

REQUEST FOR ADDITIONAL INFORMATION

RELATED TO TOPICAL REPORT ANP-10341P

“THE ORFEO-GAIA AND ORFEO-NMGRID CRITICAL HEAT FLUX CORRELATIONS”

AREVA INC.

CAC NO. MF8400

RAI-SNPB-01

Provide a reference which describes the French Atomic Energy Commission Omega loop.

RAI-SNPB-02

The information provided in Table 4-1 of the topical report demonstrates that the overall statistics of the measured critical heat flux (CHF) divided by predicted CHF (M/P) value is similar at Karlstein Thermal-Hydraulic test facility (KATHY), Alliance Research Center, OMEGA, and Columbia University's Heat Transfer Research Facility. However, it does not provide clear justification that the same measured value of CHF would be obtained at each test facility under the same conditions. Provide experimental evidence that, given the same inputs (i.e., experimental state point), each facility would measure the same value for CHF within some small uncertainty.

RAI-SNPB-03

Provide a discussion on the experiments performed at the KATHY loop in terms of how the state points are chosen in a random fashion to ensure appropriate randomization in keeping with good practices in statistical design of experiment. If complete randomization is not possible, provide an explanation as to why complete randomization is not possible, what was permed instead, and the technical justification demonstrating the deviation did not impact the experimental results.

RAI-SNPB-04

Provide a discussion on repeated test points. Confirm that the same state point (pressure, mass flux, inlet temperature) is chosen. Confirm that the criteria used to determine if the same state point has been reached is the maximum deviation criteria provided in Tables 4-3, 4-4, and 4-5. Finally, discuss and/or provide the results from the repeated test point measurements.

RAI-SNPB-05

Provide a discussion on how the heat losses from the test section are treated. If the heat losses are ignored, demonstrate that for the very worst case (e.g., likely to be low power) the heat loss is a minuscule fraction of the heat into the test section and could have a negligible impact (less than 1 percent) on the minimum departure from nucleate boiling ratio value from that test.

RAI-SNPB-06

Provide a list of the fuels for which AREVA's CHF correlation form for pressurized water reactor (PWR) fuel assemblies non-mixing grid design (ORFEO-NMGRID) will be applied. Additionally, provide the justification for ORFEO-NMGRID to be applied to those fuel types and under what conditions it would be applied to those fuel types. Additionally, confirm that the mixing grid CHF data set analyzed in Section 7.2.4 is for the CHF correlation form for AREVA's PWR fuel assembly and grid design (ORFEO-GAIA).

RAI-SNPB-07

Provide detailed justification for the claims made in Section 8 of the topical report concerning the geometric comparison between the production and tested grid spacers. Demonstrate that the minor geometric variations did not increase the performance of the test grid as compared to the production grid. In your response, provide figures which capture the local flow behavior of the grid spacers.

RAI-SNPB-08

Provide justification that the use of simple support grids in the testing for ORFEO-GAIA and ORFEO-NMGRID does not artificially increase the CHF performance of the tested assemblies compared to the production assemblies.

RAI-SNPB-09

Provide 2-dimensional plots of the ORFEO-GAIA and ORFEO-NMGRID data with the expected domain of use identified on the plot. Justify the data density in the expected regions. Justify the use of the models in any regions of sparse or missing data in the expected regions. These plots should include all necessary combinations to describe the expected domain, and at a minimum contain: pressure versus mass flux, pressure versus quality, mass flux versus quality, pressure versus boiling length, mass flux versus boiling length, and quality versus boiling length.

RAI-SNPB-10

What prevents ORFEO-GAIA and ORFEO-NMGRID from being used outside of their application domain?

RAI-SNPB-11

A plot of burnout length versus M/P for non-mixing data revealed a [

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[

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Justify the use of ORFEO-GAIA and ORFEO-NMGRID in these subregions.

RAI-SNPB-12

Using a similar method of analysis to that provided in EMF-92-153(P)(A), Revision 1, the NRC staff [

]. Justify the use of ORFEO-GAIA at these lower qualities and justify an unbounded lower quality limit.