March 8, 1994

Docket No. 52-003

Mr. Nicholas J. Liparulo
Nuclear Safety and Regulatory Activities
Westinghouse Electric Corporation
P.O. Box 355
Pittsburgh, Pennsylvania 15230

Dear Mr. Liparulo:

SUBJECT: STAFF REVIEW ACTIVITIES FOR THE AP600 DESIGN CERTIFICATION TESTING PROGRAM

Enclosed for your information are copies of the staff's implementation plan for the review of the AP600 testing program and staff guidance regarding monitoring and reporting on the conduct of design certification tests. The implementation plan was originally issued on October 21, 1992, and subsequently revised on February 17 and September 15, 1993 (Enclosures 1, 2, and 3, respectively). All three versions of the plan are enclosed since they build on one another. The staff guidance dated January 14, 1994 (Enclosure 4), supplements the information provided in the implementation plan. It is the staff's expectation that your review of these documents will provide better insight into the staff's review process and lead to more productive interactions between the staff and Westinghouse on the AP600 testing program.

Sincerely,

(Original signed by)

Frederick W. Hasselberg, Project Manager
Standardization Project Directorate
Associate Directorate for Advanced Reactors
and License Renewal
Office of Nuclear Reactor Regulation

Enclosures:
1. Plan dtd 10/21/92
2. Revised Plan dtd 2/17/93
3. Rev. 2 Plan dtd 9/15/93
4. Guidance dtd 1/14/94

cc w/enclosure:
See next page

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DATE:	03/7/94	03/7/94	03/9/94

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Mr. Nicholas J. Liparulo
Westinghouse Electric Corporation

Docket No. 52-003
AP600

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March 8, 1994

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

October 21, 1992

MEMORANDUM FOR: Dennis M. Crutchfield, Associate Director
for Advanced Reactors and License Renewal
Office Of Nuclear Reactor Regulation

FROM: Ashok C. Thadani, Director
Division of Systems Safety and Analysis
Office of Nuclear Reactor Regulation

Brian W. Sheron, Director
Division of Systems Research
Office of Nuclear Regulatory Research

SUBJECT: IMPLEMENTATION PLAN FOR THE REVIEW OF VENDOR TESTING PROGRAMS FOR THE AP600 AND SBWR

Enclosed is the detailed review plan for the vendor's testing programs supporting the AP600 and SBWR designs. This review plan implements the NRC's program to evaluate, monitor, and approve the vendor's testing programs consistent with SECY-91-273, and the coordination plan given in T. Murley's memorandum of June 8, 1992.

SRXB is responsible for the review of the AP600 testing program, and SCSB for review of the SBWR testing program. These branches will monitor progress per the attached plan.

The plan has been developed based on the current vendor's testing schedules. However, further information is required from the vendors, especially detailed schedules for the code verification analysis efforts and the schedule for submitting various documents for the testing programs, such as scaling analysis, test plans and matrices, and test results. The vendors also need to keep the NRC informed of modifications to testing schedules as they occur. ADAR is requested to obtain this information and, as necessary, the schedules given in this plan will be adjusted.

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Enclosure 1

If you have any questions concerning this plan, or the status of implementation, please contact M. Rubin (SRXB) for the AP600 or J. Kudrick (SCSB) for the SBWR.

Ashok C. Thadani, Director
Division of Systems Safety and Analysis
Office of Nuclear Reactor Regulation

Brian W. Sheron, Director
Division of Systems Research
Office of Nuclear Regulatory Research

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REVIEW PLAN FOR AP600 AND SBWR TESTING PROGRAMS

INTRODUCTION

To support certification of the AP600 and the Simplified Boiling Water Reactor (SBWR) passive reactor designs, both Westinghouse and General Electric have developed testing and analysis programs. It is the responsibility of the Office of Nuclear Reactor Regulation (NRR) to evaluate the applicants' testing and analysis programs to ensure that the requirements of 10 CFR 52.47(b)(2) are met. Assistance from the Office of Nuclear Regulatory Research (RES) has previously been requested to support this effort.

In SECY-91-273, NRC described its approach for review of the design certification testing programs. Reference 1 describes NRC's program to evaluate, monitor and approve the vendor's testing program consistent with SECY-91-273. Both NRR and RES personnel will be needed to perform this evaluation. Reference 2 provides the overall coordination plan for implementing this program. However, both these references provide only a general outline; the specific work efforts, and estimated resources, were not defined.

This implementation plan describes in detail the activities planned to reach a conclusion on the adequacy of the vendor's testing and analytical programs. This plan assigns responsibility for each activity, the estimated resources, schedule, and the products which are to be produced. Further, a general outline is provided for the DSER and FSER inputs to assure that the plan elements can be integrated into a focused assessment.

OVERALL RESPONSIBILITY

The purpose of this implementation plan is to describe in detail all activities necessary for NRR to make its safety determination that the vendor's testing program meets the requirements of 10 CFR 52.47(b)(2). Development of the DSER and FSER input is the responsibility of SRXB for the AP600, and SCSB for the SBWR. These inputs are to meet the dates established by ADAR (currently 6/93 for AP600 DSER, 8/93 for SBWR DSER, 5/94 for AP600 FSER and 8/94 for SBWR FSER) needed to support the issuance of the FDA. An outline for the SER inputs is provided in Enclosure 1. Although the DSER is likely to have many open items because the testing programs will not have been completed, the DSER should use this outline to explain what will be documented in the FSER.

Many of the activities described below are expected to produce detailed technical reports. As these reports are produced, copies shall be provided to DAR and SRXB or SCSB, as appropriate, for information. However, it is unreasonable to expect either SRXB or SCSB to summarize each of these reports in a form appropriate for the SER. Therefore, within each activity, the assigned review branch is to provide SER inputs to SRXB or SCSB, as appropriate, consistent with the outline in Enclosure 1. These inputs should be prepared using WordPerfect 5.1, and copies of input shall be provided on floppy discs to SRXB or SCSB, as appropriate, one month prior to the DSER and FSER input dates. SRXB or SCSB, as appropriate, shall provide the combined DSER and FSER inputs to ADAR.

Resources:

SRXB 8 psw
SCSB 8 psw

Schedule:

SRXB	DSER input for AP600 to ADAR	6/93
	FSER input for AP600 to ADAR	5/94
SCSB	DSER input for SBWR to ADAR	8/93
	FSER input for SBWR to ADAR	8/94

OVERVIEW OF ACTIVITIES

Table 1 provides a summary of the implementation plan. Across the top of the table are the elements of the staff's review program as outlined in Reference 1; down the side is a listing of the testing programs planned by the vendor. Thus, this table provides a matrix of those activities to be accomplished and the Branches involved. The "lead" branch for the specific activity is listed first on the table. As noted on the table, there are several activities wherein no action is planned. This is consistent with the "sampling" approach discussed in Reference 1. In addition, within a given activity, some sampling will also occur as listed in the more detailed description of the activities given below.

Each of the vendor testing programs is separately discussed below to indicate the work which is to be performed. Included is the estimated schedule for the review, based on the current vendor testing schedules. Delays in the vendor schedules will result in modification of the schedule and may also impact resource estimates. Estimated resources for each activity are also

provided for each Branch; a summary of total resources is provided in Table 2.

AP600 Review Plan

Core Makeup Tank (CMT) Tests

The CMT tests are to evaluate the draining modes of the CMT, provide confirmation on the adequacy of the level instrumentation used in the CMT to initiate ADS, and provide data on specific thermal-hydraulic behavior in the CMT, such as condensation behavior and thermal stratification. These tests will be used by Westinghouse to verify their computer codes.

Currently, the test configuration has been established and detailed test facility design is underway. Facility construction is to be completed by November, 1992 shakedown tests are to be completed January, 1993; testing is to be completed by March, 1993. No schedule has been provided for either the submission of the test results or the associated code verification effort.

Overall review of the CMT tests belongs to SRXB, however, significant assistance is needed from RPSB. The effort will include a review of the testing program, and testing matrix to ensure that the objectives will address the NRC's concerns related to the CMT, as addressed in SECY-91-273, and ensure that an appropriate range of conditions is examined. Further, a detailed review of the scaling chosen for the tests, and the instrumentation to be used will be performed to ensure that sufficient data is provided for code assessment. An audit of approximately 5 test plans will be performed to ensure that the testing is properly conducted, and some of these tests will be witnessed to confirm the tests are conducted consistent with the test plans.

Test data will be reviewed to confirm that expected phenomena were tested and that results confirm the behavior predicted by the AP600 safety analyses. The vendor code verification efforts will be reviewed to ascertain whether the code adequately predicted the observed phenomena. Tests will be selected for analysis by the staff to confirm the capability of the RELAP5/MOD3 code for use in audit analyses of the AP600 design.

SRXB will have lead responsibility for the review of the test program, matrices, and test plan reviews. RPSB will assist SRXB in its efforts and will provide comments to SRXB for inclusion in its assessment. RPSB will have primary review of the scaling analysis and instrumentation review and will forward its assessment to SRXB. SRXB will assess the data to ensure its

adequacy, and will specifically address the adequacy of the vendors code verification results.

Verification of the staff's computer code will be performed by RPSB. RPSB shall inform SASG and SRXB of the tests selected for analysis. Results of the verification analysis shall be provided to SASG and SRXB to allow conclusions on code adequacy to be considered in assessing the results of audit analyses performed for the AP600 design. SRXB will compile DSER/FSER input for transmittal to ADAR.

Resources:

SRXB 12 psw/$40k
RPSB 20 psw/$600k

Schedule:

SRXB

Evaluation of test program and matrix	2 mo. after W submittal
Audit of testing plans	2 mo. after W submittal
View Test	Nov., 1992 - March, 1993
DSER input	6/93
Evaluation of test data	2 mo. after W submittal
Evaluation of code verification	5/94
FSER input	5/94

RPSB

Comments on test program and matrix to SRXB	6 wk. after W submittal
Comments on test plans to SRXB	6 wk. after W submittal
Evaluation of scaling and instrumentation	2 mo. after W submittal
DSER input to SRXB	5/93
Post test analyses with RELAP5	4 to 6 mo. after data receipt
FSER input to SRXB	5/94

Automatic Depressurization System (ADS) Tests

A critical component in the AP600 design is the ADS. These valves depressurize the reactor coolant system to allow gravity injection from the In-containment Refueling Water Storage Tank (IRWST) to provide long-term cooling. Full-scale tests of the ADS valves and the sparger in the IRWST are being performed in

Casaccia, Italy. The Phase A tests are underway, to examine the sparger performance and IRWST loads, and are scheduled for completion in October, 1992.

Phase B tests are to evaluate full scale performance of the valves used in the first three ADS stages. Facility modifications for these tests are to be completed in April, 1993, and testing completed in December, 1993.

The staff has previously notified Westinghouse of the need to test the fourth stage ADS valve. Westinghouse has added such testing to its program, but no details on the testing to be performed is available. Planning is underway and it is Westinghouse's objective to complete testing by December, 1993.

SRXB will have overall lead responsibility for review of these tests. SRXB will review the test program, test matrix, and audit selected test plans to ensure that the testing program adequately characterizes ADS valve performance. SRXB also plans to visit the facility while testing activities are in progress, to view selected tests. The data and the vendor's verification analyses will be reviewed to ensure that the code properly reflects the observed behavior. EMEB will assist SRXB through review of the test program and data to assess ADS valve performance and reliability.

SCSB will perform a similar review to that planned by SRXB except its efforts will focus on the sparger behavior. SCSB shall provide results of its review to SRXB for inclusion in the DSER and FSER inputs.

Resources:

SRXB 8 psw/$20k
SCSB 8 psw/$20k
EMEB 2 psw/$0k

Schedule:

SRXB

Evaluation of test program and matrix	2 mo. after W submittal
Audit of testing plans	2 mo. after W submittal
View Test	Apr. - Dec., 1993
DSER input	6/93
Evaluation of test data	2 mo. after W submittal
Evaluation of code verification	5/94
FSER input	5/94

SCSB

Evaluation of test program and matrix	2 mo. after W submittal
Audit of testing plans	2 mo. after W submittal
DSER input to SRXB	5/93
Evaluation of test data	2 mo. after W submittal
Evaluation of code verification	5/94
FSER input to SRXB	5/94

EMEB

DSER input to SRXB	5/93
FSER input to SRXB	5/94

Passive Residual Heat Removal (PRHR) Tests

PRHR system testing has been completed by Westinghouse. The purpose of these tests was to evaluate the heat transfer behavior of the PRHR tubes, and to modify the correlations used to predict PRHR performance.

SRXB will have the lead for evaluating these tests. Since these tests have been completed, the effort will concentrate on ensuring that the test program, testing matrix and test facility design (scaling and instrumentation) was sufficient to characterize the behavior of the PRHR system. RPSB will evaluate the specifics of the test facility design and forward its evaluation to SRXB.

The test data, and the associated modeling of the PRHR by W, will be evaluated by SRXB to ensure that the PRHR system has been appropriately reflected in the AP600 safety analyses. RPSB will assess the capability of the RELAP5/MOD3 code to predict the test results. The results of its evaluation shall be forwarded to SASG and SRXB to assess audit calculations performed by the staff. Input to the DSER and FSER will be compiled by SRXB.

Resources:

SRXB 6 psw/$20k
RPSB 5 psw/$275k

Schedule:

SRXB

Evaluation of test program and matrix	2/93
Evaluation of test data	5/93
DSER input	6/93

Evaluation of code verification	5/94
FSER input	6/94

RPSB

Evaluation of scaling and instrumentation	2/93
DSER input to SRXB	5/93
Post test analyses with RELAP5	9/93
FSER input to SRXB	5/94

Wind Tunnel Tests

The AP600 containment is cooled by natural circulation around the outside of the containment shell. Westinghouse has performed a series of wind tunnel tests to examine the effect of wind direction and speed on the operation of the containment cooling air inlet design.

SCSB has the lead for evaluating these tests. SCSB will evaluate the test program, test matrix, facility design, and test results to confirm the adequacy of the air cooling inlet design. AEB will perform a detailed review of the test scaling and instrumentation and forward these results to SCSB. SCSB shall provide DSER and FSER input to SRXB for inclusion in the overall evaluation to be submitted to ADAR.

Resources:

SCSB	8 psw/$20k
AEB	3 psw/$50k
SRXB	1 psw/$0k

Schedule:

SCSB

Evaluation of test program and matrix	2/93
Evaluation of test results	5/93
DSER input to SRXB	5/93
DSER input to SRXB	5/94

AEB

Evaluation of scaling and instrumentation to SCSB	2/93
DSER input to SCSB	4/93

SRXB

DSER input to ADAR	5/93
FSER input to ADAR	5/94

Passive Containment Cooling System (PCCS) Tests

The Westinghouse test program for the PCCS includes a series of separate effects tests at various scales to examine the heat transfer behavior on the interior of the containment, heat transfer on the containment exterior, and water distribution on the containment exterior. Simple geometry tests have been completed, and those in a more complex geometry are underway. A relatively large-scale facility, approximately 1/9 scale in height and 1/8.5 in diameter, is being constructed for tests of the entire PCCS. Tests on a full scale angular sector of the containment shell will also be conducted to study water distribution on the containment exterior. These tests are to be completed by December, 1993.

Overall review of the PCCS tests belongs to SCSB, however, significant assistance is needed from AEB. The effort will include a review of the testing program, and testing matrix to ensure that the objectives will fully evaluate the performance of the PCCS and ensure that an appropriate range of conditions are examined. Further, a detailed review of the scaling chosen for the tests, and the instrumentation to be used will be performed to ensure that sufficient data is provided for code assessment. An audit of approximately 5 test plans will be performed to ensure that the testing is properly conducted, and some of these tests will be witnessed to confirm the tests are conducted consistent with the test plans.

Test data will be reviewed to confirm that expected phenomena were tested and that results confirm the behavior predicted by the AP600 safety analyses. The vendor code verification efforts will be reviewed to ascertain whether the code adequately predicted the observed phenomena. Tests will be selected for analysis by the staff to confirm the capability of the CONTAIN code for use in audit analyses of the AP600 design.

SCSB will have lead responsibility for the review of the test program, matrices, and test plan reviews. AEB will have primary review of the scaling analysis and instrumentation review and will forward its assessment to SCSB. SCSB will assess the data to ensure its adequacy, and will specifically address the adequacy of the vendor's code verification results.

Verification of the staff's computer code will be performed by AEB. AEB shall inform SASG and SCSB of the tests selected for analysis. Results of the verification analysis shall be provided to SASG and SCSB to allow conclusions on code adequacy to be considered in assessing the results of audit analyses performed for the AP600 design. Both pre-test and post-test analyses will be performed.

Input for the DSER and FSER will be provided to SRXB for inclusion in the overall safety evaluation of the vendor's testing program.

Resources:

SCSB 26 psw/$80k
AEB 50 psw/$800k
SRXB 1 psw/$0k

Schedule:

SCSB

Evaluation of test program and matrix	2 mo. after W submittal
Audit of testing plans	2 mo. after W submittal
View Test	Jan. - Dec., 1993
DSER input to SRXB	5/93
Evaluation of test data	2 mo. after W submittal
Evaluation of code verification	5/94
FSER input to SRXB	5/94

AEB

Evaluation of scaling and instrumentation	2 mo. after W submittal
DSER input to SCSB	4/93
Pre-test analyses with CONTAIN	9/93
Post-test analyses with CONTAIN	1/94
FSER input to SCSB	4/94

SRXB

DSER input to ADAR	5/93
FSER input to ADAR	5/94

Check Valve Tests

Check valves are key components in the AP600 safety system designs. These valves must open, and remain open, under relatively low pressure drops. Long-term exposure to reactor

coolant conditions could affect the behavior of the valves. Preliminary hydraulic testing of the valves has been completed, but these tests were not performed on the "biased open" valves now planned for the AP600. Qualification testing of the valves is planned for completion by December, 1993.

The Mechanical Engineering Branch (EMEB) is responsible for the review of these tests. A technical assistance contract is in place for the review of the testing program. EMEB will review the test program, testing matrix, and testing plans, to ensure that the testing will be adequate for establishing valve performance and long-term operability of the valves after exposure to RCS environment. EMEB will also view selected tests, and will analyze the data obtained. SRXB will work with EMEB to evaluate the adequacy of the vendor's test plans to ensure that an appropriate range of conditions is included to adequately assess check valve performance. For the long-term performance test, the Materials and Chemical Engineering Branch (EMCB) will assist EMEB in assessing the capability of the vendor's test program to evaluate long-term check valve performance. EMEB will assist SRXB in assuring that the test results confirm the modeling assumptions use in the safety analysis. The DSER input should discuss the adequacy of the testing plans and program; FSER input should discuss the results of the testing and conclusions relative to valve performance. SRXB will compile the DSER and FSER input for transmittal to ADAR.

Resources:

EMEB 4 psw/$50k
SRXB 2 psw/$0k
EMCB 2 psw/$0k

Schedule:

EMEB

DSER input to SRXB	5/93
FSER input to SRXB	5/94

EMCB

DSER input to SRXB	5/93
FSER input to SRXB	5/94

SRXB

DSER input	6/93
FSER input	5/94

Oregon State University (OSU) Tests

Westinghouse is performing low-pressure, reduced-height integral system testing at OSU. The purpose of these tests is to demonstrate that gravity driven injection and natural convection provided adequate long-term cooling for the AP600 design. The data will be used to verify the computer codes used in the AP600 safety analysis. Facility construction is to be completed in December, 1992, shakedown testing in April, 1993, and matrix testing in December, 1993. Schedules and details of the code verification effort has not yet been provided by Westinghouse.

