GE Nuclear Energy

General Electric Company
175 Curtner Avenue, San Jose, CA 95125

October 29, 1993

MFN No. 181-93
Docket STN 52-004

Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Attention: Richard Borchardt, Director
Standardization Project Directorate

Subject: **NRC Document Requests on the Simplified Boiling Water Reactor (SBWR) Design**

Reference: Phonecon, GE, Leatherman et al/NRC, Hasselberg et al, October 29, 1993

In response to NRC requests during this morning's phone call, GE herewith provides additional copies of GE/NRC letters MFN No. 005-93 dated January 11, 1993, Information Requested During the December 17, 1992 Meeting on the SBWR Testing Program, and MFN No. 071-93, dated May 7, 1993, entitled Testing Program Supplement to the Simplified Boiling Water Reactor (SBWR) Application for Design Certification, and GE Test Specification 23A6999/1, entitled Isolation Condenser & Passive Containment Condenser Test Requirements.

Also included, is the explicit tests chosen to represent the broad set of conditions discussed in MFN No. 071-93, referenced above, entitled FANTHERS Qualification Test Matrix, Section B.3.

Sincerely,

John Leatherman
SBWR Licensing Manager
MC 781, (408)925-2023

Attachments:
1. MFN No. 005-93
2. MFN No. 071-93
3. 23A6999/1
4. PANTHERS Qualification Test Matrix

cc: M. Malloy, Project Manager (NRC) w/o Attachments
Rick Hasselberg, Attachments (2)

LTRBK 93-62 010006

D040
1/1

9311010085 931029
PDR ADOCK 05200004
A PDR

bcc: J. A. Beard
P. F. Billig
R. H. Buchholz
R. W. Burke, Sr. (EPRI)
S. A. Delvin
D. L. Foreman
E. M. Lynch
P. W. Marriott
W. A. Marquino
F. A. Ross (DOE)
SBWR File MC-781

LTRBK 93-62

GE Nuclear Energy

January 11, 1993

MFN No. 005-93
Docket STN 52-004

Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Attention: Robert C. Pierson, Director
Standardization and Non-Power Reactor Project Directorate

Subject: **Information Requested during the December 17, 1992 Meeting on the SBWR Testing Program**

Dear Mr. Pierson:

During the subject meeting, the Staff asked GE to provide additional information concerning the GIRAFFE, PANTHERS, PANDA, and MIT/UCB testing programs. The enclosed information follows the format suggested by the Staff during the meeting. This information will clarify the on-going and completed tests that have been discussed over the past months. GE suggests that a meeting be held in San Jose on January 28, 1993, to discuss the content of the enclosure.

Sincerely,

P.P. Stancavage

P.P. Stancavage, Acting Manager
Safety & Licensing
M/C 444, (408) 925-6948

Enclosure

LTRBK 9304

9301120225 7pp.

SBWR Test Programs

University Condensation Tests

1. **Purpose:**
The MIT and UCB test programs were initiated in order to develop a heat transfer correlation for steam condensation that can be used in the TRACG analysis of the SBWR IC and PCCS condensers. The effective heat transfer in the condensers is dependent on both shear enhancement and noncondensable gas effects. Previously published studies in this area have considered the effects of noncondensable gases, but they have mainly dealt with external surfaces and report only average heat transfer coefficients. The present studies provide the local heat transfer coefficient for steam condensation inside of tubes. The noncondensables considered are air and helium representing, respectively, nitrogen and hydrogen in the SBWR containment. A correlation based on the completed test data has been incorporated in TRACG. Additional tests to be conducted this year will provide confirmation of previous results.

2. **Scaling Analysis:**
All tests used essentially full length tubes. The Reference 1 experiments used a 1" diameter tube. All others have used 2" diameter tubes, which are prototypical of SBWR condenser tubes. Additional details are given in Reference 2.

3. **Test Instrumentation:**
This is discussed in References 1 through 4.

4. **Test Matrix:**
Details are given in References 2 through 5.

5. **Test Schedule:**
Testing in support of the SSAR are complete. Additional confirmatory testing is scheduled for completion by September 1993.

6. **Post-test Analysis:**
References 1 through 6 provide the post test analysis of data used in the SSAR analysis. An additional test report documenting the ongoing testing will be provided in November 1993.

7. **NRC Site Visit:**
It is recommended that the NRC staff visit to the two test sites be the week of March 22, 1993 for the University of Calif. at Berkeley and the week of April 19, 1993 for MIT.

Mar. 15

SBWR Test Programs

University Condensation Tests (cont.)

References:

1. Karen Vierow and Virgil Schrock, "Condensation in a Natural Circulation Loop with Noncondensable Gases, Parts I and II", Proceedings of the International Conference on Multiphase Flows, Tsukuba, Japan, September 1991.
2. Karen Vierow, "Behavior of Steam-Air Systems Condensing in Cocurrent Vertical Downflow", M.S. Thesis, U.C. Berkeley Dept. of Nuclear Engineering, August 1990.
3. Mansoor Siddique, "The Effects of Noncondensable Gases on Steam Condensation under Forced Convection Conditions", Doctor of Philosophy Dissertation, Massachusetts Institute of Technology, January 1992.
4. Daniel Ogg, "Vertical Downflow Condensation Heat Transfer in Gas-Steam Mixtures", M.S. Thesis, U.C. Berkeley Dept. of Nuclear Engineering, December 1991.
5. M. Golay, "Steam Condensation Measurements at MIT", provided by J. Baechler to the U.S. NRC.
6. J. Kuhn, V.E. Schrock, P.F. Peterson, "Status of UCB Condensation Experiment", provided by J. Baechler to the U.S. NRC.

SBWR Test Programs

GIRAFFE

1. **Purpose**:
The objectives of the GIRAFFE testing program are to provide separate effects and integral test data for qualification of TRACG, the computer code which will be used for analysis of the SBWR containment. The separate effects tests address the issues of steam condensation heat transfer rates from a steam-nitrogen mixture under steady-state conditions, and of venting of noncondensable gases from scaled-down passive containment heat exchangers (PCC's) to the suppression pool. The integral tests demonstrate the concept of the PCC System and provide data for a variety of LOCA simulations, against which analytical models for the containment may be qualified.

