DATE ISSUED: 10/8/82

ACRS ECCS SUBCOMMITTEE MEETING MINUTES
SEPTEMBER 28, 1982
WASHINGTON, DC

Purpose: The purpose of the meeting is to discuss: (1) Modeling of small break LOCA for B&W plants. (2) RCP trip requirement status, (3) Results of recent Semiscale tests and status of MOD-5 proposal, (4) Status of Appendix K review proposals, and (5) Status of LOFT Consortium effort.

Attendees: Principal attendees of the meeting are noted below.

ACRS	NRC
M. Plesset, Chairman	B. Sheron
J. Ebersole, Member	H. Sullivan
D. Ward, Member	M. Fleishman
I. Catton, Consultant	N. Lauben
R. Shumway, Consultant	
Z. Zudans, Consultant	B&W Owners Group
P. Boehnert, Staff*	R. Dietrick, SMUD
*Designated Federal Employee	J. Glousdemans, B&W
	R. Duffey, EPRI

Meeting Higlights, Agreements, and Requests

1. Representatives of the B&W Owners Group (OG) discussed their approach to resolution of NRC Staff concerns with the modeling of small break LOCA for B&W plants. Mr. R. Dietrick (SMUD) led off the Owners Group presentation by noting that the Owners have spent ~$3 million to date in an attempt to resolve the Staff's concerns as identified in TMI Item II K.3.30. Specifically, the OG proposes to provide test data from the GERDA and SRI-II facilities to resolve TMI Action Item II.K.3.30 which requires revision of the LOCA EMs to properly account for SB LOCAs. In addition, a Test Advisory Group (TAG) has been established to address the Staff concerns with long-term plant performance given a SB LOCA. In response to Dr. Catton, Mr. Dietrick said all II.K.3.30 concerns have been resolved, except the item dealing with interruption of natural circulation by formation of a bubble in the "candy cane".

Mr. Glousdemans (B&W) detailed the design, description and tests scheduled in the GERDA facility. GERDA was constructed by B&W for Brown-Bouveri in Germany in response to a RSK requirement for SB LOCA integral effects test data in order to verfity LOCA code calculations. It is a single-loop, full height, full temperature and pressure facility similar to Semiscale, i.e. one-dimensional in nature (Figures 1-3).

The scaling was discussed. GERDA preserves elevations, power-to-volume ratio, total system pressure loss, and the Froude number in the hot leg. Dr. Catton expressed concern on the scaling of the bubble dynamics. He also asked if a thorough multidimensional scaling analysis was conducted. Mr. Glousdemans indicated that it was not. Dr. Plesset indicated that B&W should concentrate on attempting to develop an understanding of the important phenomena of concern rather than focusing on such attention to details associated with the facility tests.

The test matrix was detailed (Figure 4). Dr. Plesset asked if the RSK is satisfied that these tests will address their concerns. Mr. G. Ahrens representing BBR (FRG B&W licensee) indicated that the RSK worked closely with Brown-Bouveri on the GERDA project and appear satisfied that their concerns will be addressed.

The EPRI studies on decay heat removal for OTSG plants was reviewed by Mr. Duffey. Tests conducted after the TMI accident showed that: (1) the B&W system can operate in stable two-phase natural circulation flow conditions, (2) two flow regimes were identified (hot leg uncovered, hot leg covered), and that both regimes can tolerate substantial concentrations of non-condensables, and (3) loop response can be predicted by analysis. Dr. Catton urged EPRI to quantify the amount of non-condensables the plant can tolerate and still remove decay heat.

The SRI-II integral test facility data will be used for code benchmarking and validation as well as to develop an understanding of the physical processes occuring during accident conditions. SRI-II is a small scale (1/18-linear scale) low pressure ($\sim$100 psi) facility with two primary loops. It

simulates all major components including pumps, auxiliary feedwater, and core vent valves. For scaling considerations, SRI preserves the enthalphy flux in the hot legs and the volume and aspect ratios of major components. Mr. Duffey said that the SRI and GERDA facilities are complementary as noted below:

SRI-II	GERDA
Two-loop	Single loop
Volume Scaled	Full Height
Forced/Natural Ciruclation	Natural Circulation
Low Pressure	High Pressure

He also noted that the GERDA facility scales well for horizontal flow while SRI-II scales well for vertical flow. The preliminary test matrix focus is on the study of physical phenomena (Figure 5). Testing will begin in mid-1983.

