

From: [Sayoc, Emmanuel](#)
To: [Paul Aitken](#); [Eric A Blocher](#)
Cc: [Wu, Angela](#); [Oesterle, Eric](#)
Subject: Surry SLRA - Transmittal of Draft RAIs for Your Review
Date: Wednesday, May 22, 2019 10:34:00 AM
Attachments: [017 Surry FAC RAI Chereskin \(JG\) \(May-19-2019\).docx](#)
[147.07 Surry SLRA - RAI - TLAA Section 4.7.7 RPV Underclad Cracks JMedoff MYoo Rev5 05-16-2019 ERO.docx](#)
[016A Surry SLRA - RAI - PWR Vessel Internals AMP JMedoff MYoo R4 05-16-2019 DA ERO DA.DOCX](#)
Importance: High

Paul, Eric,

Attached are the draft RAIs for your review. We will schedule a clarification conference call shortly per your request.

RAI Number	Issue	Branch	Reviewer
B.2.1.8-1	Flow-Accelerated Corrosion	MCCB	Chereskin
B.2.1.8-2	Flow-Accelerated Corrosion	MCCB	Chereskin
B.2.1.8-3	Flow-Accelerated Corrosion	MCCB	Chereskin
4.7.7-1	TLAA - , Cracking Associated with Weld Deposited Cladding	MVIB	Medoff, Yoo
B.2.1.7-1	PWR Vessel Internals," And the Gap Analysis for Reactor Internals Provided in SLRA Appendix C	MVIB	Medoff, Yoo
B.2.1.7-2	PWR Vessel Internals," And the Gap Analysis for Reactor Internals Provided in SLRA Appendix C	MVIB	Medoff, Yoo
B.2.1.7-3	PWR Vessel Internals," And the Gap Analysis for Reactor Internals Provided in SLRA Appendix C	MVIB	Medoff, Yoo

Thank You
 Emmanuel "Manny" Sayoc
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 301-415-4084

Subsequent License Renewal Application (SLRA) for Surry Power Station, Units 1 and 2
Requests for Additional Information (RAIs) for SRLA AMP B2.1.7, "PWR Vessel Internals,"
And the Gap Analysis for Reactor Internals Provided in SLRA Appendix C

TRP 016A AMP RAIs

Primary Reviewer: James Medoff
Peer Reviewer: Mark Yoo

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

RAI B2.1.7-1

Background:

The applicant's gap analysis (as amended in the applicant's April 2, 2019 supplement) includes the RVI component-specific aging effect mechanism assessments, component-specific likelihood of failure, FMECA, and safety and economic consequence risk assessment rankings, component-specific subsequent license renewal (SLR) inspection category designations, and inspection bases for the components, as assessed for an 80-Year SLR basis.

Issue: The staff seeks additional clarifications for the following matters:

1. *Conflicting "SLR Inspection Category" designations for core barrel flange base metal surfaces.* SLRA Table C4.3-3 (as amended), identifies that the core barrel flange surfaces are SLR "Existing Program" category components. In contrast, SLRA Table C3.3-3, as amended in the April 2, 2019 letter, identifies that the CRGT core barrel flange surfaces are SLR "Expansion" category components.
2. *SLRA supplement changes to the line item in SLRA Table C3.3-3 that applies to the core barrel outlet nozzles.* In Enclosure 1 of the applicant's April 2, 2019 SLRA supplement, the applicant stated that the component-specific line item for the core barrel outlet nozzles in SRLA Table C3.3-3 was being amended to change the "SLRA Inspection Category" ranking for the components from "E" ("Expansion" components) to "N" (No Addition Measures components). However, the application supplement did not include the markup of the applicable Table C3.3-3 line item for the outlet nozzles in Enclosure 2 of the April 2, 2019 supplement.
3. *Amended Gap Analysis Results for core barrel assembly lower flange welds (LFWs).* SLRA Table C3.3-3, as amended in the April 2, 2019 letter, and SLRA Table C4.3-1 identify that the core barrel LFWs are SLR "Primary" category components. In contrast,

SLR Table C.4.3-2 identifies that the core barrel LFWs are SLR “Expansion” category components.