2. **Scaling Analysis**:
Details are provided in References 1, 2 and 3.

3. **Test Instrumentation**:
A description is given in References 1, 2 and 3.

4. **Test Matrix**:
Data from the separate effects condensation tests were obtained at a total pressure of 0.3 MPa, for steam flow rates of 0.01 to 0.04 kg/s and nitrogen partial pressures of 0.0 to 0.03 MPa. The initial conditions for the noncondensable venting and long-term integral tests corresponded to those at one hour after LOCA occurrence. For the venting study, the nitrogen vent line of the scaled-down heat exchanger was submerged by 0.40m, 0.65m, and 0.90m. The main steam line break, GDCS line break and bottom drain line break LOCAs were simulated during the long-term system response tests.

   Additional details are given in References 1, 2 and 3.

5. **Test Schedule**:
Testing has been completed.

GIRAFFE (cont)

6. **Post-test Analysis:**
A complete qualification of the TRACG computer code is given in Reference 6. Additional analyses are presented in References 1, 4 and 5. In May, 1993, a report presenting the results of testing completed in late 1992, specifically the Gravity-Driven Cooling System and Bottom Drain line break integral tests, will be supplied to the NRC.

7. **NRC Site Visit:**
A recommendation regarding the date for a site visit will be made by the end of this month. GE needs to confirm availability with Toshiba.

References:

1. "Joint Study Report, Feature Technology of Simplified BWR (Phase-1)", Final Report, 1990.
2. Nagasaka, H., K. Yamada, M. Katoh, S. Yokobori, "Heat Removal Tests of Isolation Condenser Applied as a Passive Containment Cooling System", from transactions of *International Conference on Nuclear Engineering - 1*, Tokyo, Japan, Nov., 1992, pp. 257-263.
3. Yokobori, S., H. Nagasaka, T. Tobimatsu, "System Response Test of Isolation Condenser Applied as a Passive Containment Cooling System", from transactions of *International Conference on Nuclear Engineering - 1*, Tokyo, Japan, Nov., 1992, pp. 265-271.
4. Oikawa, H., K. Arai, H. Nagasaka, "Optimization Study on SBWR Isolation Condenser Heat Removal Performance", from transactions of *International Conference on Nuclear Engineering - 1*, Tokyo, Japan, Nov., 1992, pp. 273-279.
5. Arai, K., H. Nagasaka, "Analytical Study on Drywell Cooler Heat Removal Performance as a Passive Containment Cooling System", from transactions of *International Conference on Nuclear Engineering - 1*, Tokyo, Japan, Nov., 1992, pp. 281-287.
6. Andersen, J. G. M., et. al, "TRACG02 Qualification Licensing Topical Report", (scheduled publication in February, 1993).

PANTHERS TEST

1. **Purpose:**
The major objective of these tests is to confirm, for the Passive Containment Cooling (PCC) condenser, the thermal-hydraulic performance for the SBWR service conditions. See reference document Par. 3.2 for more details.

2. **Scaling Analysis:**
This is a test of full-scale prototype of the condenser, therefore no scaling analysis is necessary.

3. **Test Instrumentation:**
See reference document, Par. 4.1.4.

4. **Test Matrix:**
See reference document, Par. 5.2 and Appendix A.

5. **Test Schedule:**
The test schedule is currently under revision, and the new schedule will be available by the end of this month. The PCC shakedown testing will occur during the second half of this year. Matrix testing will start approximately one month later.

6. **Post-test Analysis:**
A report describing PCC confirmatory test results will be completed during the first quarter of 1994.

7. **NRC Site Visit:**
It is recommended that the NRC visits to the PANTHERS test site be:
(1) during the May/June 1993 time frame for review of the test matrix and
(2) approximately November/December 1993 to witness the PCC tests.

Reference:

"Isolation Condenser & Passive Containment Condenser Test Requirements", GE NE Document No. 23A6999, Rev. 1, 11/12/91.

PANDA TESTS

1. **Purpose:**
The overall objectives of these tests are to demonstrate that the containment long term cooling performance is the same in a large scale system as previously demonstrated at a smaller scale (GIRAFFE) and that with non-uniform drywell conditions, no significant adverse effects are introduced on the performance of the Passive Containment Cooling System (PCCS).

2. **Scaling Analysis:**
See reference document.

3. **Test Instrumentation:**
See attached material taken from Draft TM-42-18, ALPHA-213.

4. **Test Matrix:**
Two main steamline (MSL) break tests will be performed. The first test will duplicate the initial conditions of the GIRAFFE MSL break test with uniform drywell conditions and the second will be the same except with non-uniform conditions in the drywell.

5. **Test Schedule:**
The testing will be performed in the first half of 1994.

6. **Post-test Analysis:**
A test report is expected to be available by mid-1994.

7. **NRC Site Visit:**
It is recommended that the next NRC visit to the PANDA test site be during the May/June 1993 period to review test procedures and planned data analysis.

Reference:

Coddington, P., "ALPHA - The Long Term Passive Decay heat Removal and Aerosol Retention Programme" (previously given to NRC).

PANDA

INSTRUMENTATION

Classification in categories:

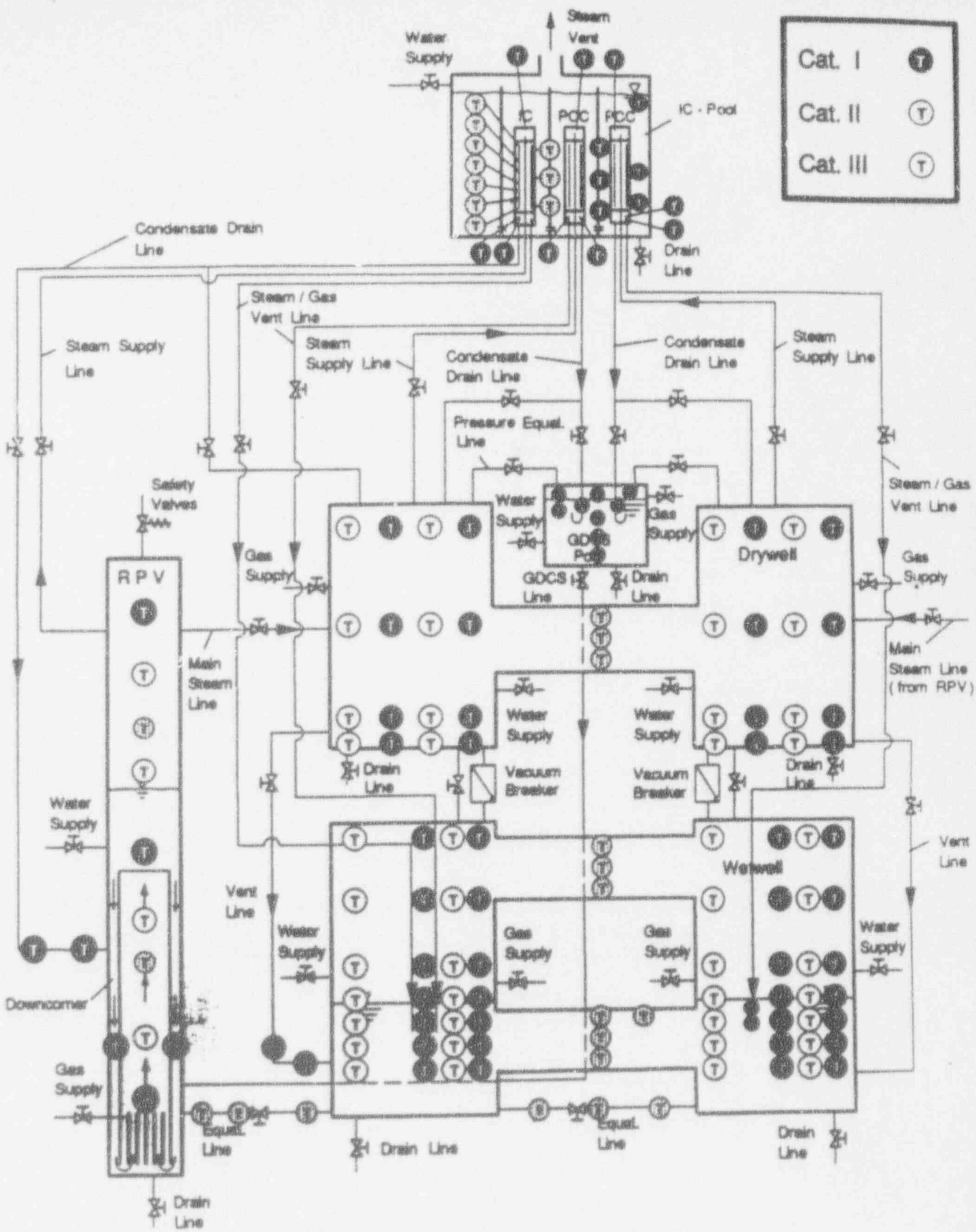
Revision 1

I	musts
II	wants
III	interesting

- Technical feasability not considered
- I → II → III means:
  - Decreasing importance of measured quantity
  - Decreasing order of secure financing