The Subcommittee raised questions that indicated an uneasiness with how the data and analysis from both facilities would be coordinated. There were also specific concerns raised about the scaling of the GERDA facility.

2. Drs. B. Sheron and H. Sullivan discussed the NRC Staff's concerns regarding modeling of SB LOCA's and transients in B&W plants. Dr. Sheron noted that NRC identified a need for experimental data for the B&W plant design in early spring 1982. There has been a series of meetings between NRC and the Owners Group since that time.

NRC sees the key issue being the need for integral test data for verification of the analytical models used for SB LOCA calculations as well as developing an understanding of the specific B&W plant phenomena associated with a SB LOCA and other transients.

As a result of a recent meeting, B&W and the OG has agreed to participate in a Task Group chaired by NRC-RES to study the relative cost/benefits of three alternatives for obtaining integral test data: (1) use of

German GERDA and SRI-II data, (2) upgrade GERDA, or (3) build a Semiscale MOD-5. Dr. Sheron said if satisfactory progress is made on agreeing how to resolve the research and code verification issues noted above, NRR will complete review of the II K.3.30 submittals. The integral test data will be treated as long term confirmation of the adequacy of SB LOCA and accident analysis methods, similar to how the Staff approached research to confirm Appendix K adequacy.

Dr. Sullivan (NRC-RES) discussed the status of the experimental work designed to support the B&W test program. He noted plans for construction of a small scale 2x4 loop at the University of Maryland, plus some supporting separate effects experiments. This program is funded by NRC. Turning to the formation of the Test Advisory Group noted above by Dr. Sheron, Dr. Sullivan noted that the first TAG meeting was held September 16, and another meeting is scheduled for October 4, 1982. Specific data interests specified by NRR, AEOD, and RES were noted including ACRS statements cited in the Committee's Annual Report on the NRC Research Program and a recent OL Letter (Midland). NRC believes a mix of of separate effects and integral system experiments are acceptable. However, an integral system without two loops is not recommended. A cost/benefit study is needed in order to support a final recommendation on the choice of a test facility.

3. Dr. R. Landry discussed the results of a recent Semiscale feed and bleed test that resulted in an unexpected core uncovery. Dr. Landry said the key parameters affecting feed and bleed are decay heat level, feed capacity (changing and HPI), and PORV emergy and mass removal rate. The parameters of greatest uncertainty for the test were the PORV removal rates. In order to meet a request for a hurriedly run test, there was insufficient pretest analysis performed. The lack of proper pretest analysis resulted in an anomolous accounting of the atypicabilities of Semiscale (e.g. decay heat level "set" too high, oversized PORV, etc.). A post-test analysis of the test using RELAP-5 indicated that had the proper HPI flow rate been used, core uncovery may have been avoided. In repsonse to a question from Mr. Ebersole, NRC said feed and bleed cooling is very sensitive to plant specific parameters. Mr. Ward suggested that the use of nonsafety-grade

pumps (charging pumps) should be factored into the feed and bleed analyses to take full advantage of all available equipment. In response to Mr. Ebersole, Dr. Sheron said the new operator procedures should address feed and bleed cooling. Mr. Watt (NRR) said, however, that the SEP review showed that feed and bleed procedures were found lacking at some of the older plants.

4. Mr. M. Flieshman (NRR) briefed the Subcommittee on the status of the ECCS Rule revision. NRR is proposing a Phase I change to 10 CFR 50.46 in the near future, and a more substantial Phase II revision in the 1983-84 time frame. Phase I changes include the following:

° Reanalysis requirements for all CP's, OL's and OR's.
- No reanalysis required if PCT decreases by > 20°F.
- One year allowed for reanalysis for increases in PCT of up to 100°F.
- Defines a significant change in PCT as > 20°F.
- In addition to the above, CP plants can defer reanalysis to the OL application if an error increases the PCT up to 200°F.

° Return to Nucleate Boiling.
- Return to nucleate boiling allowed when justified by experimental data.

° Steam Cooling Requirements for Reflood Rates Below One Inch/Second.
- Above requirement replaced with a requirement that heat transfer calculations be based on applicable experimental data accounting for flow blockage, if predicted to occur.

