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

SAFETY REVIEW

RAI B2.1.21-1

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

Background
SLRA Section B2.1.21, "Selective Leaching," states the following:

- "[t]he Oconee Selective Leaching AMP is a new program that, when implemented, will be consistent with the recommendations in NUREG-2191 XI.M33, Selective Leaching."
- "OE [operating experience] example 2 provides objective evidence that significant degradation due to selective leaching is not occurring in susceptible materials exposed to closed cycle cooling water or treated water environments at Oconee, and therefore, the use of one time inspection for selective leaching in these environments is appropriate for the SPEO [subsequent period of extended operation]."

SLRA Section 3.3.2.1.21, "Recirculating Cooling Water [RCW] System," states components in the system are constructed of the following materials: copper alloys with greater than 15 percent zinc, glass, gray cast iron, stainless steel, and steel. In addition, SLRA Table 3.3.2-21, "Auxiliary Systems - Recirculating Cooling Water System - Aging Management Evaluation," does not include any aging management review items for malleable iron. Furthermore, the staff notes that the only malleable iron components identified in the SLRA are high voltage electrical insulators in SLRA Table 3.6.2-1, "Electrical and Instrumentation and Controls - Electrical and Instrumentation and Controls Commodities – Aging Management Evaluation."

During its audit, the staff reviewed AR 02354397, "¾-inch RCW pipe break at 1D2 HDP [Heater Drain Pump]," dated October 21, 2020, and noted the following: (a) although the RCW system is molybdate treated, there was evidence of internal general corrosion, pitting, and graphitic corrosion; (b) the attachment titled "Metallurgical Evaluation of Couplings" dated November 19, 2020, shows dark corrosion product layers (potentially indicative of graphitic corrosion) on the internal surfaces of malleable iron fittings.

GALL-SLR Report Table IX.C, "Use of Terms for Materials," states the following for steel:

> "[i]n some environments, carbon steel, alloy steel, gray cast iron, ductile iron, malleable iron, and high-strength low-alloy steel are vulnerable to general, pitting, and crevice corrosion, even though the rate of loss of material may vary amongst material types. Consequently, these metal types are generally grouped under the broad term "steel." Note that this does not include SS [stainless steel], which has its own category. However, gray cast iron and ductile iron are susceptible to selective leaching, and high-strength low-alloy steel is susceptible to SCC [stress corrosion cracking]. Therefore, when these aging effects are being considered, these materials are specifically identified."

GALL-SLR Report AMP XI.M33 states the following:

- "[o]ne-time inspections are only conducted for components exposed to CCCW [closed-cycle cooling water] or treated water when no plant-specific OE of selective leaching exists in these environments."
- "[o]pportunistic and periodic inspections are conducted for…components in CCCW or treated water where plant-specific OE includes selective leaching in these environments."

Issue

The staff has the following issues based on its review of AR 02354397:

1. Mechanical components (e.g., piping, valves) constructed of malleable iron may be within the scope of subsequent license renewal (SLR) at Oconee. The staff recognizes that this material may be currently classified in the SLRA under the material type "steel." However, as noted in GALL-SLR Report Table IX.C, cast iron materials (e.g., gray cast iron, ductile iron) are specifically identified when they are susceptible to selective leaching.
2. Malleable iron components at Oconee may be susceptible to selective leaching (based on the staff's review of "Metallurgical Evaluation of Couplings" attached to the subject AR). The staff seeks clarification regarding why selective leaching is not an aging effect requiring management for malleable iron components at Oconee.
3. Based on evidence of graphitic corrosion in the RCW system (i.e., a closed-cycle water related system), the staff seeks clarification regarding why one-time inspections (in lieu of opportunistic and periodic inspections) are appropriate for components susceptible to selective leaching exposed to treated water or CCCW environments.

Request

1. State if mechanical components constructed of malleable iron are within the scope of SLR at Oconee and are exposed to environments where selective leaching could occur (i.e., raw water, CCCW, treated water, waste water, or soil).
2. If mechanical components constructed of malleable iron are within the scope of SLR at Oconee and are exposed to environments where selective leaching could occur, state the basis for why selective leaching is not an aging effect requiring management. Alternatively, revise the SLRA as appropriate to reflect that malleable iron mechanical components exposed to environments where selective leaching could occur will be managed for loss of material due to selective leaching.

3. State the basis for why one-time inspections are appropriate for components susceptible to selective leaching exposed to a treated water or CCCW environment.

RAI B3.1-1

Regulatory Basis
Pursuant to 10 CFR 54.21(a)(3), the SLRA must 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 subsequent period of extended operation.

