



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

JUL 18 1994

MEMORANDUM FOR: Martin J. Virgilio, Deputy Director, DSSA/NRR
THRU: M. Wayne Hodges, Director, DSR/RES *MWD*
THRU: Louis M. Shotkin, Chief, RPSB/DSR/RES
THRU: David E. Bessette, RPSB/DSR/RES
FROM: Marino diMarzo, RPSB/DSR/RES
SUBJECT: REQUEST FOR ADDITIONAL INFORMATION ON FRICTION NUMBER
ASSESSMENT FOR THE OSU AP600 FACILITY

Background: The scaling analysis for the OSU AP600 facility performed by W is based on assumptions similar to the one proposed by Ishii [1]. In particular, the requirement of dynamic similarity dictates the preservation of the sum of the frictional and form losses given as

$$\sum_i \left[f_i \frac{(L+L_e)_i}{d_i} + K_i \right]$$

where i is the generic component.

Consider the case where the form losses, K , are dominant, then the dynamic similarity is obtained by preserving the flow path geometrical characteristic. In the other extreme, when the frictional losses dominates, dynamic similarity cannot be obtained over a broad range of Reynolds numbers typical of natural circulation driven systems. The overall loss coefficient ratio and relative magnitude of the two terms, $f(L/d)$ and K , has relevant implications on the scaling rationale. The time scale depends on the fluid velocity. Therefore, a distortion of the overall loss coefficient may result in a lower than scaled fluid velocity in the facility. Hence, the time ratio will be higher than scaled and consequently an adjustment to the power input and sink configuration may be required. The a-priori quantification of the loss coefficient distortions is not feasible, but it is possible to deduce the loss coefficient from measurements. This information is now available (W has conducted a number of tests using the OSU facility). This additional knowledge will greatly improve the accuracy of initial and boundary conditions for the test matrix to be performed by NRC using the OSU facility and should be available by September 1, 1994, to NRC, since we plan to initiate testing at OSU on or about October 1, 1994. W should also seek this information to validate the basic assumptions of their scaling analysis.

Based on a meeting with NRR (A. Levin), it was agreed that NRR would prepare the RAI based on the information provided below.

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M. Virgilio

Additional Information Needed: Provide an order of magnitude comparison between the two terms of the loss coefficient based on the experimental data available for the principal natural circulation loops (i.e., primary, PRHR, ADS-IRKST-RV, etc.). The extent of the documentation should be consistent with the uncertainty of the measurements and with the complexity of the flow modes exhibited by the system.

In order to identify the range of operating conditions of the OSU facility and to assess the scaling distortions associated with the momentum equation, provide also the following experimental data or estimates:

1. liquid single phase velocity in the various active loops;
2. temperature distribution and phase distribution in each of the active natural circulating loops;
3. estimates of the density difference and of difference in elevation between the thermal centers in each of the active loops;
4. density of the liquid single phase where the velocity measurements are obtained or can be estimated;
3. estimates of the overall loss coefficient;
4. form losses estimated from inspection of the geometrical characteristics of each flow loops;
5. two-phase flow multiplier (e.g., Martinelli-Nelson) from the measurements or estimates of the quality;
6. estimates of the frictional losses;
7. comparison of the frictional and form losses in the active loops.

[1] G. Kocamustafaogullari, M. Ishii, NUREG/CR-3420 (1983)

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Marino diMarzo, RPSB/DSR/RES

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*Previously concurred.

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