Overall review of the OSU tests belongs to SRXB, however, significant assistance is needed from RPSB. The effort will include a review of the testing program, and testing matrix to ensure that the objectives will address the NRC's concerns related to long-term cooling of the AP600 design and ensure that an appropriate range of conditions are examined. Further, a detailed review of the scaling chosen for the tests, and the instrumentation to be used will be performed to ensure that sufficient data is provided for code assessment. An audit of approximately 5 test plans will be performed to ensure that the testing is properly conducted, and some of these tests will be witnessed to confirm the tests are conducted consistent with the test plans. Vendor pre-test predictions will be reviewed to confirm that overall facility behavior is representative of the expected AP600 behavior.

Test data will be reviewed to confirm that expected phenomena were tested and that results confirm the behavior predicted by the AP600 safety analyses. The vendor post-test code verification efforts will be reviewed to ascertain whether the code adequately predicted the observed phenomena. Tests will be selected for analysis by the staff to confirm the capability of the RELAP5/MOD3 for use in audit analyses of the AP600 design.

SRXB will have lead responsibility for the review of the test program, matrices, and test plan reviews. RPSB will assist SRXB in its efforts and will provide comments to SRXB for inclusion in its assessment. RPSB will have primary review of the scaling analysis and instrumentation review and will forward its assessment to SRXB. SRXB will assess the data to ensure its adequacy, and will specifically address the adequacy of the vendor's code verification results.

Verification of the staff's computer code will be performed by both SASG and RPSB. RPSB and SASG shall inform SRXB of the tests selected for analysis. Results of the verification analysis shall be provided to SRXB to allow conclusions on code adequacy to be considered in assessing the results of audit analyses

performed for the AP600 design.

Resources:

SRXB 26 psw/$60k
SASG 20 psw/$0k
RPSB 35 psw/$1265k

Schedule:

SRXB

Evaluation of test program and matrix	2 mo. after W submittal
Audit of testing plans	2 mo. after W submittal
View Test	Apr. - Dec., 1993
DSER input	6/93
Evaluation of test data	2 mo. after W submittal
Evaluation of code verification	5/94
FSER input	5/94

RPSB

Comments on test program and matrix to SRXB	6 wk. after W submittal
Comments on test plans to SRXB	6 wk. after W submittal
Evaluation of scaling and instrumentation to SRXB	2/93
Pre-test analyses to SRXB	5/93
DSER input to SRXB	5/93
Post-test analyses to SRXB	4 mo. after data receipt
FSER input to SRXB	5/94

SASG

Pre-test analyses to SRXB	5/93
DSER input to SRXB	5/93
Post-test analyses to SRXB	4 mo. after data receipt
FSER input to SRXB	5/94

SPES-2 Tests

Full-height, high-pressure integral systems testing of the AP600 design is planned to be performed at the SPES-2 facility in Piacenza, Italy. This testing is to provide thermal-hydraulic data at high pressure to be used to verify the safety analysis computer codes. Scaling analysis for the facility is nearly complete. Facility construction is estimated to be completed by November, 1992, shakedown testing by March, 1993, and matrix testing by December, 1993. Details of the code verification program and submittal schedule has not yet been provided by

Westinghouse.

SRXB has lead responsibility for evaluation of the SPES-2 tests and preparation of DSER/FSER inputs. This review will be performed in the same manner as that described above for the OSU tests.

Resources:

SRXB 40 psw/$100k
SASG 20 psw/$0k
RPSB 35 psw/$1260k

Schedule:

SRXB

Evaluation of test program and matrix	2 mo. after W submittal
Audit of testing plans	2 mo. after W submittal
View Test	March - Dec., 1993
DSER input	6/93
Evaluation of test data	2 mo. after W submittal
Evaluation of code verification	5/94
FSER input	5/94

RPSB

Comments on test program and matrix to SRXB	6 wk. after W submittal
Comments on test plans to SRXB	6 wk. after W submittal
Evaluation of scaling and instrumentation to SRXB	2/93
DSER input to SRXB	5/93
Pre-test analyses to SRXB	7/93
Post-test analyses to SRXB	5 mo. after data receipt
FSER input to SRXB	5/94

SASG

Pre-test analyses to SRXB	7/93
Post-test analyses to SRXB	4 mo. after data receipt
FSER input to SRXB	5/94

ROSA-V Tests

The staff will perform confirmatory full-height, high-pressure integral systems testing of the AP600 design in the ROSA-V facility in Japan. Negctiations are underway with the Japanese for this testing. The tentative schedule is to complete facility modifications by October, 1993, initiate testing in December

1993, and complete testing by December, 1994. An option is expected to allow for an additional year of testing at the facility.

Although these tests are confirmatory, and therefore not required to certify the AP600 design, the results of these tests will be used to verify the staff's RELAP5/MOD3 computer code. The staff will utilize this code to perform audit calculations of the AP600 design. DSER input is not required for this testing.

RPSB has the lead responsibility for these tests. RPSB will perform the scaling analyses, and develop the test plans and matrices. RPSB shall keep SRXB informed of its plans and will solicit SRXB comments on the proposed test plans and matrices. RPSB will station a resident engineer at the ROSA-V facility to provide oversight of the testing program. Data reports will be forwarded to SRXB for review. If any unusual behavior is identified during the tests, RPSB shall immediately inform SRXB and ADAR in order to allow these results to be considered in the staff's safety evaluation of the design.

Pre-test and post-test predictions will be performed by RPSB and SASG using the RELAP5/MOD3 code. These Branches shall coordinate their efforts to minimize duplication of effort. SRXB shall be kept informed of the results to allow conclusions on code adequacy to be considered in assessing audit results performed for the AP600 design.

Resources:

RPSB 54 psw/$1955k
SASG 16 psw/$0k
SRXB 20 psw/$0k

Schedule:

Because this testing is confirmatory, no schedule is required for using these test results.

SBWR Review Plan

University of California at Berkeley/ Massachusetts Institute of Technology (UCB/MIT) Correlations

The SBWR design utilizes isolation condensers for decay heat removal from the reactor coolant system and passive heat removal from the containment. A series of prototypical, single tube tests have been completed at UCB and MIT to evaluate the effect of non-condensible gases on tube-side heat transfer. The data

was utilized to develop a heat transfer correlation which has been incorporated into the TRACG code.

SCSB has the lead for reviewing these tests. It will review the test conduct and instrumentation to ensure that an adequate range of initial conditions have been tested to cover possible SBWR conditions. SRXB will review the specific implementation of the correlation in the TRACG code. RPSB will also review the data to incorporate and test an appropriate correlation for use in the RELAP5/MOD3 code. Both SRXB and RPSB will provide summary DSER and FSER inputs to SCSB for incorporation into the safety evaluation.

Resources:

SCSB 4 psw/$10k
SRXB 4 psw/$10k
RPSB 5 psw/$100k

Schedule:

SCSB

Evaluate test program, test matrix and results	3/93
DSER input	8/93
FSER input	8/94

SRXB

Evaluate correlation implementation in TRACG	6/93
DSER input to SCSB	7/93
FSER input to SCSB	7/94

RPSB

Incorporate correlation in RELAP5	12/92
Provide comments on correlation to SRXB	2/93
DSER input to SCSB	7/93
FSER input to SCSB	7/94

GIRAFFE

General Electric (GE) performed the GIRAFFE tests in Japan to confirm the performance of the Passive Containment Cooling System (PCCS) and provide data for verification of the analytical models used for the SBWR safety analysis. These tests utilized a simulation of the SBWR containment to examine the overall PCCS performance, particularly the performance of the isolation condenser to purge non-condensible gases. While these tests have

been completed, GE is planning additional testing in GIRAFFE to address staff questions. These tests are currently being planned and are anticipated to be completed by December, 1993.

Overall review of this testing belongs to SCSB. Assistance will be provided by SRXB, AEB, and RPSB. SCSB will review the test program, matrix and audit selected test plans to confirm the testing addressed staff concerns relative to the performance of the PCCS. This review should be used to identify additional testing needed from GE. AEB and RPSB shall review the scaling and instrumentation for the facility and forward a coordinated review evaluation to SCSB.

Data review will be performed by SCSB to assess the overall performance of the PCCS. SRXB will evaluate the vendor's predictions with the TRACG code as part of its overall evaluation of the code.

Pre- and post-test analyses of these tests will be performed by AEB, RPSB, and SASG. These branches shall inform SCSB of the tests selected for analysis. Results of these evaluations shall be forwarded to SCSB to allow consideration of these results in assessing audit analyses performed for the SBWR.

Resources:

SCSB	26 psw/$80k
SRXB	6 psw/$40k
SASG	12 psw/$0k
RPSB/AEB	25 psw/$400K

Schedule:

SCSB

Evaluation of test program and matrix	2 mo. after submittal
Audit of testing plans	2 mo. after submittal
View Test	March - Dec., 1993
DSER input	8/93
Evaluation of test data	2 mo. after submittal
FSER input	8/94

SRXB

DSER input to SCSB	7/93
Evaluation of TRACG code verification	2/94
FSER input to SCSB	7/94

RPSB/AEB

Comments on test program and matrix to SCSB	6 wk. after submittal
Comments on test plans to SCSB	6 wk. after submittal
Evaluation of scaling and instrumentation to SCSB	2/93
DSER input to SCSB	7/93
Pre-test analyses to SCSB	10/93
Post-test analyses to SCSB	4 mo. after data receipt
FSER input to SCSB	7/94

SASG

Post-test analyses to SCSB	4 mo. after data receipt
FSER input to SCSB	7/94

PANTHERS

Full-scale testing of the isolation condensers is planned as part of the PANTHERS testing program at Piacenza, Italy. This testing will provide final confirmation of the performance of the isolation condenser including heat transfer and structural behavior. Testing is to be completed in March, 1994 for the PCCS and July, 1994 for the isolation condenser.

SCSB has the lead review for this effort, concentrating on the full scale performance of the PCCS. SRXB will assist SCSB by evaluating the isolation condenser tests. Both SCSB and SRXB will evaluate the test programs and testing matrix for the PCCS and isolation condenser, respectively. Audits of the testing plans will be performed and the tests will be viewed to ensure testing is conducted in accordance with the test plans.

RPSB will review the scaling and instrumentation used in these tests to ensure that adequate data is obtained. The results of its review shall be forwarded to SCSB for inclusion in the safety evaluation.

SRXB shall review GE's code predictions for these tests. This will be performed as part of the overall evaluation of the TRACG code. A summary of the review shall be provided to SCSB.

Pre- and post-test analyses using the staff's computer codes are planned by SASG and RPSB. These branches shall inform SCSB of the tests selected for analysis. These results shall be provided to SCSB for assessing the adequacy of audit analyses performed for the SBWR.

Resources:

SCSB	8 psw/$20k
SRXB	4 psw/$20k
SASG	8 psw/$0k
RPSB	15 psw/$275k

Schedule:

SCSB

Evaluation of test program and matrix	2 mo. after submittal
Audit of testing plans	2 mo. after submittal
DSER input	8/93
View test	Jan. - Mar., 1994
Evaluation of test data	2 mo. after submittal
FSER input	8/94

SRXB

Comments on test program and matrix to SCSB	2 mo. after submittal
Audit of testing plans	2 mo. after submittal
DSER input to SCSB	7/93
Evaluation of TRACG code verification	5/94
FSER input to SCSB	7/94

RPSB

Comments on test program and matrix to SCSB	6 wk. after submittal
Comments on test plans to SCSB	6 wk. after submittal
Evaluation of scaling and instrumentation to SCSB	6/93
DSER input to SCSB	7/93
Pre-test analyses to SCSB	12/93
Post-test analyses to SCSB	4 mo. after data receipt
FSER input to SCSB	7/94

SASG

Pre-test analyses to SCSB	12/93
Post-test analyses to SCSB	4 mo. after data receipt
FSER input to SCSB	7/94

PANDA

Testing at the PANDA facility at the Paul Scherer Institute in Switzerland is being performed to investigated multidimensional behavior of the SBWR containment. The staff has concluded that

these tests are necessary to support design certification. This test will include simulation of the major SBWR components, including the wetwell, drywell, isolation condenser, GDCS and the PCCS. The facility is 1/25-scale and full-height. The current schedule is for facility construction to be completed in November, 1993, and testing initiated in October, 1994. GE has stated that it will attempt to accelerate the schedule.

Overall coordination of this review shall be performed by SCSB. SCSB will review the test program and matrix to ensure that the tests fully examine the SBWR containment performance. AEB will evaluate the scaling rationale and instrumentation planned for the facility. The evaluation of the PANDA facility will be provided to SCSB for inclusion in the safety analysis. Audit of approximately 5 test plans will be performed by SCSB, and tests will be viewed to ensure that test conduct is consistent with the test plans.

SCSB will review the vendor's code predictions for the PANDA facility to ensure that the code adequately predicts SBWR containment behavior.

Pre- and post-test analysis will be performed by SASG, and AEB. SCSB will coordinated these analysis efforts to minimize duplication of effort. SCSB will be informed of the tests selected for analysis. Results of the predictions shall be forwarded to SCSB for review to allow consideration of the results in assessing the staff's audit analyses of the SBWR.

Resources:

SCSB 40 psw/$100k
SASG 20 psw/$0k
AEB 25 psw/$350k
RPSB 15 psw/$300k

Schedule:

SCSB

Evaluation of test program and matrix	2 mo. after submittal
Audit of testing plans	2 mo. after submittal
DSER input	8/93
View Tests	Oct., 1994 - March, 1995
FSER input	8/94
Evaluation of test data	2 mo. after submittal
FSER supplement	4/95

AEB/RPSB

Evaluation of scaling and instrumentation to SCSB	6/93
DSER input to SCSB	7/93
Pre-test analyses to SCSB	6/94
FSER input to SCSB	7/94
Post-test analyses to SCSB	4 mo. after data receipt
FSER supplement	3/95

SASG

Pre-test analyses to SCSB	6/94
FSER input to SCSB	7/94
Post-test analyses to SCSB	4 mo. after data receipt
FSER supplement	3/95

Gravity-Driven Cooling System (GDCS) Integrated System Test (GIST)

Testing of the GDCS was completed at the GIST facility. This testing was an integrated test simulating major components of the SBWR, although based on an earlier configuration of the design. The purpose of the test was to provide thermal-hydraulic data for verification of the TRACG code.

SRXB has lead responsibility for evaluating these tests. SRXB shall review the test program and matrix to ensure that an adequate range of conditions were tested. RPSB shall review the scaling and instrumentation used in the test to determine whether the tests were adequate to provide data for code assessment of the GDCS behavior. Since the SBWR design, and specifically the GDCS, has been modified since the GIST tests were performed, the evaluation shall specifically examine whether the tests were adequate for the current SBWR configuration. The results of this review shall be forwarded to SRXB for inclusion in the safety evaluation. SRXB will review the test data, and the verification of the TRACG code as part of its overall assessment of the TRACG code.

Post test analyses are planned by SASG and RPSB. SRXB shall be informed of the tests selected for analysis. Results of these analyses shall be forwarded to SRXB to assess the adequacy of audit calculations performed for the SBWR.

SRXB shall forward its evaluation of the GIST tests to SCSB for incorporation in the coordinated SER input to ADAR.

Resources:

SRXB 6 psw/$40k
RPSB 15 psw/$585k
SASG 6 psw/$0k

Schedule:

SRXB

Evaluation of test program and matrix	3/93
DSER input to SCSB	7/93
Evaluation of TRACG verification	2/94
FSER input to SCSB	7/94

RPSB

Evaluation of facility scaling and and instrumentation	3/93
DSER input to SRXB	6/93
Post-test analyses to SRXB	9/93
FSER input to SRXB	6/94

SASG

Post-test analyses to SRXB	9/93
FSER input to SRXB	6/94

Squib Valve Testing

The squib valves are important components in the SBWR, and are required to depressurize the SBWR to allow draining from the GDCS. Limited squib valve testing has been performed by GE, and the staff has recommended additional testing be performed to ensure adequate valve reliability. GE has not yet informed the staff of any additional testing planned.

The Mechanical Engineering Branch (EMEB) is responsible for the review of these tests. A technical assistance contract is in place for the review of the testing program. EMEB will review the test program, testing matrix, testing plans, and test results to ensure that the testing will be adequate for establishing reliable valve performance. EMEB will assist SRXB in assuring that the test results confirm the modeling assumptions use in the safety analysis. EMCB will also review the test data to assess squib valve performance from the aspect of valve degradation due to possible internal crevice corrosion. The DSER input should discuss the adequacy of the testing plans and program; FSER input should discuss the results of the testing and conclusions relative to valve performance.

Resources:

EMEB 4 psw/$50K
SRXB 2 psw/$0K
SCSB 1 psw/$0k
EMCB 1 psw/$0k

Schedule:

EMEB

DSER input to SCSB	7/93
FSER input to SCSB	7/94

SRXB

DSER input to SCSB	7/93
FSER input to SCSB	7/94

EMCB

DSER input to SCSB	7/93
FSER input to SCSB	7/94

SCSB

DSER input to ADAR	8/93
FSER input to ADAR	8/94

SBWR Small Scale Loop

The staff is planning confirmatory, small scale integral systems testing of the SBWR. A request for proposal has been issued, and testing is expected to begin in FY94.

Although these tests are confirmatory, and therefore not required to certify the SBWR design, the results of these tests will be used to verify the staff's RELAP5/MOD3 computer code. The staff will utilize this code to perform audit calculations of the SBWR design. DSER input is not required for this testing.

RPSB has the lead responsibility for these tests. RPSB will perform the scaling analyses, and develop the test plans and matrices. RPSB shall keep SRXB informed of its plans and will solicit SRXB comments on the proposed test plans and matrices. Data reports will be forwarded to SRXB for review. If any unusual behavior is identified during the tests, RPSB shall immediately inform SRXB, SCSB and DAR in order to allow these results to be considered in the staff's safety evaluation of the design.

Pre-test and post-test predictions will be performed by RPSB and SASG using RELAP5/MOD3 code. These Branches shall coordinate their efforts to minimize duplication of effort. SRXB shall be kept informed of the results to allow conclusions on code adequacy to be considered in assessing audit results performed for the AP600 design.

Resources:

RPSB 25 psw/$555K
SASG 16 psw/$0K
SRXB 16 psw/$0K

Schedule:

Because this testing is confirmatory, no schedule is required for using these test results.

REFERENCES

1. Memorandum, T. E. Murley and E. S. Beckjord to J. M. Taylor, SUBJECT: Program for the Review of Vendor's Test Programs to Support Design Certification of Advanced Reactors, April 6, 1992.

2. Memorandum, T. E. Murley to E. S. Beckjord, SUBJECT: Coordination Plan for Passive Reactor Testing and Analysis, June 8, 1992.

TABLE 2

Summary of Resources for Testing Reviews

Branch	FTE	Tech Assist ($k)
SRXB*	3.0	350
SCSB	2.5	330
SASG	2.3	0
EMEB	0.2	100
RPSB**	5.5	7370
AEB**	1.7	1400
EMCB	0.1	0
ADAR	0.6	0

* Additional 0.5 FTE/$200K allocated for code review and verification

** Where resources/technical assistance were shown combined for these branches, the total has been split approximately equally for inclusion in this table

ENCLOSURE 1

OUTLINE FOR SER INPUT

Executive Summary (SRXB for AP600 or SCSB for SBWR)

1. Introduction (SRXB for AP600 or SCSB for SBWR)

   This section should describe the general purpose of the evaluation. Specifically, it should provide a brief summary of the passive safety features used in the design, and how they are unique in comparison to currently operating plants. It should then discuss the requirements of 10 CFR 52.47(b)(2). It should be noted that validated computer codes are needed to predict the safety performance of the design and that the vendor has developed a testing program to gather the data necessary to confirm code adequacy. Finally, an outline of how the report is organized should be provided.