Background
SLRA Section B3.1 states that the program assures that the number of occurrences of each critical transient remains within the limits of the fatigue analyses. The SLRA also indicates that the design transients and associated design cycles are listed in Oconee UFSAR Tables 5-2 (for reactor coolant system other than pressurizer surge line) and 5-23 (for pressurizer surge line).

Issue
Enhancement 3 of the program states that the program will be enhanced to expand existing corrective action guidance associated with exceeding a cycle counting surveillance limit. The staff finds a need to clarify the meaning of the cycle surveillance limit. In addition, the staff needs to clarify whether the cycle counting surveillance limit includes the cycle limits associated with the analytical flaw evaluation (SLRA Section 4.3.5), weld overlay fatigue analysis (SLRA Section 4.3.6), cumulative usage factors and environmental cumulative usage factors in addition to the design transient cycles.

Request
Describe the meaning of the cycle counting surveillance limit addressed in Enhancement 3 of the Fatigue Monitoring program. As part of the response, clarify whether the surveillance limit includes the cycle and design limits associated with the analytical flaw evaluation (SLRA Section 4.3.5), weld overlay fatigue analyses (SLRA Section 4.3.6), cumulative usage factors and environmental cumulative usage factors in addition to the design transient cycles. If not, explain why the surveillance limit does not include the cycle or design limits associated with the analytical flaw evaluation, weld overlay fatigue analyses, cumulative usage factors and environmental cumulative usage factors.

RAI B3.1-2

Regulatory Basis
Pursuant to 10 CFR 54.21(a)(3), the SLRA must 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 subsequent period of extended operation.

Background
SLRA Section B3.1 provides the evaluation of the operating experience related to the Fatigue Monitoring program.

Issue
The applicant's evaluation of the operating experience does not address an evaluation of the following NRC generic communication: Regulatory Issue Summary (RIS) 2011-14, "Metal Fatigue Analysis Performed by Computer Software." RIS 2011-14, in part, addresses the concern that the fatigue calculations of the WESTEMS software package may involve the algebraic summation of three orthogonal moment vectors, which is not consistent with ASME Code, Section III, Subsection NB, Subarticle NB-3650. RIS 2011-14 also states that the NRC encourages addressees to review the documents discussed above and to consider actions, as appropriate, to ensure compliance with the requirements for ASME Code fatigue calculations and QA programs, as described in 10 CFR 50.55a and Appendix B to 10 CFR Part 50, respectively.

Request
Provide the operating experience evaluation regarding RIS 2011-14, including the applicability of the RIS to the Oconee plant.

RAI 3.5.2.2.2.5-1

Regulatory Basis
Pursuant to 10 CFR 54.21(a)(3), the SLRA must 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 subsequent period of extended operation.

Background
SLRA Section 3.5.2.2.2.5 states that the evaluations of fatigue for component support members, anchor bolts, and welds for Groups B1.1, B1.2, and B1.3 component supports are TLAAs as defined in 10 CFR 54.3, and are addressed in SLRA Section 4.3, "Metal Fatigue." The component support groups are the following: (1) Group B1.1: supports for ASME Code Class 1 piping and components; (2) Group B1.2: supports for ASME Class 2 and 3 piping and components; (3) Group B1.3: supports for ASME Class MC (metal containment) components.

Issue
However, SLRA Sections 3.5.2.2.2.5 and 4.3 do not clearly identify the component supports, anchor bolts, and welds evaluated in the fatigue TLAAs and the dispositions of the fatigue TLAAs.

Request
Identify the component supports, anchor bolts and welds in Groups B1.1, B1.2, and B1.3 that are evaluated in the fatigue TLAAs. In addition, describe the fatigue TLAAs, including the TLAA dispositions, for the component supports, anchor bolts, and welds.

RAI 4.3.2-1

Regulatory Basis

Pursuant to 10 CFR 54.21(c), the SLRA must include an evaluation of time-limited aging analyses (TLAAs). The applicant must demonstrate that (i) the analyses remain valid for the period of extended operation, (ii) the analyses have been projected to the end of the period of extended operation, or (iii) the effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

Background

SLRA Section 4.3.2.2 addresses the fatigue TLAA for the reactor vessel internals (RVIs) as part of the Class 1 metal fatigue evaluations. The applicant indicated that the fatigue analysis addressed in the section is the low-cycle (design transient) fatigue analysis for the replacement bolts that fasten the lower end of the reactor vessel thermal shield to the lower grid assembly. SLRA Section 4.3.2.2 does not address a low-cycle fatigue analysis for the other RVIs.

