosion.

Issue:
SLRA Section 2.4.8 lists several commodities and components that were identified as within the scope of Structures Monitoring Program. However, based on the review of the audited documents and the SLRA enhancements, it is unclear why some of these commodities or components (e.g., piping supports, fuel transfer tube, fire barriers – penetration seals, penetration sleeves, louvers, line supports, aluminum components, liners, sump, drains/curbs, piles, unit vent, lead shield supports, etc.) were not included in the scope of the Structures Monitoring Program to demonstrate that the effects of aging will be adequately managed during the subsequent period of extended operation. The staff noted it was not clear how the procedure identified these components within the scope of the program and their inspection criteria.

Furthermore, SLRA enhancement no. 2 adds the inspection of supports and bracings components associated with masonry walls to the scope of the Structures Monitoring Program. However, the existing program does not seem to include the parameters to be monitored or inspected for these components (e.g., deflection or distortion). Therefore, it is not clear how the Structures Monitoring Program will be consistent the GALL-SLR Report for the parameters to be monitored or inspected for the steel bracing and edge supports associated with masonry walls.

Request:
1. For the commodities and components identified as being managed by the Structures Monitoring Program in SLRA Section 2.4.8, clarify why some of these commodities and components (as listed, in part, above) were not included/added to the scope of the program to demonstrate that they will be adequate managed. Update the SLRA as necessary.

2. Clarify how the Structures Monitoring Program will be consistent with the parameters to be monitored or inspected for the steel bracing and edge supports components associated with masonry walls.

RAI B2.1.33-2

Background:
SLRA Section B2.1.33, "Structures Monitoring," states that the Oconee Structures Monitoring AMP, with the enhancements provided in the SLRA, will be consistent with the ten program elements of GALL-SLR Report AMP XI.S6, "Structures Monitoring." For the "detection of aging effects" program element, the GALL-SLR Report AMP states that the program includes a provision for more frequent inspections based on an evaluation of the observed degradations,

and also states that, in general, that all structures be monitored on an interval not to exceed 5 years.

SLRA Supplement No. 3, dated December 15, 2021 (ADAMS Accession No. ML21349A005), revised the program's description in SLRA Sections A2.33 and B2.1.33 to eliminate the previous discussion related to increasing the inspection frequency from 5 years to 10 years. The SLRA Supplement further stated that the program aligns with the GALL-SLR Report for a 5 year inspection frequency.

Issue:
During the audit, the staff reviewed the documents and procedure associated with the Structures Monitoring program. During the review of Section 5.1.2 of Procedure No. AD-EG-ONS-1214, it was noted that the current procedure includes a provision that allows for an increased inspection frequency of up to a 10 year interval. Therefore, it is not clear how Oconee's Structures Monitoring AMP will still be consistent with the "detection of aging effects" program element of the GALL-SLR Report AMP XI.S6 if the existing program includes a provision that allows for an increased inspection frequency of up to 10 years.

During the review of Section 5.1.2 of Procedure No. AD-EG-ONS-1214, it was also noted that the procedure requires more frequent inspection when an unusual event, such as flooding or seismic activity, occurs. However, no similar provision was identified for when an evaluation of the observed degradations warrants an increased inspection frequency. Therefore, it is unclear if Section 5.1 is consistent with the GALL-SLR Report to ensure that provision exist for more frequent inspections based on an evaluation of the observed degradations.

Request:
1. Clarify how the Structures Monitoring Program will be consistent with the GALL-SLR Report, as claimed in the SLRA, for ensuring that all structures and components be monitored on an interval not to exceed 5 years.

2. Clarify how the Structures Monitoring Program will be consistent with the GALL-SLR Report, as claimed in the SLRA, for ensuring that provision exist for more frequent inspections based on an evaluation of the observed degradations.

3. Update the SLRA as necessary consistent with the responses to Requests 1 and 2 above.

RAI B2.1.33-3

Background:
SLRA Section B2.1.33, "Structures Monitoring," states that the Oconee Structures Monitoring AMP, with the enhancements provided in the SLRA, will be consistent with the ten program elements of GALL-SLR Report AMP XI.S6, "Structures Monitoring." For the "detection of aging effects" program element, the GALL-SLR Report AMP states that, for sites with nonaggressive groundwater/soil (pH > 5.5, chlorides < 500 ppm, and sulfates < 1,500 ppm), the program needs to (a) evaluate the acceptability of inaccessible areas when conditions exist in accessible areas that could indicate the presence of, or result in, degradation to such inaccessible areas, and (b) examine representative samples of the exposed portions of the below grade concrete, when excavated for any reason.