2. Issues of Concerns (SRXB for AP600 or SCSB for SBWR)

   In this section a summary of the important issues related to performance of the passive safety systems should be provided. This should highlight those issues which required testing and will lead into the subsequent sections of the report.

3. Overview of Vendor Testing Programs (responsible Branch)

   This section should describe, on a test program basis, the vendors testing program. The purpose of the tests should be described here. These should be directly related to the issues of concern.

4. Overview of NRC Activities (responsible Branch)

   On a test program basis, a description of the NRC activities should be provided in this section. An introductory paragraph should explain the "audit" nature of the review. This section should be very similar to the task descriptions presented in this plan.

5. Evaluation of Vendor Testing Programs (responsible Branch)

   Within this section, on a test program basis, the evaluation of the testing program should be provided. It should reflect an evaluation of how the issues of concerns were satisfied by the testing, and the evaluation of the test facility (e.g. results of scaling review if performed).

6. Code Validation (responsible branch)

   Within this section, a summary of the vendor's code validation program should be described along with the staff's conclusion on code adequacy. The basis for concluding that the code is adequate for supporting certification should be provided.

7. Compliance with 10 CFR 52.47(b)(2) (SRXB for AP600 or SCSB for SBWR).

   Each element of 10 CFR 52.47(b)(2) should be discussed separately. It is expected that this section will simply be a summary of the document and its conclusions.

TABLE 1

OVERVIEW OF IMPLEMENTATION PLAN

	TEST PROGRAM & MATRIX	SCALING AND INSTRUMENTATION	TEST PLAN REVIEW	VENDOR PRE-TEST PREDICTION	NRC PRE-TEST PREDICTION	VIEW TEST	RESIDENT ENGINEER	VENDOR POST-TEST PREDICTION	DATA REVIEW	NRC POST-TEST PREDICTION
AP600										
CMT TESTS	SRXB/RPSB	RPSB/SRXB	SRXB/RPSB	NO	NO	SRXB	NO	SRXB	SRXB/RPSB	RPSB/SASG/SRXB
ADS TESTS	SRXB/SCSB	NO	SRXB/SCSB	NO	NO	SRXB/SCSB	NO	SRXB/SCSB	SRXB/SCSB	NO
PRHR TESTS	SRXB/RPSB	RPSB/SRXB	NO	NO	NO	NO	NO	SRXB	SRXB/RPSB	RPSB/SASG/SRXB
WIND TUNNEL TESTS	SCSB	AEB/SCSB	NO	NO	NO	NO	NO	NO	SCSB	NO
PCCS TESTS	SCSB	AEB/SCSB	SCSB	NO	NO	SCSB/AEB	NO	SCSB	SCSB/AEB	AEB/SASG/SCSB
CHECK VALVE TESTS	EMEB/EMCB	NO	EMEB/EMCB	NO	NO	EMEB	NO	SRXB	EMEB/EMCB	NO
OSU	SRXB/RPSB	RPSB/SRXB	SRXB/RPSB	SRXB	RPSB/SASG	SRXB/RPSB	NO	SRXB	SRXB/RPSB	RPSB/SASG
SPES	SRXB/RPSB	RPSB/SRXB	SRXB/RPSB	SRXB	RPSB/SASG	SRXB/RPSB	NO	SRXB	SRXB/RPSB	RPSB/SASG
ROSA	RPSB/SRXB	RPSB/SRXB	RPSB/SRXB	NO	RPSB/SASG	RPSB/SRXB	RPSB	NO	RPSB/SRXB	RPSB/SASG
SBWR										
UCB/MIT	SCSB SRXB/RPSB	RPSB	RPSB	NO	NO	NO	NO	SRXB	SCSB SRXB/RPSB	RPSB
GIRAFFE	SCSB SRXB/AEB RPSB	AEB RPSB/SCSB	SCSB SRXB/AEB RPSB	SCSB	AEB RPSB	SCSB SRXB/RPSB	NO	SCSB	SCSB SRXB/AEB RPSB	AEB RPSB/SASG
PANTHERS	SCSB SRXB	RPSB/SCSB	SCSB SRXB	NO	RPSB/SASG	SCSB SRXB	NO	SCSB	SCSB SRXB/RPSB	RPSB/SASG
PANDA	SCSB	AEB/SCSB/RPSB	SCSB	SCSB	AEB/SASG	SCSB/AEB/RPSB	NO	SCSB	SCSB/AEB	AEB/SASG/RPSB
GIST	SRXB	RPSB/SRXB	NO	NO	NO	NO	NO	SRXB	SRXB/RPSB	RPSB/SASG
SQUIB VALVES	EMEB	NO	EMEB	NO	NO	NO	NO	NO	EMEB/EMCB	NO
SBWR LOOP	RPSB/SRXB	RPSB/SRXB	RPSB/SRXB	NO	RPSB/SASG	RPSB/SRXB	NO	NO	RPSB/SRXB	RPSB/SASG

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

February 17, 1993

MEMORANDUM FOR: Dennis M. Crutchfield, Associate Director for Advanced Reactors and License Renewal

FROM: Ashok C. Thadani, Director
Division of Systems Safety and Analysis

SUBJECT: REVISED IMPLEMENTATION PLAN FOR THE REVIEW OF VENDOR TESTING PROGRAMS FOR THE AP600 AND SBWR

Enclosed is a revision of the detailed review plan for the vendors' testing programs supporting the AP600 and SBWR designs, the original version of which was transmitted to you by memorandum dated October 21, 1992. This revision does not affect any resource estimates or review commitments. The revisions to the plan relate to two items.

1. The review schedules for the AP600 and SBWR have been extended by several months, to account for the time required for the vendors to complete their design certification applications. In addition, some of the vendors' testing programs, most notably Westinghouse's core makeup tank, automatic depressurization system, and reduced-scale integral systems tests, have been delayed substantially beyond their original completion dates. The schedules for review and for input to the DSERs and FSERs have thus been revised to reflect the extension of the review schedules, and also to be consistent with the current projected schedules for vendor testing, analysis, and issuance of test reports.

2. In recent meetings between NRR and RES management and the ACRS, the staff committed to work with the ACRS to assure that the Committee has the opportunity to participate fully in the review of the vendors' test facility designs, test matrices, and test results. The review schedule for each separate test program has therefore been amended to include projected interaction points between the staff and the ACRS. The ACRS meetings shown for early 1993 have been tentatively scheduled. The meeting dates shown in 1994 are estimates, and are subject to change depending on future alterations in the vendors' or the staff's schedules.

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Enclosure 2

Questions on this plan should to be directed to M. Rubin (SRXB) for the AP600 and R. Lobel (SCSB) for the SBWR.

ORIGINAL SIGNED BY A. C. THADANI

Ashok C. Thadani, Director
Division of Systems Safety and Analysis

Enclosure:
As stated

cc: J. Taylor
J. Sniezek
E. Beckjord
T. Speis
B. Sheron
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REVIEW PLAN FOR AP600 AND SBWR TESTING PROGRAMS

INTRODUCTION

To support certification of the AP600 and the Simplified Boiling Water Reactor (SBWR) passive reactor designs, both Westinghouse and General Electric have developed testing and analysis programs. It is the responsibility of the Office of Nuclear Reactor Regulation (NRR) to evaluate the applicants' testing and analysis programs to ensure that the requirements of 10 CFR 52.47(b)(2) are met. Assistance from the Office of Nuclear Regulatory Research (RES) was previously requested to support this effort.

In SECY-91-273, NRC described its approach for review of the design certification testing programs. Reference 1 describes NRC's program to evaluate, monitor and approve the vendor's testing program consistent with SECY-91-273. Both NRR and RES personnel will be needed to perform this evaluation. Reference 2 provides the overall coordination plan for implementing this program. However, both these references provide only a general outline; the specific work efforts, and estimated resources, were not defined.

This implementation plan describes in detail the activities planned to reach a conclusion on the adequacy of the vendor's testing and analytical programs. This plan assigns responsibility for each activity, the estimated resources, schedule, and the products which are to be produced. Further, a general outline is provided for the DSER and FSER inputs to assure that the plan elements can be integrated into a focused assessment.

OVERALL RESPONSIBILITY

The purpose of this implementation plan is to describe in detail all activities necessary for NRR to make its safety determination that the vendor's testing program meets the requirements of 10 CFR 52.47(b)(2). Development of the DSER and FSER input is the responsibility of SRXB for the AP600, and SCSB for the SBWR. These inputs are to meet the dates established by ADAR (currently 12/93 for AP600 DSER, 3/94 for SBWR DSER, 12/94 for AP600 FSER and 2/95 for SBWR FSER) needed to support the issuance of the FDA. An outline for the SER inputs is provided in Enclosure 1. Although the DSER is likely to have many open items because the testing programs will not have been completed, the DSER should use this outline to explain what will be documented in the FSER.

Many of the activities described below are expected to produce detailed technical reports. As these reports are produced, copies shall be provided to DAR and SRXB or SCSB, as appropriate, for information. However, it is unreasonable to expect either SRXB or SCSB to summarize each of these reports in a form appropriate for the SER. Therefore, within each activity, the assigned review branch is to provide SER inputs to SRXB or SCSB, as appropriate, consistent with the outline in Enclosure 1. These inputs should be prepared using WordPerfect 5.1, and copies of input shall be provided on floppy discs to SRXB or SCSB, as appropriate, one month prior to the DSER and FSER input dates. SRXB or SCSB, as appropriate, shall provide the combined DSER and FSER inputs to ADAR.

Resources:

SRXB 8 psw
SCSB 8 psw

Schedule:

SRXB	DSER input for AP600 to ADAR	12/93
	FSER input for AP600 to ADAR	12/94
SCSB	DSER input for SBWR to ADAR	3/94
	FSER input for SBWR to ADAR	2/95

OVERVIEW OF ACTIVITIES

Table 1 provides a summary of the implementation plan. Across the top of the table are the elements of the staff's review program as outlined in Reference 1; down the side is a listing of the testing programs planned by the vendor. Thus, this table provides a matrix of those activities to be accomplished and the Branches involved. The "lead" branch for the specific activity is listed first on the table. As noted on the table, there are several activities wherein no action is planned. This is consistent with the "sampling" approach discussed in Reference 1. In addition, within a given activity, some sampling will also occur as listed in the more detailed description of the activities given below.

Each of the vendor testing programs is separately discussed below to indicate the work which is to be performed. Included is the estimated schedule for the review, based on the current vendor testing schedules. Delays in the vendor schedules will result in modification of the schedule and may also impact resource estimates. Estimated resources for each activity are also

provided for each Branch; a summary of total resources is provided in Table 2.

AP600 Review Plan

Core Makeup Tank (CMT) Tests

The CMT tests are to evaluate the draining modes of the CMT, provide confirmation on the adequacy of the level instrumentation used in the CMT to initiate ADS, and provide data on specific thermal-hydraulic behavior in the CMT, such as condensation behavior and thermal stratification. These tests will be used by Westinghouse to verify their computer codes.

Currently, the test configuration has been established and detailed test facility design is underway. Facility construction is to be completed by January 1993; shakedown tests are to be completed February 1993; testing is to be completed by May 1993. No schedule has been provided for either the submission of the test results or the associated code verification effort.

Overall review of the CMT tests belongs to SRXB, however, significant assistance is needed from RPSB. The effort will include a review of the testing program, and testing matrix to ensure that the objectives will address the NRC's concerns related to the CMT, as addressed in SECY-91-273, and ensure that an appropriate range of conditions is examined. Further, a detailed review of the scaling chosen for the tests, and the instrumentation to be used will be performed to ensure that sufficient data is provided for code assessment. An audit of approximately 5 test plans will be performed to ensure that the testing is properly conducted, and some of these tests will be witnessed to confirm the tests are conducted consistent with the test plans.

Test data will be reviewed to confirm that expected phenomena were tested and that results confirm the behavior predicted by the AP600 safety analyses. The vendor code verification efforts will be reviewed to ascertain whether the code adequately predicted the observed phenomena. Tests will be selected for analysis by the staff to confirm the capability of the RELAP5/MOD3 code for use in audit analyses of the AP600 design.

SRXB will have lead responsibility for the review of the test program, matrices, and test plan reviews. RPSB will assist SRXB in its efforts and will provide comments to SRXB for inclusion in its assessment. RPSB will have primary review of the scaling analysis and instrumentation review and will forward its assessment to SRXB. SRXB will assess the data to ensure its

adequacy, and will specifically address the adequacy of the vendors code verification results.

Verification of the staff's computer code will be performed by RPSB. RPSB shall inform SASG and SRXB of the tests selected for analysis. Results of the verification analysis shall be provided to SASG and SRXB to allow conclusions on code adequacy to be considered in assessing the results of audit analyses performed for the AP600 design. SRXB will compile DSER/FSER input for transmittal to ADAR.

Resources:

SRXB 12 psw/$40k
RPSB 20 psw/$600k

Schedule:

SRXB

Evaluation of test program and matrix	2/93
Audit of testing plans	2/93
View Test	2/93-5/93
DSER input	12/93
Evaluation of test data	8/94
Evaluation of code verification	12/94
FSER input to ADAR	12/94

RPSB

Comments on test program and matrix to SRXB	2/93
Comments on test plans to SRXB	2/93
Evaluation of scaling and instrumentation	3/93
DSER input to SRXB	10/93
Post test analyses with RELAP5	10/93-12/93
FSER input to SRXB	10/94

ACRS Interaction Points

Review of facility design and test matrix	3/93
Review of test results and analyses	2/94

Automatic Depressurization System (ADS) Tests

A critical component in the AP600 design is the ADS. These valves depressurize the reactor coolant system to allow gravity injection from the In-containment Refueling Water Storage Tank (IRWST) to provide long-term cooling. Full-scale tests of the ADS valves and the sparger in the IRWST are being performed in Casaccia, Italy. The Phase A tests are underway, to examine the sparger performance and IRWST loads, and are scheduled for completion in October 1992.

Phase B tests are to evaluate full scale performance of the valves used in the first three ADS stages. Facility modifications for these tests are to be completed in July 1993, and testing completed in December 1993.

The staff has previously notified Westinghouse of the need to test the fourth stage ADS valve. Westinghouse has decided not to test this valve as part of the Phase B ADS program, but will test the fourth stage valves separately at a later date. Estimated completion date for these tests is December 1994.

SRXB will have overall lead responsibility for review of these tests. SRXB will review the test program, test matrix, and audit selected test plans to ensure that the testing program adequately characterizes ADS valve performance. SRXB also plans to visit the facility while testing activities are in progress, to view selected tests. The data and the vendor's verification analyses will be reviewed to ensure that the code properly reflects the observed behavior. EMEB will assist SRXB through review of the test program and data to assess ADS valve performance and reliability.

SCSB will perform a similar review to that planned by SRXB except its efforts will focus on the sparger behavior. SCSB shall provide results of its review to SRXB for inclusion in the DSER and FSER inputs.

Resources:

SRXB 8 psw/$20k
SCSB 8 psw/$20k
EMEB 2 psw/$0k

Schedule:

SRXB

Evaluation of test program and matrix	3/93
Audit of testing plans	3/93
View Test	10/93 - 12/93
DSER input to ADAR	12/93
Evaluation of test data	4/94
Evaluation of code verification	12/94
FSER input to ADAR	12/94

SCSB

Evaluation of test program and matrix	3/93
Audit of testing plans	3/93
DSER input to SRXB	10/93
Evaluation of test data	4/94
Evaluation of code verification	10/94
FSER input to SRXB	10/94

EMEB

DSER input to SRXB	10/93
FSER input to SRXB	10/94

ACRS Interaction Points

Review of facility design and test matrix	5/93
Review of test results and analyses	7/94

Passive Residual Heat Removal (PRHR) Tests

PRHR system testing has been completed by Westinghouse. The purpose of these tests was to evaluate the heat transfer behavior of the PRHR tubes, and to modify the correlations used to predict PRHR performance.

SRXB will have the lead for evaluating these tests. Since these tests have been completed, the effort will concentrate on ensuring that the test program, testing matrix and test facility design (scaling and instrumentation) was sufficient to characterize the behavior of the PRHR system. RPSB will evaluate the specifics of the test facility design and forward its evaluation to SRXB.

The test data, and the associated modeling of the PRHR by W, will be evaluated by SRXB to ensure that the PRHR system has been appropriately reflected in the AP600 safety analyses. RPSB will

assess the capability of the RELAP5/MOD3 code to predict the test results. The results of its evaluation shall be forwarded to SASG and SRXB to assess audit calculations performed by the staff. Input to the DSER and FSER will be compiled by SRXB.

Resources:

SRXB 6 psw/$20k
RPSB 5 psw/$275k

Schedule:

SRXB

Evaluation of test program and matrix	2/93
Evaluation of test data	5/93
DSER input	12/93
Evaluation of code verification	12/94
FSER input	12/94

RPSB

Evaluation of scaling and instrumentation	2/93
DSER input to SRXB	10/93
Post test analyses with RELAP5	2/94
FSER input to SRXB	10/94

ACRS Interaction Points

Review of test program	5/93

Wind Tunnel Tests

The AP600 containment is cooled by natural circulation around the outside of the containment shell. Westinghouse has performed a series of wind tunnel tests to examine the effect of wind direction and speed on the operation of the containment cooling air inlet design. The first two phases of this program have been completed; the third and fourth phases are scheduled to be completed by September 1993.

SCSB has the lead for evaluating these tests. SCSB will evaluate the test program, test matrix, facility design, and test results to confirm the adequacy of the air cooling inlet design. AEB will perform a detailed review of the test scaling and instrumentation and forward these results to SCSB. SCSB shall provide DSER and FSER input to SRXB for inclusion in the overall evaluation to be submitted to ADAR.

Resources:

SCSB 8 psw/$20k
AEB 3 psw/$50k
SRXB 1 psw/$0k

Schedule:

SCSB

Evaluation of test program and matrix	8/93
Evaluation of test results	12/93
DSER input to SRXB	10/93
FSER input to SRXB	10/94

AEB

Evaluation of scaling and instrumentation to SCSB	8/93
DSER input to SCSB	10/93

SRXB

DSER input to ADAR	12/93
FSER input to ADAR	12/94

ACRS Interaction Points

Review of test program	2/94

Passive Containment Cooling System (PCCS) Tests

The Westinghouse test program for the PCCS includes a series of separate effects tests at various scales to examine the heat transfer behavior on the interior of the containment, heat transfer on the containment exterior, and water distribution on the containment exterior. Simple geometry tests have been completed, and those in a more complex geometry are underway. A relatively large-scale facility, approximately 1/9 scale in height and 1/8.5 in diameter, is being constructed for tests of the entire PCCS. Tests on a full scale angular sector of the containment shell will also be conducted to study water distribution on the containment exterior. These tests are to be completed by June 1993.

Overall review of the PCCS tests belongs to SCSB, however, significant assistance is needed from AEB. The effort will include a review of the testing program, and testing matrix to ensure that the objectives will fully evaluate the performance of the PCCS and ensure that an appropriate range of conditions are

examined. Further, a detailed review of the scaling chosen for the tests, and the instrumentation to be used will be performed to ensure that sufficient data is provided for code assessment. An audit of approximately 5 test plans will be performed to ensure that the testing is properly conducted, and some of these tests will be witnessed to confirm the tests are conducted consistent with the test plans.

Test data will be reviewed to confirm that expected phenomena were tested and that results confirm the behavior predicted by the AP600 safety analyses. The vendor code verification efforts will be reviewed to ascertain whether the code adequately predicted the observed phenomena. Tests will be selected for analysis by the staff to confirm the capability of the CONTAIN code for use in audit analyses of the AP600 design.