Issue

The following reference provides the staff-approved, existing fatigue analyses for the applicant's RVIs for 60 years of operation (Reference: BAW-2248A, Demonstration of the Management of Aging Effects for the Reactor Vessel Internals, March 2000, ADAMS Accession No. ML003708443). Section 3.4 of the staff's safety evaluation for BAW-2248A, as contained in BAW-2248A, indicates that Section 4.5 of the BAW-2248A report addresses the low-cycle fatigue TLAA for the RVIs, including the fatigue TLAA for thermal shield replacement bolts.

Specifically, Section 4.5.1 of BAW-2248A states that the "[reactor vessel] internals designers did, however, consider the reactor coolant system functional design requirements when performing their structural design." The section also states that meeting these requirements in the original design meant that the RVIs were implicitly designed for low cycle fatigue based on the projected reactor coolant system design transients. Therefore, BAW-2248 identifies the implicit fatigue analysis as a time-limited aging analysis for the Babcock and Wilcox-designed RVIs.

Accordingly, Section 5.1.5 of BAW-2248A addresses the fatigue in the RVIs and related transient cycle count assumptions. The section states that, since the original RVIs design implicitly considered the reactor coolant system transient cycle assumptions, validation of these assumptions for 60 years of operation will assure the original design intent of the RVIs is maintained. The section also states that, since the design transients applicable for 40 years of operation remain valid for 60 years of operation with no increase in the number of transients anticipated, fatigue of the RVIs, implicit in the original design, is acceptable for 60 years of operation in accordance with 10 CFR 54.21(c)(1)(i).

In relation to the implicit fatigue TLAA, License Renewal Action Item 11 in the staff's safety evaluation for the BAW-2248A report specifies that a license renewal applicant must address the plant-specific plans to continue monitoring and tracking design transient occurrences for the RVIs, which include the thermal shield replacement bolts and the other RAIs.

As discussed above, SLRA Section 4.3.2.2 only addresses the low-cycle fatigue TLAA for the thermal shield replacement bolts, excluding the fatigue TLAA for the other RVIs. Therefore, the fatigue TLAA in SLRA Section 4.3.2.2 is not consistent with BAW-2248A and Action Item 11 of the BAW- 2248A report. Action Item 11 addresses the monitoring activity to ensure that the implicit fatigue TLAA remains valid for the RVIs including the thermal shield replacement bolts. The action item states that the applicant must address the plant-specific plans to continue monitoring and tracking design transient occurrences.

The staff needs additional information to resolve this potential inconsistency between the implicit fatigue TLAA for RVIs identified in BAW-2248A and the staff's safety evaluation for BAW-2248A (including Action Item 11) and the absence of such a TLAA from SLRA Section 4.3.2.2.

In addition, the following reference indicates that the current licensing basis fatigue analysis for RVI bolts is based on the design cycles (18000 cycles each) of the "power loading 8 to 100 percent power" and "power unloading 100 to 8 percent power" design transients (Reference: Table 6 of Framatome Technologies Engineering Information Record 1234566-02, "Fatigue Trackable Component & Transients," May 30, 1996). The staff found a need to clarify whether the fatigue analysis for RVI bolts (including bolts other than thermal shield replacement bolts) is a TLAA.

Request

1. Resolve the potential inconsistency between the implicit fatigue TLAA for RVIs, which is identified in BAW-2248A and the staff's safety evaluation for BAW-2248A (including Action Item 11), and the absence of such a TLAA in SLRA Section 4.3.2.2.

2. Clarify whether the fatigue analysis for RVI bolts (including bolts other than thermal shield replacement bolts), which is addressed in the engineering information record discussed above, is a TLAA. If so, provide the summary and disposition of the TLAA.

RAI 4.3.3-1

Regulatory Basis

Pursuant to 10 CFR 54.21(c), the SLRA must include an evaluation of time-limited aging analyses (TLAAs). The applicant must demonstrate that (i) the analyses remain valid for the period of extended operation, (ii) the analyses have been projected to the end of the period of extended operation, or (iii) the effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

Background

SLRA Section 4.3.3 addresses the fatigue TLAA for the non-Class 1 piping systems. In the section, Table 4.3.3-2 provides 80-year thermal cycle projections for the piping systems and the conservative cycle assumptions used in the cycle projections. Specifically, SLRA Table 4.3.3-2 describes the specific cycle numbers associated heatup, cooldown or other relevant cycles, or cycle number per a specific time period (e.g., monthly cycles).

Issue
However, the applicant did not describe how the conservative cycle basis of the cycle projections was determined. The staff needs additional information to clarify the basis of the cycle projections. In addition, the applicant did not describe the number of emergency feedwater actuation cycles per year, which is referenced in SLRA Table 4.3.3-2.