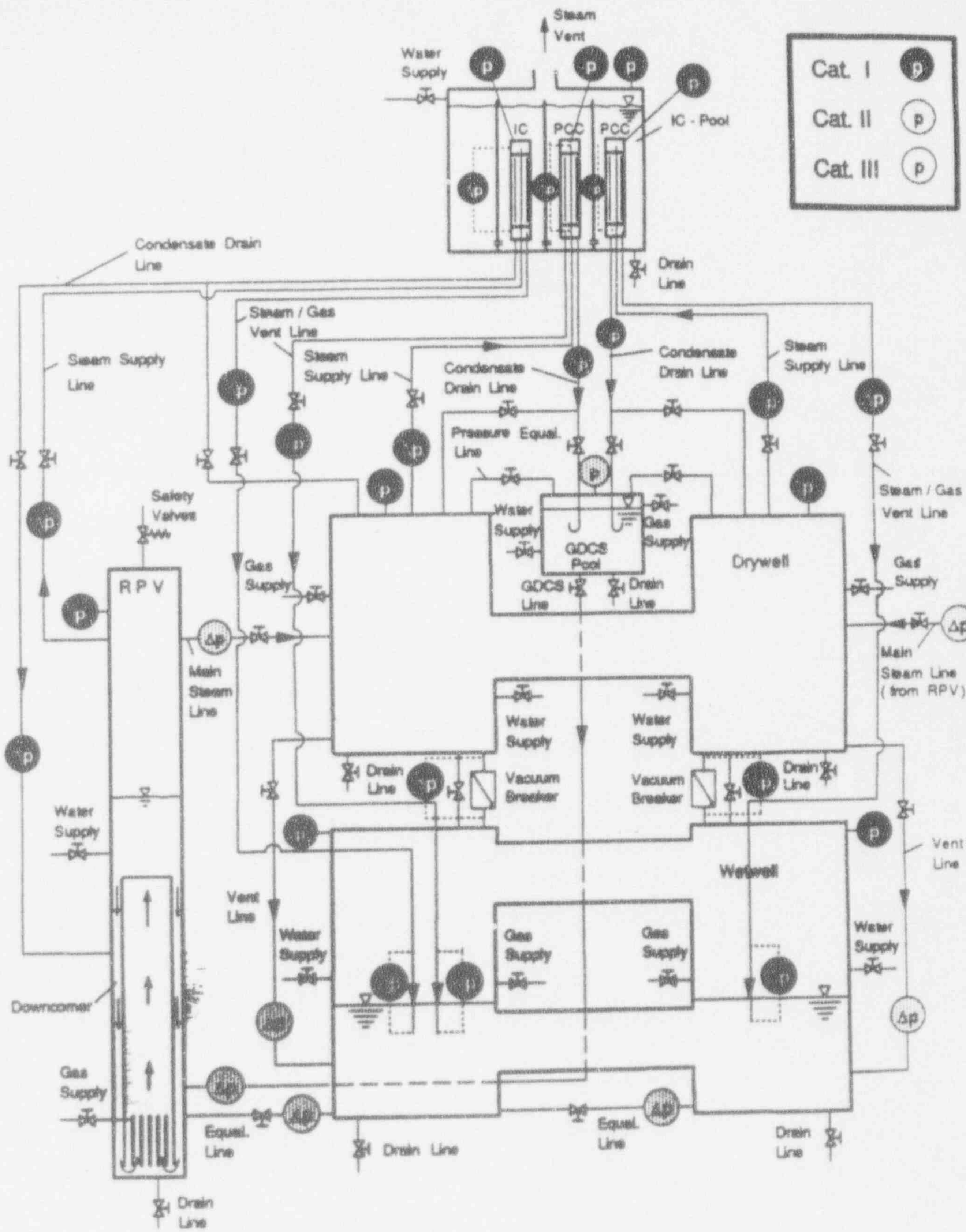
NUMBER OF SENSORS

	Cat. I	Cat. I+II	Cat. I+II+III
Mass flow	13	14	21
Gas concentration/humidities	15	25	62
Temperature	174	252	405
Pressure	9	10	10
Level/void	9	14	14
Pressure difference	17	24	24
Electrical power	1	1	1
Conductivity	2	8	8
Total	240	348	545
Total (4 sensors per mass flow)	279	390	608