SCSB will have lead responsibility for the review of the test program, matrices, and test plan reviews. AEB will have primary review of the scaling analysis and instrumentation review and will forward its assessment to SCSB. SCSB will assess the data to ensure its adequacy, and will specifically address the adequacy of the vendor's code verification results.

Verification of the staff's computer code will be performed by AEB. AEB shall inform SASG and SCSB of the tests selected for analysis. Results of the verification analysis shall be provided to SASG and SCSB to allow conclusions on code adequacy to be considered in assessing the results of audit analyses performed for the AP600 design. Both pre-test and post-test analyses will be performed.

Input for the DSER and FSER will be provided to SRXB for inclusion in the overall safety evaluation of the vendor's testing program.

Resources:

SCSB 26 psw/$80k
AEB 50 psw/$800k
SRXB 1 psw/$0k

Schedule:

SCSB

Evaluation of test program and matrix	4/93
Audit of testing plans	4/93
View Test	4/93 - 6/93
DSER input to SRXB	12/93
Evaluation of test data	10/93
Evaluation of code verification	10/94
FSER input to SRXB	10/94

AEB

Evaluation of scaling and instrumentation	4/93
DSER input to SCSB	10/93
Pre-test analyses with CONTAIN	6/93
Post-test analyses with CONTAIN	6/94
FSER input to SCSB	10/94

SRXB

DSER input to ADAR	12/93
FSER input to ADAR	12/94

ACRS Interaction Points

Review of test program and test matrix	5/93
Review of test data and analyses	7/94

Check Valve Tests

Check valves are key components in the AP600 safety system designs. These valves must open, and remain open, under relatively low pressure drops. Long-term exposure to reactor coolant conditions could affect the behavior of the valves. Preliminary hydraulic testing of the valves has been completed, but these tests were not performed on the "biased open" valves now planned for the AP600. Qualification testing of the valves is planned for completion by June 1994.

The Mechanical Engineering Branch (EMEB) is responsible for the review of these tests. A technical assistance contract is in place for the review of the testing program. EMEB will review the test program, testing matrix, and testing plans, to ensure that the testing will be adequate for establishing valve performance and long-term operability of the valves after exposure to RCS environment. EMEB will also view selected tests, and will analyze the data obtained. SRXB will work with EMEB to evaluate the adequacy of the vendor's test plans to ensure that an appropriate range of conditions is included to adequately assess check valve performance. For the long-term performance test, the Materials and Chemical Engineering Branch (EMCB) will assist EMEB in assessing the capability of the vendor's test program to evaluate long-term check valve performance. EMEB will assist SRXB in assuring that the test results confirm the modeling assumptions use in the safety analysis. The DSER input should discuss the adequacy of the testing plans and program; FSER input should discuss the results of the testing and conclusions relative to valve performance. SRXB will compile the DSER and FSER input for transmittal to ADAR.

Resources:

EMEB 4 psw/$50k
SRXB 2 psw/$0k
EMCB 2 psw/$0k

Schedule:

EMEB

DSER input to SRXB	10/93
FSER input to SRXB	10/94

EMCB

DSER input to SRXB	10/93
FSER input to SRXB	10/94

SRXB

DSER input	12/93
FSER input	12/94

ACRS Interaction Points

Review of in-situ program	5/93
Review of in-situ test data	7/94

Oregon State University (OSU) Tests

Westinghouse is performing low-pressure, reduced-height integral system testing at OSU. The purpose of these tests is to demonstrate that gravity driven injection and natural convection provided adequate long-term cooling for the AP600 design. The data will be used to verify the computer codes used in the AP600 safety analysis. Facility construction is to be completed in April 1993, shakedown testing in June 1993, and matrix testing in October 1993. Westinghouse's post-test analysis effort is scheduled to be completed in February 1994, but the details of that effort have not yet been provided.

Overall review of the OSU tests belongs to SRXB, however, significant assistance is needed from RPSB. The effort will include a review of the testing program, and testing matrix to ensure that the objectives will address the NRC's concerns related to long-term cooling of the AP600 design and ensure that an appropriate range of conditions are examined. Further, a detailed review of the scaling chosen for the tests, and the instrumentation to be used will be performed to ensure that sufficient data is provided for code assessment. An audit of approximately 5 test plans will be performed to ensure that the

testing is properly conducted, and some of these tests will be witnessed to confirm the tests are conducted consistent with the test plans. Vendor pre-test predictions will be reviewed to confirm that overall facility behavior is representative of the expected AP600 behavior.

Test data will be reviewed to confirm that expected phenomena were tested and that results confirm the behavior predicted by the AP600 safety analyses. The vendor post-test code verification efforts will be reviewed to ascertain whether the code adequately predicted the observed phenomena. Tests will be selected for analysis by the staff to confirm the capability of the RELAP5/MOD3 for use in audit analyses of the AP600 design.

SRXB will have lead responsibility for the review of the test program, matrices, and test plan reviews. RPSB will assist SRXB in its efforts and will provide comments to SRXB for inclusion in its assessment. RPSB will have primary review of the scaling analysis and instrumentation review and will forward its assessment to SRXB. SRXB will assess the data to ensure its adequacy, and will specifically address the adequacy of the vendor's code verification results.

Verification of the staff's computer code will be performed by both SASG and RPSB. RPSB and SASG shall inform SRXB of the tests selected for analysis. Results of the verification analysis shall be provided to SRXB to allow conclusions on code adequacy to be considered in assessing the results of audit analyses performed for the AP600 design.

Resources:

SRXB 26 psw/$60k
SASG 20 psw/$0k
RPSB 35 psw/$1265k

Schedule:

SRXB

Evaluation of test program and matrix	2/93
Audit of testing plans	4/93
View Test	6/93 - 10/93
DSER input	12/93
Evaluation of test data	4/94
Evaluation of code verification	12/94
FSER input	12/94

RPSB

Comments on test program and matrix to SRXB	1/93
Comments on test plans to SRXB	3/93
Evaluation of scaling and instrumentation to SRXB	3/93
Pre-test analyses to SRXB	7/93
DSER input to SRXB	10/93
Post-test analyses to SRXB	6/94
FSER input to SRXB	10/94

SASG

Pre-test analyses to SRXB	7/93
DSER input to SRXB	10/93
Post-test analyses to SRXB	6/94
FSER input to SRXB	10/94

ACRS Interaction Points

Review of test program	5/93
Review of test data and analyses	8/94

SPES-2 Tests

Full-height, high-pressure integral systems testing of the AP600 design is planned to be performed at the SPES-2 facility in Piacenza, Italy. This testing is to provide thermal-hydraulic data at high pressure to be used to verify the safety analysis computer codes. Scaling analysis for the facility is nearly complete. Facility construction is estimated to be completed by January 1993, shakedown testing by May 1993, and matrix testing by December 1993. All post-test analyses are scheduled to be completed by February 1994, but details of the analysis plan have not been provided by Westinghouse at this time.

SRXB has lead responsibility for evaluation of the SPES-2 tests and preparation of DSER/FSER inputs. This review will be performed in the same manner as that described above for the OSU tests.

Resources:

SRXB 40 psw/$100k
SASG 20 psw/$0k
RPSB 35 psw/$1260k

Schedule:

SRXB

Evaluation of test program and matrix	2/93
Audit of testing plans	2/93
View Test	4/93 - 12/93
DSER input	12/93
Evaluation of test data	2/94
Evaluation of code verification	12/94
FSER input	12/94

RPSB

Comments on test program and matrix to SRXB	1/93
Comments on test plans to SRXB	2/93
Evaluation of scaling and instrumentation to SRXB	2/93
DSER input to SRXB	10/93
Pre-test analyses to SRXB	6/93
Post-test analyses to SRXB	5/94
FSER input to SRXB	10/94

SASG

Pre-test analyses to SRXB	6/93
Post-test analyses to SRXB	4/94
FSER input to SRXB	10/94

ACRS Interaction Points

Review of test program	5/93
Review of test data and analyses	8/94

ROSA-V Tests

The staff will perform confirmatory full-height, high-pressure integral systems testing of the AP600 design in the ROSA-V facility in Japan. Negotiations are underway with the Japanese for this testing. The tentative schedule is to complete facility modifications by October 1993, initiate testing in December 1993, and complete testing by December 1994. An option is expected to allow for an additional year of testing at the facility.

Although these tests are confirmatory, and therefore not required to certify the AP600 design, the results of these tests will be used to verify the staff's RELAP5/MOD3 computer code. The staff will utilize this code to perform audit calculations of the AP600 design. DSER input is not required for this testing.

RPSB has the lead responsibility for these tests. RPSB will perform the scaling analyses, and develop the test plans and matrices. RPSB shall keep SRXB informed of its plans and will solicit SRXB comments on the proposed test plans and matrices. RPSB will station a resident engineer at the ROSA-V facility to provide oversight of the testing program. Data reports will be forwarded to SRXB for review. If any unusual behavior is iden* ed during the tests, RPSB shall immediately inform SRXB and in order to allow these results to be considered in the staf: afety evaluation of the design.

Pre-test and post-test predictions will be performed by RPSB and SASG using the RELAP5/MOD3 code. These Branches shall coordinate their efforts to minimize duplication of effort. SRXB shall be kept informed o the results to allow conclusions on code adequacy to be idered in assessing audit results performed for the AP600 n.

Resources:

RPSB 54 psw/$1955k
SASG 16 psw/$0k
SRXB 20 psw/$0k

Schedule:

Because this ting is confirmatory, no schedule is required for using these test results.

SBWR Review Plan

University of California at Berkeley/ Massachusetts Institute of Technology (UCB/MIT) Correlations

The SBWR design utilizes isolation condensers for decay heat removal from the reactor coolant system and passive heat removal from the containment. A series of prototypical, sirgle tube tests have been completed at UCB and MIT to evaluate the effect of non-condensible gases on tube-side heat transfer. The data were utilized to develop a heat transfer correlation which has been incorporated into the TRACG code.

SCSB has the lead for reviewing these tests. It will review the test conduct and instrumentation to ensure that an adequate range of initial conditions have been tested to cover possible SBWR

conditions. SRXB will review the specific implementation of the correlation in the TRACG code. RPSB will also review the data to incorporate and test an appropriate correlation for use in the RELAP5/MOD3 code. Both SRXB and RPSB will provide summary DSER and FSER inputs to SCSB for incorporation into the safety evaluation.

Resources:

SCSB 4 psw/$10k
SRXB 4 psw/$10k
RPSB 5 psw/$100k

Schedule:

SCSB

Evaluate test program, test matrix and results	3/93
DSER input to ADAR	3/94
FSER input to ADAR	2/95

SRXB

Evaluate correlation implementation in TRACG	1/94
DSER input to SCSB	2/94
FSER input to SCSB	1/95

RPSB

Incorporate correlation in RELAP5	6/93
Provide comments on correlation to SRXB	8/93
DSER input to SCSB	2/94
FSER input to SCSB	1/95

ACRS Interaction Points

Review of test program	4/93
Review of test data and analyses	1/94

GIRAFFE

General Electric (GE) performed the GIRAFFE tests in Japan to confirm the performance of the Passive Containment Cooling System (PCCS) and provide data for verification of the analytical models used for the SBWR safety analysis. These tests utilized a simulation of the SBWR containment to examine the overall PCCS performance, particularly the performance of the isolation

condenser to purge non-condensible gases. While these tests have been completed, GE is planning additional testing in GIRAFFE to address staff questions. These tests are currently being planned and are anticipated to be completed by December, 1993.

Overall review of this testing belongs to SCSB. Assistance will be provided by SRXB, AEB, and RPSB. SCSB will review the test program, matrix and audit selected test plans to confirm the testing addressed staff concerns relative to the performance of the PCCS. This review should be used to identify additional testing needed from GE. AEB and RPSB shall review the scaling and instrumentation for the facility and forward a coordinated review evaluation to SCSB.

Data review will be performed by SCSB to assess the overall performance of the PCCS. SRXB will evaluate the vendor's predictions with the TRACG code as part of its overall evaluation of the code.

Pre- and post-test analyses of these tests will be performed by AED, RPSB, and SASG. These branches shall inform SCSB of the tests selected for analysis. Results of these evaluations shall be forwarded to SCSB to allow consideration of these results in assessing audit analyses performed for the SBWR.

Resources:

SCSB	26 psw/$80k
SRXB	6 psw/$40k
SASG	12 psw/$0k
RPSB/AEB	25 psw/$400K

Schedule:

SCSB

Evaluation of test program and matrix	4/93
Audit of testing plans	4/93
View Test	3/93 - 12/93
DSER input	2/94
Evaluation of test data	4/94
FSER input	2/95

SRXB

DSER input to SCSB	2/94
Evaluation of TRACG code verification	9/94
FSER input to SCSB	1/95

RPSB/AEB

Comments on test program and matrix to SCSB	4/93
Comments on test plans to SCSB	4/93
Evaluation of scaling and instrumentation to SCSB	4/93
SER input to SCSB	~~8/93~~ 2/94
Pre-test analyses to SCSB	10/93
Post-test analyses to SCSB	6/94
FSER input to SCSB	1/95

SASG

Post-test analyses to SCSB	6/94
FSER input to SCSB	1/95

ACRS Interaction Points

Review of previous data and plans for additional tests	4/93
Review of test data and analyses	11/94

PANTHERS

Full-scale testing of the isolation condensers is planned as part of the PANTHERS testing program at Piacenza, Italy. This testing will provide final confirmation of the performance of the isolation condenser including heat transfer and structural behavior. Testing is to be completed in March, 1994 for the PCCS and July, 1994 for the isolation condenser.

SCSB has the lead review for this effort, concentrating on the full scale performance of the PCCS. SRXB will assist SCSB by evaluating the isolation condenser tests. Both SCSB and SRXB will evaluate the test programs and testing matrix for the PCCS and isolation condenser, respectively. Audits of the testing plans will be performed and the tests will be viewed to ensure testing is conducted in accordance with the test plans.

RPSB will review the scaling and instrumentation used in these tests to ensure that adequate data is obtained. The results of its review shall be forwarded to SCSB for inclusion in the safety evaluation.

SRXB shall review GE's code predictions for these tests. This will be performed as part of the overall evaluation of the TRACG code. A summary of the review shall be provided to SCSB.

Pre- and post-test analyses using the staff's computer codes are planned by SASG and RPSB. These branches shall inform SCSB of the tests selected for analysis. These results shall be provided to SCSB for assessing the adequacy of audit analyses performed for the SBWR.

Resources:

SCSB	8 psw/$20k
SRXB	4 psw/$20k
SASG	8 psw/$0k
RPSB	15 psw/$275k

Schedule:

SCSB

Evaluation of test program and matrix	2/93
Audit of testing plans	3/93
DSER input to ADAR	3/94
View test	3/93 - 2/94
Evaluation of test data	5/94
FSER input to ADAR	2/95

SRXB

Comments on test program and matrix to SCSB	4/93
Audit of testing plans	8/93
DSER input to SCSB	1/94
Evaluation of TRACG code verification	12/94
FSER input to SCSB	1/95

RPSB

Comments on test program and matrix to SCSB	4/93
Comments on test plans to SCSB	7/93
Evaluation of scaling and instrumentation to SCSB	6/93
DSER input to SCSB	2/94
Pre-test analyses to SCSB	12/93
Post-test analyses to SCSB	11/94
FSER input to SCSB	1/95

SASG

Pre-test analyses to SCSB	12/93
Post-test analyses to SCSB	11/94
FSER input to SCSB	1/95

ACRS Interaction Points

✓Review of test program	4/93
✓Review of test data and analyses	11/94

PANDA

Testing at the PANDA facility at the Paul Scherer Institute in Switzerland is being performed to investigated multidimensional behavior of the SBWR containment. The staff has concluded that these tests are necessary to support design certification. This test will include simulation of the major SBWR components, including the wetwell, drywell, isolation condenser, GDCS and the PCCS. The facility is 1/25-scale and full-height. The current schedule is for facility construction to be completed in November 1993, and testing initiated in October 1994. GE has stated that it will attempt to accelerate the schedule.

Overall coordination of this review shall be performed by SCSB. SCSB will review the test program and matrix to ensure that the tests fully examine the SBWR containment performance. AEB will evaluate the scaling rationale and instrumentation planned for the facility. The evaluation of the PANDA facility will be provided to SCSB for inclusion in the safety analysis. Audit of approximately 5 test plans will be performed by SCSB, and tests will be viewed to ensure that test conduct is consistent with the test plans.

SCSB will review the vendor's code predictions for the PANDA facility to ensure that the code adequately predicts SBWR containment behavior.

Pre- and post-test analysis will be performed by SASG, and AEB. SCSB will coordinated these analysis efforts to minimize duplication of effort. SCSB will be informed of the tests selected for analysis. Results of the predictions shall be forwarded to SCSB for review to allow consideration of the results in assessing the staff's audit analyses of the SBWR.

Resources:

SCSB	40 psw/$100k
SASG	20 psw/$0k
AEB	25 psw/$350k
RPSB	15 psw/$300k

Schedule:

SCSB

Evaluation of test program and matrix	2 mo. after submittal
Audit of testing plans	2 mo. after submittal
DSER input to ADAR	3/94
View Tests	10/94 - 3/95
FSER input to ADAR	2/95
Evaluation of test data	2 mo. after submittal
FSER supplement to ADAR	10/95

AEB/RPSB

Evaluation of scaling and instrumentation to SCSB	12/93
DSER input to SCSB	2/94
Pre-test analyses to SCSB	12/94
FSER input to SCSB	1/95
Post-test analyses to SCSB	4 mo. after data receipt
FSER supplement	9/95

SASG

Pre-test analyses to SCSB	10/94
FSER input to SCSB	1/95
Post-test analyses to SCSB	4 mo. after data receipt
FSER supplement	9/95

ACRS Interaction Points

Review of test program and test matrix	3 mo. after submittal
Review of test data and analyses	6 mo. after data receipt

Gravity-Driven Cooling System (GDCS) Integrated System Test (GIST)

Testing of the GDCS was completed at the GIST facility. This testing was an integrated test simulating major components of the SBWR, although based on an earlier configuration of the design. The purpose of the test was to provide thermal-hydraulic data for verification of the TRACG code.

SRXB has lead responsibility for evaluating these tests. SRXB shall review the test program and matrix to ensure that an adequate range of conditions were tested. RPSB shall review the scaling and instrumentation used in the test to determine whether the tests were adequate to provide data for code assessment of

the GDCS behavior. Since the SBWR design, and specifically the GDCS, has been modified since the GIST tests were performed, the evaluation shall specifically examine whether the tests were adequate for the current SBWR configuration. The results of this review shall be forwarded to SRXB for inclusion in the safety evaluation. SRXB will review the test data, and the verification of the TRACG code as part of its overall assessment of the TRACG code.

Post test analyses are planned by SASG and RPSB. SRXB shall be informed of the tests selected for analysis. Results of these analyses shall be forwarded to SRXB to assess the adequacy of audit calculations performed for the SBWR.

SRXB shall forward its evaluation of the GIST tests to SCSB for incorporation in the coordinated SER input to ADAR.

Resources:

SRXB	6 psw/$40k
RPSB	15 psw/$585k
SASG	6 psw/$0k

Schedule:

SRXB

Evaluation of test program and matrix	3/93
DSER input to SCSB	7/93
Evaluation of TRACG verification	2/94
FSER input to SCSB	7/94

RPSB

Evaluation of facility scaling and and instrumentation	3/93
DSER input to SRXB	6/93
Post-test analyses to SRXB	9/93
FSER input to SRXB	6/94

SASG

Post-test analyses to SRXB	9/93
FSER input to SRXB	6/94

ACRS Interaction Points

Review of test program, data, and vendor analyses	4/93
Review of staff analyses	1/94

Squib Valve Testing

The squib valves are important components in the SBWR, and are required to depressurize the SBWR to allow draining from the GDCS. Limited squib valve testing has been performed by GE, and the staff has recommended additional testing be performed to ensure adequate valve reliability. GE has not yet informed the staff of any additional testing planned.