Request
1. Describe how the applicant determined the cycle projection basis for the non-Class 1 piping systems. As part of the response, discuss relevant references that were used to determine the conservative projection basis (e.g., by using the operating procedures, manuals or test requirements for the piping systems).

2. Provide the number of emergency feedwater actuation cycles per year, which is used in the cycle projections, and the basis for the yearly cycle estimate.

RAI 4.3.3-2

Regulatory Basis
Pursuant to 10 CFR 54.21(c), the SLRA must include an evaluation of time-limited aging analyses (TLAAs). The applicant must demonstrate that (i) the analyses remain valid for the period of extended operation, (ii) the analyses have been projected to the end of the period of extended operation, or (iii) the effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

Background
SLRA Section 4.3.3 indicates that none of the non-Class 1 piping lines in the scope for SLR exceed the allowable number of thermal cycles specified in the ANSI B31.1 Code and, therefore, the stress range reduction factors applied to the piping systems remain valid in all locations. In comparison, SLRA Table 4.3.3-2, Note 1 indicates that the pressurizer sampling piping stress range reduction factor has been reduced from 1.0 to 0.7 to allow a total of 45,000 cycles for the piping.

Issue
SLRA Section 4.3.3 does not clearly address whether the updated stress reduction factor for the pressurizer sampling system (from 1.0 to 0.7) is adequately used in the stress analysis for the piping system and whether the related stress analysis is acceptable.

Request
Clarify whether the thermal expansion stress (S_E) of the pressurizer sampling piping meets the acceptance criteria (i.e., the stress does not exceed the allowable stress range (S_A), as modified by applying the stress reduction factor of 0.7 for the piping). If not, provide justification for why the applicant's stress analysis results with the updated stress reduction factor are acceptable, including relevant references (e.g., edition and provisions of a code).

RAI 4.3.3-3

Regulatory Basis

Pursuant to 10 CFR 54.21(c), the SLRA must include an evaluation of time-limited aging analyses (TLAAs). The applicant must demonstrate that (i) the analyses remain valid for the period of extended operation, (ii) the analyses have been projected to the end of the period of extended operation, or (iii) the effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

Background

SLRA Section B3.1 indicates that the high energy line break (HELB) analyses do not exclude break locations based on fatigue so that the Fatigue Monitoring program does not apply to HELB.

Issue

The applicant's discussion in SLRA Section B3.1 does not clearly describe whether the implicit fatigue analysis (SLRA 4.3.3) for the non-Class 1 piping systems, which involves a stress range reduction factor, may have a potential impact on the HELB location postulation.

The following reference indicates that the applicant's HELB location postulation includes a criterion using the allowable stress range for thermal expansion (S_A) compared to the thermal expansion stress (Reference: Oconee Nuclear Station, Units 1, 2, and 3 – Issuance of Amendments Nos. 421, 423, And 422 Re: Revision Of Licensing Basis For High Energy Line Breaks Outside Of Containment, March 15, 2021 (ADAMS Accession No. ML21006A098)). S_A needs to be adjusted by the stress range reduction factor that is based on the implicit fatigue analysis (SLRA Section 4.3.3) for the non-Class 1 piping systems.

Therefore, the staff found a need to clarify whether the implicit fatigue analysis, which involves a stress range reduction factor, is used associated with the HELB location postulation. In addition, the staff finds a need to clarify whether the HELB location postulation does not use cumulative usage factors as an input for the break location determination.

Request

1. Clarify whether the implicit fatigue analysis (SLRA Section 4.3.3) for the non-Class 1 piping systems, which involves a stress range reduction factor, provides an input for the HELB location determination. If so, identify the HELB analysis as a TLAA and provide the disposition of the TLAA with a relevant revision to SLRA Table 4.1.4-2 (TLAA identification) as appropriate.

2. Clarify whether the pressurizer sampling piping is within the scope of the HELB analysis. If so, clarify whether the non-Class 1, implicit fatigue analysis (SLRA Section 4.3.3) for pressurizer sampling piping may have an impact on the HELB location determination.

3. Clarify whether the HELB location postulation uses cumulative usage factors to provide an input for the break location determination. If so, identify the HELB analysis as a TLAA and provide the disposition of the TLAA and its basis.