Issue:
During the review of Procedure No. AD-EG-ONS-1214, it was noted that, in Section 5.2.3, the current plant procedure includes a provision to ensure that visual inspections are performed in normally inaccessible areas when areas are made accessible by excavation or by other means (effectively addressing item (b) from the GALL-SLR Report for underground structures). However, it is not clear what provision exists in the current procedure to ensure that inaccessible areas are evaluated for acceptability when conditions exist (has been identified) in accessible areas that could indicate the presence of, or result in, degradation to such inaccessible areas (i.e., to effectively address item (a) from the GALL-SLR Report). Therefore, it is not clear how the Structures Monitoring Program will be consistent with the GALL-SLR Report for adequately managing the aging effects of inaccessible structural elements when exposed to a nonaggressive groundwater/soil environment. It is noted that a similar criterion might be applicable to other inaccessible structural elements (e.g., structural components covered by metal siding) located above ground.

Request:
Clarify how the Structures Monitoring Program is consistent with the GALL-SLR Report for evaluating the acceptability of inaccessible areas (including inaccessible areas aboveground) when conditions exist in accessible areas that could indicate the presence of, or result in, degradation to such inaccessible areas. Update the SLRA as necessary.

RAI B2.1.33-4

Background:
SLRA Sections B2.1.32, “Masonry Walls,” and B2.1.33, “Structures Monitoring,” state that the Oconee programs, with the enhancements provided in the SLRA, will be consistent with the ten program elements of GALL-SLR Report AMPs XI.S5, “Masonry Walls,” and XI.S6, “Structures Monitoring.” The SRPSLR states that as part of the development of the SLRA, the applicant should assess the AMPs in the GALL-SLR Report. It is incumbent on the applicant to ensure that the conditions and operating experience (OE) at the plant are bounded by the conditions and OE for which the GALL-SLR Report program was evaluated. If these bounding conditions are not met, the applicant should address the additional effects of aging and augment the AMP(s) in the GALL-SLR Report in the SLRA, as appropriate.

During the on-site audit, the staff noted that most of the structures above ground were covered with metal siding on the exterior, which makes the exterior of the structural components inaccessible for inspection. This plant-specific condition is not generically bounded by the general conditions for which the GALL-SLR Report programs XI.S5 and XI.S6 were evaluated. To address this plant-specific condition, the applicant revised SLRA Sections B2.1.32 and B2.1.33 in Attachment 15 of SLRA Supplement 3, dated December 15, 2021 (ADAMS Accession No. ML21349A005), to describe the actions that will be taken to manage the structural components that are inaccessible for inspection by the metal siding.

Issue:
Although the changes provided in SLRA Supplement 3 describes, in part, how the programs will manage the inaccessible areas covered by metal siding, additional clarification is necessary for the following:

1. It is not clear how plant procedures ensure that engineering inspections are performed on structural elements covered by metal siding when portions are exposed for any

reason (e.g., maintenance activities, modification, etc.). It is noted that Section 5.2 of procedure no. ADEGONS1214 provides a similar provision for inaccessible areas requiring an excavation, but it is not clear if a similar provision exist for inaccessible areas covered by metal siding.

2. SLRA Section A2.33, "Structures Monitoring," describes the "opportunistic inspections for the condition of below grade concrete." SLRA Section A2.32, "Masonry Walls," describes the general inspections associated with the monitoring of masonry walls. However, it is not clear why the programs' descriptions do not describe the program actions associated this plant specific condition (i.e., the type of evaluation and/or opportunistic inspections that will be used to monitor the condition for inaccessible areas covered by metal siding).

3. The SLRA, as revised by SLRA Supplement 3, does not (a) state if plant specific operating experience from the inspection of accessible concrete structures considered to be leading indicators has resulted in indication of the presence of, or result in, degradation to such inaccessible areas, and (b) provide a justification to demonstrate that the proposed monitoring actions will be adequate to manage the aging effects for inaccessible areas covered by metal siding so that the intended function(s) will be maintained consistent with the current licensing basis for the period of extended operation.

Request:

1. Clarify how the existing Structures Monitoring Program ensures that engineering inspections are performed on structural elements covered by metal siding when portions are exposed for any reason (e.g., maintenance activities, modification, etc.). Update the SLRA as necessary.

2. Clarify why the program descriptions in SLRA Sections A2.33 and A2.32 do not describe the program actions associated with the monitoring of inaccessible areas covered by metal siding. Update the SLRA as necessary.

