Westinghouse Electric Corporation
Energy Systems
Box 355
Pittsburgh Pennsylvania 15230-0355

NSD-NRC-97-5003
DPC/NRC0755
Docket No.: STN-52-003

February 27, 1997

Document Contr. l Desk
U. S. Nuclear Regulatory Commission
Washington, DC 20555

TO: T. R. QUAY

SUBJECT: WESTINGHOUSE RESPONSES TO NRC REQUESTS FOR ADDITIONAL INFORMATION ON THE AP600.

Dear Mr. Quay:

Enclosed are three copies of the Westinghouse responses to open items on AP600 topics. Responses to three RAIs are included in this transmittal. The attached RAIs, 480.330, 480.379, and 480.380 are revised responses to questions concerning the WGOTHIC. A reference for all three of the RAIs, WCAP 14845, is being sent concurrently in a separate transmittal.

The NRC technical staff should review these responses as a part of their review of the AP600 design. These responses close, from a Westinghouse perspective, the addressed questions. The NRC should inform Westinghouse of the status to be designated in the "NRC Status" column of the OITS.

Please contact Brian A. McIntyre on (412) 374-4334 if you have any questions concerning this transmittal.

Brian A. McIntyre, Manager
Advanced Plant Safety and Licensing

jml

Enclosures

cc: T. Kenyon, NRC - (w/o enclosures)
W. Huffman, NRC - (w/enclosures)
N. Liparulo, Westinghouse - (w/o enclosures)

E004 1/1

Question 480.330 Revision 1

Re: (WGOTHIC MODELS AND PHENOMENA)DOWNCOMER
Does WEC consider that the effects of the downcomer are negligible, and if so how has this been demonstrated? How can the effects of a downcomer be quantified without experimental validation?

Response:

The effects of the downcomer on AP600 are quantified by the PIRT (Reference 480.330-1) and scaling analysis (Reference 480.330-2), and shown to be of low to moderate importance. The effect of the downcomer on AP600 is small, but is not negligible. The downcomer is modeled in the evaluation model.

The lack of a downcomer in the LST has no effect on the data that were used to validate phenomenological models or on the use of the LST pressure as a comparison to the evaluation model. This is true because the LST is not used as a transient representation of AP600. The data collected from the LST at numerous locations for heat and mass transfer to the riser provide measurements of heat flux, shell surface temperature, air temperature, and air steam partial pressure that are used to validate the heat and mass transfer correlations. This separate effects approach is not affected by the presence or absence of a downcomer.

The downcomer in the AP600 evaluation model is modeled as a channel operating with mixed convection thermal interactions with the shield building and baffle. The scaling analysis energy pi group for heat transfer from the baffle to the downcomer, $\pi_{e,q,bfa}$ in Table 8 showed the energy transfer to the downcomer to be minor. The buoyancy contribution of the downcomer to the net PCS air flow path buoyancy is shown by the value of $\pi_{mv,dc}$ in Table 9-1 to be minor. The phenomena that occur in the downcomer were addressed in the PIRT and were all ranked low to moderate importance. Because the PIRT and scaling analysis showed the downcomer and its associated phenomena to be minor, it is sufficient to model the downcomer using ordinary analytical models.

References:

480.330-1 M. Loftus, J. Woodcock, D. Spencer, "Accident Specification and Phenomena Evaluation for AP600 Passive Containment Cooling System", WCAP-14811, December 1996, Westinghouse Electric Coproration.

480.330-2 D. R. Spencer, "Scaling Analysis for AP600 Containment Pressure During Design Basis Accidents," WCAP-14845, February 1997, Westinghouse Electric Corporation

SSAR Revision: NONE

Question 480.379 Revision 1

Re: (The following questions are based on the WEC March 29-30, 1995 ACRS Presentation on Scaling). Where does the "U" in the correlations come from when the main steam line break (MSLB) is being analyzed? How were equations derived, what assumption were used?

Response:

The containment rate of pressure change equation is derived from the energy equation for the containment gas. The energy equation for the containment gas is derived from the energy equation for a control volume which relates the internal energy, u, to the enthalpy fluxes and heat fluxes through the control surface. The derivation of the energy and rate of pressure change equations for the scaling analysis are presented in Section 6 of the scaling report (480.379-1).

References:

480.379-1 D. R. Spencer, "Scaling Analysis for AP600 Containment Pressure During Design Basis Accidents," WCAP-14845, February, 1997, Westinghouse Electric Corporation.

SSAR Revision: NONE

Question 480.380 Revision 1

Re: The following questions are based on the WEC March 29-30, 1995 ACRS Presentation on Scaling.
The Large-Scale Test air-annulus was scaled by matching Reynolds (Re) numbers. This tends to result in higher heat transfer and more vigorous in-containment convection than might be expected in the AP600. It would seem that scaling to the following form would be more appropriate:

integral (q dA / v)

What are the ramifications?

Response:

The scaling analysis (Reference 480.380-1, Sections 10.1.2 and 10.1.3) demonstrated that the Reynolds number is the appropriate dimensionless group to use to scale evaporation mass transfer and heat transfer to the riser.

References:

480.380-1 D. R. Spencer, "Scaling Analysis for AP600 Containment Pressure During Design Basis Accidents," WCAP-14845, February, 1997, Westinghouse Electric Corporation

SSAR Revision: NONE