

CERTIFIED BY:
I. CATTON - 5/6/92

CERTIFIED

DATE ISSUED: 4/17/92

ACRS-2806

PDR 7/25/92

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
THERMAL HYDRAULIC PHENOMENA SUBCOMMITTEE MEETING MINUTES
NEED FOR INTEGRAL SYSTEM TESTING (IST) IN SUPPORT OF AP600 DESIGN
MARCH 3, 1992
BETHESDA, MARYLAND

PURPOSE:

The purpose of the meeting is for the Subcommittee to continue its review of the integral system testing requirements for the Westinghouse Electric Corporation's (W) AP600 passive plant design.

ATTENDEES:

Principal meeting attendees included:

<u>ACRS</u>	<u>NRC</u>
1. Catton, Chairman	A. Thadani, NRR
J. Carroll, Member	R. Jones, NRR
W. Kerr, Member	A. Levin, NRR
C. Michelson, Member	M. Ortiz, INEL
D. Ward, Member	P. Griffith, MIT
E. Wilkins, Member	M. DeMarizo, U. Md
V.J. Dhir, Consultant	
V. Schrock, Consultant	<u>Westinghouse</u>
H. Sullivan, Consultant	B. McIntyre
N. Zuber, Invited Expert	L Hochreiter

Portions of this meeting were closed to the public to discuss information proprietary to the Westinghouse Electric Corporation

A complete list of meeting attendees is attached to the Office copy of these Minutes.

Meeting Highlights, Agreements and Requests

1. In opening comments, Dr. Catton posed the following questions for the Subcommittee's consideration during the day's presentations:

- Is it necessary to conduct full-height/full-pressure (FHFP) testing in order to validate the AP600 design? If the answer is "yes", should W perform such testing?
- Should NRC-RES conduct its own confirmatory test program in this regard? If the answer is "yes", should the testing be conducted at the Japanese ROSA-IV facility?

Dr. Catton said he would query the Subcommittee Consultants at the conclusion of the meeting presentations. He also requested that they provide him written responses before they leave the meeting.

2. Dr. Catton asked Messrs. Schrock and Zuber to summarize their impressions of the NRC/Y working-level meeting which was held on

9210050221 920506
PDR ACRS
2806

PDR

DESIGNATED ORIGINAL

Certified By EJB

R501 10

T/H Phon. Sub. Mtg.
March 3, 1992

2

February 25, 1992. The goal of this meeting was to attempt to come to closure on the issue of the need for W to perform FHFP testing. The following comments were noted:

Mr. Schrock - Overall, little was accomplished towards the goal of reaching closure. NRC presented a stronger case for W performing FHFP integral system testing (IST) than W did in refuting the need for such testing. NRC also noted that the lessons of history need to be considered here vis-a-vis the large-break LOCA issue and development of 10 CFR 50.46 and Appendix K.

W also revealed a number of new changes to the AP600 design.

The DOE representative present said he doesn't see a need for FHFP IST. In response to Mr. Michelson, Mr. Schrock said that, at this point, no one on the NRR staff feels comfortable with the particulars of the AP600 design such that a Safety Evaluation Report can be written.

Dr. Zuber - Agrees with Schrock's comments. Feels W has done a lot of work, but still does not have their arms around the issues of concern. The scaling rationale for the OSU facility was not presented, nor was there any discussion of the test matrix for same. The new design changes may impact performance of the safety systems as well.

In response to questions from the Subcommittee Members, Dr. Zuber indicated that use of ROSA-IV by RES for confirmatory testing will be fruitless; also, he does not believe the RELAP5 code is up to the challenge at hand. However, if FHFP tests are run, (at the proper facility) the job of bringing the RELAP5 code up to snuff can be done in - three years.

Dr. Hochreiter noted that the staff has not been provided all the information associated with the particularity of the AP600 design. This material will be submitted in June, 1992 pursuant to their "FSAR" for design approval. Further, Hochreiter noted that W believes their design is sound but acknowledged that they still need to prove their case.

3. NRC-NRR discussed the rationale for W to perform FHFP integral system testing. In opening remarks, Mr. A. Thadani noted that 10 CFR Part 52 requires the staff to both make a finding of acceptability for the safety features employed and verify the analysis tools used, prior to certification of the acceptability of their designs. As noted by Mr. Schrock, NRR is in part driven by the past experience with LB LOCA. While they agree with W that they don't have all the design information available, they do have sufficient understanding of the design such that they believe safety concerns exist which must be addressed.

T/H Phon. Sub. Mtg.
March 3, 1992

3

R. Jones noted the following points regarding the need for IST for AP600:

- The W testing program is sufficient for development of the necessary code models. However, IST is needed in order to allow assessment of synergistic effects of interactions occurring between processes in various components of the RCS. Such testing provides crucial data needed for code validation.
- Analyses using RELAP5 has identified the need for high-pressure IST data. The RCS can remain at high pressure for several minutes due to activation of the ADS (automatic depressurization system) on core makeup tank (CMT) level. Several parallel flow paths compete at these high-pressure conditions.