4. Gap analysis results for CRGT flexures in Unit 1. The staff notes that the line item for the CRGT flexures (Unit 1) in SLRA Table C3.3-3 places the components in the “No Additional Measures” category even though the line item identifies that the flexures have a high safety consequence risk ranking (i.e., a ranking of “C”).

Requests:¹

1. Identify the correct “SLR Inspection Category” designation for the core barrel flanges (i.e., for the base metal surfaces of the flanges).
2. Identify the correct “SLR Inspection Category” designation for the core barrel outlet nozzles.
3. Identify the correct “SLR Inspection Category” designations for the core barrel assembly LFWs.
4. Clarify why the SLRA Table C3.3-3 places the Unit 1 CRGT flexures into the SLR “No Additional Measures” category when the flexures have been given a “Safety Consequence Risk Category” ranking of “C”.

¹ The requests in RAI B2.1.7-1 assume that the applicant will assess the need for further amendments of the line items in SLRA Tables C3.3-3, C4.3-1, C4.3-2, or C4.3-3 accordingly. The issue section of the RAI identifies where the potential conflicts may arise in the gap analysis table entries.

RAI B.2.1.7-2 (Clarifications for Programmatic Enhancement No. 7)

Background:

The program in SLRA AMP B.2.1.7, "PWR Vessel Internals," includes programmatic Enhancement No. 7. In this enhancement, the applicant states that "procedures will be revised to address expansion criteria when degradation occurs for clusters of baffle-former bolts." The enhancement also includes the following additional statement:

"MRP 2018-002 identifies expansion criteria as a Needed requirement (per NEI 03-08) to include one-time visual (VT-3) examination of barrel-former bolts if large clusters of baffle-former bolts are found during the initial volumetric (UT) examination."²

Additional "Expansion" criteria for performing ultrasonic test (UT) inspections of barrel-former bolts are given in Table 5-3 of EPRI Report No. 3002005349, Revision 1 (MRP-227, Rev. 1).

Issue: The staff understands that the program currently references two different sources for the acceptance criteria that will be applied to potential contingency inspections of the barrel-former bolts. As a result, the application does not clearly identify whether MRP-2018-002, MRP-227 Revision 1, or some other industry report will be used to establish the acceptance criteria to assess the inspection needs for the barrel-former bolts.

Request: Clarify whether the acceptance criteria for initiating and performing potential "Expansion"-based inspections of the barrel-former bolts will be based on: (a) MRP-227, Revision 1, (b) MRP-2018-002, (c) the combination of the two reports (i.e., MRP-227, Revision 1, for UT inspections of the bolts and MRP-2018-002 for initiating VT-3 visual inspections of the bolts), or (d) an alternative report that provides the basis for inspecting the barrel-former bolts. If it is an alternate report, identify the source (report reference) that will be used to provide the acceptance criteria for initiating "Expansion"-based inspections of the barrel-former bolts, and clarify whether the report's methodology has been endorsed for use by the NRC or provide an appropriate justification for its use.

² The staff acknowledges that the term clusters in the enhancement is referring to a cluster of degraded bolts, as defined in NSAL 16-1, Revision 1 or in MRP-2017-009.

RAI B.2.1.7-3 (Minimum Inspection Coverages for Core Barrel Assembly “Expansion”-Category Welds Referenced in Enhancement Nos. 9 and 16)

Background:

The program in SLRA AMP B.2.1.7, “PWR Vessel Internals,” includes programmatic Enhancement Nos. 9 and 16. Collectively, in these enhancements, the applicant states that the minimum EVT-1 visual inspection coverages for the core barrel assembly lower flange welds (LFWs), upper axial welds (UAWs), middle axial welds (MAWs), lower axial welds (LAWs), and upper girth welds (UGWs) is a minimum of 50% of the weld surface.