3. State if plant-specific operating experience from the inspection of accessible concrete areas considered to be leading indicators of the above grade inaccessible structural elements has resulted in indication of the presence of, or result in, degradation to such inaccessible areas. Also, provide a justification to demonstrate that the proposed monitoring actions will be adequate to manage the aging effects for inaccessible areas covered by metal siding.

RAI B2.1.33-5

Background:

The GALL-SLR Report contains an AMR evaluation of a large number of structures and components (SCs) that may be in the scope of a typical SLRA and may need to be the subject of an AMR in accordance with requirements in 10 CFR 54.21(a)(1). However, the AMR line items in the SRP-SLR and GALL-SLR Report may not provide a comprehensive list of all structures and components that need to be within the subject of an AMR or a comprehensive list of all potential aging effects that may be applicable to those structures or components as being the subject of an AMR. Therefore, plant-specific AMRs should be performed if additional aging effects or components (not referenced in the SRP-SLR and GALL-SLR Report) are applicable to

a specific structure or component subject to an AMR. Any deviation or exception to the GALL-SLR Report AMP should be described and justified.

SLRA Section B2.1.33, "Structures Monitoring," stated that the installation of the fiber reinforced polymer (FRP) associated with masonry walls was allowed through a license amendment request that was approved by the NRC on June 27, 2011 (ADAMS Accession No. ML11164A257). The SLRA also stated that that the Structures Monitoring Program will be used to inspect and manage the aging effects for the FRP component. Since the GALL-SLR Report does not generically address FRP components, SLRA Table 3.5.2-1 performed a plant-specific AMR of this component by considering the aging effects of hardening or loss of strength, loss of material, cracking or blistering. SLRA Section B2.1.33, as revised by SLRA Supplement No. 3 in letter dated December 15, 2021 (ADAMS Accession No. ML21349A005), also provided a new exception to the "detection of aging effects" program element to allow for the inspection and testing of the FRP on a 6 year inspection frequency. In this exception, the SLRA described the environment for which the FRP is exposed and the additional testing that is performed (i.e., adhesion pull-off testing).

Issue:
Additional clarification is necessary for the following:

1. SLRA B2.1.33, as amended, states that the program inspection includes visual inspection of the FRP, visual inspection of mortar joints along the bottom edge of the FRP strengthened masonry walls, and an adhesion pull-off testing of control panels which constitutes a more thorough and robust inspection than the typical visual inspection of the Structures Monitoring program. Since the adhesion pull-off testing is intended to monitor any degradation associated with bonding failure between the masonry wall and the FRP material, it is not clear what AMR line item, in SLRA Table 3.5.2-1, was used to evaluate/credit the associated aging effect/mechanism (e.g., loss of adhesion) that will be monitored or inspected for the FRP.

2. SLRA B2.1.33, generally states that the inspection of the FRP is within the scope of the Structures Monitoring Program. Since the installation of the FRP was allowed through a license amendment request that only considered the inspections until the end of the (current) license in July 2034, it is not clear if the intent for the Structures Monitoring Program is to manage the FRP, throughout the subsequent period of extended operations, using the same parameters, inspection criteria, and methods described in the approved license amendment request to ensure its intended functions are maintained during SPEO.

3. Considering that SLRA Supplement No. 3 added an exception to the Structures Monitoring Program, it is not clear why the "NUREG 2191 Consistency" Section in SLRA B2.1.33 only states that the Structures Monitoring AMP will be consistent with the enhancements, without crediting the exception.

4. It is not clear why the programs description, for the UFSAR Supplement in Section A2.33, does not describe, as required by 10 CFR 54.21(d), the program's plant specific activities for managing the effects of aging for FRP associated with the masonry walls (i.e., the type of inspection and testing, including the inspection frequency, that will be used to monitor the condition for this component). It is noted that the inspection of FRP is not generically addressed or described in the FSAR Supplement Summaries of the GALLSLR Report for the Structures Monitoring Program.

Request:

1. Clarify what line item in SLRA Table 2 addresses the plant-specific aging effect that is associated with the adhesion pull-off testing (e.g., loss of adhesion).

2. Clarify if the Structures Monitoring Program will manage the degradations associated with the FRP, throughout the subsequent period of extended operations, using the same inspection parameters, inspection criteria, and methods described in the license amendment request that was authorized by the NRC on June 27, 2011, to ensure its intended functions are maintained during SPEO.

3. Clarify why the "NUREG 2191 Consistency" Section in SLRA B2.1.33 did not credit the exception in its statement.

4. Clarify why the program description from the UFSAR Supplement in Section A2.33 does not describe the program's plant specific activities for managing the effects of aging of the FRP associated with the masonry walls (including the type of inspection, testing, and inspection frequency), as required by 10 CFR 54.21(d).