RAI 4.3.1-1

Regulatory Basis
Pursuant to 10 CFR 54.21(c), the SLRA must include an evaluation of time-limited aging analyses (TLAAs). The applicant must demonstrate that (i) the analyses remain valid for the period of extended operation, (ii) the analyses have been projected to the end of the period of extended operation, or (iii) the effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

Background
SLRA Section 4.3.1 indicates that the fatigue analyses are based upon numbers and amplitudes of thermal and pressure transients in UFSAR Table 5-2, "Transient Cycles for RCS [reactor coolant system] Components Except Pressurizer Surge Line" and UFSAR Table 5-23, "Operating Design Transient Cycles for Pressurizer Surge Line." Specifically, SLRA Table 4.3.1-1 describes the 80-year projected transient cycles in comparison with the design transient cycles that are described in UFSAR Tables 5-2 and 5-23.

In its review, the staff noted that the following transients in UFSAR Table 5-2 are not listed in SLRA Table 4.3.1-1: (1) Transient 3, power loading 8 to 100 percent power; (2) Transient 4, power unloading 100 to 8 percent power; (3) Transient 5, 10 percent step load increase; (4) Transient 6, 10 percent step load decrease; (5) Transient 12, hydrotests; (6) Transient 18, loss of feedwater heater; (7) Transient 19, feed and bleed operations; and (8) Transient 20, miscellaneous transients.

Issue
The SLRA does not clearly discuss why the transients discussed above are excluded from SLRA Table 4.3.1-1 that addresses the transient cycle projection and monitoring for 80-year operation.

Request

1. Justify the exclusion of the following transients from SLRA Table 4.3.1-1 for 80-year transient cycle projections and monitoring: (1) Transient 3, power loading 8 to 100 percent power; (2) Transient 4, power unloading 100 to 8 percent power; (3) Transient 5, 10 percent step load increase; (4) Transient 6, 10 percent step load decrease; (5) Transient 12, hydrotests; (6) Transient 18, loss of feedwater heater; (7) Transient 19, feed and bleed operations; and (8) Transient 20, miscellaneous transients. If a relevant reference is available regarding the transient exclusion, provide the reference, too.

2. If the exclusions of the transients are based on the large allowable transient cycles or insignificant fatigue effect for 80-year operation, discuss (1) why the allowable cycle numbers are large enough to exclude the transients in comparison with the actual cycles and (2) why the fatigue effects of the transients are insignificant.

RAI 4.3.1-2

Regulatory Basis
Pursuant to 10 CFR 54.21(c), the SLRA must include an evaluation of time-limited aging analyses (TLAAs). The applicant must demonstrate that (i) the analyses remain valid for the period of extended operation, (ii) the analyses have been projected to the end of the period of extended operation, or (iii) the effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

Background
SLRA Table 4.3.1-1, Note 1 and the related discussion in SLRA Section 4.3.4 indicate that the pressurizer surge line, main steam penetrations, and main feedwater penetrations have a reduced set of transient cycles in comparison with the design transient cycles listed in SLRA Table 4.3.1-1.

Issue
SLRA Sections 4.3.1 and 4.3.4 do not clearly provide the following information: (1) the reduced set of the transient cycles for the pressurizer surge line, main steam penetrations, and main feedwater penetrations and (2) whether the Fatigue Monitoring program will monitor actual cycles against the reduced set of the transient cycles.

Request

1. Provide the reduced set of transient cycles discussed in SLRA Table 4.3.1-1, Note 1 for the pressurizer surge line, main steam penetrations, and main feedwater penetrations. As part of the response, discuss why these transient cycles can reasonably represent the transient cycles for the pressurizer surge line, main steam penetrations, and main feedwater penetrations (e.g., compared to 80-year projected cycles).

2. Clarify whether the Fatigue Monitoring program will perform monitoring to ensure that the actual transient cycles do not exceed the reduced cycles addressed in SLRA Table 4.3.1-1, Note 1. If not, justify why the absence of such monitoring is acceptable to ensure that the actual cycles do not exceed the reduced set of cycles.

RAI 4.3.1-3

Regulatory Basis
Pursuant to 10 CFR 54.21(c), the SLRA must include an evaluation of time-limited aging analyses (TLAAs). The applicant must demonstrate that (i) the analyses remain valid for the period of extended operation, (ii) the analyses have been projected to the end of the period of extended operation, or (iii) the effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

Background
UFSAR Table 5-2, Note 2 indicates that, in order to analytically demonstrate a usage factor of less than 1.0, certain welds associated with the emergency high pressure injection (HPI) nozzles have been qualified for fewer than the design number of cycles of two transients as follows. Specifically, the sum of the cycles of the "manual actuation of HPI system after reactor trip" transient (Transient 8) and the cycles of "rapid depressurizations" transient (Transient 9) cannot exceed 29 cycles.

