UNITED STATES
NUCLEAR REGULATORY COMMISSION
Nuclear Safety Research Review Committee
Washington, D.C. 20555

30 December 1992

Mr. Eric S. Beckjord, Director
Office of Nuclear Regulatory Research
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Dear Mr. Beckjord:

This is an update on the deliberations of the Nuclear Safety Research Review Committee on the reports of its Advanced Reactor Subcommittee concerning its meeting of July 1-2, 1992, on AP600 integral testing, and of the Severe Accident Subcommittee concerning its meeting of July 2, 1992, on the Severe Accident Research Program Plan Update (Draft NUREG-1365, Revision 1).

The committee discussed these reports at a telephone conference meeting on October 22, 1992, in which eleven of the twelve members of the Committee participated. Three members (Drs. Isbin, Morrison, and Vogel) were present in person; the other members participated by conference telephone hookup. One member (Dr. Todreas) participated only during the advanced reactor part of the meeting. The Committee had the benefit of the presence in person and inputs to the discussion by the Director and other cognizant staff members of the Office of Nuclear Regulatory Research. The meeting was noticed in the *Federal Register* and was open to the public.

The Committee, after deliberating on the subcommittee reports, endorsed the reports, accepting them as reports of the Committee.

The Advanced Reactor and Severe Accident Subcommittee reports were transmitted to you on July 22, 1992, and August 11, 1992, respectively. I enclose them again herewith, for the convenience of having an integrated record of the results of the Committee's October 22, 1992 meeting.

Sincerely,

David L. Morrison, Chairman
Nuclear Safety Research Review
Committee

DLM/sje

Enclosures(2)

UNITED STATES
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22 July 1992

Mr. Eric S. Beckjord
Director
Office of Nuclear Regulatory Research
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Dear Mr. Beckjord:

Enclosed please find a copy of a letter report of NSRRC's ALWR Subcommittee on AP600 thermal hydraulic testing. This letter report has been received and reviewed by the NSRRC and is accepted as a statement of the Committee's current position on AP600 thermal hydraulic testing.

If you have any questions on this NSRRC report, please contact Dr. Neil Todreas or me.

Sincerely,

David L. Mor. on
Chairman
Nuclear Safety Research Review Committee

DLM/sje

Attachment

UNITED STATES
NUCLEAR REGULATORY COMMISSION
Nuclear Safety Research Review Committee
Washington, D.C. 20555

July 20, 1992

Dr. David Morrison
The MITRE Corporation
7525 Colshire Drive, MC W766
McLean, VA 22102

Dear Dr. Morrison,

The NSRRC Advanced Reactors Subcommittee (Messrs T. Boulette, S. Burstein, H. Isbin and N. Todreas (Chairman) in attendance) met on July 1 and 2, 1992, and reviewed Office of Nuclear Regulatory Research (RES) programs pertaining principally to the AP-600 program. Among these programs, the RES proposal to conduct integral systems tests at the ROSA facility of the Japanese Atomic Energy Research Institute (JAERI) was examined in detail. Because of the timeliness of this NSRRC review regarding the forthcoming Commission decision whether to proceed with this program, this letter has been prepared to set forth the relevant conclusions of our review. A supplementary report of the full scope of the July 1 and 2 meeting will follow which will contain detailed observations and suggestions relevant to the RES programs examined.

THE RES PROPOSAL

The RES proposal examined was to conduct USNRC sponsored confirmatory integral systems tests on AP-600 using a full-pressure, full-height facility. The purpose of these tests is to develop a sufficient data base with which to enhance the assessment of an analytical tool that could then be used with confidence to assess full size plant responses to initiating accident sequences. The selection of a facility is constrained by the: (a) desire to obtain test results prior to the currently scheduled preparation (Summer, 1994) of the Draft Safety Evaluation Report (DSER) and the issuance (November, 1994) of the Final Design Assessment (FDA), and (b) need to obtain these results within the currently anticipated budget for this work of approximately $10 million. The selected facility is ROSA modified as proposed by RES and agreed to by JAERI to a configuration (ROSA V) representing a 1/30 by volume scaled model of AP-600 with the major model deviation being the use of a single versus the actual two cold legs per loop.

The NSRRC Subcommittee examined this proposal by posing and resolving a series of questions, starting with the need for this testing and culminating in the examination of the efficacy and adequacy of the proposed solution. These questions, restated specifically for AP-600 integral systems testing, will be sequentially reviewed next by summarizing the NRC position and then stating the Subcommittee's conclusion.

"What are the NRC's needs for confirmatory systems research on AP-600"?

Integral systems tests in a full-pressure, full-height facility are deemed necessary because the response of the systems to initiating events cannot be analytically predicted with confidence by the use of existing analytical tools (computer codes). This is due to both the possibility of interactions between systems and components and the low driving heads uniquely inherent in the passive system design as currently proposed. The test data are to be

used to qualify an analytical tool to assess plant response. This approach is taken because no scaled facility can serve as a demonstration of full size plant response to initiating events. System behavior under three accident sequences is of particular interest because the passive safety systems are called upon to operate at high pressure:

- Small break loss-of-coolant accident,
- Steam generator tube rupture, and
- Steam line break.