Regulatory Basis:
Title 10 of the *Code of Federal Regulations* (CFR) Section 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. As described in SRP-SLR, an applicant may demonstrate compliance with 10 CFR 54.21(a)(3) by referencing the GALL-SLR Report when evaluation of the matter in the GALL-SLR Report applies to the plant.

RAI 3.5.1-092-1

Background:
The GALL-SLR Report contains an AMR evaluation of a large number of structures and components (SCs) that may be in the scope of a typical SLRA and may need to be the subject of an AMR in accordance with requirements in 10 CFR 54.21(a)(1). However, the AMR line items in the SRP-SLR and GALL-SLR Report may not provide a comprehensive list of all structures of components that need to be within the subject of an AMR or a comprehensive list of all potential aging effects that may be applicable to those structures or components as being the subject of an AMR. Therefore, plant-specific AMRs should be performed if additional aging effects (not referenced in the SRP-SLR and GALL-SLR Report) are applicable to a specific structure or component subject to an AMR. It is noted that wear plate components are not generically addressed by the GALL-SLR Report.

Issue:
During the review of the AMR items in SLRA Table 3.5.2-22, as revised by Attachment 3 of SLRA Supplement No. 3 dated December 15, 2021 (ADAMS Accession No. ML21349A005), the staff noted two instances where the table includes two separate AMR line items addressing the same material, environment, and aging effect combination for wear plates (each instance has a different material (steel, stainless steel) and environment combination). In the revised SLRA Table 3.5.2-22 (page 3-1449) in Attachment 3 of SLRA Supplement No. 3, for the instance where the steel wear plate is exposed to an "air-indoor uncontrolled (external)" environment, one of the two AMR line items is associated with the GALL-SLR Report AMR line item 3.5.1-092 and references generic note C to indicate that a different component was used.

The other AMR line item for steel wear plate is a plant-specific AMR that references generic note H to indicate that the aging effect is not in the GALL-SLR Report for this component, material, and environment combination. For the instance where the stainless steel wear plate is exposed to an "air (external)" environment, one of the two AMR line items is associated with the GALL-SLR Report AMR line item 3.5.1-100 and references generic note C. The other AMR line item for stainless steel wear plate is a plant-specific AMR that also references generic note H. Therefore, for each of steel and stainless steel wear plate, it is not clear which line item the SLRA intends to use to evaluate the wear plates and demonstrate that the associated aging effects will be adequately managed by the program.

During the review of AMR items in SLRA Table 3.5.2-22, as revised by SLRA Supplement No. 3, it was also noted that cracking is an aging effect that will be managed for stainless steel wear plates by the Structures Monitoring Program. However, SLRA enhancement no. 19 specifies only monitoring for loss of material for wear plates but does not include monitoring for cracking. Therefore, it is not clear how the Structures Monitoring Program will be adequate to manage all the applicable aging effects refenced in SLRA Table 3.5.2-22.

Request:

1. Clarify, with sufficient justification, which of the line items from SLRA Table 3.5.2-22, as revised in Attachment 3 of SLRA Supplement No. 3, will be used to evaluate the wear plates (for each instance describe above) and demonstrate that the associated aging effects of wear plates will be adequately managed during the period of extended operations. Update the SLRA as necessary.

2. Clarify how the Structures Monitoring Program will also be adequate to manage all the applicable aging effect of cracking for wear plates identified in SLRA Table 3.5.2-22, as revised in Attachment 3 of SLRA Supplement No. 3. Update the SLRA as necessary.

RAI 3.5.1-093-1

Background:

SRP-SLR Table 3.5-1, item 093, states that the component "Galvanized steel support members; welds; bolted connections; support anchorage to building structure" for applicable structural components that are associated with cable trays, conduit, HVAC ducts, tube track, instrument tubing, non-ASME piping and components, emergency diesel generator supports, HVAC system components, and/or other miscellaneous mechanical equipment should be managed for loss of material due to pitting and crevice corrosion by the AMP XI.S6, "Structures Monitoring," program when the component is exposed to an air outdoor environment. For this material and component combination, the SRP-SLR Table 3.5.1, item 095, states that no aging effects needs to be managed or aging management program required for "galvanized steel support members; welds; bolted connections; support anchorage to building structure" when the component is exposed to an air indoor (uncontrolled) environment.

SLRA Table 3.5.1, AMR item 3.5.1-093, stated that this AMR line item is not applicable/used because galvanized steel components were evaluated using the GALL/SRP-SLR AMR line items associated with steel. Similarly, SLRA Table 3.5.1, AMR item 3.5.1-095, stated that this AMR line item is not applicable/used because galvanized steel components were evaluated using the GALL/SRP-SLR AMR line items associated with steel.