Similarly, Note 7 of UFSAR Table 5-2 explains that the reactor vessel closure head assemblies are limited to 5000 cycles of "power loading and unloading" transient (Transients 3 and 4) and 15 cycles of "hydrotests" transient (Transient 12).

Issue
In contrast, SLRA Table 4.3.1-1 does not include the design transients that have the reduced set of transient cycles that are specified in Notes 2 and 7 of UFSAR Table 5-2. The staff needs to resolve this potential inconsistency.

Request
1. Clarify whether the reduced transient cycles specified in Notes 2 and 7 of UFSAR Table 5-2 are also applied to SLRA Table 4.3.1-1 that describes the design cycles and cycle projections for subsequent license renewal fatigue monitoring.

2. If there are additional components for which reduced transient cycles are applied (other than HPI nozzles and the reactor vessel closure head assemblies), identify the components and the reduced transient cycles. The response to this request may exclude the discussion on the pressurizer surge line, main steam penetrations and main feedwater penetrations, which are addressed in a separate RAI.

3. Clarify whether the Fatigue Monitoring program will perform monitoring to ensure that the actual transient cycles do not exceed the reduced cycles addressed in request items 1 and 2 above. If not, justify why the Fatigue Monitoring program does not monitor the reduced transient cycles (such as reduced cycles for Transients 8 and 9 and Transients 3, 4 and 12).

RAI 4.3.1-4

Regulatory Basis
Pursuant to 10 CFR 54.21(c), the SLRA must include an evaluation of time-limited aging analyses (TLAAs). The applicant must demonstrate that (i) the analyses remain valid for the period of extended operation, (ii) the analyses have been projected to the end of the period of extended operation, or (iii) the effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

Background
SLRA Section 4.3.5 addresses the analytical evaluation of flaws for the 80-year operation. The section indicates that the flaws identified for initial license renewal have been re-evaluated or the component containing the flaw has been replaced. SLRA Section 4.3.5 also explains that these reanalyzed flaws are now acceptable for their full controlling design basis transient cycles as discussed in Section 4.3.1.

Issue
In comparison, UFSAR Table 5-2, Note 1 indicates that certain components have flaw tolerance evaluations (as addressed in UFSAR Sections 5.2.2 and 5.2.3.12.4) and that these evaluations assume a reduced number of heatup and cooldown cycles. Therefore, the staff finds a need to further confirm that the analytical evaluations of the flaws discussed in SLRA Section 4.3.5 use the design transient cycles identified in SLRA Section 4.3.1 without using a reduced set of transient cycles. The staff needs a similar confirmation for the weld overlay fatigue analysis discussed in SLRA Section 4.3.6.

Request
1. Clarify whether the analytical evaluations of the flaws discussed in SLRA Section 4.3.5 use the design transients and cycles identified in SLRA Section 4.3.1 without assuming a reduced set of transient cycles. If not, identify the reduced set of transient cycles and discuss why the reduced cycles can reasonably represent the transient cycles for the flaws.

2. Clarify whether the transients and cycles used in SLRA Section 4.3.6 (weld overlay fatigue analysis) are consistent with the design transients and cycles identified in SLRA Table 4.3.1-1. If not, identify the reduced set of transient cycles and discuss why the reduced cycles can reasonably represent the transient cycles for the weld overlays.

3. Clarify whether a certain fraction of the design cycles is used for the flaw evaluation or weld overlay fatigue analysis (e.g., the 60-year design cycles were divided by 6 to estimate the cycles for the 10-year inspection interval cycles). If so, clarify whether the inspection frequency for the flaws and weld overlays is consistent with the time period corresponding to the certain fraction of the design cycles in order to ensure the component integrity.
4. Clarify whether the Fatigue Monitoring program will ensure that the actual transient cycles do not exceed the transient cycles that are assumed in the flaw evaluations and weld overlay fatigue analysis. If not, provide the justification.

RAI 4.3.4-1

Regulatory Basis
Pursuant to 10 CFR 54.21(c), the SLRA must include an evaluation of time-limited aging analyses (TLAAs). The applicant must demonstrate that (i) the analyses remain valid for the period of extended operation, (ii) the analyses have been projected to the end of the period of extended operation, or (iii) the effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

Background
SLRA Section 4.3.4, as supplemented by the SLR-ONS-TLAA-0306NP report, discusses the environmentally-assisted fatigue (EAF) screening process to determine the leading EAF locations. The section indicates that, to reduce excess conservatism for stainless steel location due to the very large maximum F_{en} (environmental fatigue correction factor), an estimated F_{en} is calculated as the average of the value based on a qualitative estimate of strain rate and the value based on the worst possible strain rate.

