BRAIDWOOD STATION, UNIT 1 AND BYRON STATION, UNIT 1

REQUEST FOR ADDITIONAL INFORMATION

STEAM GENERATOR LICENSE RENEWAL RESPONSE TO COMMITMENT 10

DOCKET NOS. 50-456 and 50-454

**RAI C10-1**

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 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 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 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.

Background

In December 2015, the NRC published the final "Safety Evaluation Report Related to the License Renewal of Byron Station, Units 1 and 2, and Braidwood Station, Units 1 and 2," as NUREG-2190, Volume 1 (ADAMS Accession No. ML15350A038) and NUREG-2190, Volume 2 (ML15350A041). In NUREG-2190, Volume 2, Appendix A, "Byron Station Units 1 and 2, and Braidwood Station, Units 1 and 2, License Renewal Commitments," Commitment 10 parts 1 and 2 gave Bryon Station, Units 1 and 2, and Braidwood Station, Units 1 and 2, three options to fulfill this commitment. By letter dated June 7, 2022 (ML22158A294), Constellation Energy Generation, LLC (CEG), submitted to the NRC a response to Commitment 10 of the Braidwood Station, Unit 1 and Byron Station, Unit 1 safety evaluation report. Commitment 10 is related to enhancing the Steam Generators program by validating that primary water stress corrosion cracking (PWSCC) of divider plate welds to the primary head and tubesheet cladding is not occurring for Braidwood Units 1 and 2 and Byron Units 1 and 2, and by validating that PWSCC of the tube-to-tubesheet welds is not occurring for Braidwood Unit 1 and Byron Unit 1. Braidwood Unit 1 and Byron Unit 1 have chosen Option 2, Analysis and Analysis – Susceptibility, for both Commitment 10 parts 1 and 2. The response does not include discussion of part 1 of Commitment 10 for Braidwood Unit 2 or Byron Unit 2.

Issue

Section 7.3, “End-of-Life Flaw Size,” in Revision 1 of BWXT Report No. M2004-SR-01, “Byron / Braidwood Unit 1 Flaw Tolerance Evaluation at Primary Head / Tubesheet / Divider Plate Triple Point Analysis Report,” states that a value of [[ ]] was used for the upper shelf fracture toughness (KIC) of the steam generator primary head base material and is based on the equation in A-4200 and Figure A-4200-1 in Section XI of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code). However, the staff is unclear on why this value is appropriate.

Request

Please discuss:

1. The basis for using [[ ]] by addressing the following, (i) the impacts of the toughness selection on the analysis conservatism as compared to the analyses in EPRI Report 3002002850, “Steam Generator Management Program: Investigation of Crack Initiation and Propagation in Steam Generator Channel Head Assembly,” which uses a value of 200 ksi-√in for the same material; (ii) it is unclear to the staff how the technical paper[1] referenced in the audit shows that KIC would be at least [[ ]] for all forgings; and (iii) according to PVP2011-57173, “A Proposal for the Maximum KIC for Use in ASME Code Flaw and Fracture Toughness Evaluations,” even 200 ksi-√in can be a non-conservative value, especially at higher temperatures.

2. Regarding the use of [[

   ]], if a lower fracture toughness value was determined to be appropriate based on the response to 1 above, what would be the effect on the end-of-life flaw acceptability if the critical crack size was adjusted according to [[ ]]?

[1] Suzuki, K et al, “Application of high strength MnMoNi steel to pressure vessels for nuclear power plant,” Nuclear Engineering and Design 206 (2001), 261-278.

**RCI C10-1**

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Issue

Section 5.0, "Materials and Properties," in Revision 1 of BWXT Report No. M2004-SR-01 states that the material properties used in the flaw tolerance evaluation were taken from Part D in Section II of the ASME Code. However, during the audit, CEG stated that the material properties were taken from Division 1 Appendices in Section III of the ASME Code.

Request

Please confirm that the material properties used for the flaw tolerance evaluation were taken from Division 1 Appendices in Section III of the ASME Code, not Part D in Section II of the ASME code as stated in Section 5.0 of Revision 1 of BWXT Report No. M2004-SR-01 (Attachments 5 (non-proprietary) and 6 (proprietary)) of the response to Commitment 10, dated June 7, 2022.

**RCI C10-2**

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 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 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 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.

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Issue

The Byron Unit 1 and Braidwood Unit 1 checklist in Appendix A of Revision 2 of BWXT Report No. M1702-LR-01, "Steam Generator Divider Plate Design for Possibility of Cracking," states that the minimum channel head thickness is [[ ]]. However, during the audit, CEG stated that the minimum channel head thickness is [[ ]].

Request

Please confirm that the minimum channel head thickness is [[ ]], not [[ ]] as stated in Appendix A of Revision 2 of BWXT Report No. M1702-LR-01 (Attachment 7 (proprietary)) of the response to Commitment 10 dated June 7, 2022.