UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

July 20, 2009

Mr. Charles G. Pardee
President and Chief Nuclear Officer
Exelon Nuclear
4300 Winfield Road
Warrenville, IL 60555

SUBJECT: BRAIDWOOD STATION, UNITS 1 AND 2, AND BYRON STATION, UNIT NOS. 1 AND 2 - REQUEST FOR ADDITIONAL INFORMATION RELATED TO STEAM GENERATOR PERMANENT ALTERNATE REPAIR CRITERIA (TAC NOS. ME1613, ME1614, ME1615, AND ME1616)

Dear Mr. Pardee:

By letter to the Nuclear Regulatory Commission (NRC) dated June 24, 2009 (Agencywide Documents Access and Management System Accession No. ML091770543), Exelon Generation Company, LLC (the licensee) proposed to revise Technical Specification (TS) 5.5.9, "Steam Generator (SG) Program," to exclude portions of the tube below the top of the SG tubesheet from periodic SG tube inspections and plugging or repair. In addition, the licensee proposed to revise the wording of reporting requirements in TS 5.6.9, "Steam Generator (SG) Tube Inspection Report."

The NRC staff is reviewing your June 24, 2009, letter, and has determined that additional information is required to complete its review. The specific information requested is addressed in the enclosed Request for Additional Information (RAI). Your staff has agreed to provide a response to this RAI by August 7, 2009.

The NRC staff considers that timely responses to requests for additional information help ensure sufficient time is available for staff review and contribute toward the NRC's goal of efficient and effective use of staff resources. If circumstances result in the need to revise the requested response date, please contact me at (301) 415-1547.

Sincerely,

Marshall J. David, Senior Project Manager
Plant Licensing Branch III-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. STN-456, STN-457,
STN 50-454, and STN 50-455

Enclosure:
Request for Additional Information

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REQUEST FOR ADDITIONAL INFORMATION

BRAIDWOOD STATION, UNITS 1 AND 2

AND BYRON STATION, UNIT NOS. 1 AND 2

DOCKET NOS. STN 50-456, STN 50-457

STN 50-454, AND STN 50-455

The Nuclear Regulatory Commission (NRC) staff is reviewing Exelon Generation Company, LLC's (the licensee's) license amendment request (LAR) dated June 24, 2009 (Agencywide Documents Access and Management System Accession No. ML091770545), to revise the technical specifications (TSs) of Byron Station (Byron) Unit Nos. 1 and 2 and Braidwood (Braidwood) Station Units 1 and 2. The request proposed changes to the inspection scope and repair requirements of TS 5.5.9, "Steam Generator (SG) Program" and to the reporting requirements of TS 5.6.9, "Steam Generator (SG) Tube Inspection Report." The proposed changes would establish permanent alternate repair criteria for portions of the SG tubes within the tubesheet. Although the TS changes only affect Byron, Unit No. 2, and Braidwood, Unit 2, the TSs are common to Units 1 and 2 for both Byron and Braidwood. In order to complete its review, the NRC staff needs the additional information requested below.

Westinghouse document, WCAP-17072-P, Rev. 0, "H*: Alternate Repair Criteria for the Tubesheet Expansion Region in Steam Generators with Hydraulically Expanded Tubes (Model D5)" (Reference 1), was submitted with the June 24, 2009, LAR. The NRC staff notes that its review of Reference 1 is still ongoing and it may have additional questions in the future.

1. Reference 1, Page 6-21, Table 6-6. This table contains a number of undefined parameters and some apparent inconsistencies with Table 5-2 on page 5-6. Please define the input parameters in Table 6-6.

2. Reference 1, Section 6.2.2.2. Why was the finite element analysis not run directly with the modified temperature distribution rather than running with the linear distribution and scaling the results?

3. Reference 1, Section 6.2.3. Why is radial displacement the "figure of merit" for determining the bounding segment? Does circumferential displacement not enter into this? Why is the change in tube hole diameter not the "figure of merit?"

4. Reference 1, Page 6-70. In Section 6.2.5.3, it is concluded that the tube outside diameter and the tubesheet tube bore inside diameter always maintain contact in the predicted range of tubesheet displacements. However, for tubes with through-wall cracks at the H* distance, there may be little or no net pressure acting on the tube for some distance above H*. In Tables 6-18 and 6-19, the fourth increment in the step that occurs two steps prior to the last step suggests that there may be no contact between the tube and tubesheet, over a portion of the circumference, for a distance above H*. Is the conclusion in 6.2.5.3 valid for the entire H* distance, given the possibility that the tubes may contain through wall cracks at that location.

