December 8, 1997

Mr. Nicholas J. Liparulo, Manager
Nuclear Safety and Regulatory Analysis
Nuclear and Advanced Technology Division
Westinghouse Electric Corporation
P.O. Box 355
Pittsburgh, PA 15230

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION (RAI) ASSOCIATED WITH THE REVIEW OF THE AP600 HYDRO-DYNAMIC LOADS ON THE IN-CONTAINMENT REFUELING WATER STORAGE TANK (IRWST)

Dear Mr. Liparulo:

The Containment Systems and Severe Accident Branch has requested additional information to complete its input for AP600 SER Section 6.2.8 related to the hydro-dynamic loads experienced by the IRWST as a result of ADS 1, 2, and 3 discharge. The RAIs are attached as an enclosure to this letter.

If you have any questions regarding this matter, you may contact me at (301) 415-1118.

Sincerely,

original signed by: Jerry N. Wilson

Theodore R. Quay, Director
Standardization Project Directorate
Division of Reactor Program Management
Office of Nuclear Reactor Regulation

Docket No. 52-003

Enclosure: As stated

cc w/encl: See next page

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Mr. Nicholas J. Liparulo
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Docket No. 52-003
AP600

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REQUEST FOR ADDITIONAL INFORMATION
ON THE AP600 IRWST HYDRO-DYNAMIC LOADS

480.1104 The following RAIs have been generated based on the assumption that the hydro-dynamic loading in the IRWST is significant to the structures and piping. If this is not true, describe how the loading was considered.

480.1105 No information can be found on the drag induced forces acting on structure or piping submerged in the IRWST. Since the AP600 has submerged piping within the IRWST, the drag forces acting on those structures would need to be addressed. Those forces would include both the standard drag load associated with a structure within a constant velocity fluid field and the acceleration drag load from forces associated with fluid acceleration. Please provide the methodology used to calculate the drag force on submerged piping and structural columns within the IRWST. Also, include the results of the analyses.

480.1106 WCAP-13891,"AP600 Automatic Depressurization System Phase A Test Data Report," does not discuss the fluid structure interaction (FSI) effects at the tank walls. The issue is how the stiffness of the test facility tank versus the stiffness of the IRWST tank floor and walls affects the measured loads. If the IRWST wall is excited, the wall may transmit forces to other attached structures and piping. Please describe how the FSI is considered for the specific AP600 plant IRWST, how the test facility analysis considers FSI, and what were the calculated loads which will be imparted to the IRWST attached piping and structures.

480.1107

(a) In WCAP-13891,"AP600 Automatic Depressurization System Phase A Test Data Report," a floor pressure plot for test A-11, PE-10, page 380, shows a pronounced pressure oscillation beginning approximately 22.70 seconds and decaying quickly to zero by 22.80 seconds. This oscillation appears to be significantly larger, in terms of measured wall pressure, than any of the other tests conducted as shown in WCAP-13891, Table 1 "Test Matrix." Please explain the reason for this oscillation occurring at approximately 22.7 seconds and why the magnitude of this rapidly decaying pulse does not appear on other pressure plots. Also, provide the structural significance of this load on the walls of the AP600.

(b) In WCAP-13891,"AP600 Automatic Depressurization System Phase A Test Data Report," a floor pressure plot for test A-18, PE-10, page 464, does not show the same spike at 22.7 seconds but a much lower and earlier peak occurring at approximately 5 seconds. This would appear to be within the air clearing phase of the quencher phase followed by somewhat steady steam condensation out to 50 seconds. The expanded time scale plot on page 465 of WCAP-13891 provides added insight into the peaks occurring at approximately 5.0 seconds which shows irregular oscillations shifted to the positive pressure and appear to be characteristic of an oscillating air bubble. The negative portion of the curve appears jagged, irregular and uncharacteristic of an air bubble rising to the surface. Please explain what phase the quencher is operating in (i.e. air clearing or unsteady steam condensation) and the apparent difference with essentially the same test conditions except for nominal temperature as test A11 as shown in WCAP-13891, Table 1 "Test Matrix."

Enclosure

480.1108 The IRWST attached piping and submerged structures such as the support columns, "Integrated HD Support" as shown on drawing 1030 P2 001, revision 7 could experience an acceleration and or drag force from the IRWST tank during a quencher discharge. Please provide a discussion on the magnitude for those accelerations and forces and explain how those accelerations and forces were developed.

480.1109 There was a minimal amount of instrumentation (i.e. 8 pressure transducers) within the IRWST for the ADS tests. Discuss how this level of instrumentation can measure the various loads with a degree of precision that is necessary.

480.1110 Based on the measured test forces, how were the AP600 design loads determined and with what level of margin.

480.1111 Show how the ADS test conditions (pool temperature, pool submergence, and pipe flow in Table 1, page 15 of WCAP-13891) envelopes the DBA design conditions.