The Mechanical Engineering Branch (EMEB) is responsible for the review of these tests. A technical assistance contract is in place for the review of the testing program. EMEB will review the test program, testing matrix, testing plans, and test results to ensure that the testing will be adequate for establishing reliable valve performance. EMEB will assist SRXB in assuring that the test results confirm the modeling assumptions use in the safety analysis. EMCB will also review the test data to assess squib valve performance from the aspect of valve degradation due to possible internal crevice corrosion. The DSER input should discuss the adequacy of the testing plans and program; FSER input should discuss the results of the testing and conclusions relative to valve performance.

Resources:

EMEB	4 psw/$50K
SRXB	2 psw/$0K
SCSB	1 psw/$0k
EMCB	1 psw/$0k

Schedule:

EMEB

DSER input to SCSB	7/93
FSER input to SCSB	7/94

SRXB

DSER input to SCSB	7/93
FSER input to SCSB	7/94

EMCB

DSER input to SCSB	7/93
FSER input to SCSB	7/94

SCSB

DSER input to ADAR	8/93
FSER input to ADAR	8/94

ACRS Interaction Points

Review of test program and data 4/93

SBWR Small Scale Loop

The staff is planning confirmatory, small scale integral systems testing of the SBWR. A request for proposal has been issued, and testing is expected to begin in FY94.

Although these tests are confirmatory, and therefore not required to certify the SBWR design, the results of these tests will be used to verify the staff's RELAP5/MOD3 computer code. The staff will utilize this code to perform audit calculations of the SBWR design. DSER input is not required for this testing.

RPSB has the lead responsibility for these tests. RPSB will perform the scaling analyses, and develop the test plans and matrices. RPSB shall keep SRXB informed of its plans and will solicit SRXB comments on the proposed test plans and matrices. Data reports will be forwarded to SRXB for review. If any unusual behavior is identified during the tests, RPSB shall immediately inform SRXB, SCSB and DAR in order to allow these results to be considered in the staff's safety evaluation of the design.

Pre-test and post-test predictions will be performed by RPSB and SASG using the RELAP5/MOD3 code. These Branches shall coordinate their efforts to minimize duplication of eff t. SRXB shall be kept informed of the results to allow conclusions on code adequacy to be considered in assessing audit results performed for the AP600 design.

Resources:

RPSB 25 psw/$555K
SASG 16 psw/$0K
SRXB 16 psw/$0K

Schedule:

Because this testing is confirmatory, no schedule is required for using these test results.

REFERENCES

1. Memorandum, T. E. Murley and E. S. Beckjord to J. M. Taylor, SUBJECT: Program for the Review of Vendor's Test Programs to Support Design Certification of Advanced Reactors, April 6, 1992.

2. Memorandum, T. E. Murley to E. S. Beckjord, SUBJECT: Coordination Plan for Passive Reactor Testing and Analysis, June 8, 1992.

TABLE 2

Summary of Resources for Testing Reviews

Branch	FTE	Tech Assist ($k)
SRXB*	3.0	350
SCSB	2.5	330
SASG	2.3	0
EMEB	0.2	100
RPSB**	5.5	7370
AEB**	1.7	1400
EMCB	0.1	0
ADAR	0.6	0

* Additional 0.5 FTE/$200K allocated for code review and verification

** Where resources/technical assistance were shown combined for these branches, the total has been split approximately equally for inclusion in this table

ENCLOSURE 1

OUTLINE FOR SER INPUT

Executive Summary (SRXB for AP600 or SCSB for SBWR)

1. Introduction (SRXB for AP600 or SCSB for SBWR)

   This section should describe the general purpose of the evaluation. Specifically, it should provide a brief summary of the passive safety features used in the design, and how they are unique in comparison to currently operating plants. It should then discuss the requirements of 10 CFR 52.47(b)(2). It should be noted that validated computer codes are needed to predict the safety performance of the design and that the vendor has developed a testing program to gather the data necessary to confirm code adequacy. Finally, an outline of how the report is organized should be provided.

2. Issues of Concerns (SRXB for AP600 or SCSB for SBWR)

   In this section a summary of the important issues related to performance of the passive safety systems should be provided. This should highlight those issues which required testing and will lead into the subsequent sections of the report.

3. Overview of Vendor Testing Programs (responsible Branch)

   This section should describe, on a test program basis, the vendors testing program. The purpose of the tests should be described here. These should be directly related to the issues of concern.

4. Overview of NRC Activities (responsible Branch)

   On a test program basis, a description of the NRC activities should be provided in this section. An introductory paragraph should explain the "audit" nature of the review. This section should be very similar to the task descriptions presented in this plan.

5. Evaluation of Vendor Testing Programs (responsible Branch)

   Within this section, on a test program basis, the evaluation of the testing program should be provided. It should reflect an evaluation of how the issues of concerns were satisfied by the testing, and the evaluation of the test facility (e.g. results of scaling review if performed).

6. Code Validation (responsible branch)

   Within this section, a summary of the vendor's code validation program should be described along with the staff's conclusion on code adequacy. The basis for concluding that the code is adequate for supporting certification should be provided.

7. Compliance with 10 CFR 52.47(b)(2) (SRXB for AP600 or SCSB for SBWR).

   Each element of 10 CFR 52.47(b)(2) should be discussed separately. It is expected that this section will simply be a summary of the document and its conclusions.

TABLE 1

OVERVIEW OF IMPLEMENTATION PLAN

	TEST PROGRAM & MATRIX	SCALING AND INSTRUMENTATION	TEST PLAN REVIEW	VENDOR PRE TEST PREDICTION	NRC PRE TEST PREDICTION	VIEW TEST	RESIDENT ENGINEER	VENDOR POST TEST PREDICTION	DATA REVIEW	NRC POST TEST PREDICTION
AP600										
CMT TESTS	SRxB/RPSB	RPSB/SRxB	SRxB/RPSB	NO	NO	SRxB	NO	SRxB	SRxB/RPSB	RPSB SASG/SRxB
ADS TESTS	SRxB/SCSB	NO	SRxB/SCSB	NO	NO	SRxB/SCSB	NO	SRxB/SCSB	SRxB/SCSB	NO
PRHR TESTS	SRxB/RPSB	RPSB/SRxB	NO	NO	NO	NO	NO	SRxB	SRxB/RPSB	RPSB SASG/SRxB
WIND TUNNEL TESTS	SCSB	AEB/SCSB	NO	NO	NO	NO	NO	NO	SCSB	NO
PCCS TESTS	SCSB	AEB SCSB	SCSB	NO	NO	SCSB/AEB	NO	SCSB	SCSB/AFS	AEB/SAS / SCSB
CHECK VALVE TESTS	EMEB/EMCB	NO	EMEB EMCB	NO	NO	EMEB	NO	SRxB	EMEB EMCB	NO
OSU	SRxB/RPSB	RPSB SRxB	SRxB RPSB	SRxB	RPSB/SASG	SRxB/RPSB	NO	SRxB	SRxB RPSB	RPSB SA G
SPES	SRxB/RPSB	RPSB SAxB	SRxB RPSB	SRxB	RPSB/SASG	SRxB/RPSA	NO	SRxB	SRxB RPSB	RPSB SA G
ROSA	RPSB/SRxB	RPSB SRxB	RPSB/SRxB	NO	RPSB SASG	RPSB/SRx	RPSB	NO	RPSA SRxB	RPSB SA G
EBWR										
UCB/MIT	SCSB SRxB/RPSB	RPSB	RPSB	NO	NO	NO	NO	SRxB	SRxB RPSB	RPSB
GIRAFFE	SCSB SRxB/AEB RPSB	AEB RPSB/	SCSB SRxB AEB RPSB	SCSB	AEB RPSB	SCSB SRxB RPSB	NO	SCSB	SCSB SRxB AEB RPSB	AEB RPSB/SASG
PANTHERS	SCSB SRxB	RPSB SCSB	SCSB SRxB	NO	RPSB/SASG	SCSB SRxB	NO	SCSB	SCSB SRxB RPSB	RPSB/SASG
PANDA	SCSB	AEB SCSB RPSB	SCSB	SCSB	AEB/SASG	SCSB/AEB/RPSB	NO	SCSB	SCSB/AEB	AEB SASG/RPSB
LIST	SRxB	RPSB/SRxB	NO	NO	NO	NO	NO	SRxB	SRxB RPSB	RPSB SASG
SOURCE VALVES	EMEB	NO	EMEB	NO	NO	NO	NO	NO	EMEB/EMCB	NO
SBWR LOOP	RPSB/SRxB	RPSB SRxB	RPSB/SRxB	NO	RPSB/SASG	RPSB SRxB	NO	NO	RPSB SRxB	RPSB SA G

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

September 15, 1993

MEMORANDUM FOR: Dennis Crutchfield, Associate Director
for Advanced Reactor and License Renewal
Office of Nuclear Reactor Regulation

FROM: Ashok C. Thadani, Director
Division of Systems Safety and Analysis
Office of Nuclear Reactor Regulation

SUBJECT: REVISION 2 OF THE IMPLEMENTATION PLAN FOR THE REVIEW OF VENDOR TESTING PROGRAMS FOR THE AP600 AND SBWR

Enclosed is a revision of the subject plan. The revisions concern the manner in which the reviewers are to coordinate their efforts and reflect the discussions held at a meeting of the responsible parties in NRR and RES on July 7, 1993.

Reviewers of each test program, including reviewers of the relevant computer codes, are to form review groups under the leadership of the lead reviewer, prepare PERT charts showing the interface of their reviews with the test program and meet monthly to review the status of their work and to update the PERT chart. Guidance on the monitoring of the test program has been added to the plan to assist the review group in this aspect of its work.

Resources and schedules which were listed in the previous version have been omitted here; the resource requirements should be unchanged and the schedules which are now out-of-date are being replaced by the PERT charts. The charts will be continually updated and provided monthly to all interested parties.

Finally, it is important to note that more attention is given here to the reviewers of the relevant computer codes. This situation should develop further, in subsequent revisions, as the focus of this work moves from the experiment programs to the codes used in the design assessments, for in the end it will be these codes which must support the staff's safety determinations for the two designs.

Questions on this plan should be directed to Don McPherson, DSSA. He can be reached on 504-1246.

A. Thadani

Ashok C. Thadani, Director
Division of Systems Safety and Analysis
Office of Nuclear Reactor Regulation

Enclosure:
As stated

cc: See attached list

9410310254

Enclosure 3

REVIEW PLAN FOR AP600 AND SBWR TESTING PROGRAMS
REVISION 2

INTRODUCTION

To support certification of the AP600 and the Simplified Boiling Water Reactor (SBWR) passive reactor designs, both Westinghouse and General Electric have developed testing and analysis programs. It is the responsibility of the Office of Nuclear Reactor Regulation (NRR) to evaluate the applicants' testing and analysis programs to ensure that the requirements of 10 CFR 52.47(b)(2) are met. Assistance from the Office of Nuclear Regulatory Research (RES) has been requested to support this effort.

In SECY-91-273, NRC described its approach for review of the design certification testing programs. Reference 1 describes NRC's program to evaluate, monitor and approve the vendor's testing program consistent with SECY-91-273. Both NRR and RES personnel will be needed to perform this evaluation. Reference 2 provides the overall coordination plan for implementing this program. The first revision of this Implementation Plan, Reference 3, defined the specific work efforts, estimated resources and a summary schedule, and incorporated the NRC confirmatory test program. **In this revision of the Plan, more details are provided concerning the organization and management of the work** including its integration into the activities of the vendors and the overall certification schedule.

For completness, this revision includes, unchanged, the original descriptions of activities planned to reach a conclusion on the adequacy of the vendor's testing and analytical programs, the assignment of responsibility for each activity and a general outline of the DSER and FSER. However, the estimated resources have been omitted, and the schedule lists are being replaced by PERT charts which are to be updated monthly.

OVERALL RESPONSIBILITY

The purpose of this implementation plan is to describe in detail all activities necessary for NRR to make its safety determination that the vendor's testing program meets the requirements of 10 CFR 52.47(b)(2). Development of the DSER and FSER input is the responsibility of SRXB for the AP600, and SCSB for the SBWR. These inputs are to meet the dates established by ADAR (now **2/94 for AP600 DSER, 6/94 for SBWR DSER, 4/95 for AP600 FSER and 7/95 for SBWR FSER**) needed to support the issuance of the FDA. An outline for the SER inputs is provided (unchanged from the

original version) in Enclosure 1. The DSER should use this outline to explain what will be documented in the FSER. Many of the activities described below are expected to produce detailed technical reports. As these reports are produced, copies shall be provided to DAR and SRXB or SCSB, as appropriate, for information. The assigned review branch is to provide SER inputs to SRXB or SCSB, as appropriate, consistent with the outline in Enclosure 1. These inputs should be prepared using WordPerfect 5.1, and copies of input shall be provided on floppy discs to SRXB or SCSB, as appropriate, one month prior to the DSER and FSER input dates (indicated by the PERT chart). SRXB or SCSB, as appropriate, shall provide the combined DSER and FSER inputs to ADAR.

In the performance of its responsibilities, the lead branch need not seek the concurrence of the support branches, unless the topic is in the area of expertise of the support branch, or there are other reasons for the lead branch to do so. However, the support branches should always be copied.

ORGANIZATION OF ACTIVITIES

Table 1 provides a summary of the implementation plan reproduced from Reference 3 with only minor modifications concerning support branches. It provides a matrix of those activities to be accomplished and the Branches involved.

FORMATION OF TEST PROGRAM REVIEW GROUPS

An important innovation in this revision to the plan is the formation of Test Program Review Groups (TPRG) for each of the vendor and NRC testing programs. For each line item of Table 1, the lead reviewer, support reviewer and associated code reviewer constitute the Review Group for that test program. The group has the responsibility, under the leadership of the lead reviewer, of coordinating all activities within this plan. Enclosure 2 is a listing of all test programs showing the reviewers and hence the Review Group responsible for each one.

HOW THE TEST PROGRAM REVIEW GROUPS ARE TO FUNCTION

In addition to the coordination of their review activities and preparation of the relevant reports, the group is to prepare a PERT chart* showing the significant activities of each branch and their relation to the vendor's testing/reporting activities. Enclosure 3 provides a sample to be used as guidance. The

*Lead reviewers should work with Ray Scholl of DSSA who will accept the input and prepare the PERT charts.

initiative for prepariang this chart will rest with the lead reviewer who should include on it each activity and event he believes important to the test program review, and for the management and control of that review. The submission of RAIs, the receipt of vendor responses, ACRS interaction points, and the staff approval of the test program are important events to be included.

Each group is to meet monthly to discuss the status of each reviewer's work, changes in review schedules, problems in obtaining information requested from vendors, areas in which required vendor testing beyond that planned is identified, and new work identified for the staff. Enclosure 4 is recommended as a typical agenda for the review group meetings. The group will mark up their PERT chart and submit it and a brief report on the significant items from their meeting to the overall coordinator, Don McPherson, on the first of each month, beginning October 1, 1993. After reviewing and coordinating these charts and reports, McPherson will provide a copy of the complete monthly package to RES, ADAR, and other interested parties. Subsequent revisions of this plan will contain PERT charts for all test programs.

Another important function of the review groups is to monitor selected experiments within the test program of their responsibility. The experiments to be monitored are to be selected on the basis of uncertainty in outcome, challenge to the safety systems, and diversity in the nature of the experiment. It is desirable that some of the more complex tests such as the integral tests be monitored by a group of 2 or 3 persons from the review group, subject to the agency's foreign travel restrictions. Guidance for Monitoring and Reporting on the Conduct of Thermal-Hydraulic Experiments - Enclosure 5 - should be adopted to the experiment in question and followed.

Each of the vendor testing programs is separately discussed below to indicate the work which is to be performed. The data and other information to be supplied ultimately by the vendors is described in Enclosure 6, which is being communicated to the vendors by ADAR.

AP600 Review Plan

CORE MAKEUP TANK (CMT) TESTS

The CMT tests are to evaluate the draining modes of the CMT, provide confirmation on the adequacy of the level instrumentation used in the CMT to initiate ADS, and provide data on specific thermal-hydraulic behavior in the CMT, such as condensation

behavior and thermal stratification. These tests will be used by Westinghouse to verify their computer codes.

Overall review of the CMT tests is the responsibility of SRXB, however, significant assistance is needed from RPSB. The effort will include a review of the testing program, and testing matrix to ensure that the objectives will address the NRC's concerns related to the CMT, as addressed in SECY-91-273, and ensure that an appropriate range of conditions is examined. Further, a detailed review of the scaling chosen for the tests, and the instrumentation to be used will be performed to ensure that sufficient data is provided for code assessment. An audit of approximately 5 test plans will be performed to ensure that the testing is properly conducted, and some of these tests will be witnessed to confirm the tests are conducted consistent with the test plans.

Test data will be reviewed to confirm that expected phenomena were tested and that results confirm the behavior predicted by the AP600 safety analyses. The vendor code verification efforts will be reviewed to ascertain whether the code adequately predicted the observed phenomena. Tests will be selected for analysis by the staff to confirm the capability of the RELAP5/MOD3 code for use in audit analyses of the AP600 design.

SRXB will have lead responsibility for the review of the test program, matrices, and test plan reviews. RPSB will assist SRXB in its efforts and will provide comments to SRXB for inclusion in its assessment. RPSB will have primary review of the scaling analysis and instrumentation review and will forward its assessment to SRXB. SRXB will assess the data to ensure its adequacy, and will specifically address the adequacy of the vendors code verification results.

Verification of the staff's computer code will be performed by RPSB. RPSB shall inform SASG and SRXB of the tests selected for analysis. Results of the verification analysis shall be provided to SASG and SRXB to allow conclusions on code adequacy to be considered in assessing the results of audit analyses performed for the AP600 design. SRXB will compile DSER/FSER input for transmittal to ADAR.

AUTOMATIC DEPRESSURIZATION SYSTEM (ADS) TESTS

A critical component in the AP600 design is the ADS. These valves depressurize the reactor coolant system to allow gravity injection from the In-containment Refueling Water Storage Tank (IRWST) to provide long-term cooling. Full-scale tests of the ADS valves and the sparger in the IRWST are being performed in Casaccia, Italy. The Phase A tests to examine the sparger performance and IRWST loads are completed. Phase B tests are to

evaluate full scale performance of the valves used in the first three ADS stages, and are to be done from Feb. to May 1994.

The staff has previously notified Westinghouse of the need to test the fourth stage ADS valve. While such tests will not be done as part of the Phase B ADS program, they will be done separately at a later date.

SRXB will have overall lead responsibility for review of these tests. SRXB will review the test program and audit selected test plans to ensure that the testing program adequately characterizes ADS valve performance. The data and the vendor's verification analyses will be reviewed to ensure that the code properly reflects the observed behavior. NRR/EMEB, with the advice of RES//EMEB will assist SRXB through review of the test program and data to assess ADS valve performance and reliability.

SCSB will perform a similar review to that planned by SRXB except its efforts will focus on the sparger behavior. SCSB shall provide results of its review to SRXB for inclusion in the DSER and FSER inputs.