Details of the staff's technical concerns related to the AP600 design were provided by Dr. A. Levin (NRR). Key items noted by Dr. Levin included:

- The staff's early review has been based on preliminary/draft material. In addition, both the plant design and the W test program has changed considerably over the past year. NRC has developed areas of technical concern, characterized as both specific phenomenological questions and global system-related performance issues. Many of these concerns will require FHFP IST data for resolution.

Dr. Kerr suggested to the staff that the testing may be unnecessary if W provided all the information NRR needed. Mr. Jones indicated that the staff believes that they have a sufficient understanding of the design at this time such that IST is believed necessary.

- Dr. Levin detailed the following technical concerns with the AP600 design:

- Effect of condensation in CMTs
- Effect of thermal stratification in CMTs
- Effect of system depressurization on CMT behavior
- Refilling of CMTs through recirculation from cold legs or accumulators
- Interactions between RCS/CMTs during pressure balancing line breaks
- Effect of asymmetric safety injection
- Influence of high pressure system response on low-pressure safety system behavior
- Influence of operator actions on high-pressure safety system performance
- Behavior of multiple natural circulation paths and possible steam generator holdup effects

- Transient non-LOCA behavior, notably multiple SGTR events, that could activate passive safety systems
- Reliance on natural circulation driving heads and potential for disruptions of these balances by system interactions

Members of the Subcommittee noted the following points during discussion of the above items: Dr. Shotkin indicated that the need for modification of RELAP5 to model the AP600 design was identified some time ago. Mr. Jones said NRR will rely on the CSAU process in order to obtain sufficient confidence in the modeling capability of the code. Dr. Zuber expressed concern with the ability of W to establish the proper initial boundary conditions for the tests at low pressure, absent high-pressure test data. Based on his extensive experience in this area, Dr. Zuber said FHFP tests will be needed so that the impact of scale distortions seen in these tests is minimized.

Dr. Sullivan opined that much will be learned from the W test program; one should examine that test data before deciding on the need for FHFP ISTs. Mr. Ward said he believes that the decision to perform FHFP tests is really a business decision for W and that they assume the risk if they made a "bad" decision. The staff noted that they are not sanguine that the W low-pressure ISTs planned at the Oregon State University (OSU) facility will suffice, due to scaling distortion problems seen at the University of Maryland test facility. During further discussion, W noted that they have added the capability to model the AP600 non-safety systems to the OSU facility.

4. Representatives of the Westinghouse Electric Corporation provided their rationale for not performing FHFP IST. In opening comments, Mr. B. McIntyre noted that the addition of a pumped high-pressure safety injection system (recommended by W in lieu of performing FHFP IST), is counter to the fundamental principle of the AP600 design, i.e. simplicity. In addition, installation of a pumped SI system would require addition of safety-grade rotating support equipment which W is trying to eliminate from this plant design.

Mr. McIntyre noted that W will be submitting the SSAR for AP600 to the NRC staff for its review on June 26, 1992.

CLOSED SESSION DELETED DUE TO PROPRIETARY INFORMATION
- FOIA EX(b)(4)

CLOSED SESSION DELETED DUE TO PROPRIETARY INFORMATION
- FOIA EX(b) (4)

6. In open session, Dr. B. Sheron provided discussion on the staff's plan for confirmatory research in support of the AP600 design certification effort. Dr. Sheron indicated that the main reason for RES to pursue a FHFP integral test program is to obtain data that will allow the staff to make best-estimate analyses. He noted that RES has been criticized by, among others, the ACRS for not utilizing BE analyses.

Dr. Sheron said the current staff plans call for construction of a small-scale, low-pressure integral test facility similar in size to the University of Maryland test rig. For FHFP testing, RES proposes use of the ROSA-IV facility, located in Japan. The reasons for using ROSA include: funding needed to construct a new facility in the U.S. (~\$25-30M) is not available; the schedule for

T/H Phon. Sub. Mtg.
March 3, 1992

6

completing the certification review favors use of an existing facility; a cooperative test program with W does not appear viable given both their lack of interest and potential conflict of interest concerns.

Dr. M. DeMarizo (University of Maryland) provided comments on the potential usefulness of ROSA-IV to simulate behavior of the AP600 design. Dr. DeMarizo served on the RES-sponsored Review Group as did Dr. Griffith, who's comments are noted above. In brief, Dr. DeMarizo indicated that if suitably modified pursuant to plan, ROSA should be able to capture the major T/H phenomena of interest. He also indicated that the staff's low-pressure facility should have a maximum pressure capability of ~600 psig, which exceeds the planned capability of the W OSU facility (300 psig).

7. At RES's behest, INEL performed analysis of AP600 and the ROSA-IV facility in order to attempt to determine the suitability of ROSA for AP600 simulation and to discover what modifications to ROSA are necessary to make it acceptable for such use. The code used for the analysis was RELAP5. Dr. M. Ortiz (INEL) was the presenter.