Issue
The staff needs to clarify the meanings of (1) the qualitative estimate of strain rate and (2) the worst possible strain rate.

Request
1. Clarify the meanings of (1) the qualitative estimate of strain rate and (2) the worst possible strain rate in the discussion on the reduction of the excessive conservatism.
2. For the other materials (e.g., carbon steel and nickel alloy), discuss how the strain rate is determined in the F_{en} calculations.

RAI 4.3.4-2

Regulatory Basis
Pursuant to 10 CFR 54.21(c), the SLRA must include an evaluation of TLAAs. The applicant must demonstrate that (i) the analyses remain valid for the period of extended operation, (ii) the analyses have been projected to the end of the period of extended operation, or (iii) the effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

Background
SLRA Section 4.3.4, as supplemented by the SLR-ONS-TLAA-306NP report, indicates that, for locations where the conservatively determined screening CUF_{en} (environmental cumulative usage factor) exceeded 1.0, further evaluations were performed in accordance with NUREG/CR-6909, Revision 1.

Issue
The SLRA does not clearly discuss how the conservatism associated with the screening CUF_{en} calculation has been removed in the further evaluations.

Request
Discuss how the conservatism associated with the screening CUF_{en} calculation has been removed to refine the calculations in the further evaluations.

RAI 4.3.4-3

Regulatory Basis
Pursuant to 10 CFR 54.21(c), the SLRA must include an evaluation of TLAAs. The applicant must demonstrate that (i) the analyses remain valid for the period of extended operation, (ii) the analyses have been projected to the end of the period of extended operation, or (iii) the effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

Background
SLRA Section 4.3.4, as supplemented by the SLR-ONS-TLAA-306NP report, indicates that the high pressure injection (HPI) piping stop valve-to-check valve location is bounding for the HPI nozzle that is identified in NUREG/CR-6260 as one of the leading locations for EAF in Babcock and Wilcox designed plants.

Issue
The staff needs the F_{en} (environmental fatigue correction factor) and CUF_{en} values of these piping locations for 80 years to confirm the adequacy of the applicant's evaluation.

Request
1. Provide the F_{en} and CUF_{en} values of the HPI stop valve-to-check valve weld and HPI nozzle to confirm that the HPI stop valve-to-check valve weld is bounding for the HPI nozzle in the EAF analysis. In addition, describe the fabrication materials of these welds.

2. If periodic inspections are performed on these welds (e.g., inspections on nickel alloy locations), describe the inspection method, frequency and results to confirm that the inspection results are consistent with the fatigue analysis (e.g., absence of fatigue cracking).

RAI 4.3.4-4

Regulatory Basis
Pursuant to 10 CFR 54.21(c), the SLRA must include an evaluation of TLAAs. The applicant must demonstrate that (i) the analyses remain valid for the period of extended operation, (ii) the analyses have been projected to the end of the period of extended operation, or (iii) the effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

Background
Table 4.3.4-1 of SLRA Section 4.3.4, as supplemented by the SLR-ONS-TLAA-306NP report, addresses the leading EAF locations. The table indicates that the control rod drive mechanism (CRDM) weld is part of the reactor vessel closure head (RVCH) replacement. The table also indicates that the 80-year CUF of the CRDM weld is based on reduced "power loading/unloading" cycles. The table further states that the "power loading/unloading" transients are excluded from the Fatigue Monitoring program, which will require reconsideration if the applicant implements flexible power operation (i.e., operation involving load-following).

Issue
Given the reduced "power loading/unloading" cycles used in the CUF_{en} calculation, the staff notes that the transients may need to be monitored by the Fatigue Monitoring program to ensure that the projection basis with the reduced cycles remains valid. However, these transients are excluded from the fatigue monitoring. The staff also needs to clearly identify the specific CRDM weld discussed in Table 4.3.4-1 of SLRA Section 4.3.4.

Request
1. Describe which weld of the CRDM is specifically referenced in Table 4.3.4-1 of SLRA Section 4.3.4 (e.g., reactor vessel head penetration nozzle weld or CRDM housing weld above the reactor vessel head closure).

2. Describe the reduced cycles and 80-year projected cycles for the CRDM welds to confirm that the reduced cycles are comparable to the 80-year projected cycles.

3. Provide justification for excluding the "power loading/unloading" transients from the fatigue monitoring even though the reduced cycles are used in the CUF_{en} calculation for the CRDM weld. If it cannot be justified, include the power loading/unloading transients in the scope of the Fatigue Monitoring program to ensure the cycle projection basis remains valid.