PASSIVE CONTAINMENT COOLING SYSTEM (PCCS) TESTS

PRHR system testing has been completed by Westinghouse. The purpose of these tests was to evaluate the heat transfer behavior of the PRHR tubes, and to modify the correlations used to predict PRHR performance.

SRXB will have the lead for evaluating these tests. Since these tests have been completed, the effort will concentrate on examining whether or not the test program, testing matrix, and test facility design (scaling and instrumentation) were sufficient to characterize the behavior of the PRHR system. RPSB will evaluate the specifics of the test facility design and forward its evaluation to SRXB.

The test data, and the associated modeling of the PRHR by W, will be evaluated by SRXB to ensure that the PRHR system has been appropriately reflected in the AP600 safety analyses. RPSB will assess the capability of the RELAP5/MOD3 code to predict the test results. The results of its evaluation shall be forwarded to SASG and SRXB to assess audit calculations performed by the staff. Input to the DSER and FSER will be compiled by SRXB.

WIND TUNNEL TESTS

The AP600 containment is cooled by natural circulation around the outside of the containment shell. Westinghouse has performed a series of wind tunnel tests to examine the effect of wind

direction and speed on the operation of the containment cooling air inlet design. The first two phases of this program have been completed; the third and fourth phases are scheduled to be completed by September 1993.

SCSB has the lead for evaluating these tests. SCSB will evaluate the test program, test matrix, facility design, and test results to confirm the adequacy of the air cooling inlet design. AEB will perform a detailed review of the test scaling and instrumentation and forward these results to SCSB. SCSB shall provide DSER and FSER input to SRXB for inclusion in the overall evaluation to be submitted to ADAR.

PASSIVE CONTAINMENT COOLING SYSTEM (PCCS) TESTS

The Westinghouse test program for the PCCS includes a series of separate effects tests at various scales to examine the heat transfer behavior on the interior of the containment, heat transfer on the containment exterior, and water distribution on the containment exterior. Simple geometry tests have been completed. A 1/8 scale facility has been constructed for tests of the entire PCCS and tests in this facility are scheduled for completion in September 1993. Tests on a full scale angular sector of the containment shell to study water distribution on the containment exterior were completed.

Overall review of the PCCS tests belongs to SCSB, however, significant assistance is needed from AEB. The effort will include a review of the testing program, and testing matrix to ensure that the objectives will fully evaluate the performance of the PCCS and ensure that an appropriate range of conditions are examined. Further, a detailed review of the scaling chosen for the tests, and the instrumentation to be used will be performed to ensure that sufficient data is provided for code assessment. An audit of approximately 5 test plans will be performed to ensure that the testing is properly conducted. Some tests will be witnessed to confirm the tests are conducted consistent with the test plans, and the data from one test will be locked up to permit a blind prediction by the vendor and by NRC.

Test data will be reviewed to confirm that expected phenomena were tested and that results confirm the behavior predicted by the AP600 safety analyses. The vendor code verification efforts will be reviewed to ascertain whether the code adequately predicted the observed phenomena.

SCSB will have lead responsibility for the review of the test program, matrices, and test plan reviews. AEB will have primary review of the scaling analysis and instrumentation review and

will forward its assessment to SCSB. SCSB will assess the data to ensure its adequacy, and will specifically address the adequacy of the vendor's code verification results.

Verification of the staff's computer code will be performed by AEB. AEB shall inform SASG and SCSB of the tests selected for analysis. Results of the verification analysis shall be provided to SASG and SCSB to allow conclusions on code adequacy to be considered in assessing the results of audit analyses performed for the AP600 design. Both pre-test and post-test analyses will be performed.

Input for the DSER and FSER will be provided to SRXB for inclusion in the overall safety evaluation of the vendor's testing program.

CHECK VALVE TESTS

Check valves are key components in the AP600 safety system designs. These valves must open, and remain open, under relatively low pressure drops. Long-term exposure to reactor coolant conditions could affect the behavior of the valves. Preliminary hydraulic testing of the valves has been completed, but these tests were not performed on the "biased open" valves now planned for the AP600. Qualification testing of the valves is planned for completion by June 1994.

The Mechanical Engineering Branch (EMEB) is responsible for the review of these tests. A technical assistance contract is in place for the review of the testing program. NRR/EMEB, with the assistance of RES/EMEB, will review the test program, testing matrix, and testing plans, to ensure that the testing will be adequate for establishing valve performance and long-term operability of the valves after exposure to RCS environment. EMEB will also view selected tests, and will analyze the data obtained. SRXB will work with EMEB to evaluate the adequacy of the vendor's test plans to ensure that an appropriate range of conditions is included to adequately assess check valve performance. For the long-term performance test, the Materials and Chemical Engineering Branch (EMCB) will assist EMEB in assessing the capability of the vendor's test program to evaluate long-term check valve performance. EMEB will assist SRXB in assuring that the test results confirm the modeling assumptions use in the safety analysis. The DSER input should discuss the adequacy of the testing plans and program; FSER input should discuss the results of the testing and conclusions relative to valve performance. SRXB will compile the DSER and FSER input for transmittal to ADAR.

OREGON STATE UNIVERSITY (OSU) TESTS

Westinghouse is performing low-pressure, reduced-height integral system testing at OSU. The purpose of these tests is to demonstrate that gravity driven injection and natural convection provided adequate long-term cooling for the AP600 design. The data will be used to verify the computer codes used in the AP600 safety analysis. Matrix testing is to begin in October 1993.

Overall review of the OSU tests is the responsibility of SRXB, however, significant assistance is needed from RPSB. The effort will include a review of the testing program, and testing matrix to ensure that the objectives will address the NRC's concerns related to long-term cooling of the AP600 design and ensure that an appropriate range of conditions is examined. Further, a detailed review of the scaling chosen for the tests, and the instrumentation to be used will be performed to ensure that sufficient data are provided for code assessment. Vendor pre-test predictions will be reviewed to confirm that overall facility behavior is representative of the expected AP600 behavior.

Test data will be reviewed to confirm that expected phenomena were tested and that results confirm the behavior predicted by the AP600 safety analyses. The vendor post-test code verification efforts will be reviewed to ascertain whether the code adequately predicted the observed phenomena. Tests will be selected for analysis by the staff to confirm the capability of the RELAP5/MOD3 for use in audit analyses of the AP600 design.

SRXB will have lead responsibility for the review of the test program, matrices, and test plan reviews. RPSB will provide comments to SRXB for inclusion in its assessment and will have primary review of the scaling analysis and instrumentation review. SRXB will assess the data to ensure its adequacy, and will specifically address the adequacy of the vendor's code verification results.

Verification of the staff's computer code will be performed by both SASG and RPSB. RPSB and SASG shall inform SRXB of the tests selected for analysis. Results of the verification analysis shall be provided to SRXB to allow conclusions on code adequacy to be considered in assessing the results of audit analyses performed for the AP600 design.

SPES-2 TESTS

Full-height, high-pressure integral systems testing of the AP600 design is planned to be performed at the SPES-2 facility in Piacenza, Italy. This testing is to provide thermal-hydraulic

data at high pressure to be used to verify the safety analysis computer codes. Matrix testing is expected to begin by October 1993 and end by March 1994. All post-test analyses are scheduled to be completed two months later, but details of the analysis plan have not been provided by Westinghouse at this time.

SRXB has lead responsibility for evaluation of the SPES-2 tests and preparation of DSER/FSER inputs. This review will be performed in the same manner as that described above for the OSU tests.

ROSA-V TESTS

The staff will perform confirmatory full-height, high-pressure integral systems testing of the AP600 design in the ROSA-V facility in Japan. The tentative schedule is to complete facility modifications by October 1993, initiate testing in December 1993, and complete testing by December 1994. An option is expected to allow for an additional year of testing at the facility.

Although these tests are confirmatory, and therefore not required to certify the AP600 design, the results of these tests will be used to verify the staff's RELAP5/MOD3 computer code. The staff will utilize this code to perform audit calculations of the AP600 design. DSER input is not required for this testing.

RPSB has the lead responsibility for these tests. RPSB will perform the scaling analyses, and develop the test plans and matrices. RPSB shall keep SRXB informed of its plans and will solicit SRXB comments on the proposed test plans and matrices. RPSB will station a resident engineer at the ROSA-V facility to provide oversight of the testing program. Data reports will be forwarded to SRXB for review. If any unusual behavior is identified during the tests, RPSB shall immediately inform SRXB and ADAR in order to allow these results to be considered in the staff's safety evaluation of the design.

Pre-test and post-test predictions will be performed by RPSB and SASG using the RELAP5/MOD3 code. These Branches shall coordinate their efforts to minimize duplication of effort. SRXB shall be kept informed of the results to allow conclusions on code adequacy to be considered in assessing audit results performed for the AP600 design.

SBWR Review Plan

University of California at Berkeley/ Massachusetts Institute of Technology (UCB/MIT) Correlations

The SBWR design utilizes isolation condensers for decay heat removal from the reactor coolant system and passive heat removal from the containment. A series of prototypical, single tube tests have been completed at UCB and MIT to evaluate the effect of non-condensible gases on tube-side heat transfer. The data were utilized to develop a heat transfer correlation which has been incorporated into the TRACG code.

SCSB has the lead for reviewing these tests. It will review the test conduct and instrumentation to ensure that an adequate range of initial conditions have been tested to cover possible SBWR conditions. SRXB will review the specific implementation of the correlation in the TRACG code. RPSB will also review the data to incorporate and test an appropriate correlation for use in the RELAP5/MOD3 code. Both SRXB and RPSB will provide summary DSER and FSER inputs to SCSB for incorporation into the safety evaluation.

GIRAFFE

General Electric (GE) performed the GIRAFFE tests in Japan to confirm the performance of the Passive Containment Cooling System (PCCS) and provide data for verification of the analytical models used for the SBWR safety analysis. These tests utilized a simulation of the SBWR containment to examine the overall PCCS performance, particularly the performance of the isolation condenser to purge non-condensible gases.

Overall review of this testing is the responsibility of SCSB. Assistance will be provided by SRXB, AEB, and RPSB. SCSB will review the test program and audit selected test plans to confirm the testing addressed staff concerns relative to the performance of the PCCS. This review should be used to identify additional testing needed from GE. AEB and RPSB shall review the scaling and instrumentation for the facility and forward a coordinated review evaluation to SCSB.

Data review will be performed by SCSB to assess the overall performance of the PCCS. SRXB will evaluate the vendor's predictions with the TRACG code as part of its overall evaluation of the code.

Post-test analyses of these tests using NRC codes will be performed by AEB, RPSB, and SASG. These branches shall inform

SCSB of the tests selected for analysis. Results of these evaluations shall be forwarded to SCSB to allow consideration of these results in assessing audit analyses performed for the SBWR.

PANTHERS

Full-scale testing of the isolation condensers is planned as part of the PANTHERS testing program at Piacenza, Italy. This testing will provide final confirmation of the performance of the isolation condenser including heat transfer and structural behavior. Testing is to be completed in March 1994 for the PCCS and late 1994 for the isolation condenser.

SCSB has the lead review for this effort, concentrating on the full scale performance of the PCCS. SRXB will assist SCSB by evaluating the isolation condenser tests. SCSB and SRXB will evaluate the test programs for the PCCS and isolation condenser, respectively. Audits of the testing plans will be performed and the tests will be viewed to ensure testing is conducted in accordance with the test plans.

RPSB and AEB will review the scaling and instrumentation used in these tests to ensure that adequate data is obtained. The results of its review shall be forwarded to SCSB for inclusion in the safety evaluation.

SRXB shall review GE's code predictions for these tests. This will be performed as part of the overall evaluation of the TRACG code. A summary of the review shall be provided to SCSB.

Pre- and post-test analyses using the staff's computer codes are planned by SASG, AEB, and RPSB. These branches shall inform SCSB of the tests selected for analysis. These results shall be provided to SCSB for assessing the adequacy of audit analyses performed for the SBWR.

PANDA

Testing at the PANDA facility at the Paul Scherrer Institute in Switzerland is being performed to investigated multidimensional behavior of the SBWR containment. The staff has concluded that these tests are necessary to support design certification. This test will include simulation of the major SBWR components, including the wetwell, drywell, isolation condenser, GDCS and the PCCS. The facility is 1/25-scale and full-height. The current schedule is for facility construction to be completed in November 1993, and testing initiated in October 1994. GE has stated that it will attempt to accelerate the schedule.

Overall coordination of this review shall be performed by SCSB. SCSB will review the test program to ensure that the tests fully examine the SBWR containment performance. AEB will evaluate the scaling rationale and instrumentation planned for the facility. The evaluation of the PANDA facility will be provided to SCSB for inclusion in the safety analysis. Audit of approximately 5 tests will be performed by SCSB.

SCSB will review the vendor's code predictions for the PANDA facility to ensure that the code adequately predicts SBWR containment behavior.

Pre- and post-test analysis will be performed by SASG, and AEB. SCSB will coordinated these analysis efforts to minimize duplication of effort. SCSB will be informed of the tests selected for analysis. Results of the predictions shall be forwarded to SCSB for review to allow consideration of the results in assessing the staff's audit analyses of the SBWR.

GRAVITY-DRIVEN COOLING SYSTEM (GDCS) INTEGRATED SYSTEM TEST (GIST)

Testing of the GDCS was completed at the GIST facility. This was an integratal test simulating major components of the SBWR, although based on an earlier configuration of the design. The purpose of the test was to provide thermal-hydraulic data for verification of the TRACG code.

SRXB has lead responsibility for evaluating these tests and RPSB for reviewing the scaling and instrumentation. Subsequent to the GIST testing, the GDCS was modified. Therefore, the evaluation shall specifically examine whether the tests were adequate for the current SBWR configuration. To date, the information provided have not been found adequate for code assessment of the GDCS behavior. DRIL has therefore performed an audit of the relavent information. The results of this audit and any subsequent review shall be forwarded to SRXB for further consideration. Ultimately the data sought are to be used by SCSB in its assessment of the TRACG code.

SRXB shall forward its evaluation of the GIST tests to SCSB for incorporation in the coordinated SER input to ADAR.

SQUIB VALVE TESTING

The squib valves are important components in the SBWR, and are required to depressurize the SBWR to allow draining from the GDCS. Limited squib valve testing has been performed by GE, and

the staff has recommended additional testing to ensure adequate valve reliability. GE has not yet informed the staff of any additional testing planned.

The Mechanical Engineering Branch (NRR/EMEB) with assistance of RES/EMEB, is responsible for the review of these tests. A technical assistance contract is in place for the review of the testing program. EMEB will review the test program and test results to ensure that the testing will be adequate for establishing reliable valve performance. EMEB will assist SRXB in assuring that the test results confirm the modeling assumptions used in the safety analysis. EMCB will also review the test data to assess squib valve performance from the aspect of valve degradation due to possible internal crevice corrosion. The DSER input should discuss the adequacy of the testing plans and program; FSER input should discuss the results of the testing and conclusions relative to valve performance.

SBWR SMALL SCALE LOOP

The staff is planning confirmatory, small scale integral systems testing of the SBWR. Purdue University has been selected to construct and operate a 1/4 height, 1/400 scale facility. Testing in this facility is expected to begin in late FY94.

Although these tests are confirmatory and therefore not required to certify the SBWR design, the results of these tests will be used to verify the staff's RELAP5/MOD3 computer code which will be used to perform audit calculations of the SBWR design. DSER input is not required for this testing.

RPSB has the lead responsibility for these tests. RPSB will perform the scaling analyses, and develop the test plans and matrices. RPSB shall keep SRXB and SCSB informed of its plans and will solicit their comments on the proposed test plans and matrices. Data reports will be forwarded to SRXB and SCSB for review. If any unusual behavior is identified during the tests, RPSB shall immediately inform SRXB, SCSB, and DAR to allow these results to be considered in the staff's safety evaluation of the design.

Pre-test and post-test predictions will be performed by RPSB and SASG using the RELAP5/MOD3 code. These Branches shall coordinate their efforts to minimize duplication of effort. SRXB shall be kept informed of the results to allow conclusions on code adequacy to be considered in assessing audit results performed for the AP600 design.

REFERENCES

1. Memorandum, T. E. Murley and E. S. Beckjord to J. M. Taylor, SUBJECT: Program for the Review of Vendor's Test Programs to Support Design Certification of Advanced Reactors, April 6, 1992.

2. Memorandum, T. E. Murley to E. S. Beckjord, SUBJECT: Coordination Plan for Passive Reactor Testing and Analysis, June 8, 1992.

3. Memorandum, A. C. Thadani to D. M. Crutchfield, SUBJECT: Revised Implementation Plan for the Review of Vendor Testing Programs for the AP600 and SBWR, February 17, 1993.

TABLE 1

OVERVIEW OF IMPLEMENTATION PLAN

	TEST PROGRAM & MATRIX	SCALING AND INSTRUMENTATION	TEST PLAN REVIEW	VENDOR PRE-TEST PREDICTION	NRC PRE-TEST PREDICTION	VIEW TEST	RESIDENT ENGINEER	VENDOR POST-TEST PREDICTION	DATA REVIEW	NRC POST-TEST PREDICTION
AP600										
CMT TESTS	SRXB/RPSB	RPSB/SRXB	SRXB/RPSB	NO	NO	SRXB	NO	SRXB	SRXB/RPSB	RPSB/SASG/SRXB
ADS TESTS	SRXB/SCSB	NO	SRXB/SCSB	NO	NO	SRXB/SCSB	NO	SRXB/SCSB	SRXB/SCSB	NO
PNHR TESTS	SRXB/RPSB	RPSB/SRXB	NO	NO	NO	NO	NO	SRXB	SRXB/RPSB	RPSB/SASG/SRXB
WIND TUNNEL TESTS	SCSB	AEB/SCSB	NO	NO	NO	NO	NO	NO	SCSB	NO
PCCS TESTS	SCSB	AEB/SCSB	SCSB	NO	NO	SCSB/AEB	NO	SCSB	SCSB/AEB	AEB/SASG/SCSB
CHECK VALVE TESTS	EMEB/EMCB	NO	EMEB/EMCB	NO	NO	EMEB	NO	SRXB	EMEB/EMCB	NO
OSU	SRXB/RPSB	RPSB/SRXB	SRXB/RPSB	SRXB	RPSB/SASG	SRXB/RPSB	NO	SRXB	SRXB/RPSB	RPSB/SASG
SPES	SRXB/RPSB	RPSB/SRXB	SRXB/RPSB	SRXB	RPSB/SASG	SRXB/RPSB	NO	SRXB	SRXB/RPSB	RPSB/SASG
ROSA	RPSB/SRXB	RPSB/SRXB	RPSB/SRXB	NO	RPSB/SASG	RPSB/SRXB	RPSB	NO	RPSB/SRXB	RPSB/SASG
BBWR										
UCB/MIT	SCSB SRXB/RPSB	RPSB	RPSB	NO	NO	NO	NO	SRXB	SCSB SRXB/RPSB	RPSB
GIRAFFE	SCSB SRXB/AEB RPSB	AEB RPSB/SCSB	SCSB SRXB/AEB RPSB	SCSB	AEB RPSB	SCSB SRXB/RPSB	NO	SCSB	SCSB SRXB/AEB RPSB	AEB RPSB/SASG
PANTHERS	SCSB SRXB	RPSB/SCSB	SCSB SRXB	NO	RPSB/SASG	SCSB SRXB	NO	SCSB	SCSB SRXB/RPSB	RPSB/SASG
PANDA	SCSB	AEB/SCSB/RPSB	SCSB	SCSB	AEB/SASG	SCSB/AEB/RPSB	NO	SCSB	SCSB/AEB	AEB/SASG/RPSB
GIST	SRXB	RPSB/SRXB	NO	NO	NO	NO	NO	SRXB	SRXB/RPSB	RPSB/SASG
SOURB VALVES	EMEB	NO	EMEB	NO	NO	NO	NO	NO	EMEB/EMCB	NO
BBWR LOOP	RPSB/SRXB/SCSB	RPSB/SRXB/SCSB	RPSB/SRXB/SCSB	NO	RPSB/SASG	RPSB/SRXB/SCSB	NO	NO	RPSB/SRXB/SCSB	RPSB/SASG

NOTE: Where more than one branch has responsibilities, the lead branch is listed first

OUTLINE FOR SER INPUT

Executive Summary (SRXB for AP600 or SCSB for SBWR)

1. Introduction (SRXB for AP600 or SCSB for SBWR)

   This section should describe the general purpose of the evaluation. Specifically, it should provide a brief summary of the passive safety features used in the design, and how they are unique in comparison to currently operating plants. It should then discuss the requirements of 10 CFR 52.47(b)(2). It should be noted that validated computer codes are needed to predict the safety performance of the design and that the vendor has developed a testing program to gather the data necessary to confirm code adequacy. Finally, an outline of how the report is organized should be provided.