PANDA Instrumentation

Temperatures



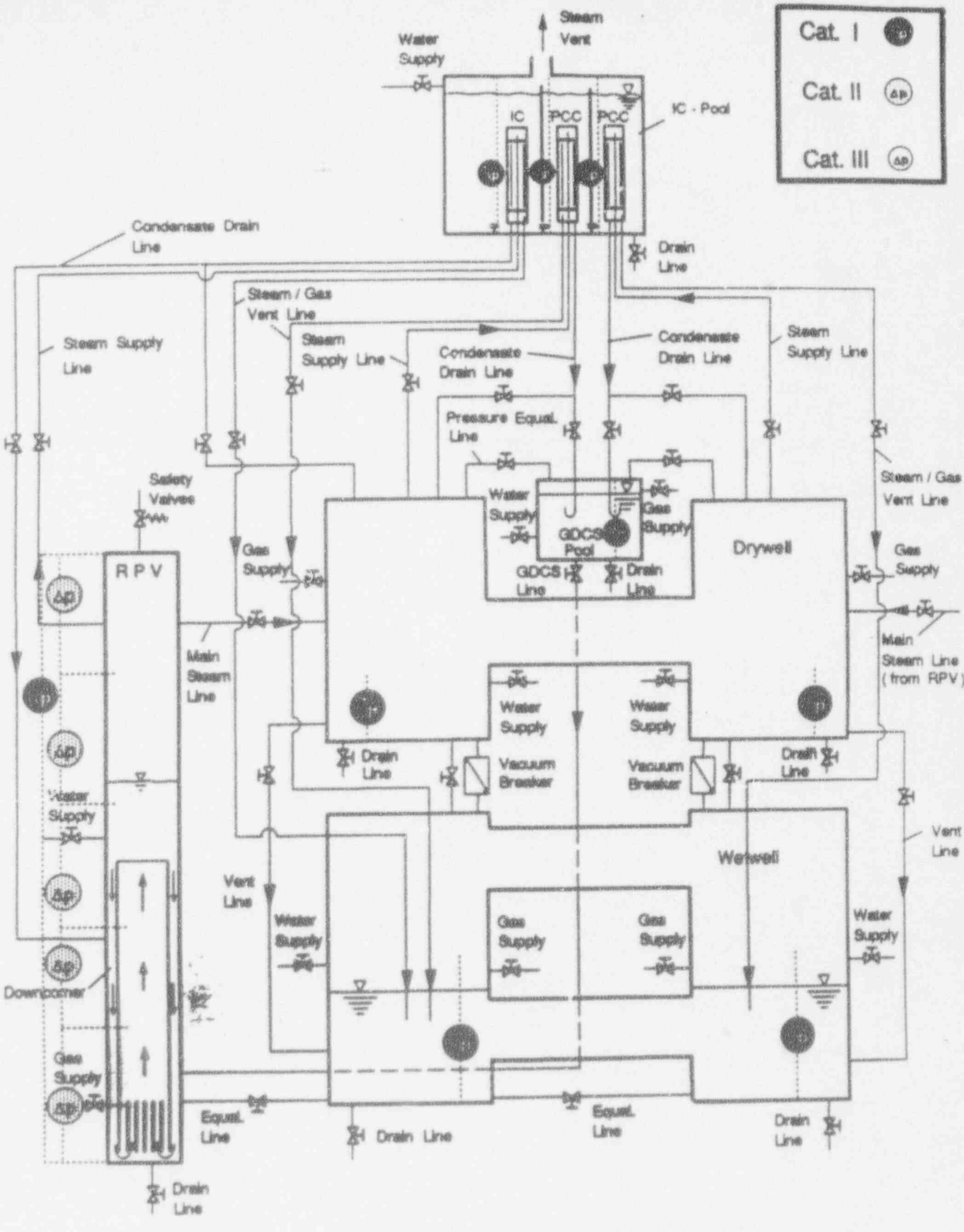
PANDA Instrumentation

Pressures , pressure differences

4/2

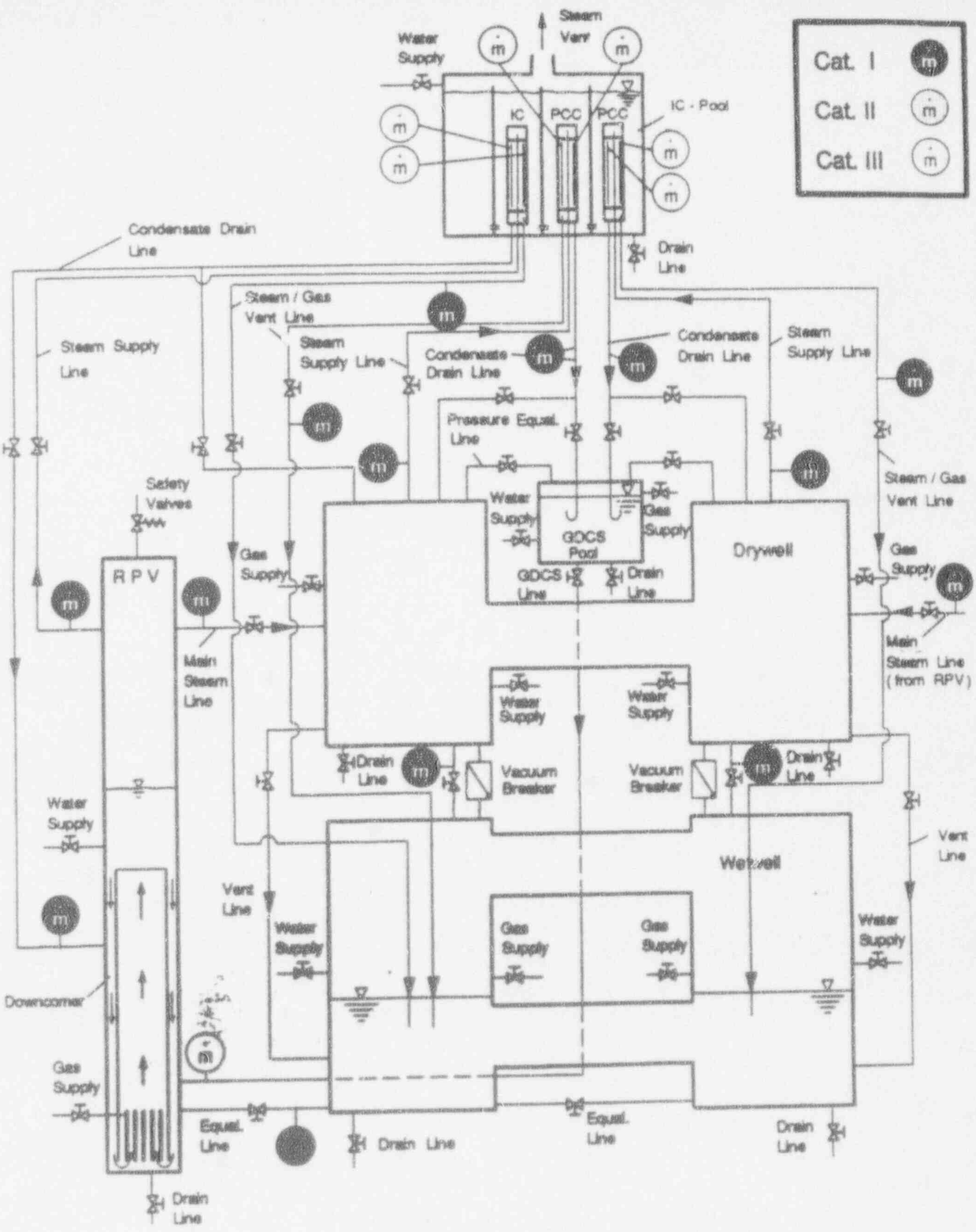
4231 - 920507

PSI / ALPHA / PANDA



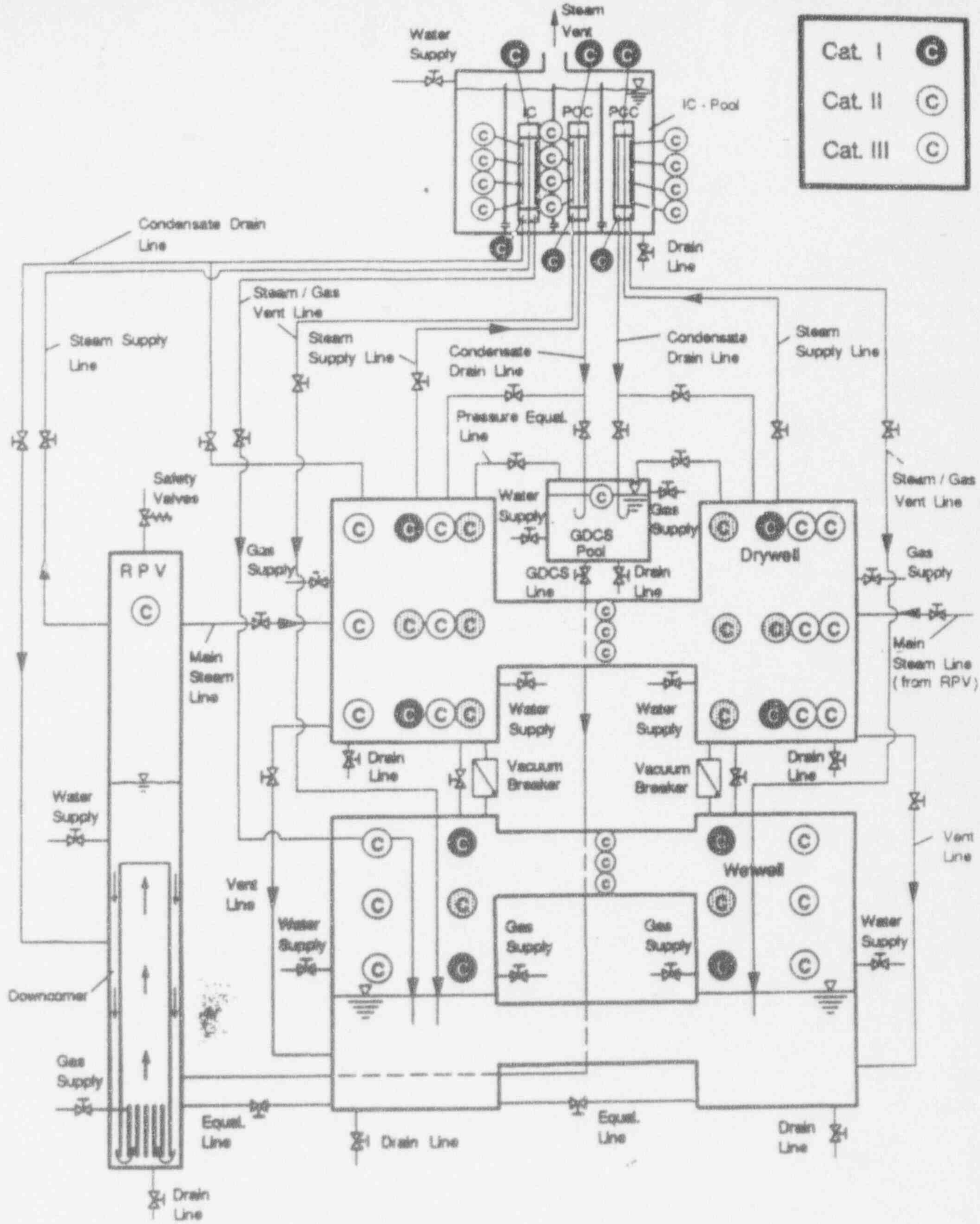
PANDA Instrumentation

Levels and voids



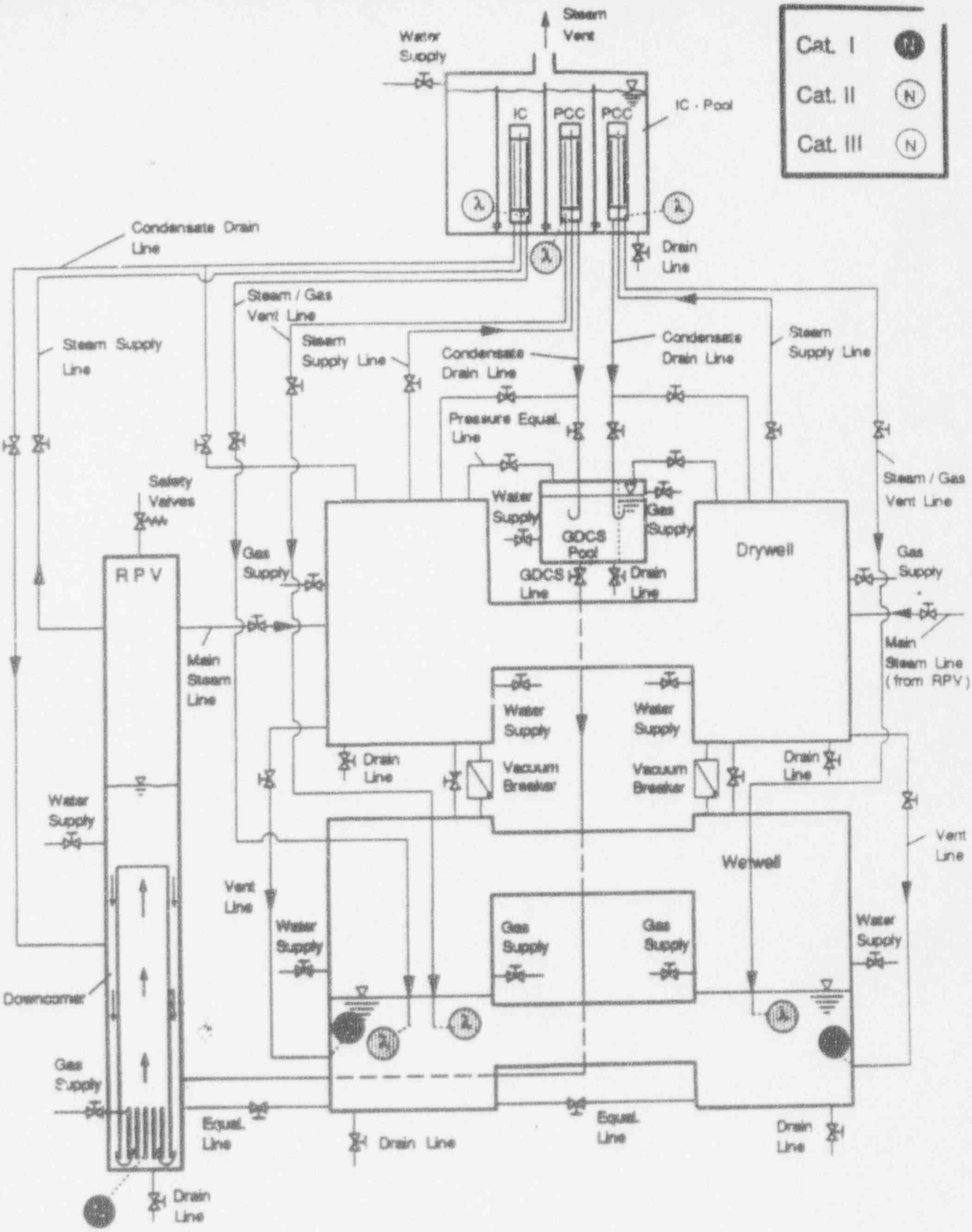
PANDA Instrumentation

Mass flows / Flow indicators



PANDA Instrumentation

Gas concentrations / humidities



PANDA Instrumentation

Miscellanous

GE Nuclear Energy

General Electric Company
175 Curtner Avenue, San Jose, CA 95125

May 7, 1993

MFN No. 071-93
Docket STN 52-004

Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Attention: Richard Borchardt, Acting Director
Standardization Project Directorate

Subject: **Testing Program Supplement to the Simplified Boiling Water Reactor (SBWR) Application for Design Certification**

Dear Mr. Borchardt:

The enclosed information is provided as an advance draft of material to be submitted in the next supplement to the application for design certification of the SBWR. This is in response to Staff requests that GE provide a summary of the SBWR testing programs and applicable reference material for systems and components unique to the SBWR.

Sincerely,

P.W. Marriott, Manager
Safety & Licensing
M/C 444, (408) 925-6948

cc: Melinda Malloy (NRC)

LTRBK 93-28

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SBWR Test Programs

Introduction

As part of the SBWR design effort, GE has conducted extensive testing on those components and systems unique to SBWR that are safety-related. These tests are described below along with how the results are used in qualification of the computer codes used for the design of the plant. The major computer code utilized in all these areas is TRACG (Reference 14). The qualification basis and tests utilized to qualify the code are discussed in detail in Reference 15. The following paragraphs summarize some of the tests performed to cover SBWR specific features. However, the testing basis described in Reference 15 is also directly applicable to SBWR.

The tests summarized here are categorized by the function of the system or component they represent. Table 1 identifies the applicable reference for each test.