° Correction of transition boiling correlation reference.

In response to Dr. Catton, NRC said the nucleate boiling and steam cooling revisions will only have a minor impact on PCT calculations. Phase II changes contemplated include the following topics: (1) decay heat curve, (2) zircaloy oxidation rate, (3) consideration of additional data including that which may indicate the present Rule is less conservative than previously believed, and (4) new operating experience.

In response to Subcommittee questions, Dr. Sheron said the Staff is moving cautiously in this area and noted that the Phase II program includes a Staff recommendation that overall Rule revision, or even elimination of the Rule, be considered. The Phase I Rule changes should clear NRC Staff review by the end of November. This would allow ACRS review in December 1982.

The GE Exemption Request proposal to allow the use of the 1979 ANS Decay Heat Curve was discussed. NRR is reviewing the technical adequacy of the 1979 Correlation and Dr. Sheron said he expects that it will be approved. NRC will not address the use of the 1979 Curve; licensees should submit exemption requests for use of the new correlation. GE also has a "better-estimate" ECCS code (SAFER) under review by NRR that if approved will substantially lower plant PCTs. Staff review of SAFER should be completed in the December-January 1983 time frame. [Note: the ECCS Subcommittee has scheduled a meeting on the SAFER code revision for December 2-3, 1982 in San Jose, California.]

5. Dr. Sheron provided a status report on the efforts to form a LOFT Consortium. The currently proposed three-year program would cost $80 M, with NRC paying $30 M. Following a meeting in Paris on September 20-21, 1982, it appears that the Consortium is $15 M short of its $80 M goal. France will not participate, and Germany is also doubtful. The Japanese are contributing ~ $2.5M less than anticipated. Dr. Sheron said he believes the shortfall will be found, perhaps from DOE or some non-OECD Member countries.

6. The status of the requirement for tripping the reactor coolant pumps (RCP) in the event of a SB LOCA on PWRs was reviewed by Dr. Sheron. NRC is proposing that the industry address the issue of RCP trip and propose resolution, consistent with safety guidelines from the NRC Staff. The vendors and Owners Groups contacted believe the pumps should be tripped for SB LOCA but not for any other overcooling events, including SG tube ruptures. It is also clear that the signal/parameter to be used for the trip setpoint will vary according to plant design.

NRR decided to inform the Commission before issuing the above RCP trip guidance letters to industry. The CRGR is currently performing a quick independent assessment of the Staff proposal. In response to Mr. Ward, Dr. Sheron said best-estimate calculations indicate W plants would not exceed the 2200°F PCT limit if the RCPs are not tripped during a SB LOCA, but CE plants could be in trouble if the pumps are not tripped and one HPI pump fails to start.

7. The meeting was adjourned at ~ 3:00 p.m.

NOTE: Additional Meeting details can be obtained from a transcript of this meeting available in the NRC Public Document Room, 1717 H Street, N.W., Washington, D.C., or can be purchased from Alderson Reporting Company, Inc., 400 Virginia Avenue, S.W., Washington, D.C. 20024, (202) 554-2345.

