REQUEST FOR ADDITIONAL INFORMATION

RELATED TO VOLUME 6 OF TOPICAL REPORT WCAP-17788-P/NP

"COMPREHENSIVE ANALYSIS AND TEST PROGRAM FOR GSI-191 CLOSURE"

PRESSURIZED WATER REACTOR OWNERS GROUP

RAI-1, Vol 6

Describe the development of the flow vs. differential pressure (dP) curves used in the test program to realistically or conservatively represent the conditions of a full scale core. The U.S. Nuclear Regulatory Commission (NRC) staff understands that the flow vs. dP inputs to the testing were developed from a full core model and applied to a partial fuel assembly. How was it determined that application of results that are averaged over a large area can be applied to the test facility without introducing significant uncertainty that could result in non-conservative conclusions?

RAI-2, Vol 6

Provide a comparison between the results of the WCAP-17788 test program and the WCAP-16793 test program (pre-chemical results). Are any tests (including informational or preliminary tests that may not have been included in the test report) comparable from a debris loading and test velocity perspective? If so, how do the results compare? The NRC staff recognizes the differences in test methods and conditions between the two programs, but concluded that a comparison of the new testing to testing under somewhat similar but larger scale conditions could provide additional justification for use of a smaller scale test facility.

RAI-3, Vol 6

Provide an example of how the total mass of debris captured in the filter bags was determined (reference Section 3.6). Please describe the relative magnitude associated with the predominant sources of uncertainties. Discuss the significance of the total debris mass measurement uncertainty in terms of the experimental program conclusions. Significant uncertainties would include the potential for lost debris, fluid lost from the bags resulting in loss of dissolved chemicals, and fluid chemical concentrations.

RAI-4, Vol 6

Table 4-2 shows the test matrix for alternate flow path (AFP) testing.

a. Provide a justification for the fiber amounts used. Describe how this amount of fiber bounds all four plant categories.

b. Section 4 states that the amounts were added on a per fuel assembly basis. Why is the amount of fiber per fuel assembly important to the AFP evaluation?

Enclosure

c. Provide information on how the debris was introduced during the AFP tests. Was it introduced all at once or introduced over time intervals?

d. Two hole sizes were tested over a range of flow conditions. There are AFPs in Combustion Engineering and Westinghouse Electric Company upflow plants that are smaller diameter and/or flow area than the hole sizes tested. How are the hole dimensions tested representative of the AFP geometries in all four plant categories in Volume 4? Provide the geometries and dimensions of all credited AFPs for each plant category and the associated flow area. Justify that the test geometries provide acceptable bounding results for debris capture at the openings. In the response, consider the effects of velocity through the openings in combination with geometry effects and range of fiber sizes.

RAI-5, Vol 6

Figure 3-35 shows two of the dP sensors sensing lines across the bottom nozzle, p-grid, and a bottom grid. Verify the accuracy of this configuration. Was any dP attributed to build up at the lowest “bottom grid?”

RAI-6, Vol 6

Some of the plots of head loss versus time indicate that head loss is increasing at the termination of the test. Discuss whether the tests were allowed to run until a stable head loss was achieved. If not, how was it determined that adequate data had been collected to ensure valid results were obtained for the overall evaluation?

RAI-7, Vol 6

Define the term “estimated component of total capture due to fiber” in Figures 5-31 and 5-35.

RAI-8, Vol 6

Figure 5-39 shows that at a particulate-to-fiber (p/f) ratio of 30:1, the grid has a much higher head loss than the prototypical inlet geometry. At a p/f of 10:1, the bottom nozzle produced limiting head loss. At a p/f of 50:1, both the grid and bottom nozzle had about the same head loss. Justify that the conclusion in Section 5.3.1.1 that the core entrance geometry showed a more significant pressure drop than the single grid geometry. Could the grid result in limiting headloss for some conditions as appears to be the case illustrated in Figure 5-39?

RAI-9, Vol 6

In Figures 5-47 and 5-51, it appears that lower fiber loads result in higher head losses when p/f ratios and other test parameters are maintained constant. The results are discussed on Pages 5-35 and 5-39. The conclusion is that there may have been experimental bias that caused this result (debris injection system tank mixing/particulate settling), but the theory could not be confirmed. The trend of increasing head loss at lower fiber loads appears to be consistent across several tests. If the potential causes were as discussed, would the results have been more random? Explain how the stronger bias with increasing p/f ratio explains the particulate settling theory. Explain how lower fiber loads can result in higher head losses.

RAI-10, Vol 6

Provide the basis for the assumption that sensitivities conducted with the single grid geometry are valid for the core inlet geometry cases. For example, in the parametric study of head loss versus fiber mass, it was not apparent from the test results that the single grid tests reflected a similar response when compared to the tests with the core inlet geometry. Some of the conclusions from the single grid sensitivities were not confirmed in tests with core inlet geometries.

RAI-11, Vol 6

Table 3-6 provides a dimension of the tested bottom nozzle with a gap. The open flow area ratio is larger than the open flow area ratio of the robust fuel assembly bottom nozzle as reported in Table 3-5. How is this potential non-conservatism accounted for in the test results?

RAI-12, Vol 6

For the AFP tests, results show that pressure drop across the plate increases as flow rate increases. As shown in Figure 5-71, the data from test 1090-AFP-T002 compares with high accuracy to the relationship in Equation 5-1. On the other hand, the data from test 1090-AFP-T003 (Figure 5-73) do not fit the relationship well. How was the relationship in Equation 5-1 determined to be applicable to the test conditions?