A. Inventory Control

A.1 GIST

A key feature of the SBWR design is the Gravity-Driven Cooling System (GDCS). This system provides makeup to the core in the event of a loss-of-coolant accident (LOCA) by draining water from elevated pools into the reactor pressure vessel (RPV). To qualify computer codes to analyze the performance of this system, GE conducted integrated systems tests to demonstrate the performance of the GDCS.

The GDCS Integrated Systems Test (GIST) Facility was built at the GE Nuclear Energy site in San Jose, California. All significant plant features which could affect the performance of the GDCS (e.g., RPV, containment, depressurization system, break flows, etc.) were included in the design. GIST had a one-to-one vertical scale and a one-to-five hundred eight (1:508) horizontal area (or volume) scale of the RPV and containment volumes.

Tests run at GIST provided a qualification base for the TRACG code and also demonstrated the technical feasibility of the GDCS concept to depressurize the RPV to sufficiently low pressures to allow reflood via a gravity-fed emergency core cooling system. Four accident types were modeled at GIST; three LOCAs (main steam line, GDCS line, and bottom drain line) and a no break (isolation event) transient with loss of inventory. Data from these tests were used to qualify the TRACG code (the GE version of TRAC-BWR) for SBWR applications.

A.2 DPV

The successful operation of the GDCS depends on lowering the RPV pressure sufficiently to allow gravity-fed reflood. In addition to standard BWR safety-relief valves (SRVs), the SBWR also has depressurization valves (DPVs). These squib-operated valves ensure a diverse means of RPV depressurization for all accidents where GDCS operation is required to provide core makeup.

GE conducted a development test program to develop, design, build, and provide test data to qualify a DPV for the SBWR. As part of the test program, prototype valves were used in flow and reaction load tests. These tests confirmed that the DPV can be simply supported as a cantilever off the main steam line or the RPV. They also confirmed that the design will meet the flow requirements for the valve.

Environmental Qualification (EQ) dynamic loads tests were conducted to qualify the valve. These tests simulated conditions the DPV (with components aged to end-of-life) would be subjected to while sustaining plant flow and pipe induced vibrations. These tests modeled the vibrations the DPV would undergo during normal plant operation, SRV cycling, seismic events, and chugging events, and confirmed that the DPV, when called upon by an actuation signal, will perform its safety function for the SBWR.

A.3 PANTHERS - IC

The SBWR will use isolation condensers (ICs) to provide inventory control for isolation transient events. The ICs will take steam from the RPV, condense it, and return the condensate to the RPV. The heat removed will be deposited in an outside containment pool (IC Pool) which is open to the atmosphere. The IC System in SBWR is similar in design to others found on some operating BWR plants; therefore, system operation does not need to be tested.

The SBWR IC is a vertical tube heat exchanger with vents (normally closed) going to the suppression pool. Since the design of the condenser unit is different from existing units, which have horizontal tubes, a prototype condenser will be built and tested. This test program is part of the PANTHERS Test Program. Tests on a full-size IC module will look at the thermal hydraulic performance of the unit, as well as the structural performance to ensure that the condenser will meet the 60-year life of the SBWR. The tests will be conducted in Piacenza, Italy by SIET and are scheduled for late 1994.

GE does not consider the completion of these tests as necessary for SBWR certification. These component tests will confirm that the selected IC design will satisfy the SBWR performance requirements and provide data to quantify the margin above those requirements.

B. Containment Cooling

The SBWR uses a Passive Containment Cooling System (PCCS) to provide heat removal from the containment during a LOCA. The PCCS consists of a Passive Containment Condenser (PCC) which draws steam and nitrogen from the drywell airspace, condenses the steam, returns the condensate to the drywell into the GDCS Pools, and vents the non-condensable gases to the wetwell through the suppression pool. All lines in the PCCS, steam inlet, condensate, and vent, are always open during normal plant operation, as well as LOCA events. The PCCS performs the same function for the containment as the IC System does for the RPV.

An extensive test program has been conducted to qualify the system for SBWR design. These tests include studies on tube condensation with steam/gas mixtures, integrated systems testing, and component testing and are described below.

B.1 Single Tube Condensation Tests

At the Massachusetts Institute of Technology (MIT) and the University of California at Berkeley (UCB) tests were conducted on condensation in vertically oriented tubes.

The MIT and UCB test programs were initiated in order to develop a heat transfer correlation for steam condensation that can be used in the TRACG analysis of the SBWR PCCS condensers. The effective heat transfer in the condensers is dependent on both shear enhancement and noncondensable gas effects. Previously published studies in this area have considered the effects of noncondensable gases, but they have mainly dealt with external surfaces and report only average heat transfer coefficients. These studies provide the local heat transfer coefficient for steam condensation inside of tubes. The noncondensables considered are air and helium representing, respectively, nitrogen and hydrogen in the SBWR containment. A correlation based on the completed test data has been incorporated in TRACG. Additional tests are being conducted in 1993 to provide confirmation of previous results.

B.2 GIRAFFE

Tests have been conducted on separate effects and integral systems effects for the PCCS at the GIRAFFE Test Facility at Toshiba, Japan. The objectives of the GIRAFFE testing program were to provide separate effects and integral systems test data for qualification of TRACG, the computer code which will be used for analysis of the SBWR containment. The separate effects tests addressed the issues of steam condensation heat transfer rates from a steam-nitrogen mixture under steady-state conditions, and of venting of noncondensable gases from PCCS to the suppression pool. Test were conducted using a full-height three-tube condenser to represent the PCC. For the venting study, the nitrogen vent line of the scaled-down heat exchanger was submerged by 0.40m, 0.65m, and 0.90m.

The integral tests demonstrated the concept of the PCCS and provide data for a variety of LOCA simulations, against which TRACG models for the containment have been qualified. The GIRAFFE Test Facility consisted of a full-scale vertical and 1:400 scale volume representation of the SBWR. Key scaled components included the RPV and containment volumes. The initial conditions for the long-term integral tests corresponded to those at one hour after LOCA occurrence. The main steam line break, GDCS line break and bottom drain line break LOCAs were simulated during the long-term system response tests. Data from these tests were used to qualify the TRACG code for SBWR applications.