Independent NRC testing at low pressure is not considered essential since the planned vendor test program is deemed to yield sufficient data. However, it is anticipated that the high pressure ROSA facility to be used by the NRC as discussed later can be run to yield supplementary lower pressure data.

The NSRRC Subcommittee concurs with the NRC's need for independent confirmatory systems research to insure that its analytic tools are qualified to assess full plant response. The availability of integral systems low pressure data to insure performance of the gravity drain/core cooling system behavior is recognized as equally important as high pressure test results.

"What integral systems testing program has the vendor proposed for AP-600"?

A high pressure test program will be conducted in the full-pressure, full-height, 1/395 by volume, scaled SPES-2 facility in Italy. A low pressure (400 psi maximum) test program will be conducted in the 1/200 by volume scaled Oregon State University (OSU) facility. The extension of SPES tests below 400 psi so as to initialize OSU tests is being explored.

The NSRRC Subcommittee took note of this planned vendor test program.

"Why should the NRC conduct confirmatory integral systems tests on AP-600 using a full-pressure, full-height facility when the vendor will conduct a similar test program"?

The NRC stated that they had a need to extend the expected vendor test matrix beyond the design basis to develop confidence that the design basis is a satisfactory limit. This would be achieved by experiments at or slightly beyond design basis conditions to ensure that no unanticipated phenomena or major effects occurred in this operating band, and thereby confirm the adequacy of the design basis limit.

The NSRRC Subcommittee concurs with the NRC need to develop confidence in the design basis in this manner. However, it is emphasized that we do believe that vendor demonstration of satisfactory plant performance within the design basis should clearly remain the required standard for design approval.

"Why did the NRC select ROSA as the test facility rather than use the Italian SPES facility in which the vendor will conduct tests or construct a new, domestic facility"?

The NRC could have chosen to contract separately with the SPES operators for conduct of an independently prescribed NRC test matrix, thereby avoiding conflict of interest. This was not done primarily for two reasons:

- Vendor access to the facility will take precedence over NRC access. Delay in conducting the vendor program or extension of the vendor program is possible and would severely upset the NRC schedule for acquisition of NRC independently produced test data. The value of the test results will be maximized if they can be used in the assessment of codes required for NRC safety analyses.

- The vendor has not presented analysis to the NRC to firmly establish that the data from SPES is valid by itself to qualify an analytic tool for use on a full scale plant. Scale effects probably need to be assessed and confirmed, as they have in past NRC thermal/hydraulic test programs, by tests at different scales.

The NSRRC Subcommittee concurs that plans to conduct NRC tests in SPES would not be prudent because of the cited schedule and test scale concerns.

"What is the NRC doing to ensure that the ROSA facility will be configured correctly and will simulate the performance of the AP-600 passive safety features with acceptable fidelity"?

The NRC has performed an extensive comparative assessment, using the RELAP 5, MOD 2.5 analytic tool, of the behavior of the ROSA facility and the AP-600 plant to the same set of initiating events. From these analyses, desired improvements in the ability of ROSA to simulate the phenomena appearing in the plant were identified. Costs for these improvements, specifically changes in the facility configuration, were estimated and subsequently negotiated with the ROSA owner. The final negotiated configuration has been analyzed and is expected to satisfactorily represent all full plant phenomena including many, but not all, aspects of asymmetrical loop behavior. The cost for ROSA modifications and the schedule for their implementation and the conduct of the test program meet NRC criteria. Further, the NRC stated to us that no domestic facility could come close to meeting the NRC cost and schedule criteria in that a cost of $40-50 million and a time of approximately three (3) years would be required to construct a domestic facility meeting or improving on the ROSA V facility criteria.

The NSRRC Subcommittee reviewed the technical basis for the proposed modifications to ROSA and its consequent suitability as the NRC's selected high pressure test facility. The Subcommittee concludes that the following key factors need to be balanced in reaching a decision:

- The importance of obtaining independent NRC data to confirm the adequacy of the design basis limit.
- The advantage of obtaining these data in a timely manner to allow their use in assessing codes used in safety analyses.
- The need to avoid the possibility of introducing ambiguity into the assessment process from experimental data taken on a test facility which may not represent full plant phenomena in all aspects.

After reviewing the data presented[1] and weighing these factors, the Subcommittee concurs with the RES recommendation to proceed with the ROSA V program for integral systems testing of the AP-600 plant design. This activity needs to be part of a well integrated

1 During the preparation of this report, the Subcommittee received and reviewed the comments of the ACRS consultants concerning the SPES and ROSA integral test facilities.

program involving careful code enhancement and assessment, and possibly well-selected separate-effects tests for phenomena that cannot be fully explored in these integral facilities. Such a program is needed since the purpose of the integral testing is not a demonstration of AP-600 performance, but rather it is to gather data for code assessment. These aspects will be discussed more fully in our supplemental report.

Sincerely,

Neil Todreas

Neil E. Todreas
Chairman, NSRRC
Advanced Reactors Subcommittee