2. Issues of Concerns (SRXB for AP600 or SCSB for SBWR)

   In this section a summary of the important issues related to performance of the passive safety systems should be provided. This should highlight those issues which required testing and will lead into the subsequent sections of the report.

3. Overview of Vendor Testing Programs (responsible Branch)

   This section should describe, on a test program basis, the vendors testing program. The purpose of the tests should be described here. These should be directly related to the issues of concern.

4. Overview of NRC Activities (responsible Branch)

   On a test program basis, a description of the NRC activities should be provided in this section. An introductory paragraph should explain the "audit" nature of the review. This section should be very similar to the task descriptions presented in this plan.

5. Evaluation of Vendor Testing Programs (responsible Branch)

   Within this section, on a test program basis, the evaluation of the testing program should be provided. It should reflect an evaluation of how the issues of concerns were satisfied by the testing, and the evaluation of the test facility (e.g. results of scaling review if performed).

6. Code Validation (responsible branch)

   Within this section, a summary of the vendor's code validation program should be described along with the staff's conclusion on code adequacy. The basis for concluding that the code is adequate for supporting certification should be provided.

7. Compliance with 10 CFR 52.47(b)(2) (SRXB for AP600 or SCSB for SBWR).

   Each element of 10 CFR 52.47(b)(2) should be discussed separately. It is expected that this section will simply be a summary of the document and its conclusions.

ENCLOSURE 2

NRC STAFF RESPONSIBILITIES FOR REVIEWING
PASSIVE SAFETY SYSTEMS TEST FACILITIES FOR CODE ASSESSMENT
REVISED 2/1/94

AP600	Lead		Support	
Core Makeup Tank				
Testing 02/15/94-7/94	SRXB	A. Levin	RES/EMEB	G. Weidenhamer
			RPSB	F. Odar
			NRR/EMEB	D. Fischer
			SASG	W. Jensen
			HICB	H. Li
Automatic Depressurization System				
Testing 7/94 - 10/94 (hot shakedown/preop 4/94)	SRXB	A. Levin	SCSB	C. Hoxie
			RPSB	G. Rhee
			NRR/EMEB	D. Fischer& E. Sullivan
			RES/EMCB	G.Weidenhamer
Passive Reactor Heat Removal				
Testing Completed	SRXB	A. Levin	RPSB	F. Odar
			SASG	K. Campe
Wind Tunnel Tests				
Testing Completed	SCSB	C. Hoxie	AEB	A.Notafrancesco
			SASG	K. Campe
Passive Containment Coolant System Tests				
1/8th Scale HT Testing Completed	SCSB	C. Hoxie	AEB	A.Notafrancesco
			RES/SSEB	H. Graves
			SASG	K. Campe
			ECGB	S. Ali/S.Lee
Water Distribution Tests				
Weir Performance, Film thickness Testing Completed	SCSB	C. Hoxie	RES/SSEB	H. Graves
			SASG	K. Campe
			ECGB	S. Ali/S.Lee
Check Valve Tests In situ at Farley NPP, and/or Braidwood 4/94	EMEB	D. Fischer	EMCB	R. Hermann
			SRXB	A. Levin
			RES/EMEB	G.Weidenhamer
DNB TESTS Phase 2 2/94 - ?	SRXB	T. Attard		

AP600 CONT'D	LEAD		SUPPORT	
Oregon State University - APEX Testing 6/94 - 2/95 (hot shakedown/preop - 4/94)	SRXB	A. Levin	RPSB SASG	H. Scott W. Jensen
SPES-2				
(Integral Test Facility) 4 Cold-Leg break tests 2/94 to 4/94	SRXB	A. Levin	RPSB SASG	J. Kelly W. Jensen
2 DVI break tests 5/94		"		"
2 CMT/CL balance line break 6/94		"		"
3 SGTR tests 7/94 to 9/93		"		"
1 Steamline break 10-11/94		"		"
ROSA-V				
(Integral Test Facility) Phase 1: 2/94 to 1/95	RPSB	G. Rhee	SRXB SASG	A. Levin J.Staudenmeier
RELAP 5	RPSB	D. Solberg	SASG	W. Jensen
CONTEMPT LT/28	SASG	K. Campe		
VGothic	SCSB	C. Hoxie	SASG AEB	K. Campe A.Notafrancesco
CONTAIN	AEB	A. Notafrancesco	SASG SCSB	K. Campe C. Hoxie
COMMIX	AEB	A. Notafrancesco	SASG	W. Jensen C. Hoxie
MELCOR	AEB	S. Basu	SASG SCSB	W. Jensen A. Drozd
TRAC-P	RPSB	F. Odar	SASG	J.Staudenmeier
W COBRA/TRAC	SRXB	F. Orr	SASG	J.Staudenmeier
NO TRUMP	SRXB	F. Orr	SASG	J.Staudenmeier
Coupled RELAP 5 & CONTAIN	RPSB	D. Solberg	SASG	W. Jensen
SCDAP/RELAP 5	AEB	Y. Chen	SASG	W. Jensen

SBWR	LEAD		SUPPORT	
UCB/MIT Completed	SCSB	R. Elliott	SRXB RPSB	A. Levin T. Lee
Giraffe Completed	SCSB	R. Elliott	SRXB AEB RPSB SASG	A. Levin A.Notafrancesco T. Lee W. Jensen
Panthers Passive Contain.Cool(PCCS) Tests 4/94-6/94	SCSB	R. Elliott	SRXB AEB ECGB SASG	A. Levin A.Notafrancesco S. Ali/S. Lee J.Staudenmeier
Isolation Condenser (IC) Tests late 1994 into 95	SRXB	A. Levin	SASG ECGB SCSB RPSB	J.Staudenmeier S. Hou R. Elliott T. Lee
Panda Hot shakedown mid-94 Matrix Tests late '94 - '96	SCSB	R. Elliott	AEB SRXB RPSB SASG	A.Notafrancesco A. Levin T. Lee K. Campe
GIST (Gravity Driven Containment System) Completed	SRXB	A. Levin	RPSB SASG	J. Han J.Staudenmeier
Squib Valves No defined schedule	BMEB	D. Fischer	BMDB RES/BMEB	R. Hermann G. Weidenhamer
Vacuum Breakers Testing begins 4/94 at SIET	BMEB	D. Fischer		
SBWR Loop (PUMA) Testing in 1995	RPSB	J. Han	SRXB SASG SCSB AEB	A. Levin J.Staudenmeier R. Elliott A.Notafrancesco

	Lead		Support	
TRACG.	SCSB	R. Elliott	SASG SRXB	J.Staudenmeier M. Razzaque
Coupled RELAP5 & CONTAIN	RPSB	D. Solberg	SASG	W. Jensen
CONTAIN	AEB	A. Notafrancesco	SCSB SASG	R. Elliott K. Campe
TRAC-BAR	SRXB	A. Rubin	SASG	J.Staudenmeier
MELCOR	AEB	S. Basu	SASG SCSB	W. Jensen A. Drozd
RAMONA	RPSB	F. Odar	SASG	J.Staudenmeier
RELAP5	RPSB	D. Solberg	SASG	W. Jensen
SCDAP/RELAP 5	AEB	Y. Chen	SASG	W. Jensen
CONTEMPT	SASG	K. Campe		

Enclosure 4

TYPICAL AGENDA FOR TEST PROGRAM REVIEW GROUPS

Layout schedule per example done for CMT test program (1st meeting)

Status of each reviewer's work

Status of RAIs, vendor's responses, and reviewer's conclusions

Problems and resolution

Additional work for staff

Additional work (analysis, test or questions) for vendor

Plan for monitoring tests

Schedule mark-up

On the first of each month, send schedule mark-up together with a short report on the points above to Don McPherson MS: 8E2, or E-Mail (GDM).

GUIDANCE TO NRC STAFF FOR MONITORING AND REPORTING ON THE CONDUCT OF THERMAL-HYDRAULIC EXPERIMENTS

In view of the large series of experimental programs underway, and the variety of NRC staff members responsible for reviewing them, the following guidance is prepared a) to assist staff members in the process of witnessing certain tests, and b) to provide a format for reporting their observations. Since it assumes the test(s) is being performed in an integral systems facility, it may be too elaborate for simpler, separate effects tests, but for those cases the guidance should be readily modified, keeping in mind that the reporting format should be followed so as to maintain a consistency in the visit reports.

Prior to the visit, the reviewer should become completely familiar with a description of the facility and its instrumentation, the test(s) to be performed, and any pretest predictions. He (she) should begin the visit about 2 days prior to the date of the test, preferably to observe a test "readiness review" (see below).

On site, the reviewer should carry out his review and subsequently report on the following areas:

Review
- Status of preparations with test engineer/supervisor [note how well preparations are proceeding, what problem areas, and test difficulties to watch for].

Instrumentation
- Have types and locations been chosen to support code needs?
- Has a list of instruments been prepared (and followed) which is considered essential to the running of the test?
- Has an error analysis been performed on the important instruments (including calibration, range, transient effects)?

Facility Tour
- Neatness, leaks, knowledge of operators of facility layout.
- Check location of a few instruments.

Preparation
- Are there written procedures, are they rehearsed?
- Is a readiness review performed? Describe.
- Safety considerations.
- Repairs and modifications completed?
- Check of instrumentation performance made?
- Are test termination criteria established to define when the test is completed?

Performance of Test
- Adequate number of operators? With duty assignments?
- Do they follow the procedures?
- Control room ambiance (professional? chaotic?)
- Instrumentation and controls carefully monitored?
- Data recording frequency.
- As problems arose, how were they resolved?
- Did the test proceed to its defined termination point?

Data Processing
- Assigned responsibilities for analysis.
- Follow-up data qualification.
- Planning in place for quick look and other reporting.

Was a post-test meeting held to review test success and the goodness of the data?

Any other general observations?

Are there any follow-up actions?

The report covering these points is to be provided to the lead reviewer and other members of the review group within one month of the visit and should be discussed at the next monthly meeting of the group.

Additional guidance directed at the quality of the test is provided in 10 CFR 50 Part 21 and ANSI/ASME NQA-1-1986, from which the pertinent information will be provided to the lead test reviewers.

Format and Content of Documentation for Specified Experiments in Support of the Advanced Light Water Reactor Safety Systems

Facility Description Document

The following should be provided, either as a single report or as a series.

Facility Dimensions

All sketches, drawings, operational procedures, material specifications, geometric information, and other information pertinent to the facility should be included such that an input model can be generated. A system schematic drawing should be provided to clearly show how the various components form the overall system. The facility should be described component by component. providing all necessary information to convey the component's function and operation as well as its geometry (areas, volumes, etc.). The drawings should include all dimensions, materials, and configurations of each part of the materials and configuration of each part of the facility. All important dimensions of the facility and test section should be given in a table. Pipe sizes and lengths should be included.

Characteristics of Active Components

Component operational data should include delay times, rates of change (valve movement), performance curves (pumps) and all other control and performance information necessary to fully describe the experiment. Hydraulic characteristics of valves and pumps should be included. Control systems associated with a component or group of components should be described to the level of detail necessary to convey their function and operation. Sufficient control system data should be included to allow duplication of the modeled control system. Trip points and setpoints should be clearly tabulated for control systems functions.

Facility Characterization

Hydraulic and geometric information necessary to determine loss coefficients and heat transfer coefficients should be included in the data package and referenced. Insulation of components and piping should be clearly identified and, where heaters were used to insulate a component (guard heaters), their control procedure for the experiment should by provided. If available, regionally quantified heat loss information should be provided. Insulation material properties and dimensions must be specified. Heat loss due to instrument cooling or uninsulated regions should be identified and quantified if possible. System coolant leakage estimates should be evaluated and included in the facility description package. Results from any startup and facility characterization tests should be described.

Instrumentation Description

--Describe types, numbers, and locations of instruments. The locations of instruments should be unambiguous.

--Describe the instrument accuracy and calibration procedures to NIST calibration standards.

--Describe signal processing and signal conditioning.

--Describe data acquisition system including recording equipment, response time and sampling time.

Facility Scaling

The objective of the scaling evaluation is to obtain the physical dimensions of the test facility that will preserve the phenomena and processes expected to be present in the full scale plant. Describe the facility scaling approach with the objectives to:

--Obtain the similarity groups which should be preserved between the test facility and the full scale prototype;

--Establish priorities for preserving the similarity groups;

--Assure that important processes have been idertified and addressed in the above;

--Provide specifications for test facility design; and

--Quantify biases due to scaling distortions.

Quick Look Report

Quick Look Reports (QLR) should be provided for integral experiments if they are part of the vendor's planned reporting although the vendor may also find it useful to prepare them for certain separate effects tests. For integral tests it may be more convenient or appropriate to prepare a QLR to cover a test series e.g. small breaks or SGTR's, rather than each separate test. The objectives of QLRs should be to describe test objectives, how the tests proceeded, the degree to which objectives were met, show the most significant data plots (unqualified data are acceptable at this point) and their agreement with pretest predictions, and list important preliminary conclusions.

The WEC letter, reference ET-NRC-93-3946, NSRA-93-0305, Docket No. STN-52-003, Subject: General Outline for Quick Look Data Reports on AP600 Tests, signed by N. J. Liparulo, dated August 16, 1993, is consistent with the above description and would be quite acceptable to NRC.

Data Reports

The data report is designed to:

Transmit all data to the NRC.

Be a referable document.

The report should include:

Qualified Data Tape

All qualified data should be transmitted via either data tape or electronically if feasible. Non-functioning data channels should be identified. If certain channels are erratic, a note should be provided to indicate for which period the channels in question should be ignored.

Equipment Interaction Log

A listing of the equipment behavior for all hardware that was used in the experiment should be included. Thus, valve opening and closing, pump power downs or programmed changes in speed, core power ramps or power increases, equipment failures and any equipment interactions should be listed.

Data Microplots

Small figures showing the behavior of all the instrumentation channels should be transmitted. For certain specified parameters such as gamma-densitometer reading, both engineering and raw voltages plots are needed.

Data Uncertainty

Uncertainty of all data should be listed. If the only available uncertainties are the manufacturer's published uncertainties not including allowances for the signal processing equipment and recording equipment, then that should be stated. The best possible estimates of uncertainties are required for all key instrumentation.

Data Log

A log listing interpretations by the Vendor's Data Analysis Team should be included. The Data Log will give the results of the Data Analysis Team's data review. Observations concerning instrumentation zero shifts, noise, superimposed signals, time lags, channel interdependencies, miscalibrations, improper instrumentation hookups, bad channels, and the like from the Data Analysis Team should be entered in the Data Log and transmitted as an attachment to the Data Report.

Instrumentation List

All instrumentation used in the data report should be either referenced to an existing Instrumentation Description Report (containing instrumentation locations, specifications, hookup polarities, and label nomenclature) or described in the subject Instrumentation List such that all changes and modifications to earlier descriptions in the Instrumentation Description Report are clearly stated.

Data Formats

Data produced by experiments should be provided to the NRC staff in two ways. First, as part of the experimental data reports described above, with accompanying analyses and evaluation, in support of the verification and validation of the design and the analytical tools. Second, the qualified raw data should be provided either on magnetic media, or through direct interconnection with the NRC via modem or electronic data network.

The staff currently has the ability to read 3.5 inch floppy disks and 4 mm Digital Audio Tape (DAT). For small quantities of data, either the floppies or the electronic data network exchange method would be suitable. For large amounts of data, the DAT is preferred.

The data files for the tests should follow the following format, which has been used for data stored in the NRC data bank from test facilities sponsored by NRC and other thermal-hydraulic organizations.

The standard format for the data consists of 80 column card images in ASCII code. Cards will never cross record boundaries, and data for an individual measurement will not cross media boundaries, i.e., each floppy disk or DAT cassette is a "stand alone" record.

Each dataset for an experiment is described by two to 86 files of information. The first file is a directory file which describes the contents of the dataset. The remaining files are the data files. The following pages are a word-by-word description of the files.

The data are organized in the dataset in files by measurement type, so that all of the temperatures are in one file, the pressures in another, levels in a third, and so on. The individual measurements are named, within the files, with the name assigned by the data source, up to 16 characters long.

The keywords in the description are optional, with general keywords used to describe common items such as test start time, etc., and "Keyword" information, such as measurement uncertainty, applicable to specific measurements.

This format has proven to be very adaptable, and has caused virtually no problems in reformatting by previous data users.

Test Analysis Reports

An analysis report should be prepared following each test or a group of similar tests. This report should describe what happened, why it happened, and what phenomena of significance occurred. In addition, this report should contain comparisons of code calculations with the data. The analysis report should include plots of key parameters as a function of time, describe the behavior of the key parameters, and provide an analysis of major experimental results.

The Test Analysis Report is designed to:

--Provide the exact initial and boundary conditions for each experiment;

--Provide figures showing the key parameters and instrumentation that describe the experiment transient behavior;

--Provide an interpretation of the important events that occur during the transient including the basis for the interpretation; and

--Be a referable document.

The report should include:

Test Description

A description of the test matrix and objectives for each test including how a test series relates to other test series in the same facility. For separate effects and component test facilities, the rationale for selection of parametric variations and boundary conditions should be described to show that the testing encompasses the range of conditions expected to occur in the full scale plant.

Experimental Configuration

A description of special hardware changes, hardware configurations or installations. All configurational changes, details on initial conditions and test boundary conditions should be specified. All the instrumentation used should be either referenced to an existing Instrumentation Description Report (containing instrumentation locations, specifications, hookup polarities, and label nomenclature) or describe in the Test Analysis Report such that all changes and modification to earlier descriptions in the Instrumentation Description Report are clearly stated.

Test Procedure

The way the experiments were conducted should be described. For example, when valves opened, what caused the valves to open, when pumps turned on or off, etc. The test conditions should be described in as much detail as possible.

Description of Experiments

The transients should be described, transient chronologies should be prepared, major events should be identified, and analysis performed to explain unexpected results. The key instrumentation channels should be described, including their uncertainty.

Conclusions and Observations

Identify whether the experiment met the stated objectives, list unexpected results, and present the explanation of all major events.

Code Qualification Report

Introduction

The introduction should include a detailed discussion of the assessment study background, scope and objectives, and should present the assessment methodology used for the study.

Facility and Test Description

A brief discussion should be provided of the experimental facility including its geometric layout, instrumentation, operation procedures, and other information, as required for understanding the code analyses. Reference may be make to the detailed facility description and test results reports. The experiments to be calculated should be discussed including important thermal hydraulic information, initial and boundary conditions, and operational information pertinent to the calculation. Measurement uncertainty must also be discussed.

