REQUEST FOR ADDITIONAL INFORMATION TOPICAL REPORT
THE ADVANCED ACCUMULATOR, REV.2
MUAP-07001-P

US-APWR TOPICAL REPORT

Mitsubishi Heavy Industries

Docket No. 52-021

Modified RAI for Advanced Accumulator- Topical Report MUAP-07001-P

34. Figure 4.2.4-9 in the topical report (MUAP-07001) compares Case 1 and Case 5 of the ½ scale tests with same accumulator tank and exhaust tank pressures. In Case 5, the liquid was saturated with nitrogen. A comparison of data from two tests indicates that the data for cavitation factor and flow rate coefficient are shifted to lower values for Case 5. In response to RAI 16-B, dated July 20, 2007, on why Case 5 was not included in developing correlations, MHI stated that "using the Case 5 test data will result in evaluating flow rate coefficient smaller than that of the actual accumulator because the test condition in test Case 5 with nitrogen gas compulsorily saturated by bubbling and showering is much more critical than the actual accumulator". However, disregard of Case 5 test result would completely ignore the effect the dissolved nitrogen, though not saturated, in the actual accumulator.

    (a) Explain why Case 5 has lower values of the flow rate coefficient and cavitation factor relative to Case 1.

    (b) How do the proposed accumulator flow rate characteristic correlations for flow rate coefficient account for dissolved nitrogen?

    (c) How is the effect of nitrogen accounted for in implementing accumulator characteristic equations? Is there any delay in accumulator flow to account for nitrogen effect? How is this delay estimated? How is this delay validated to full scale accumulator?

41. With respect to the uncertainties associated with the accumulator flow characteristic equations, instrumentation, manufacturing, and the flow rate switching water level:

    (a) What contributes to bias (systematic) and standard deviation (precision or random) part of uncertainty in the flow rate coefficients of the large- and small-flow characteristic correlations of the flow damper?

    (b) What are the other contributors to uncertainty beside instrument uncertainty, dispersion or regression analyses error and manufacturing uncertainties? How are these combined? How is the scaling uncertainty determined and accounted for in the characteristic correlations?

(c) What is the relationship between the diversion of correlations listed in Table 3.5-5 (in MUAP-07011 Large-Break LOCA Methodology) and listed in Table 5.2-1 in MUAP-07001)?

43. Citing ANSI/ASME PTC19.1-1985 in the response to RAI 17 (July 2007), MHI uses the square-root-sum-of-squares (RSS) method to combine bias with precision (standard deviation) in the uncertainty analysis as shown in Eqs. 17.5 and 17.6. The USNRC staff has accepted the RSS methodology for combining the uncertainties that are random, normally distributed, and independent, whereas the algebraic method is used to combine uncertainties that are not random, not normally distributed, or are dependent.

(a) Provide justification of combining bias with precision (standard deviation) through the RSS method.

(b) In the case of instrument uncertainty, why is the standard deviation of the mean used? Why the standard deviation of the distribution not used?