Issue: It is not clear to the NRC staff that the proposed minimum inspection coverage of 50% is consistent with MRP 2018-026 which specifies: “a minimum coverage of 75% of the weld length on the surface being examined shall be achieved; however, for welds with limited access (Note 4), a minimum examination coverage of 50% of the weld length on the surface being examined shall be achieved”.

Requests:

1. For the Surry-specific RVI designs, clarify whether the MAWs and LAWs are restricted by the presence of a thermal shield, thermal panels, or other components located near the welds).
2. Provide the basis for applying a minimum EVT-1 coverage criterion of 50% for potential “Expansion”-based EVT-1 visual inspections that may be performed on the core barrel assembly UGWs, LFWs, and UAWs. If applicable, identify any components near the UGWs, LFWs, and UAWs that may: (a) restrict access to the components, and (b) limit the ability of Dominion to achieve a minimum 75% coverage criterion for the EVT-1 based contingency inspections of these weld components, as established in MRP 2018-026.

Regulatory Basis: 10 CFR 54.21(a)(3) requires an applicant to demonstrate that the effects of aging for structures and components will be adequately managed so that the intended function(s) will be maintained consistent with the current licensing basis (CLB) 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 CLB. In order to complete its review and enable making a finding under 10 CFR 54.29(a), the staff requires additional information in regard to the matters described below.

RAI B.2.1.8-1

Background:

In SLRA, Section B2.1.8, “Flow-Accelerated Corrosion,” the applicant claimed consistency with the GALL-SLR Report AMP XI.M17, “Flow-Accelerated Corrosion.” SLRA Section B2.1.8 states that the erosion activity implements the recommendation of EPRI 3002005530, “Recommendations for an Effective Program Against Erosive Attack.” The “parameters monitored or inspected,” “detection of aging effects,” and “monitoring and trending” program elements for GALL-SLR Report AMP XI.M17 discuss recommendations to monitor, detect, and trend degradation due to erosion mechanisms (e.g. cavitation, flashing, etc.).

During the In-Office audit, the staff reviewed the program basis document ETE-SLR-2018-1311, “Surry Subsequent License Renewal Project – Aging Management Program Evaluation Report – Flow-Accelerated Corrosion,” Revision 1, to evaluate whether the applicant is consistent with the GALL-SLR Report AMP XI.M17 recommendations for the flow-accelerated corrosion (FAC) program. In the document, the applicant stated that the FAC erosion module in CHECWORKS will be used to assist in the development of the inspection plan for the Erosion Control program.

Issue:

The staff has not previously reviewed EPRI 3002005530. Neither the Surry SLRA nor the applicant’s procedures provide information that describes how the FAC erosion module within the CHECWORKS software will be used to model erosion, and how these results will be used in planning erosion inspections.

Request:

Provide a justification for how the FAC erosion module will meet the recommendations of the GALL-SLR with respect to monitoring effects of wall thinning due to erosive mechanisms (including methods to calculate wear rate), its use in planning inspections for erosive degradation, as well as for monitoring and trending potential degradation due to erosive mechanisms. Additionally, describe how the guidance in EPRI 3002005530 incorporates the use of the FAC erosion module into the Surry erosion program for the program elements described above.

RAI B.2.1.8-2

Background:

In SLRA, Section B2.1.8, “Flow-Accelerated Corrosion [FAC],” the applicant claimed consistency with the GALL-SLR Report for the AMP XI.M17, “Flow-Accelerated Corrosion.” The GALL-SLR Report “detection of aging effects” program element, states that guidance for

inspection scope expansions, when unexpected or inconsistent results are identified in the initial sample scope, is described in the Electric Power Research Institute document NSAC-202L, Revision 4.

Guidance in NSAC-202L, Section 4.4.6 “Expanded Sample Inspection” states that the reasons for any unexpected or inconsistent inspection results should be investigated by performing an updated FAC predictive analysis, conducting additional inspections, and making material determinations as appropriate. In addition, expanded sample inspections should include any component within two diameters of the affected component and “a minimum of the next two most susceptible components from the relative wear ranking in the same train as that containing the piping component displaying significant wear.”

