52-003

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

March 1, 1996

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

SUBJECT: STAFF SUFFICIENCY REVIEW OF WESTINGHOUSE SUBMITTAL NTD-NRC-96-4634 "AP600 WGOTHIC NODING CONVERGENCE STUDIES"

Dear Mr. Liparulo:

The Nuclear Regulatory Commission (NRC) Containment Systems and Severe Accident Branch (SCSB) evaluated the subject report, submitted in letter dated January 31, 1996, and determined that it does not contain sufficient information to complete the review regarding noding convergence for the WGOTHIC computer code. The report does not demonstrate adequate engineering analysis to support the conclusions drawn. The staff is continuing to review the WGOTHIC computer program in other areas. It is requested that a complete noding convergence study be provided on an expedited basis. The staff is unable to complete the review of WGOTHIC without this information.

Nodalization selection should define the minimum nodalization needed to capture the important phenomena. In a noding convergence study, only the noding detail should be changed for the same model. A noding convergence study should demonstrate that the key results (in this case pressure and temperatures) do not change significantly when a finer nodalization is used. The first part of the Westinghouse report only evaluated small bare shell models which do not reflect the important passive cooling phenomena for AP600. The remainder of the report compared three completely different models and concluded that obtaining similar results demonstrates convergence. This approach does not allow for the possibility of compensating errors, or for the possibility that these models achieve similar results due to a common influence.

The study provided does have some interesting content, however, the report is insufficient for an adequate technical review and the results shown are incomplete. If Westinghouse wants to obtain staff review of the content of the original document, the information identified herein should also be provided.

Bare Shell Noding Studies - Two-dimensional Parallelepiped Models:

1. Provide a detailed description of the input for each model: node size, volume, momentum assumption between cells, initial conditions (pressure, temperature, etc).

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2. Provide a description of the source term: Mass and energy as a function of time, location in each model.

3. Provide the location used for each model to present the pressures shown in Figure 3 and for the differential temperatures shown in Figure 4. Note in Figure 4 that the y-axis should indicate differential temperature. Provide the location used for each model to present the flow rates shown in Figure 6.

4. Provide the justification for changing the plot identifiers from curve to curve for this set of analyses. Provide a sufficient detailed listing of each output to verify that the notations for each plot are correct as provided.

5. Explain why the 2x4z model predicts a temperature inversion.

6. Explain what causes the vapor velocities (Figure 5) for the most detailed nodal schemes to continue to increase after about 800 seconds.

7. Provide a discussion on the merit of this study to demonstrate that the assumption used in the AP600 DBA evaluation model. The study used the velocity dependent Gido-Koestel correlation while the AP600 used free convection only. There are no structures or internals modeled. The AP600 exterior boundary is not a constant temperature.

Bare Shell Noding Studies - Full Above Deck Models

1. Provide a detailed description of the input for each model: Node size, volume, momentum assumption between cells, initial conditions (pressure, temperature, etc). Provide a nodalization diagram for each model.

2. Provide a description of the source term: Location in each model.

3. Provide the location used for each model to present the pressures shown in Figure 8 and for the differential temperatures shown in Figure 9. Note in Figure 9 that the y-axis should indicate differential temperature, as should the figure title. Provide the location used for each model to present the near-wall velocities shown in Figure 10.

4. Provide a discussion on the merit of this study to demonstrate that the assumptions used in the AP600 DBA evaluation model are correct. This study used the velocity dependent Gido-Koestel correlation while the AP600 uses free convection only. There are no structures or internals modeled. The AP600 exterior boundary is not a constant temperature.

Complete AP600 Noding Studies

1. Provide a detailed description of the input for each model: Node size, volume, momentum assumption between cells, initial conditions (pressure, temperature, etc). Provide a nodalization diagram for each model.

2. Explain this sentence: "The NAI and Westinghouse models agree quite well and the NAI model deviates again due to coarse noding through the internal heat sinks."

3. If the bad NAI analysis was corrected, explain why the results from that analysis are not shown in Figures 14 through 17.

4. Include the results for the lumped parameter model in Figures 12 through 18.

5. Provide a correct Figure 13 to include data out to 10,000 seconds for comparison to Figure 12.

If you have any questions regarding this matter, you can contact me at (301) 415-8548.

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

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Docket No. 52-003
AP600

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