Code Input Model Description

The code input mode should be discussed in detail including nodalization diagram, nodalization rationale, assumptions, boundary and initial conditions and operational conditions for the calculation. The nodalization description should be related to the full scale plant model. Discuss modifications to the input model (nodalization, boundary, initial and/or operational conditions resulting from sensitivity studies (if conducted). Provide an input model listing in both hard copy and on data tape.

Results

Results of the calculation that lead to major conclusions should be clearly presented and discussed. Applicable key assessment parameters should be discussed. The rationale for performing any sensitivity studies should be discussed along with the methodology used to perform them. Modifications to base case conditions and the resulting effect should be fully described and qualified. The discussion should include:

--A comparison between the code prediction and the experiments with regard to the important physical phenomena that occurred during the experiments. Identify and explain the causes of discrepancies between the code and data, i.e. discuss the deficiency in the code or the inaccuracy of the experimental measurements. Assess whether the timing of events agrees with the experimental data.

--Assess whether the calculated results are self consistent and present a cohesive set of information that is technically rational and acceptable. Explain any unexpected or at first glance strange results calculated by the code, particularly when experimental measurements are not available to give

credence to the calculated results. Determine whether calculated results are due to compensating errors. Discuss how important the code deficiency is to the overall results (parameters of interest) or explain why it may not be important for the particular scenario.

--Provide guidelines for performing similar analyses.

Code Comparison Calculations

Background

Assessing the safety of a nuclear installation requires the use of a number of highly specialized tools: computer codes, experimental facilities and their instrumentation, special measurement techniques, methods for testing materials and components and so on. A highly effective way of increasing confidence in the validity and accuracy of such tools is provided by code comparison exercises in which calculations produced by a computer code is gauged against agreed standards. For example, predictions of different computer codes for a given physical problem may be compared with each other and with the results of a carefully controlled experimental study which also could be a real plant transient.

These exercises are performed as "open" or as "blind" problems. In an open problem the results of an experiment are available to analysts before it is evaluated. In a blind problem the results of the experiment are not made known to the analysts until after delivery of the calculated results. Depending on the kind of experiment and its objectives, certain boundary and initial conditions of the experiment may be communicated to the analysts before they start the exercise. For all exercises, the analysts are provided with a complete description of the experimental facility as discussed below.

Experimental Description Document

Once the particular experiment has been selected for the exercise, a detailed description of the experiment is necessary.

The experimental description document which is prepared for this purpose should include:

-- A description of the experimental facility, including engineering drawings providing exact facility configurations (no assumptions on what is important). These drawings should include all dimensions, materials, and configurations of each part of the facility. The drawings should be of sufficient detail to allow detailed analytical models to be developed. Unambiguous descriptions of instrumental locations should be provided. All important dimensions of the facility and the test sections should be given in a table.

-- Results to be calculated. The points at which parameter values are to be calculated should be specified. If these include points where experimental data are not available, this should be pointed out and the reason explained. The type of experimental measurements to which calculated results will be compared should be described.

-- Experimental data to be available after the experiment is completed, including expected error bands as a function of time. This may help analysts' selection of calculational nodes, considering which data will be available for post-test analysis.

-- Initial and boundary conditions. For a blind exercise, initial conditions should be provided after the experiment is performed. The analyst should be able to use preliminary expected initial values to formulate a simulation model and check it out. The analysis would then be performed using the measured initial conditions from the actual experiment with very little change to the previous checked-out simulation model. For an open exercise, all the measured parameters are specified and communicated to the analysts. If specifically recommended boundary conditions are given, a justification for using them should be provided.

Calculation Comparison Report

Reporting the results of the comparison exercise results requires sufficient information to allow evaluation of the analytical models used, to provide guidance for future code development efforts, and to contribute to better understanding of phenomena. The following should, therefore, be included in the comparison report:

Facility Description

The experimental facility should be discussed briefly. The description should indicate the position and error bands of experimental measurements, major components and positions for which calculations have been requested. Calculated results should refer to these descriptions.

Computer Codes

-- Computer codes and versions should be clearly identified. Code descriptions should contain relevant information on the analytical models available, including appropriate equations and assumptions used in the derivation.

-- Changes made to the computer code to perform the exercise that are not documented in the referenced code description should be described along with reasons for the changes.

Simulation Model

-- A description of the code application model used including nodalization, time step control, empirical program options selected, and other options.

-- Assumptions used in the calculation to simulate the experimental facility (physical properties).

-- Specified initial and boundary conditions and assumed initial and boundary conditions used in the calculation.

Calculations Performed

-- Computer used and running time to perform the calculation.

-- Results for all points and parameters specified in the problem specifications should be plotted and given in tables using metric system units (SI Units).

-- Calculated results should be discussed briefly including interesting and unexpected results.

-- Results should be plotted to further explain specific phenomena revealed during the calculation.

Comparison of Calculated Results and Experimental Data

Plots of calculated results and corresponding experimental data with error bands should be shown. It may be necessary to present more than one plot per calculated position because of overlapping results or the need to use an expanded scale in one area.

Additionally, the comparison report should include information on deviations between planned conditions of the experiment and conditions actually achieved.

Explanation of Results

The experimental results should be discussed. Any deviations from expected results should be explained if possible. This aids in assessing the difference between computed results and experimental

Post-exercise Analysis

Post-exercise analysis is important. Analysts should run sensitivity studies to determine which inputs to their codes require closest scrutiny. Various options or models should be tried to see how they affect the results. Nodalization should be scrutinized to see if it was adequate for the problem. Areas which may require additional study include, for example, time step convergence, Nodalization or variation of code options.

Each analyst should include the results of any post-test analysis as an appendix to the final comparison report, where they add additional pertinent information to previous results. Particular attention should be paid to explaining why substantial deviations occurred between calculated best estimate results and actual data. If a predictive evaluation model calculation is to be reported (in addition to a best estimate calculation), anomalous behavior of the evaluation model compared to the data or to the best estimate calculation should be explained. The differences between best-estimate and evaluation model applications of the codes involved should be tabulated.

Comparison Calculations to be Performed

The staff has determined that the vendors should calculate the following experiments "blind", as described in the Enclosure above. This list is not final, and is expected to be revised as the staff reviews the test programs and the computer codes used by the vendors.

AP600

SBWR

Attachment

cc: J. Taylor
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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

January 14, 1994

MEMORANDUM FOR: Test Program Review Groups
(see distribution)

FROM: G. Donald McPherson, Senior
Thermal-Hydraulics and Testing Expert, DSSA

SUBJECT: GUIDANCE FOR MONITORING AND REPORTING ON THE CONDUCT OF THERMAL-HYDRAULIC EXPERIMENTS PERFORMED UNDER PART 52 ON DESIGN CERTIFICATION TESTING

Reference: Reference 1, Revision 2, of the Implementation Plan for the Review of Vendor Testing Programs for the AP600 and SBWR, memorandum from A. C. Thadani to D. M. Crutchfield, dated 9/15/93. [Call Don McPherson at 504-1246 for a copy.]

The original version of the subject guidance is contained in Reference 1. To date, that version has served well in the generation of several reports on tests in support of the Westinghouse passive containment cooling system. (Six reports by NRC reviewers are now on file and available to you in my office.) Meanwhile, however, the Division of Reactor Inspection and Licensee Performance has reviewed the original guidance and suggested improvements in the details. I have integrated these suggestions into the original guidance, and added some changes based on experience to date. Then, to simplify its use in the field, Chris Hoxie has arranged it all in tabular form. The resultant document is provided here as enclosure 1. In addition, enclosure 2 provides an update of the reviewers on each test facility and relevant computer code.

Those of you who will take part in a test monitoring exercise should be aware of management expectations from your efforts. As you are aware, the reactor designs in question have not been constructed; nor are they likely to be, before they receive NRC certification. It is therefore essential that the test programs provide the data necessary for us to reach firm and defensible conclusions regarding the performance of the designs and their safety systems.

While there are many elements involved in reaching these conclusions, one which is key will be the file of test monitoring reports now being assembled. Once you have monitored a test and prepared your report, that report will become a part of that file. It is expected that by following this guidance closely, you will succeed in covering all the significant ingredients needed to characterize that test, you will collect the information needed to prepare your report, and the format of your report will be consistent with the others in the file. This should thus provide an orderly mechanism for dealing with this element of the task of reaching overall conclusions on the test program supporting design certification.

RAI 630.3-57

Enclosure 4

For these reasons you are encouraged to familiarize yourself with the guidance, with the test facility, and then with the test to be monitored. By following the guidance carefully you will make an important contribution to the design certification process.

G. Donald McPherson, Senior
Thermal-Hydraulics and Testing Expert, DSSA

Enclosures: As stated

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Frank Orr
Muhammed Razzaque
Gene Rhu
Alan Rubin
Harold Scott
Donald Solberg
Joseph Staudenmeier
Edmund Sullivan
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Enclosure 1

GUIDANCE FOR MONITORING AND REPORTING ON THE CONDUCT
OF THERMAL-HYDRAULIC EXPERIMENTS PERFORMED UNDER PART 52
ON DESIGN CERTIFICATION TESTING
REVISED 12/28/93

Test Monitor's Preparation Prior to Visit	
Test Program Review Group Responsibilities:	Checkoff
1. Periodic (Monthly) Meetings	
2. Review Test Specification	
3. Review Facility Design	
4. Review Test Matrix	
5. Review Test Objectives	
6 Review types and locations of instruments; have these been chosen to support computer code verification needs?	
7. Rev ew Relevant RAIs and Responses	
8. Review Quality Assurance (QA) Documents	
o 10 CFR 50 Appendix B	
o Vendor's commitment to QA as defined in the Test Specification.	
9. Provide input to Test Monitors regarding the above.	

Note: Additional responsibilities of the Test Program Review Groups are described Reference 1.

Test Monitor's Overall Responsibilities:	Checkoff
1. Participate in the Test Program Review Group, as discussed above	
2. Review the Test Procedures	
3. Arrive at the Test Site a day* early to:	
o Review any changes to the test procedures	
o Attend a readiness review	
o Witness a test rehearsal in the control room	
o Allocate test monitoring responsibilities among the test monitors	
o Confirm that vendor has a Quality Assurance Program that meets the requirements of 10 CFR 50 Appendix B with the following areas of emphasis:	
✓ instrumentation	
✓ test procedures	
✓ recording of data	
o Perform any additional test observation tasks from the remainder of this list that can be performed in advance.	
4. Observe the test(s).	
5. Attend post-test review meetings.	
6. Write test report.	

*While a full day may not be necessary for the simpler tests, most integral system tests will require at least a full day on the first visit.

General Onsite Observations:	Checkoff
1. Spot Check QA Implementation	
o Instrumentation	
o Procedures	
o Data Recording	
2. Review status of preparations with test engineer/supervisor:	
o How well are the preparations for the test proceeding?	
o As problems arise how are they being dealt with?	
o Are precautions in place to handle failures in equipment and instruments?	
o Is the full complement of test operators and supervisors on hand when needed?	
3. Are the pretest procedures being followed and signed off?	
4. Is a readiness review performed?	
5. Is a test rehearsal performed?	
6. Are adequate safety precautions taken?	
7. Do last minute changes to the test procedures provide any insights of which our reviewers should be aware?	

COMMENTS:

Instrumentation:	Checkoff
1. Were process and test instruments procured, calibrated, and maintained in accordance with the vendor's quality assurance program?	
2. Were these instruments calibrated for this test in accordance with the quality assurance program?	
3. Were pretest and operability checks performed?	
4. Are all instruments properly ranged for the test?	
5. Is there a prerequisite list of operating instruments?	
6. Has an error analysis been performed on the important instruments including calibration, range, and transient effects?	

COMMENTS:

Facility Tour [Arrange for an operator to accompany you]	Checkoff
1. Ask questions to determine if he/she can identify various components and instruments.	
2. Using a facility drawing, spot check that instruments are located in the correct position and check the physical arrangements for conformance with the drawing.	
3. Check on the availability of a full set of as-built drawings.	
4. Make observations regarding:	
o housekeeping	
o leaks	
o operator alertness	
o documentation associated with last minute repairs, replacements and adjustments.	

COMMENTS:

Final Preparations:	Checkoff
1. Determine whether the test specifications, requirements and procedures are being followed.	
2. If a final rehearsal is done, describe the degree of care and thoroughness used.	
3. Are the test procedures followed?	
4. Is a systematic approach used to determine that all repairs, checks lists, calibrations, instrumentation and other test prerequisites have been completed?	
5. Is there a serious and professional atmosphere in the control room?	
6. Are the lines of authority apparent and are they respected?	

COMMENTS:

Performance of Test:	Checkoff
1. Is there an adequate number of operators?	
2. Do they all have assigned duties and posts?	
3. Are lines of authority strictly followed?	
4. Are the procedures followed and signed off?	
5. Are logs kept to record significant events, instrument failures, unexpected system responses and anomalies?	
6. What is the nature of the control room ambience?	
7. Is the recording of all test data monitored carefully?	
8. Is the recording frequency appropriate?	
9. As problems arise, how are they resolved?	

COMMENTS:

Post-Test:	Checkoff
1. Is there a post-test meeting of the appropriate personnel to discuss the adequacy of the data and the achievement of the test goals?	
2. Are anomalies, non-conformances and other items from the test log properly documented and dispositioned?	
3. Are post-test steps taken to permit data validation (e.g., checks of calibrations and constants, etc.)?	
4. Were steps taken to verify the software used to convert the raw data to engineering units and to manipulate those data?	
5. Are arrangements in place for an orderly transfer of data to the test analyst?	
6. Is planning in place to proceed with the data analysis, preparation of the quick-look report and follow-on reports?	

COMMENTS:

General Observations and Comments:	Checkoff
1. With consideration to the needs of NRC reviewers who must examine the data from this facility and this test, describe in your test report any observations you make relating to the question of the acceptability of the data from the test, the facility and the team of operators.	
2. Review your report to pick up any points that may bring into question the data accuracy, quality, or applicability, and include them in the general observations and comments portion of your test report so that NRC reviewers will be sure to focus on them.	

Final Tips:

1. Take detailed notes while observing the tests.

2. Write your test observation report at the earliest opportunity.

Enclosure 2

NRC STAFF RESPONSIBILITIES FOR REVIEWING
PASSIVE SAFETY SYSTEMS TEST FACILITIES FOR CODE ASSESSMENT
REVISED 1/11/94

AP600	Lead		Support	
Core Makeup Tank				
Testing 01/31-7/94	SRXB	A. Levin	RES/EMEB RPSB NRR/EMEB SASG HICB	G. Weidenhamer F. Odar D. Fischer W. Jensen H. Li
Automatic Depressurization System				
Testing 6/94 - 9/94 Sullivan G.Weidenhamer	SRXB	A. Levin	SCSB RPSB NRR/EMEB	C. Hoxie G. Rhee D. Fischer& E. RES/EMCB
Passive Reactor Heat Removal				
Testing Completed	SRXB	A. Levin	RPSB SASG	F. Odar K. Campe
Wind Tunnel Tests				
Testing Completed	SCSB	C. Hoxie	AEB SASG	A.Notafrancesco K. Campe
Passive Containment Coolant System Tests				
1/8th Scale HT Testing Completed	SCSB	C. Hoxie	AEB RES/SSEB SASG ECGB	A.Notafrancesco J. Costello K. Campe S. Ali/S.Lee
Water Distribution Tests				
Weir Performance, Film thickness Testing Completed	SCSB	C. Hoxie	RES/SSEB SASG ECGB	J. Costello K. Campe S. Ali/S.Lee
Check Valve Tests In situ at Farley NPP, 4/94	EMEB	D. Fischer	EMCB SRXB RES/EMEB	R. Hermann A. Levin G.Weidenhamer
DNB TESTS Phase 2 ?/94 - ?	SRXB	T. Attard		

AP600 CONT'D	LEAD		SUPPORT	
Oregon State University				
(Integral Test Facility) Testing 6/94 - ?	SRXB	A. Levin	RPSB SASG	H. Scott W. Jensen
SPES-2				
(Integral Test Facility) 4 Cold-Leg break tests 2/94 to 4/94	SRXB	A. Levin	RPSB SASG	J. Kelly W. Jensen
2 DVI break tests 5/94		"		"
2 CMT/CL balance line break 6/94		"		"
3 SGTR tests 7/94 to 8/93		"		"
1 Steamline break tests 9/94		"		"
ROSA-V				
(Integral Test Facility) Phase 1: 2/94 to 1/95	RPSB	G. Rhee	SRXB SASG	A. Levin J.Staudenmeier
RELAP 5	RPSB	D. Solberg	SASG	W. Jensen
CONTEMPT LT/28	SASG	K. Campe		
WGothic	SCSB	C. Hoxie	SASG AEB	K. Campe A.Notafrancesco
CONTAIN	AEB	A. Notafrancesco	SASG SCSB	K. Campe C. Hoxie
COMMIX	AEB	A. Notafrancesco	SASG	W. Jensen C. Hoxie
MELCOR	AEB	S. Basu	SASG SCSB	W. Jensen A. Drozd
TRAC-P	RPSB	F. Odar	SASG	J.Staudenmeier
W COBRA/TRAC	SRXB	F. Orr	SASG	J.Staudenmeier
NO TRUMP	SRXB	F. Orr	SASG	J.Staudenmeier
Coupled RELAP 5 & CONTAIN	RPSB	D. Solberg	SASG	W. Jensen
SCDAP/RELAP 5	AEB	Y. Chen	SASG	W. Jensen

SBWR	LEAD		SUPPORT	
UCB/MIT Completed	SCSB	R. Elliott	SRXB RPSB	A. Levin T. Lee
Giraffe Completed	SCSB	R. Elliott	SRXB AEB RPSB SASG	A. Levin A.Notafrancesco T. Lee W. Jensen
Panthers Passive Contain.Cool(PCCS) Tests 3/94-1/95	SCSB	R. Elliott	SRXB AEB ECGB SASG	A. Levin A.Notafrancesco S. Ali/S. Lee J.Staudenmeier
Isolation Condenser (IC) Tests 2/95 - 10/95	SRXB	A. Levin	SASG ECGB SCSB RPSB	J.Staudenmeier S. Hou R. Elliott T. Lee
Panda Tests 10/94 - '96	SCSB	R. Elliott	AEB SRXB RPSB SASG	A.Notafrancesco A. Levin T. Lee K. Campe
GIST (Gravity Driven Containment System) Completed	SRXB	A. Levin	RPSB SASG	J. Han J.Staudenmeier
Squib Valves No defined schedule	EMEB	D. Fischer	EMCB RES/EMEB	R. Hermann G. Weidenhamer
Vacuum Breakers Testing begins 4/94 at SIET	EMEB	D. Fischer		
SBWR Loop (PUMA) Testing in 1995	RPSB	J. Han	SRXB SASG SCSB AEB	A. Levin J.Staudenmeier R. Elliott A.Notafrancesco

SBWR (SBWR Cont'd	Lead		Support	
TRACG.	SCSB	R. Elliott	SASG SRXB	J.Staudenmeier M. Razzaque
Coupled RELAP5 & CONTAIN	RPSB	D. Solberg	SASG	W. Jensen
CONTAIN	AEB	A. Notafrancesco	SCSB SASG	R. Elliott Campe
TRAC-BWR	SRXB	A. Rubin	SASG	J.Staudenmeier
MELCOR	AEB	S. Basu	SASG SCSB	W. Jensen A. Drozd
RAMONA	RPSB	F. Odar	SASG	J.Staudenmeier
RELAP5	RPSB	D. Solberg	SASG	W. Jensen
SCDAP/RELAP 5	AEB	Y. Chen	SASG	W. Jensen
CONTEMPT	SASG	K. Campe		