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NSD-NRC-97-5096
DCP/NRC0836
Docket No.: STN-52-003

April 30, 1997

Document Control Desk
Nuclear Regulatory Commission
Washington, D.C. 20555

ATTENTION: T. R. Quay

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

Dear Mr. Quay:

Enclosed are three copies of the Westinghouse response to an open item on AP600. DSER-CN 21.6.2.4-4 addresses NOTRUMP methodology for transition boiling.

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. We suggest "Action N".

Westinghouse requests you provide any comments on this response by May 16, 1997 so that we can meet the milestone in SECY-97-051 to provide the final AP600 supporting documentation by May 30, 1997.

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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

br/cmp

Enclosure

cc: T. Kenyon, NRC (w/o Enclosure)
W. Huffman, NRC (w/Enclosure)
N. J. Liparulo, (W) (w/o Enclosure)

DSER-CN 21.6.2.4-4

Westinghouse needs to verify that the heat link methodology for transition boiling is not used in the AP600 NOTRUMP calculations.

Response:

The heat link methodology for transition boiling is used in the NOTRUMP AP600 calculations. However, the conditions that would cause the code to exercise this methodology are expected to occur only very infrequently, if at all, in the NOTRUMP AP600 calculations.

Based upon the wording of this question and the discussion on page 21-123 of Reference 1, Westinghouse believes that there is a misunderstanding of the implementation and/or application of the revised solution scheme for transition boiling in the noncritical heat link calculations of NOTRUMP for AP600. Therefore, the following clarification is provided.

The Westinghouse transition boiling correlation is used in two separate models of the NOTRUMP code for post-DNB heat transfer. One is in the noncritical heat link calculations, which are used to model heat transfer from metal structures (other than the fuel rods) to fluid nodes. The other is in the fuel rod-to-fluid heat transfer coefficient calculations (between core nodes and fluid nodes).

Noncritical Heat Links

The Westinghouse transition boiling correlation, as implemented in the noncritical heat link calculations of NOTRUMP, is discussed in Section 6 of Reference 2. The wall temperature calculations using Equation 6-40 of Reference 2 are performed with an iterative solution technique. The iterative scheme which was employed in the code prior to the AP600-related modifications was a crude method of successive substitution. This was improved as part of the NOTRUMP AP600-related code modifications by replacing the original scheme with the half-interval method which guarantees convergence, as discussed in Section 2-19 of the NOTRUMP Final Validation Report for AP600 (Reference 3). This improvement applies to all noncritical heat links, and thus this methodology is used in all NOTRUMP AP600 analyses in which noncritical heat links are employed. However, based on the noncritical heat link calculations for the critical heat flux which are explained in Reference 4, the actual heat flux is expected to exceed the critical heat flux only very infrequently, if at all. Therefore, the transition boiling regime is expected to be entered only rarely for noncritical heat links in the NOTRUMP AP600 analyses. This was confirmed, as stated in Reference 4, by checking the results of NOTRUMP AP600 plant runs for the entire range of break sizes. The only occurrence of a noncritical heat link exceeding the critical heat flux which was discovered was in the case of a 10-in. cold leg break. In this case, several momentary (unsustained) occurrences of transition boiling or film boiling were found in the steam generator primary side tube inlet (of both loops) during reverse heat transfer.

Fuel Rod Heat Transfer

The Westinghouse transition boiling correlation, as implemented in the fuel rod-to-fluid heat transfer coefficient calculations (between core nodes and fluid nodes) of NOTRUMP, is described in Appendix T of Reference 2, specifically in Section T-3 via Equations T-85 and T-86. There have been no modifications in this area of the code, and thus there are no changes to the core heat transfer methodology employed in the NOTRUMP AP600 analyses.

AP600

References:

1. "Supplement to the Draft Safety Evaluation Report: Related to the Certification of the AP600 Design," U. S. Nuclear Regulatory Commission, Docket No. 52-003, April 1996.

2. Meyer, P. E., et. al., "NOTRUMP - A Nodal Transient Small-Break and General Network Code," Westinghouse Electric Corporation, WCAP-10079-P-A (Proprietary), WCAP-10080-P-A (Non-Proprietary), August 1985.

3. Fittante, R. L., et. al., "NOTRUMP Final Validation Report for AP600," Westinghouse Electric Corporation, WCAP-14807, Revision 1, January 1997.

4. Westinghouse Response to NRC Request for Additional Information (RAI) Question 440.337.