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

December 15, 1995

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

SUBJECT: DISCUSSION ITEMS FOR AP600 MEETING ON APPLICATION OF WCOBRA/TRAC LONG TERM COOLING ANALYSIS

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. The enclosed questions have been recently developed by the staff as a result of the review of the WCOBRA/TRAC OSU Long Term Cooling Preliminary Validation Report. We propose that these questions serve as an agenda item in an upcoming meeting concerning AP600 code and testing issues. In addition, a question on the closure of scaling analysis of test data is included for review. During the meeting, the staff will determine which discussion items need to be formally addressed by Westinghouse.

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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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
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Office of Nuclear Reactor Regulation

Docket No. 52-003

Enclosure:
As stated

cc w/enclosure:
See next page

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Docket No. 52-003
AP600

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DISCUSSION ITEMS CONCERNING THE AP600
WCOBRA/TRAC LONG TERM COOLING
PRELIMINARY VALIDATION REPORT

The objectives of the review of the AP600 long term cooling (LTC) and of the present request for additional information are: (1) to establish the applicability of the proposed methodology for the AP600 LTC following a small or a large break LOCA and (2) to assure that during the LTC transient the core remains covered. The material in this review consists of the data and the associated analysis in the preliminary report LTCT-GSR-003 and the modeling, noding and uncertainty information from the SSAR Appendices 15A, 15C and 15E.

1. WCOBRA/TRAC (WC/T) is used in the representation of the early part of the OSU simulation of a SBLOCA, i.e. the part which in licensing applications will be analyzed using NOTRUMP. How was it established that WC/T is qualified to represent the early part of a SBLOCA, particularly since WC/T has been adapted to the LTC part of the transient as discussed in section 4 of LTCT-GSR-003?

2. The containment is not part of the OSU simulation, the steam produced during the LTC was reintroduced as condensate into the IRWST. Containment condensation is a major part of the LTC cooling cycle. There is no discussion in LTCT-GSR-003 of the process which establishes the adequacy of the containment as a heat exchanger. In particular there is no discussion on: (1) the adequacy of the primary water to fill the containment with steam without core uncovery throughout the transient (2) the interface of the GOTHIC code and WCOBRA/TRAC regarding the time dependent condensation process and (3) the coolant inventory distribution as a function of time during the transient until steady state condensation rate is achieved.

3. In the SB01 and SB21 tests (Figure 5.1-36 and Figure 5.4-36) the IRWST flows were not stabilized at the end of the first window as required for the transition to the LTC. What other criteria were applied for the selection of the window width?

4. The LTC window is supposed to represent a stable set of conditions demonstrating that the core remains covered and the system is able to dissipate the decay heat. Yet this does not seem to be the case in that there are still evolutions in the system parameters. Please comment.

5. In the context of questions 3 and 4 above consider the following: Section 15.6.5.4C.1.0 states that an entire transient was modeled. Please show the results of such a transient if it is available. If not why not?

6. In the measurements and corresponding calculations only collapsed level is shown. Is the definition of "covered core" limited to collapsed level or does it extend to the two-phase level? Why was the two-phase level neither measured nor calculated?

Enclosure

7. Code changes described in section 4 were designed to enhance the code's ability to treat the LTC phase of the transient, thus, coarse nodalization was introduced (see for example Figure 2-2). It seems that the code so changed was also used in the estimation of the early part of the transient. Did the limited core noding contribute to overestimation of the core water level, thus, obscuring core coverage?

8. Figures 5.1-2, 5.1-26 and 5.1-29 show underprediction of pressurizer, core and downcomer water level, while the break flow (Figure 5.1-3) seems to be accurate. How is the coolant mass accounted for? The same trend seems to be exhibited in Figures 5.2-2, 5.3-2 and 5.4-2. Is this systematic behavior due to code inability to predict the water level?

9. On page 5.2-3 the presence of non condensable (air) caused a 500 sec delay to CMT draindown initiation. Is the presence of the accumulator cover gas accounted in the system during the transient?

10. Figures 5.3-10 and 5.3-11 indicate significant overprediction of the CMT injection. Do these overpredictions affect the viability of the level predictions in the vessel and put in question the functionality of the code?

11. The secondary level predictions in the steam generators, Figures 5.2-22, 5.3-24 and 5.4-22 exhibit a systematic underprediction. What do these underpredictions mean regarding the viability of the code?

12. The upper head water level in Figures 5.2-24, 5.3-30 and 5.4-28 for the last 3 simulations are missing. Why?

13. There is a significant discrepancy from 320 sec to 440 sec in the CMT injection flow rate Figure 5.4-12. In addition the direction of the simulation is opposite to that of the calculation. The same trend is manifested in Figures 5.3-14, 5.2-12 and 5.1-8. What caused the discrepancy and what does it mean for the code?

14. The WC/T IRWST injection flow Figure 5.4-36 has not stabilized at the end of the early window. Similar behavior is exhibited in Figures 5.3-38, 5.2-35 and 5.1-36. How does one use the end of these calculations to estimate the initial conditions for the LTC? What does this mean for the code?

15. What is the consequence of the systematic underprediction of the IRWST level in Figures 5.5-1, 5.6-1 and 5.7-1?

16. The WC/T ADS 1,2,3 flow integrals in Figures 5.5-16, 5.7-12 and 5.8-17 disagree with the OSU results and in addition show inconsistent trends. The trends do not point to a stabilized regime as expected for LTC. Please comment.

17. There is a large initial discrepancy (which persists throughout the window) in the core level estimates as shown in Figures 5.5-24, 5.6-24, 5.7-20 and 5.8-25. Please comment on this phenomenon and it significance.

18. The upper plenum pressure is underpredicted in Figures 5.6-2, 5.7-2 and 5.8-3. The corresponding break flows in Figures 5.6-4, 5.7-4 and 5.8-5 are inconsistent in that they should all be overpredictions. Aren't pressure predictions crucial for the core LTC behavior in that small pressure differences (from the real ones) can change the outcome of the transient? What are the step decreases in the beginning of these windows?

19. Figure 5.7-21 indicates the upper plenum level to increase while in this window the inventory should have stabilized. Please explain. In the remaining upper plenum data, there is a step level change. What is this due to?

20. In Figure 5.8-14 there is a significant DVI nozzle temperature underprediction, attributed to the contribution of the IRWST water. Is IRWST injection still operating this late in the transient?

DISCUSSION ITEMS CONCERNING THE CLOSURE OF AP600 SCALING ISSUES

1. As discussed at the meeting between Westinghouse and the NRC staff on December 6, 1995, the issue of scaling requires "closure" based on evaluation of the data from the design certification test program. While the specific procedure for accomplishing this closure is to be determined by the applicant, some of the technical areas that need to be addressed include:

   a. "Validation" of the AP600 PIRTs; i.e., an examination of the PIRTs for the various events and phases thereof to determine if the test data support the phenomena and their associated importance (ranking).

   b. Demonstration that the important phenomena are reflected in the scaling analyses for the test facilities, and that significant distortions suggested by the facility scaling analyses and/or observed during testing can be explained and accounted for. This is equivalent to "validating" the assumptions made in performing the scaling analyses.

   c. Along with (b), demonstration that the appropriate dimensionless parameters, especially those representing phenomena determined to be of "high" importance, are within a thermal-hydraulic range in the test programs consistent with that expected in the AP600 plant. In addition, code models that address these phenomena must be shown to be validated over the appropriate thermal-hydraulic parametric range.