

June 26, 2001

Mr. Michael M. Corletti
Advanced Plant Safety & Licensing
Westinghouse Electric Company
P.O. Box 355
Pittsburgh, Pennsylvania 15230-0355

SUBJECT: AP1000 PRE-APPLICATION REVIEW - ACCEPTANCE REVIEW OF CODES
SUBMISSION

Dear Mr. Corletti:

At the meeting held on June 6, 2001, at NRC Headquarters you presented the results of Westinghouse's work to develop the AP600 models to represent the AP1000 and described the results of running the various analytical codes on this model. The presentation built on the contents of WCAP-15664 which you sent to NRC in May to formally set out this work in support of the pre-application review of AP1000 and of other previous submissions. One of the agreements that we reached at the meeting was that the staff would complete a formal acceptance review of WCAP-15664, to determine its fitness for purpose, by the end of July, and then advise Westinghouse of their program for completing the technical review. We agreed that we would send any comments and requests for further information as they arose. As you are aware, work on some of the codes was already in progress and we are able to give you our position on the WGOTHIC code.

Our acceptance review of WGOTHIC has concluded that the AP1000 design has not been modeled with sufficient fidelity to support your subsequent code analysis. The material provided by Westinghouse (WCAPs-15612, 15613, and 15644) does not contain sufficient information for a review to determine if the mass and heat transfer correlations developed for the AP600 passive containment cooling system licensing evaluation are adequate for the AP1000 application. The containment model presented by Westinghouse for the AP1000 differs significantly from the approved WGOTHIC model for the AP600 in the following respects; the approach used to calculate loss-of-coolant accident mass and energy release rates, the noding strategy, and the Passive Containment Cooling System (PCCS) film conditions. Taken together these preclude the use of the experience and insights gained by the NRC staff during the review of AP600 to assess the performance of this design.

It is our position that a WGOTHIC model and results for the AP1000 design based on the approved AP600 evaluation model must be provided before an evaluation can be carried out.

M. M. Corletti

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In addition to addressing the modeling issues above Westinghouse will also need to address or respond to the issues set out in the enclosure to this letter. Some of these points amplify or reiterate previous Requests for Additional Information.

Sincerely,

/RA/

Alan C Rae, AP1000 Project Manager
Future Licensing Organization
Office of Nuclear Reactor Regulation

Project No. 711

Enclosure: Request for Additional Information

cc w/encl: See next page

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Sincerely,

/RA/

Alan C Rae, AP1000 Project Manager
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cc w/encl: See next page

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Request for Additional Information

- P10. The assessment analyses do not conform with the restrictions and requirements placed on the use of WGOTHIC for passive containment cooling system (PCCS) evaluations, nor are some of the mass and energy releases consistent with the current approved licensing approach. The nodal model is not consistent with the prescribed modeling practices developed by Westinghouse for the use of the WGOTHIC computer program for passive containment cooling system licensing evaluation. The boundary conditions (driving mass and energy, PCCS water flow rates and evaporation surface areas) are non-conservative with respect to the above prescribed modeling practices. The AP600 application of WGOTHIC took essentially no credit for evaporation on the surface of the dome, therefore if credit for dome evaporation is sought for the AP1000 Design Basis Accident analysis then justification for this will need to be provided. The staff cannot conclude from the results of the analyses presented that containment shell temperatures and PCCS film temperatures will not exceed 212 °F. The mass and heat transfer correlations do not account for film boiling, a potential new phenomena for the AP1000, onset of which would cause a discontinuity in the PCS performance. The NRC staff believes that a WGOTHIC model and results for the AP1000 design based on the approved AP600 evaluation model must be provided before a meaningful evaluation can be carried out.
- P11 In support of the Westinghouse determination that there is no need to account for new phenomena for the AP1000, the containment assessment analyses provided in WCAP-15612 are used as supporting information in WCAP-15613. In WCAP-15613 it is stated that the “PCCS film temperature increases to over 200 °F, but it was not predicted to reach the boiling point.” For the AP600, Westinghouse provided supporting information to confirm that the shell temperatures would not exceed 188 °F. Westinghouse needs to provide the results from an acceptable passive containment cooling system licensing evaluation to the staff to support the conclusion that shell temperatures in excess of the boiling temperature will not occur, or provide supporting evidence that the water coverage assumed is applicable to boiling conditions, and that the effects of boiling on PCCS film flow stability have been calculated with a validated model.
- P12 The NRC staff reviewed the NAI GOTHIC 4.0 manuals during the AP600 review and found errors. Westinghouse provided markups as to their interpretation of what the errors were and said they forwarded the information to NAI for consideration. Westinghouse needs to provide the NAI response, as the staff does not know how or if they were resolved. At this time, the base-GOTHIC documentation contains known errors.
- P13 The WGOTHIC 4.2 code approved for the evaluation of the AP600 is based on the GOTHIC 4.0 code. Considerable GOTHIC development and assessment efforts have occurred since GOTHIC 4.0 (the current version is GOTHIC 7.0). These efforts have led to the discovery and correction of a number of errors and deficiencies in the GOTHIC program, some of which may significantly affect the AP1000 (and AP600 as well) containment analysis results. For example, drop behavior models have been significantly changed and improved in GOTHIC 6.0 and 7.0 to correct overestimates in droplet entrainment and deposition. Westinghouse needs to provide a list of the

significant GOTHIC changes and error corrections since GOTHIC 4.0 and identify whether these changes have (or will be) been factored into the WGOTHIC code and model, and what potential impact these changes could have on the AP1000 containment analysis results.

- P14 Westinghouse uses the AP600 scaling study to support the AP1000. However, the staff and Westinghouse agreed during the AP600 review that the Large Scale Test (LST) was not properly scaled for transient situations. The LST is only valid for steady-state, as acknowledged by Westinghouse in WCAP-15612. In WCAP-15613, Table 2.6-1, Westinghouse refers to the “Transient Phase Scaling Parameter Comparison.” Westinghouse needs to clarify the purpose of the table as there is apparently no value-added to the report with this information.
- P15 The expert’s review process is not described. Please provide a summary of the expert’s reasoning behind there being no changes at the ‘Component or Volume’ level as used in Table 2.6-1 of WCAP-15613.

AP 1000

cc:

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