GERDA SCALED ARRANGEMENT

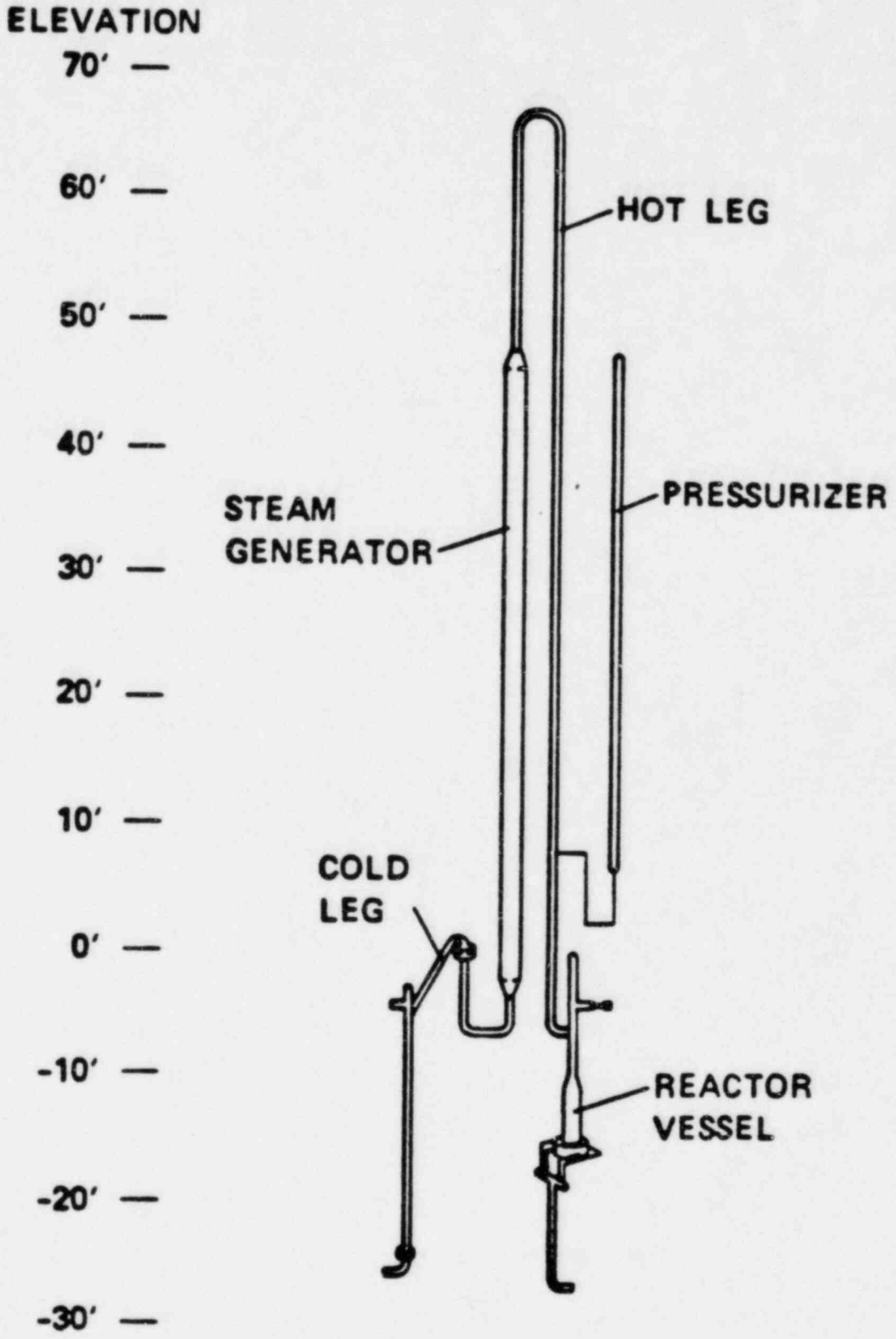
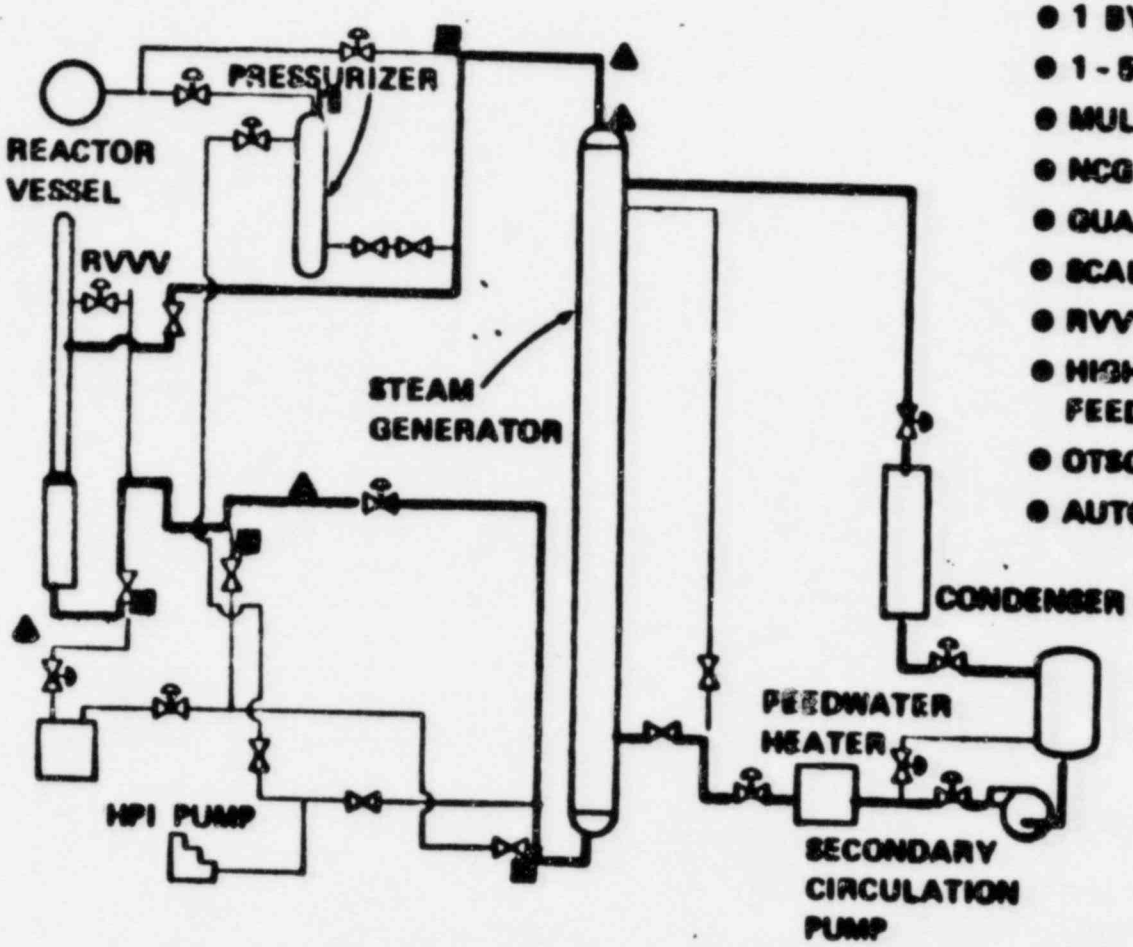