Enclosure

5. Reference 1, Page 6-86, Section 6.3. Are the previously calculated scale factors and delta D factors in Section 6.3 conservative for steam line break and feedwater line break (FLB)? Are they conservative for an intact divider plate assumption? Are they conservative for all values of primary pressure minus crevice pressure that may exist along the H* distance for intact tubes and tubes with throughwall cracks at the H* distance?

6. Reference 1, Page 6-96. How is tube temperature (T_T) on page 6-96 determined? For normal operating conditions, how is the T_T assumed to vary as a function of elevation?

7. Reference 1, Page 6-104, Figure 6-77. Contact pressures for nuclear plants with Model D5 steam generators are plotted in Figure 6-77, but it is not clear what operating conditions are represented for the plants shown in the plotted data; please clarify.

8. Reference 1, Page 6-120, Reference 6-5. This reference seems to be incomplete; please provide a complete reference.

9. Reference 1, Page 6-121, Reference 6-15. Table 6-3 in Reference 6-15 (SM-94-58, Rev. 1) appears inconsistent with Table 6-2 in the same reference. Explain how the analysis progresses from Table 6-2 to Table 6-3.

10. Reference 1, Page 8-9, Figure 8-1. There is an apparent discontinuity in the plotted data of the adjustment to H* for distributed crevice pressure. Please provide any insight you may have as to why this apparent discontinuity exists.

11. Reference 1, Page 8-6, Section 8.1.4. Clarify whether the "biased" H* distributions for each of the four input variables are sampled from both sides of the mean H* value during the Monte Carlo process, or only on the side of the mean H* value yielding an increased value of H*.

12. Reference 1, Page 8-14, Figure 8-6. The legend for one of the interactions shown between α_{TS} and E_{TS} appears to have a typo in it. Please review and verify that all values shown in the legend are correct.

13. Reference 1, Page 8-20, Case S-4. Why does the assumption of a 2-sigma value for the coefficient of thermal expansion of the tube (α_T) and the tubesheet (α_{TS}) to determine a "very conservative biased mean value of H*" conservatively bound the interaction effects between α_T and α_{TS}? Describe the specifics of how the "very conservative biased mean value of H*," as shown in Table 8-4, was determined.

14. Reference 1, Page 8-22, Case M-5. The description for this case seems to correspond to a single tube H* estimate rather than a whole bundle H* estimate. How is the analysis performed for a whole bundle H* estimate?

15. Reference 1, Page 8-22, Case M-5 states, "Interaction effects are included because the 4.237 sigma variations were used that already include the effective interactions among the variables." Case M-5 also states that the 4.237 sigma variations come from

Table 8-2. However, Table 8-2 does not appear to include interactions among the variables. Explain how the 4.237 sigma variations include the effect of interactions among the variables.

16. Reference 1, Page 8-22, Case M-6, first bullet. Should the words "divided by 4.237" appear at the end of the sentence?

17. Reference 1, Page 8-23, Case M-7. Was the "2 sigma variation of all variables" divided by a factor of 2?

18. Reference 1, Page 8-23, Case M-7. Explain how this case includes the interaction effects between the two principle variables, α_T and α_{TS}.

19. Reference 1, Page 8-25, Table 8-4. Explain why the mean H* calculated in the fifth case does not require the same adjustments, as noted by the footnotes, that all other cases in the table require.

20. Reference 1, Page 8-25, Table 8-4. Verify the mean H* shown in the last case in the table.

21. Section 8 of Reference 1. The variability of H* with all relevant parameters is shown in Figure 8-3. The interaction between α_T and α_{TS} are shown in Figure 8-5. Please explain why the direct relationships shown in these two figures were not sampled directly in the Monte Carlo analysis, instead of the sampling method that was chosen. Also, please explain why the sampling method chosen led to a more conservative analysis than directly sampling the relationships in Figures 8-3 and 8-5.

22. In the June 24, 2009, LAR, the licensee commits to determine the position of the bottom of the expansion transition for Byron Unit No. 2 and Braidwood Unit 2 in relation to the top of the tubesheet and to enter "any significant deviation" into the corrective action program. This is a one-time verification prior to implementation of H*. The commitment should be modified to also include a commitment to notify the NRC staff if significant deviations in the location of the bottom of the expansion transition relative to the top of the tubesheet are detected.

23. Reference 1, Page 9-6, Section 9.2.3.1. The FLB heat-up transient is part of the plant design and licensing basis. Thus, it is the NRC staff's position that H* and the "leakage factors," as discussed in Section 9.4, should include consideration of this transient. Explain why the proposed H* and leakage factor values are conservative, even with consideration of the FLB heat-up transient.

Reference:

1. WCAP-17072-P, Rev. 0, "H*: Alternate Repair Criteria for the Tubesheet Expansion Region in Steam Generators with Hydraulically Expanded Tubes (Model D5)," dated May 2009 (Proprietary).

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