Issue:
After reviewing the SLRA AMR line items associated with steel, it is not clear how the galvanized steel supports, associated with the SRP-SLR Table 3.5.1, items 093 and 095 (for the structural components described above), were evaluated for ONS. The SLRA Table 3.5.1 does not address which alternate SRP-SLR line item is used for galvanized support members and/or which galvanized supports do not require aging management based on environment. Additional clarification is necessary to understand what galvanized steel supports requires evaluation and will be managed for the aging effects by the Structures Monitoring Program, and what galvanized steel supports will not require a program or aging effect to be managed due to the environment.

Request:
Clarify what alternate GALL/SRP-SLR AMR line items were used to evaluate the galvanized steel supports associated with AMR line items 3.5.1-093 and 3.5.1-095 and the applicability for ONS of the different galvanized steel supports/components described in the GALL-SLR Report for these AMR line items. Update the SLRA as necessary.

RAI B2.1.28-1

Regulatory Basis:
Section 54.21(a)(3) of 10 CFR requires the applicant to demonstrate that the effects of aging for structures and components will be adequately managed so that the intended function will be maintained consistent with the current licensing basis (CLB) for the 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 when evaluation of the matter in the GALL-SLR Report applies to the plant.

Background:

ASME Section XI, Subsection IWE
SLRA Section B2.1.28, as amended by ONS SLRA Supplement 3 dated December 15, 2021 (ADAMS Accession No. ML21349A005), states, in part, that the program will be enhanced to specify that for “high strength” structural bolting consisting of ASTM A325, ASTM F1852, ASTM F2280, and/or ASTM A490 bolts, the preventative actions for storage, lubrication, and stress corrosion cracking potential discussed in Section 2.0 of Research Council for Structural Connections publication “Specification for Structural Joints Using ASTM A325 or ASTM A490 Bolts,” will be used.

SLRA Structures Monitoring
SLRA Section B2.1.33 states that the program will be enhanced to provide guidance for storage, lubricants, and the steps to minimize stress corrosion cracking potential discussed in Section 2 of Research Council for Structural Connections publication, “Specification for Structural Joints Using ASTM A325 or A490 Bolts” for structural bolting consisting of ASTM A325, ASTMF1852, and/or ASTM A490 bolts; and that program will be enhanced to provide guidance so that when replacement bolting is required, bolting material, installation torque or tension, and use of lubricants and sealants will be in accordance with the guidelines of EPRI NP-5769, EPRI TR-104213, and the additional recommendations of NUREG-1339. SLRA Section B2.1.33 also states that the program will be enhanced to provide guidance for proper specification of new high strength bolting material and lubricant to prevent or mitigate

degradation and failure of structural bolting in accordance with the guidelines of EPRI NP-5769, EPRI TR-104213, and the additional recommendations of NUREG-1339.

GALL-SLR report states that the preventive actions should emphasize proper selection of bolting material and lubricants and appropriate installation torque or tension to prevent or minimize loss of bolting preload and cracking of high-strength bolting. If the structural bolting consists of ASTM A325 and/or ASTM A490 bolts (including respective equivalent twist-off type ASTM F1852 and/or ASTM F2280 bolts), the preventive actions for storage, lubricant selection, and bolting and coating material selection discussed in Section 2 of Research Council for Structural Connections publication "Specification for Structural Joints Using High-Strength Bolts" need to be considered.

Issue:
It is unclear whether bolting and coating material selection discussed in Section 2 of the Research Council for Structural Connections publication will included in the enhancement to Element 2 in the ASME Section XI, Subsection IWE program.

It is unclear why preventive actions to ensure bolting integrity for "high strength" structural bolting consists of ASTM F2280 bolts were not addressed by the Structures Monitoring Program.

It is unclear whether coating material selection discussed in Section 2 of the Research Council for Structural Connections publication will included in the enhancement to Element 2 in the Structures Monitoring program.

Request:
1. Clarify whether bolting and coating material selection discussed in Section 2 of Research Council for Structural Connections publication will be included in the enhancement to Element 2 in the ASME Section XI, Subsection IWE program. Provide the justification if bolting and coating material selection is not included.
2. Clarify whether preventive action to ensure bolting integrity for "high strength" structural bolting consists of ASTM F2280 bolts will be included by the Structures Monitoring Program.
3. Clarify whether coating material selection discussed in Section 2 of the Research Council for Structural Connections publication will be included in the enhancement to Element 2 in the Structures Monitoring program. Provide the justification if coating material selection is not included.