FIGURE 1

GERDA GENERAL ARRANGEMENT



KEY FEATURES

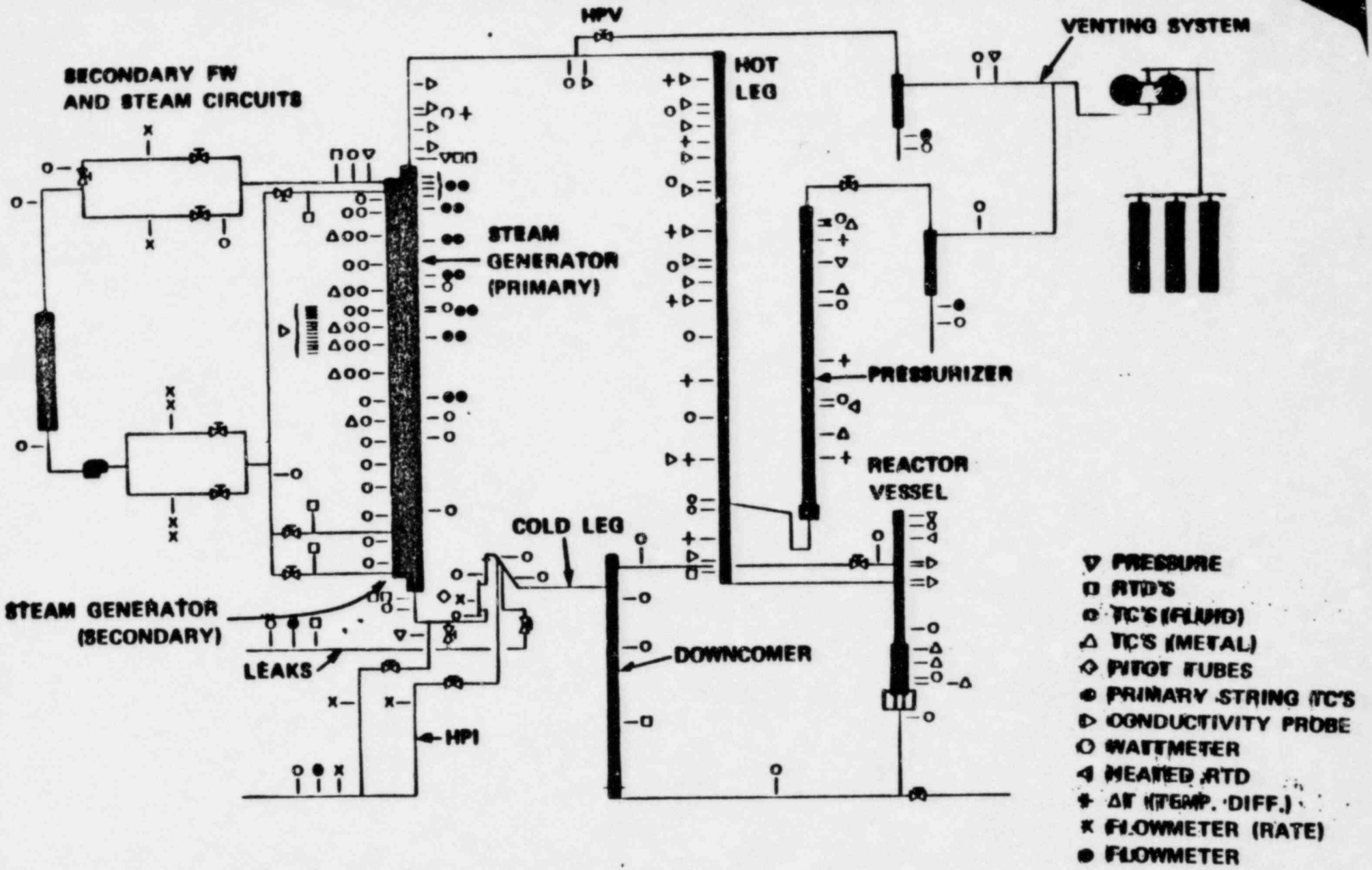
- 1 BY 1 LOOP
- 1 - 5% SCALED POWER
- MULTIPLE LEAK LOCATIONS
- NCG ADDITION
- GUARD HEATING
- SCALED HPI
- RVVV SIMULATION
- HIGH AND LOW AUXILIARY FEEDWATER ADDITION
- OTSG LEVEL CONTROL
- AUTOMATIC COOLDOWN