During the In-Office audit, the staff reviewed the program basis document ETE-SLR-2018-1311, “Surry Subsequent License Renewal Project – Aging Management Program Evaluation Report – Flow-Accelerated Corrosion,” and procedure ER-AA-FAC-102, “Flow-Accelerated Corrosion Inspection and Evaluation Activities,” to evaluate whether the applicant is consistent with the GALL-SLR Report recommendations for the Flow-Accelerated Corrosion AMP. For the “detection of aging effects” program element, Section 3.4.2 of the program basis document states that an evaluation is performed to determine the extent of expansion and cites ER-AA-FAC-102, Section 3.9.4. In addition, Section 2.1 of the program basis document states that evaluations documenting various activities including sample expansion are independently reviewed by a qualified FAC engineer. Procedure ER-AA-FAC-102, Section 3.9.4, “Inspection Scope Expansion,” includes inspection expansion to components upstream and downstream of the degraded component but does not specify any distance. The procedure includes a review of any CHECWORKS model but does not include further discussion regarding the performance of an updated FAC analysis or include, as a minimum, the next two most susceptible components.

To evaluate prior scope expansion documentation, the staff reviewed operating experience associated with the FAC Program outage summary documents ETE-CME-2017-0013, “Surry Unit 2, 2017 Refueling Outage, Results of the Flow-Accelerated Corrosion Program,” and ETE-CME-2019-0002, “Surry Unit 1, 2018, Refueling Outage, Results of the Flow-Accelerated Corrosion Program,” which provided examples of where ultrasonic thickness testing has detected unacceptable or inconsistent wall thickness values. The staff also reviewed condition report CR1096902 “Significant Wear Observed During FAC Inspection (5”-SGS-11-151),” to determine the extent of the scope expansion performed by the applicant when unexpected degradation is found as a result of inspections.

Issue:

It is unclear that the requirements of procedure ER-AA-FAC-102, Section 3.9.4 are consistent with the guidance in NSAC-202L, Section 4.4.6, regarding inspection scope expansion. The implementing procedure does not address consideration of performing an updated FAC predictive analysis or making material determinations. In addition, the distance for inspecting upstream and downstream is not discussed and the inclusion of a minimum of the next two most susceptible components from the relative ranking in the same train is not included. In addition, it is not clear that the FAC procedure includes an independent review of sample expansion documentation by a qualified FAC engineer as stated in SLRA Section B2.1.8.

The staff notes that its review of operating experience document listed above did not provide information on how far upstream and downstream piping was inspected during a scope expansion, nor did they provide detail on whether the next two most susceptible components in the CHECWORKS model were inspected for potential FAC-related degradation.

Request:

Provide information regarding scope expansion activities to show that either the Surry FAC program implementation includes the guidance in NSAC-202L, Section 4.4.6, or provide bases to show that aging will be effectively managed without being consistent with the guidance in NSAC-202L, Section 4.4.6. Also, provide information regarding the implementation of independent reviews of evaluations documenting sample expansions by qualified FAC engineers, as stated in SLRA Section B2.1.8.

RAI B2.1.8-3

Background:

As supplemented by letter dated April 2, 2019, SLRA Table 3.3.2-6 “Bearing Cooling,” was modified to address the potential for erosion in valve bodies constructed of several different materials. The supplement also states that cavitation in this system could be caused by valve throttling. Additionally, condition report CR1031398, “BC Valve – Indication of Cavitation,” describes cavitation in a Unit 1 bearing cooling valve and notes that the valve was previously replaced in 2013 due to a pin hole leak in the valve body. This CR also notes that the current non-destructive examination strategy doesn’t evaluate the valve body for wall thinning. The staff notes that condition report CR1026621, “2-BC-505 Has a Through-Wall Leak,” describes a through-wall leak for the corresponding Unit 2 valve; however, the cause of the leak was not included in the summary documentation.