INEL assumed the ROSA facility was physically modified to simulate the features of the AP600 design. The most significant modification necessary was to replace the ROSA-IV (short, fat) pressurizer with one of more prototypical design.

Dr. M. Ortiz noted the following points:

- ROSA-IV simulates the AP600 SB LOCA scenario reasonably well prior to initiation of the ADS.
- Assumed ROSA-IV configuration cannot capture the non-symmetric behavior of AP600
- The phenomena of most importance occur in both (AP600 and ROSA analyses) simulations, but magnitude, timing, and the sequence of occurrence are not always the same
- Additional analyses are in progress, with additional modifications assumed for the ROSA hardware.

8. Dr. Catton requested comments from the consultants relative to the questions he posed at the beginning of the meeting:

- Is it necessary to conduct full-height/full-pressure (FHFP) testing in order to validate the AP600 design? If the answer is "yes", should W perform such testing?

● Should NRC-RES conduct its own confirmatory test program in this regard? If the answer is "yes", should the testing be conducted at the Japanese ROSA-IV facility?

Mr. Schrock - Believe the Committee should support NRR's position relative to the need for FHFP IST. W should conduct this testing. RES should perform confirmatory research only if NRR needs it and this testing should be completed before certification of the design. The RES arguments for use of ROSA-IV are not compelling to me.

Dr. Zuber - A FHFP IST test facility is needed as is a University of Maryland-type low-pressure facility. NRR provided good arguments relative to the need for FHFP testing. The W arguments against the need for such testing were weak. Recommend that RES enter a cooperative test program with W and believe that the Commission should fund construction of a FHFP test facility in the U.S. Question that the data from ROSA IV will be useful, and do not believe it wise to transfer the related technology to Japan.

Dr. Dhir - Agree with NRR that FHFP testing needed and that W should perform these tests. Recommend that a cooperative program be constructed between W/NRC/DOE. Given expected problems with scale distortion, flow asymmetry, etc. and possible political problems as well, would recommend that the FHFP test facility be built in the U.S.

Dr. Sullivan - Do not have enough information to make a judgment on the need for FHFP IST pending results of some of the W tests. Believe if FHFP testing is needed, as decided by the staff, a cooperative program should be the vehicle to accomplish this. If there is a cooperative effort, RES doesn't need to perform its own high-pressure tests. Recommend that all parties perform more analytical work before a decision is made.

During discussion, Mr. Ward indicated that it may be prudent to postpone a decision on the need for FHFP testing until the results of the W tests at CSU, and other W separate-effects tests, are available. Given this approach, W would be given to understand that they are assuming the risks associated with impacting the certification schedule, should such testing be deemed to be needed after all.

10. The meeting was adjourned at 7:05 pm.

FUTURE SUBCOMMITTEE ACTIONS ON THIS MATTER AND ITEMS FOR FOLLOW-UP

Follow-up

T/H Phon. Sub. Mtg.
March 3, 1992

8

Dr. Zuber requested a copy of the W scaling study for their OSU test facility

Future Subcommittee Actions

This matter was discussed with the ACRS during its March Meeting. The Committee authored a letter recommending that FHFP IST be performed in support of AP600 design certification. Further, the ACRS recommended that this testing be performed under the auspices of a cooperative test program.

Note: Subsequent to the March ACRS Meeting, W agreed to perform FHFP IST at the SPIS facility, located in Italy. Further, the Commission is considering the RES proposal to perform confirmatory testing at ROSA-IV. The Committee authored a letter during its April Meeting which urged the Commission to defer a decision on this matter pending further Subcommittee/ACRS discussion with the staff.

The Subcommittee will continue to review the issues associated with this matter. The next meeting of the T/H Phenomena Subcommittee has been scheduled for June 3, 1992 to review RES's proposed ROSA-IV test program.

BACKGROUND MATERIAL PROVIDED THE SUBCOMMITTEE FC. THIS MEETING

1. Excerpt from Actions, Agreements, Assignments and Requests of January, 1992 ACRS Meeting
2. SECY-92-030, dated January 27, 1992. "Integral System Testing Requirements for Westinghouse's AP600 Plant"
3. INEL (draft) Report, dated February 8, 1991, "Applicability of RELAP5 for AP600 Safety Analysis", C. Motloch
4. INEL Report, dated May 13, 1991, "Assessment of RELAP5/MOD3 for Low Pressure Critical Flow Conditions", S. M. Sloan
5. INEL Report, dated September 26, 1991, "RELAP5/MOD3 Code Assessment Studies Performed in Support of AP600 Thermal-Hydraulic Analysis", S.M. Sloan
6. INEL Report (rough draft), "Investigation of the Applicability and Limitations of the ROSA-IV Large Scale Test Facility for AP600 Safety Assessment", J.E. Fisher, et. al.