52-003

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

March 4, 1996

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

Dear Mr. Liparulo:

SUBJECT: FOLLOWON QUESTIONS ON AP600 CONTAINMENT NATURAL CIRCULATION HEAT REMOVAL DOCUMENT NTD-NRC-95-4397

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. The enclosed questions were developed from review of Westinghouse document NTD-NRC-95-4397, dated February 16, 1995, "Basis for the use of forced convection heat transfer correlations in the AP600 PCS natural circulation driven air cooling path".

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

Sincerely,

original signed by:

Diane T. Jackson, 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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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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Questions on Westinghouse Report "Basis for The Use of Forced Convection Heat Transfer Correlations in the AP600 PCS Natural Circulation Driven Air Cooling Path"

480.397 NTD-NRC-95-4397, transmitted via letter dated February 16, 1995, from Nicholas J. Liparulo of Westinghouse to R. W. Borchardt of the NRC, was labeled preliminary on all pages of the text. Please state whether a final (non-preliminary) version of the same analysis will be submitted.

480.398 The third paragraph in the "Introduction" section of the report reads "The PCS air flow rate and temperatures were calculated by solving the coupled momentum and energy equations for the PCS air flowpath and its boundaries (shell, baffle, and shield building) with the shell temperature treated as a parameter. With the air flow rate and temperature, the riser Reynolds and Grashof numbers were calculated defining an operating map for PCS operation. The Reynolds and Grashof numbers corresponding to the AP600 operating map were used to characterize the mixed convection flow in the riser."

With respect to the previous paragraph, calculating the air flow rate requires a certain correlation; i.e., the energy and momentum equations are coupled in a natural convection problem. It appears that you are using the flowrate calculated using a certain correlation to determine the riser Re and Gr numbers in the riser, and then using these numbers to justify the use of the certain forced or mixed convection correlation in the riser. This methodology appears circular.

Given this background, please further explain how the flowrate was used in the context discussed in your submittal, and explain how its use in this context is physically and logically justified.

480.399 Referring to the discussion in Question 480.398, since Re and Gr were arrived at using a certain correlation to begin with, it seems invalid to use the Jackson-Hall criterion to establish the importance of buoyancy in the riser. Given this, please further explain and justify the use of the criterion.

480.400 Please explain the rationale for using a forced convection calculation in the riser when the naturally occurring flow is buoyant. Specifically, please state the magnitude of flows expected in the riser, how these values were obtained (experimentally, engineering judgement, etc.), whether they are prototypical of the AP600, and how they justify use of a forced/mixed convection correlation (for Scaling and SSAR analysis, respectively). If they are nonprototypical, specify the magnitude and source of the nonprototypicality.

Enclosure

480.401 What is the rationale for using different heat transfer correlations in the Scaling and SSAR Analyses (mixed convection in the SSAR and forced convection in the Scaling Analyses)? It would seem to be no more difficult, and more consistent, to use the same correlation in each analysis.

480.402 For the Dittus-Boelter turbulent forced convection correlation used to generate the Nusselt numbers in Table 1 of your report, please state what value was used for the exponent on the Prandtl number for the case of heat transfer from the outer containment shell to the air in the riser? In one instance in the report, the correlation is written with 1/3 as the exponent, and in another instance an exponent of .4 is used, while the correct value for a particular problem depends on the relative temperatures of the wall and the fluid.

480.403 For the Scaling, SSAR (AP600) WGOTHIC, and LST WGOTHIC analyses, please list the heat transfer correlations (to be) used in the riser and baffle regions. Also include the dynamic and geometric conditions for which each correlation is valid, whether it is a free, mixed, or forced correlation, and whether its use in the particular analysis is considered conservative or best estimate.