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Mr. James M. Taylor
Executive Director for Operations
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Dear Mr. Taylor:

SUBJECT: NRC TEST AND ANALYSIS PROGRAM IN SUPPORT OF AP600 ADVANCED LIGHT
WATER PASSIVE PLANT DESIGN REVIEW

During the 420th meeting of the Advisory Committee on Reactor Safeguards, April 6-7, 1995, we discussed the confirmatory test and analysis program being conducted by the Office of Nuclear Regulatory Research (RES) in support of the design certification review for the Westinghouse AP600 advanced light water reactor. During this meeting, we had the benefit of discussions with representatives of RES and its contractor, the Idaho National Engineering Laboratory. Our Subcommittee on Thermal Hydraulic Phenomena held a meeting on March 27-28, 1995, to discuss this matter. The Committee previously reviewed this matter during its October and November 1994 meetings and provided formal comments in its November 10, 1994 letter. We also had the benefit of the documents listed.

During the past year, the RES thermal-hydraulic program has undergone a dramatic change for the better. The presentations made to the Thermal Hydraulic Phenomena Subcommittee and the Committee were clear, well-organized, and demonstrated good technical thinking. We compliment the management, the staff, and the contractors for the improvement. We also note that RES is making good use of a cadre of high-quality thermal-hydraulic consultants.

Completion of the Phenomena Identification and Ranking Table (PIRT) for the AP600 remains an important task. It was much easier to develop the PIRT for the current operating plants because a great deal of relevant test data were available. This is not the case for the AP600 and SBWR passive plants. Development of the PIRT should be concurrent with a scaling analysis and review of test results to provide quantitative support for the engineering judgments that must be made. The RES approach appears to be systematic and well organized. We recommend, however, that RES fully document the development of the PIRT.

The RES analysis of test data from ROSA and Oregon State University (OSU) was very thorough. We encourage the staff to continue such efforts, while drawing on the insights from the ongoing scaling analysis. RES should strive to provide

complete documentation of the test analysis effort and should also document the phenomena that are not important.

The ongoing RES scaling analysis for the test facilities is an important effort.

This analysis can be used to assess the impact of scaling distortions and atypicalities of the different facilities to support the conclusions of PIRT as

well as to understand the physical phenomena important to AP600 thermal-hydraulic

behavior. For the current operating plants, the PIRT was developed for existing

systems whose thermal-hydraulic behavior was demonstrated over a 20-year period.

For the AP600 design certification review, however, comparable understanding must

be gained quickly. We believe that a rigorous analysis of test data based on the

use of a good scaling analysis and the PIRT should permit this to be done.

We

recommend that the OSU scaling effort performed in support of the

Westinghouse

test program be a starting point for the development of a consistent set of AP600

scaling criteria for application to the ROSA, OSU, and SPES test facilities.

Several issues were discussed during our meetings with RES. The first is the potential for water hammer in the AP600 design during LOCAs. Attention should

be given to identifying where and under what circumstances water hammer could occur. A second is the potential for thermal stratification in the Core Makeup

Tank, the Incontainment Refueling Water Storage Tank, and in the horizontal pipe

runs of the reactor coolant system. The occurrence of thermal stratification

in the cold leg combined with the possibility of steam injection could be a precursor to a significant water hammer. We recommend that the potential

safety

problems caused by these phenomena be identified and their significance to

safety

be assessed soon in order to avoid questions at the time of certification.

The

RES thermal-hydraulic consultants could be very helpful in this regard.

We are concerned about the applicability of the present thermal-hydraulic codes

(TRAC, RELAP5) for analysis of plants like the AP600. These codes have to predict types of thermal-hydraulic behavior for which they have been shown to be

weak; i.e., prediction of condensation, thermal stratification, and water level.

We recommend that RES consider developing a contingency plan in the event that

the codes cannot adequately predict these key phenomena.

Although the focus of our meetings with RES was on the development of the PIRT, some reference was made to determination of computational uncertainty. The uncertainty parameter of choice is peak clad temperature for the large-break LOCA while reactor vessel primary system inventory is the choice for the small-break LOCA. With resources being reduced, we recommend that RES focus its attention on the more safety-significant small-break LOCA.

Overall, much progress in the RES thermal-hydraulic program is evident. It is well structured and will yield a great deal of valuable insight into the behavior of passive plants.

Sincerely,

T. S. Kress
Chairman

References:

1. Memorandum dated February 14, 1995, from M. Wayne Hodges, NRC Office of Nuclear Regulatory Research, to John T. Larkins, ACRS Executive Director, transmitting INEL draft report, "Interim Phenomena Identification and Ranking Tables for Westinghouse AP600 Small Break Loss-of-Coolant Accident, Main Steam Line Break, and Steam Generator Tube Rupture Scenarios," INEL-94/0061
2. Memorandum dated February 14, 1995, from M. Wayne Hodges, NRC Office of Nuclear Regulatory Research, to John T. Larkins, ACRS Executive Director, transmitting LANL draft report by B. Boyack, "AP600 Large-Break Loss-of-Coolant Accident Phenomena Identification and Ranking Tabulation"
3. Letter dated February 15, 1995, from Gary E. Wilson, INEL, to Tim Lee, NRC, Subject: Transmittal of AP600 T/H Consultants Meeting Minutes
4. ACRS report dated November 10, 1994, from T. S. Kress, ACRS Chairman, to James M. Taylor, Executive Director for Operations, Subject: NRC Test and Analysis Programs in Support of AP600 and SBWR Advanced LWR Passive Plant Design Certification Reviews

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