

**From:** Kalyanam, Kaly  
**Sent:** Tuesday, June 09, 2009 11:12 AM  
**To:** CLARK, ROBERT W  
**Subject:** Second Round of RAIs for ME0125

Bob,

I am formally transmitting the 2nd round of RAIs on the ANO-2 LAR, Use of RCP Delta-P for CPC Flow Measurement. Please let me if you can respond to the RAI within 30 days from now.

Thanks

Kaly

### **Second Round of RAIs for ME0125**

1. Paragraph 4 of the RAI 1(b) response stated that “[a]s part of the analyses performed to support the proposed change, surveillance criteria has been established to ensure calibration errors or instrumentation problems are detected and addressed. Sensitivity analyses have been performed to establish penalties for instrument deviations that will ensure a conservative pump  $\Delta P$  flow rate.

Discuss the surveillance criteria and the sensitivity analyses used in support of the proposed TS changes.

2. Paragraph 5 of the RAI 1(b) response stated that “Figure 4 provides an indication (excore raw signals) of the radial power distribution shift from the inside of the core to the outside of the core over the course of Cycle 15. Comparison of the trend in Figure 4 to Figures 2 and 3 clearly shows the influence that radial power distribution has on hot leg stratification.”

Clarify how the above statements were obtained regarding Figure 4 about the radial power distribution shift and comparison of the trend in Figure 4 to Figures 2 and 3 about the influence of the radial power distribution on the hot leg stratification for Cycle 15. This requested clarification is also applied to Figures 5 through 7 for Cycle 20.

3. Paragraph 1 of the RAI 2(a) response indicated that the Cycles 1 and 2 calorimetric flow measurement were confirmed to be consistent with alternate, independent ultrasonic measurements not affected by flow streaming. An ultrasonic flow measurement was performed after loading the cycle 1 fuel. The flow average from the two hot legs was determined to be 13.4% with a combined uncertainty of  $\pm 7.6\%$ .
  - (a) Specify the values of the calculated calorimetric flow rates and the associated combined uncertainty for Cycles 1 and 2, and justify that the calorimetric flow measurements are within the bounds of the ultrasonic flow measurements and with the RCP  $\Delta P$  flow measurements.
  - (b) Provide the hot leg temperature measurements from all the temperature sensors for Cycles 1 and 2, and demonstrate that the differences of hot leg temperatures shown in Figures 2 and 3 for Cycle 15 and Figures 5 and 6 for Cycle 20 do not exist, and that the

flow stratification in the hot legs is not of concern in calculating the RCS flow rate using the calorimetric flow method for Cycles 1 and 2.

- (c) Provide the results of the ultrasonic flow measurements for Cycles 15 and 20, and demonstrate that the ultrasonic flow measurements are consistent with the RCP  $\Delta P$  flow measurements.

- 4. Paragraph 6 of the RAI 2(b) response indicated that guidelines were developed for periodic surveillance of the pump  $\Delta P$  and cold leg temperature instrumentation.

Discuss the criteria used in the guidelines to capture COLSS input data anomalies and ensure validity of flow measurement by compensating for any modified operation.

- 5. Paragraph 7 of the RAI 2(b) response claimed that the trends of pump  $\Delta P$  instrument shown in Figure 1 provide no evidence of degradation across recent cycles.

Figure 1 shows the from Cycles 16 to Cycle 19, the  $\Delta P$  readings from CPD6196A and CPD6196B changed significantly from cycle to cycle, and from Cycle 15 to Cycle 18, the  $\Delta P$  readings from CPD6196A were significantly different from CPD6196B. Explain the causes of the significant changes and differences of the  $\Delta P$  readings from CPD6196A and CDP6196B, and address their effects on the total RCS measured flow rate. Also, explain the significant differences (about 4 psi) in  $\Delta P$  readings from CPD6166 and CDP6186, and address the effect on the RCS flow measurement accuracy. In addition, expand Figure 1 by including the pump  $\Delta P$  data from Cycles 1 through 14 and show no pump degradation and no anomalies of pump  $\Delta P$  data for the whole RCP operating period.

- 6. Provide derivations for the following uncertainties in Table 4 of the RAI 2(c) response:

- (a)  $\pm 5.2\%$  and  $\pm 5.8\%$  for the COLSS volumetric flow uncertainties and the CPC mass flow uncertainties used in the safety analysis, respectively.

- (b) 4.1% and 2.9% for the COLSS mass flow uncertainty and the reference mass flow uncertainty used for Technical Specification monitoring of RCS flow, respectively.

- 7. Since ANO2 and Palo Verde are CPC plants manufactured by CE, the CPC design and the methods for its associated RCS flow rate calibration are similar. However, The NRC staff finds that the monthly surveillance requirements (SRs) for the RCS calibration are different. Specifically, Palo Verde SR 3.3.1.5, corresponding to note (8) of TS TABLE 4.3-1 of ANO2, states that:

“With power levels greater than or equal to 70% of the rated thermal power, verify total RCS flow rate indicated by each CPC is less than or equal to the RCS flow determined either using the reactor coolant pump differential pressure instrumentation and the ultrasonic flow meter adjusted pump curves or by calorimetric calculations.” This calibration is required to be performed once every 31 days.

It should be noted that the RCP curves used for the Palo Verde TS are adjusted by the measurements of the ultrasonic flow meter to assure the accuracy of the RCP flow measurement over an extensive period of time.

Justify the proposed removal of Note (8), instead of changing Note (8) to one similar to Palo Verde SR 3.3.1.5 to resolve the concern related to RCP flow measurement uncertainty over the whole RCP operating time until the RCPs are replaced.

8. The following sentences were added (page 3): "Considering uncertainty in the actual surface roughness of the OSG and RSG tubes, the Cycle 15 calorimetric flow rate was lower than the beat estimate predicted flow rate by at least 3% of the design mass flow rate. Considering RSG tolerances at extreme producing the minimum predicted flow, the Cycle 15 calorimetric flow rate was lower by at least 2% of the design mass flow rate". Provide the derivations of 3% and 2% referenced above.