■ LEAK

▲ NCG ADDITION

FIGURE 2

GERDA INSTRUMENTATION



TYPE OF TEST INCLUDED

IN THE PRELIMINARY TEST MATRIX

- SMALL BREAK WITH AND WITHOUT FORCED CIRCULATION
- STEAM GENERATOR TUBE RUPTURE EFFECTS
- FORCED-TO-NATURAL CIRCULATION TRANSITION
- SINGLE-TO-TWO PHASE NATURAL CIRCULATION TRANSITION
- SECONDARY SIDE DEPRESSURIZATION SIMULATION
- LOOP-TO-LOOP INSTABILITY STUDY
- DISTRIBUTION AND EFFECT OF NON-CONDENSIBLE GASES ON NATURAL CIRCULATION
- OPERATION OF HIGH-POINT VENTS ON NATURAL CIRCULATION
- FEED AND BLEED PHENOMENA

EMPHASIS ON PHYSICAL PHENOMENA

TEST OUTLINE

I. STEAM GENERATOR (SG) HEAT TRANSFER

1. SG Characterization (steady state, forced flow).
2. Auxiliary Feedwater (AFW) Effects in forced flow.
3. SG Transients (boiloff, blowdown, and refill).
4. AFW Effects in natural circulation.

II. NATURAL CIRCULATION (NC)

5. NC Characterization.
6. NC Transient: NC initiation in a stationary and isothermal system.
7. NC cooldown.
8. NC Flow Transient: Establish NC following the interruption of forced flow.

III. CONDENSING PRIMARY OR BOILER-CONDENSER MODE (BCM)

9. BCM Characterization (steady state without non-condensible gases, NCG).
10. BCM With Non-Condensible Gases (steady state)
11. BC Transient: Establish BCM after the interruption of NC.

IV. REFILL TRANSIENTS AND TRANSITION INTO NC

12. Refill Characterization and HPV Effects
13. High Pressure Injection (HPI) effects on refill (Vary HPI distribution and redundancy).
14. Leak effects on refill (vary break size and location).
15. NCG effects on refill.

V. COMPOSITE EFFECTS

16. Complete SBLOCA Transient (including NC, interruption of NC, BCM, refill, cooldown, and depressurization).