From: Cotton, Karen
Sent: Friday, August 14, 2009 2:26 PM
To: Gary D Miller
Cc: Shoop, Undine; Sreenivas, V; Johnson, Andrew
Subject: Surry Clarifications regarding H* PARC

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These are the current questions we have regarding the Model 51F Westinghouse WCAP report and the Surry H* PARC LAR as summarized in the August 14, 2009, phone call. We are still reviewing both documents and may have additional questions later.

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 FEA 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 6-66. 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? Additionally, please address the following issues:

    a. Clarify the nature of the finite element model (“slice” model versus axisymmetric SG assembly model) used to generate the specific information in Tables 6-1, 2, and 3 (and accompanying graph entitled “Elliptical Hole Factors”) of Reference 6-15. What loads were applied? How was the eccentricity produced in the model? (By modeling the eccentricity as part of the geometry? By applying an axisymmetric pressure the inside of the bore?) Explain why this model is not scalable to lower temperatures.

b. Provide a table showing the maximum eccentricities (maximum diameter minus minimum diameter) from the 3 dimensional (3-D) finite element analysis for normal operating and steam line break (SLB), for model 51F.

c. In Figure 2 of the White Paper, add plot for original relationship between reductions in contact pressure and eccentricity as given in Reference 6-15 in the graph accompanying Table 6-3. Explain why this original relationship remains conservative in light of the new relationship. Explain the reasons for the differences between the curves.

d. When establishing whether contact pressure increases when going from normal operating to steam line break conditions, how can a valid and conservative comparison be made if the normal operating case is based on the original delta contact pressure versus eccentricity curve and the SLB case is based on the new curve?

5. Reference 1, Section 6.3. Are the previously calculated scale factors and delta D factors in Section 6.3 conservative for steam line break (SLB) and feed 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 through-wall cracks at the H* distance?

6. Reference 1, Page 6-84. How is tube temperature (T_T) on page 6-84 determined? For normal operating conditions (NOP), how is the T_T assumed to vary as function of elevation?

7. Reference 1, Page 6-102, Figure 6-75. Contact pressures for nuclear plants with Model F steam generators are plotted in Figure 6-75, but it is not clear what operating conditions are represented in the plotted data, please clarify.

8. Reference 1, Page 6-108, Reference 6-5. This reference seems to be incomplete; please provide a complete reference.

9. Reference 1, Page 6-109, 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 8-5, 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 8-20, Case S-4. Why does the assumption of a 2-sigma value for the coefficient of thermal expansion of the tube (αT) and the tubesheet (αTS) to determine a

"very conservative biased mean value of H*" conservatively bound the interaction effects between αT and αTS? Describe the specifics of how the "very conservative biased mean value of H*," as shown in Table 8-4, was determined.

13. 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?

14. Reference 1, Page 8-22, Case M-5 states: "Interaction effects are included because the 4.166 sigma variations were used that already include the effective interactions among the variables." Case M-5 also states that the 4.166 sigma variations come from Table 8-2. However, Table 8-2 does not appear to include interactions among the variables. Explain how the 4.166 sigma variations include the effect of interactions among the variables.

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

16. 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. As part of response, include discussion of main steam line break and whether it continues to be less limiting, from maximum H* perspective, than three times normal operating pressure.

17. In the July 28, 2009, letter (accession no. ML092150464), SPS commits to monitor for tube slippage as part of the steam generator tube inspection program. The "due date/event" is "Starting with Unit 2 Refueling Outage 22." It is not clear whether the planned monitoring will be performed on Unit 1. Please clarify the wording so it is clear that the tube slippage will be monitored at both units during every steam generator tube inspection outage.

18. In the June 2, 2009, letter, SPS commits to determine the position of the bottom of the expansion transition in relation to the top of the tubesheet and to enter "any significant deviation" into their 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 staff if significant deviations in the location of the beginning of the expansion transition, relative to the top of the tubesheet, are detected.

19. During review of the SPS amendment request, it was noticed that wording associated with a regulatory commitment, regarding use of the leakage factor, had been stated in the body of the document (page 15 of Attachment 1) but the licensee did not actually make a commitment to establish an administrative operational leakage limit on page 15 of Attachment 1, in the list of regulatory commitments in the July 28, 2009 cover letter, or in Attachment 4. See below for an example of a complete commitment.

> *For the Condition Monitoring assessment, the component of leakage from the prior cycle from below the H* distance will be multiplied by a factor of 2.03 and added to the total leakage from any other source and compared to the allowable*

accident induced leakage limit. For the Operational Assessment, the difference between the allowable accident induced leakage and the accident induced leakage from sources other than the tubesheet expansion region will be divided by 2.03 and compared to the observed operational leakage. An administrative operational leakage limit will be established to not exceed the calculated value.

References:

1. WCAP-17092-P, Rev. 0, "H*: Alternate Repair Criteria for the Tubesheet Expansion Region in Steam Generators with Hydraulically Expanded Tubes (Model 51F)," dated June 2009.

Thanks