52-003

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

November 27, 1995

Mr. Nicholas J. Liparulo
Nuclear Safety and Regulatory Activities
Westinghouse Electric Corporation
P.O. Box 355
Pittsburgh, Pennsylvania 15230

SUBJECT: FOLLOWON QUESTIONS CONCERNING AP600 PRA SUCCESS CRITERIA USED IN THE LOW-POWER AND SHUTDOWN RISK ASSESSMENT

Dear Mr. Liparulo:

As a result of its review of the June 1992 application for design certification of the AP600, the staff has determined that it needs additional information in order to complete its review. Specifically, the enclosed questions have resulted from a review of the low-power and shutdown risk assessment in the AP600 PRA by the staff and its contractor. The question relate primarily to determination of success criteria using the MAAP4 analysis code.

You have requested that portions of the information submitted in the June 1992 application for design certification be exempt from mandatory public disclosure. While the staff has not completed its review of your request in accordance with the requirements of 10 CFR 2.790, that portion of the submitted information is being withheld from public disclosure pending the staff's final determination. The staff concludes that these followon questions do not contain those portions of the information for which exemption is sought. However, the staff will withhold this letter from public disclosure for 30 calendar days from the date of this letter to allow Westinghouse the opportunity to verify the staff's conclusions. If, after that time, you do not request that all or portions of the information in the enclosures be withheld from public disclosure in accordance with 10 CFR 2.790, this letter will be placed in the NRC Public Document Room.

These followon questions affect nine or fewer respondents, and therefore is not subject to review by the Office of Management and Budget under P.L. 96 511.

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Mr. Nicholas J. Liparulo
Westinghouse Electric Corporation

Docket No. 52-003
AP600

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Enclosure to be distributed to the following addressees after the result of the proprietary evaluation is received from Westinghouse:

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REQUEST FOR ADDITIONAL INFORMATION
ON PRA CHAPTER 54, LOW-POWER AND SHUTDOWN RISK ASSESSMENT

492.8 Are the GI (IRWST gravity injection directly through the DVI lines) and the GIRNS (gravity injection from IRWST via RNS suction line) completely redundant flow paths? Which is the limiting path between these two?

492.9 The MAAP4 code was used to analyze certain accident sequences to define the automatic depressurization system success criteria for AP600 at shutdown conditions. Since MAAP4 contains many simplified models with model parameters, e.g., VFSEP, that may be derived or tuned for the thermal-hydraulic conditions from the sequences initiated at the power operating conditions, has an evaluation been made to determine the applicability of MAAP4 for the shutdown sequences analyzed? Will the MAAP4 benchmarking cover the PRA sequences for both at-power and shutdown conditions?

492.10 P. 54-42 states that the assumed shutdown conditions for AP600 are defined in Table 54-52, which defines Modes 3 and 4 as RCS temperature ">350°F" and "200 - 350°," respectively. This mode definition is inconsistent with the AP600 Tech Specification, which defines Modes 3 and 4, respectively, as RCS temperature ">420°F" and "200 - 420°F." Please explain this difference and its acceptability.

492.11 It is stated (P.54-46) that the shutdown PRA analyses assume the decay heat starts at 1 percent of full power, which is higher than would be anticipated during these shutdown modes of operation, and therefore is quite conservative. P. 54-42 states that the decay heat of 1 percent of full power will be reached within 1 to 2 hours after shutdown, and is therefore bounding.

How much conservatism is in this value? What would be the effect on the core damage frequency if the initiating events that occur within 1 to 2 hours of shutdown with higher decay heat are included in the shutdown PRA?

492.12 In the MAAP4 modeling for shutdown conditions, the RNS relief valve is simulated as a hot leg break, which will open and close at the relief valve opening and closing pressures, respectively, and will deliver a break flow equal to the relief flow rate.

a. P. 54-44 states that "The RNS relief valve opens when the pressure reaches ~580 psia. It will relieve approximately 550 gpm. Although the actual valve has not been selected, most relief valves close within 5 to 15 percent of the opening pressure. In the MAAP4 model, the closing pressure was selected at 536 psia, which is 7.5 percent below the opening pressure." How would the results be affected by a closing pressure 15 percent below setpoint instead of 7.5 percent?

Enclosure

b. With regard to relief flow rate of 550 gpm, it is stated that "it is not known whether this prediction is consistent with the actual system response, since the MAAP4 model on the hot leg is only a rough approximation of the relief valve within the RNS. However, the only impact of the valve relief rate is on the timing on the event. The MAAP4 model just described is sufficient for the purposes of defining the automatic depressurization system success criteria." What is the basis for the conclusion that the MAAP4 model is sufficient for the purposes of defining the ADS success criteria?

492.13 With regard to the initiating event of a break in the RNS, P. 54-44 states that, because the break and the amount of water returned to the RCS are unknown, it is assumed that the RNS pumps continue to actively pump water from the RCS until the RNS pumps trip due to voiding in the hot leg. The method used to simulate the inventory lost through the RCS is to model a break on the hot leg with a break area that changes based on the hot leg water level, and a maximum break flow rate equal to the flow rate of the RNS pumps of approximately 3500 gpm. How realistic is this break model? Does the 3500 gpm pump flow represent the largest RNS break, i.e., no break in the RNS could result in a higher break flow?

492.14 Table 54-53 summarizes the MAAP4 analysis results of ADS success criteria for shutdown conditions.

a. For the sequences with manual actuation of various ADS stages (3 stage-2 and 3 valves, or 1 stage-4 valve), the results of the actuation times of 30, 60, and 120 minutes (from the event initiation) show that the cases with 60 minutes actuation time give either the highest or the lowest PCT among the three cases. What are the actual physical explanations of these phenomena?

b. For the manual ADS actuation sequences (for ADS success criteria ADTS, ADLS, and ADNS), no results are shown for actuation times of less than 30 minutes. How do you ascertain that ADS actuation earlier than 30 minutes will not result in higher peak cladding temperature than those analyzed?

c. The results for success criterion ADNS for the RNS line break sequence with manual ADS actuation are from the analysis of one break size (2000 gpm) only. Page 54-44 indicated that an RNS line break may have a maximum break flow of 3500 gpm (see RAI #492.13). Justify why this (2000 gpm) is sufficient to cover other break sizes.

November 27, 1995

If you have any questions regarding this matter, you may contact me at (301) 415-1141.

Sincerely,

Original signed by
William C. Huffman, Project Manager
Standardization Project Directorate
Division of Reactor Program Management
Office of Nuclear Reactor Regulation

Docket No. 52-003

Enclosure: As stated

cc w/enclosure:
See next page

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