4. If any components or piping other than the CRDM welds in the EAF analysis use reduced cycles compared to the design cycles in UFSAR Tables 5-2 and 5-23, identify (1) such components and piping and (2) the reduced transient cycles for the components and piping. In addition, provide justification for using the reduced cycles in the EAF analysis and clarify whether the Fatigue Monitoring program will be used to ensure that the actual cycles do not exceed the reduced cycles used in the EAF analysis.

RAI 4.3.4-5

Regulatory Basis
Pursuant to 10 CFR 54.21(c), the SLRA must include an evaluation of TLAAs. The applicant must demonstrate that (i) the analyses remain valid for the period of extended operation, (ii) the analyses have been projected to the end of the period of extended operation, or (iii) the effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

Background
The following reference provides the fatigue analysis and cumulative usage for the steam generator tube-to-tubesheet welds (Reference: Calculation Number OSC 11520, Revision 0, Replacement Once through Steam Generators Tube-to-Tubesheet Weld Stress analysis). Table 1.1 of the reference indicates that the projected cumulative usage factor of the welds is slightly less than the design limit (1.0).

Issue
However, the reference above and SLRA Section 4.3.4, as supplemented by SLR-ONS-TLAA-0306NP, do not clearly address the EAF analysis for the steam generator tube-to-tubesheet welds. Therefore, the staff needs additional information regarding the EAF analysis for these welds.

Request
1. Clarify whether the steam generator tube-to-tubesheet welds have been evaluated in the EAF analysis. If so, provide the projected 80-year CUF and CUF_{en} values.

2. If these tube-to-tubesheet welds are bounded by a leading location in terms of EAF analysis, identify the leading location.

3. Discuss how the applicant will manage the aging effect of cumulative fatigue damage for the tube-to-tubesheet welds.

RAI 4.3.4-6

Regulatory Basis
Pursuant to 10 CFR 54.21(c), the SLRA must include an evaluation of TLAAs. The applicant must demonstrate that (i) the analyses remain valid for the period of extended operation, (ii) the analyses have been projected to the end of the period of extended operation, or (iii) the effects of aging on the intended function(s) will be adequately managed for the period of extended operation

Background
The following reference indicates that the 80-year CUF_{en} for the venturi exceeds the fatigue design limit (1.0) but the CUF_{en} is acceptable because it is not a reactor coolant pressure boundary component that requires an EAF analysis (Reference: Section 8.5 of ANP-3898NP, Revision 0, “Framatome Reactor Vessel and RCP TLAA and Aging Management Review Input to the ONS SLRA”).

Issue
However, the related discussion in the reference above does not clearly discuss how the applicant will manage the aging effect of cumulative fatigue damage for the venturi.

Request
1. Describe the intended function of the venturi and how the applicant will manage the aging effect of fatigue for the venturi. As part of the response, discuss periodic inspections (e.g., visual, surface or volumetric examination) that will be performed to confirm the integrity of the venturi.

2. Discuss any conservatism associated with the CUF_{en} calculation for the venturi. In addition, provide the 80-year CUF value for the venturi as baseline information.

3. Clarify whether the applicant's aging management review (AMR) results adequately identify the aging management for the venturi.

RAI 4.3.4-7

Regulatory Basis
Pursuant to 10 CFR 54.21(c), the SLRA must include an evaluation of TLAAs. The applicant must demonstrate that (i) the analyses remain valid for the period of extended operation, (ii) the analyses have been projected to the end of the period of extended operation, or (iii) the effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

Background
Table 4.3.4-1 of SLRA Section 4.3.4, as supplemented by the SLR-ONS-TLAA-306NP report, described the leading EAF locations for thermal zones. For the following thermal zones, the fabrication material for the leading EAF locations is only stainless steel: (1) pressurizer lower head and surge line; (2) pressurizer spray; (3) high pressure injection; (4) decay heat removal system; and (5) core flood.

Issue
The SLRA does not clearly discuss why the thermal zones mentioned above do not identify any leading EAF locations that are fabricated of materials other than stainless steel.

Request
1. Justify why the following thermal zones do not identify any leading EAF locations that are fabricated of materials other than stainless steel (e.g., carbon steel and nickel alloy): (1) pressurizer lower head and surge line; (2) pressurizer spray; (3) high pressure injection; (4) decay heat removal system; and (5) core flood.

2. If the applicant determined that the leading EAF locations fabricated of stainless steel bound the locations fabricated of other materials in each thermal zone, provide the basis of the determination (e.g., comparison of the F_{en} and CUF_{en} values between the highest CUF_{en} locations fabricated of the different materials in each thermal zone).