The applicant’s erosion susceptibility evaluation (ESE) (ETE-CME-2018-1002, Revision 1, “Transmittal of True North Consulting Technical Report BP-2017-0045-TR-01, Erosion Susceptibility Evaluation – Surry,” September 2018) designated the bearing cooling system as not being susceptible to cavitation because the cavitation index is greater than 2.5. The ESE states that the bearing cooling system is a closed-loop system which does not have large enough pressure drops for cavitation to occur. The staff notes that comments for other systems in the ESE identify the potential for cavitation and flashing downstream of throttle valves and orifices. The ESE indicates that the criteria for the cavitation index greater than 2.5 is “a rule of thumb” and cites a reference to a valve manufacturer publication. The associated implementing procedure, ER-AA-FAC-105, “Erosion Control Program,” Section 3.1.1 states that the ESE is to be periodically updated based on relevant operating experience.

Issue:

Although operating experience indicates that valves in the bearing cooling system are susceptible to wall thinning due to cavitation, the ESEs for both units identify the bearing cooling system as not being susceptible to erosive mechanisms, including cavitation. The staff notes that the exclusion criteria for the “cavitation index” and “infrequent operation” parameters cited in the ESE are inconsistent with the corresponding criteria provided in the NRC-approved EPRI 112657, “Risk Informed Inservice Inspection Evaluation Procedure.” Consequently, it is not clear to the staff that there are adequate bases for the exclusion criteria parameters used in the ESE.

Request:

Provide information regarding the bases for the ESE exclusion criteria. Include a discussion about the determination that the bearing cooling system is not susceptible to erosion mechanisms with a specific explanation for why operating experience does not appear to support the ESE determination. Also provide information regarding whether other systems

determined to be not susceptible to erosion mechanisms could be similarly affected. Include a discussion regarding how operating experience has been considered by the current ESE.

Subsequent License Renewal Application (SLRA) for Surry Nuclear Plant, Units 1 and 2
SLRA TLAA Section 4.7.7, Cracking Associated with Weld Deposited Cladding

Request for Additional Information (RAI) for TRP Assignment 147.07

Reviewer: James Medoff

Peer Reviewer: Mark Yoo

RAI 4.7.7-1

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

For time-limited aging analyses (TLAAs) that are used as the basis for meeting the aging management requirements of 10 CFR 54.21(a)(3), the regulation in 10 CFR 54.21(c)(1) requires the applicant to demonstrate that the TLAAs are acceptable during the period of operation in accordance with the regulatory criteria in §54.21(c)(1)(i), (ii), or (iii). For TLAAs that are identified and dispositioned in accordance with 10 CFR 54.21(c)(1)(ii), the applicants must demonstrate that the analysis has been projected to the end of period of extended operation.

Background: The applicant provides its time-limited evaluation of underclad cracking in SLRA Section 4.7.7, "Cracking Associated with Weld Deposited Cladding" (henceforth, referred to as the TLAA on RPV Underclad Cracking). The applicant states that the current flaw evaluation in WCAP-15338-A, which assessed postulated cladding cracks over a 60-Year licensing basis was reassessed in PWR Owners Group Report No. PWROG-17031-NP, Revision 0, to account for potential flaw growth over an 80-year licensing basis. The applicant states that the TLAA is acceptable in accordance with the criterion stated in 10 CFR 54.21(c)(1)(ii) because the analysis has been projected to the end of the subsequent period of extended operation.

Issues: In order to demonstrate that the cycle-dependent flaw tolerance or crack growth evaluations of PWROG-17031-NP, Revision 1, do not involve a fluence dependency (as defined for the current operating term in accordance with Criterion 3 in 10 CFR 54.3a), the staff will need further demonstration that the use of a fracture toughness value of 200 ksi- $\sqrt{\text{in}}$ represents a valid, conservative lower-bound fracture toughness input for the values of K_{Ia} and K_{Ic} cited in the analysis.

Request: Please justify the use of a fracture toughness of 200 ksi- $\sqrt{\text{in}}$ as a conservative, lower bound value for the values of K_{Ia} and K_{Ic} in the analysis.