B.3 PANTHERS - PCC

At PANTHERS, a full-scale prototype PCC will be tested under simulated conditions representing a broad range of operating conditions. These tests will be conducted at the same facility in Italy as that for the PANTHERS IC tests. The major objective of these tests is to confirm, for the PCC, the thermal hydraulic performance for the SBWR service conditions. A series of tests representing a range of steam/air mixtures are scheduled for late 1993 with the test report to be issued soon after.

Following those initial performance tests, more tests will be conducted in early 1994 to gather additional thermal hydraulic performance data and structural data to qualify the design for the 60-year service life of the SBWR. GE does not consider the completion of these additional tests as necessary for SBWR certification. These component tests will confirm that the selected PCC design will satisfy the SBWR performance requirements and provide more data to quantify the margin above those requirements.

B.4 PANDA

The Paul Scherrer Institute (PSI) of Switzerland is building an integral systems test facility (PANDA) which will demonstrate PCCS performance on a larger scale than GIRAFFE. The facility will be full-scale vertical and 1/25 scale by volume. The overall objectives of these tests are to demonstrate that the containment long term cooling performance is the same in a large scale system as previously demonstrated at a smaller scale (GIRAFFE) and that with non-uniform drywell conditions, no significant adverse effects are introduced on the performance of the PCCS.

The test series at PANDA will consist of two main steamline (MSL) break tests. The first test will duplicate the initial conditions of the GIRAFFE MSL break test with uniform drywell conditions and the second will have non-uniform conditions in the drywell. These tests will demonstrate the adequacy of the tests at GIRAFFE and are scheduled to be performed by mid 1994. These tests are not considered necessary for further TRACG qualification and certification, but are being performed to quantify the margins in the qualified TRACG code, which has been qualified using several facilities at different scales.

C. Transients and Normal Operation

C.1 PANTHERS - IC

The use of the Isolation Condenser (IC) to control reactor inventory during isolation events and the role of the PANTHERS IC test program were discussed earlier in Section A.3.

C.2 Plant Startup

The SBWR starts up from low pressure under natural circulation conditions. It has been suggested that geysering could be a potential problem during startup. Here, geysering refers to flow oscillations induced by condensation of vapor from the core in a subcooled upper plenum, resulting in flow reversals in the channels. This instability may cause startup delay if it occurs, but is not related to plant safety.

Tests were used to assess the capability of TRACG to predict this behavior. Results of the TRACG analysis of the test data were reported in Section 5.6 of Reference 15. From this analysis, it was concluded that TRACG successfully calculated the geysering oscillations seen in the experiment and was qualified to predict this phenomena, if it occurs in the SBWR startup.

In Appendix 4D.3 of the SBWR SSAR the test data from Hitachi's small scale natural circulation test loop were also presented. In this test Freon was used as a coolant.

Additional justification for the SBWR startup procedure is based on the Dodewaard reactor, a natural circulation BWR with a 183 MW thermal power rating. Initial startup of the reactor was in 1969. Since then, it has been continuously operating. During the recent two startups (February and June1992) various plant parameters have been measured and recorded, which included recirculation flow, incore steam velocity, reactor pressure, reactor power, downcomer subcooling, reactor thermal hydraulic stability, etc. No indications of reactor instability have been observed. The startup experiences and data were presented in Reference 28.

C.3 Boron Mixing

The SBWR utilizes a standby liquid control system that injects boron into the reactor vessel to provide a diverse means to shutdown the reactor. Reference 24 provides the justification for the use of the boron injection location and mixing in the SBWR.

Table 1

SBWR Testing

FUNCTION	TEST PROGRAM	APPLICABLE REFERENCES
Inventory Control	GIST	15, 16, 22, 24, 25
	DPV	23, 24
	PANTHERS - IC	12, 24, 25, 27
Containment Cooling	Single Tube Condensation	1, 2, 3, 4, 5, 6, 14, 24, 27
	GIRAFFE	8, 9, 10, 11, 15, 16, 24, 25, 27
	PANTHERS - PCC	12, 17, 18, 19, 20, 21, 24, 25, 26, 27
	PANDA	13, 24, 25, 27
Transients and Normal Operation	PANTHERS - IC	12, 24, 25, 27
	Boron Mixing	24
	Plant Startup	15, 28

SBWR Testing Documentation References

1. "Condensation in a Natural Circulation Loop with Noncondensable Gases, Parts I and II", Karen Vierow and Virgil Schrock; Proceedings of the International Conference on Multiphase Flows, Tsukuba, Japan, September 1991.

2. "Behavior of Steam-Air Systems Condensing in Cocurrent Vertical Downflow", Karen Vierow; M.S. Thesis, U.C. Berkeley Dept. of Nuclear Engineering, August 1990.

3. "The Effects of Noncondensable Gases on Steam Condensation under Forced Convection Conditions", Mansoor Siddique; Doctor of Philosophy Dissertation, Massachusetts Institute of Technology, January 1992.

4. "Vertical Downflow Condensation Heat Transfer in Gas-Steam Mixtures", Daniel Ogg; M.S. Thesis, U.C. Berkeley Dept. of Nuclear Engineering, December 1991.

5. "Steam Condensation Measurements at MIT", M. Golay; GE Working Group Meetings, San Jose, CA, November 1992.

6. "Status of UCB Condensation Experiment", J. Kuhn, V.E. Schrock, P.F. Peterson; GE Working Group Meetings, San Jose, CA, November 1992.

7. "Joint Study Report, Feature Technology of Simplified BWR (Phase-1)", Final Report, 1990. *General Electric Proprietary*

8. "Heat Removal Tests of Isolation Condenser Applied as a Passive Containment Cooling System", (pp. 257-263), H. Nagasaka, K. Yamada, M. Katoh, S. Yokobori; from transactions of International Conference on Nuclear Engineering - 1, Tokyo, Japan, November 1992.

9. "System Response Test of Isolation Condenser Applied as a Passive Containment Cooling System", (pp. 265-271), S. Yokobori, H. Nagasaka, T. Tobimatsu; from transactions of International Conference on Nuclear Engineering - 1, Tokyo, Japan, November 1992.

10. "Optimization Study on SBWR Isolation Condenser Heat Removal Performance", (pp. 273-279), H. Oikawa, K. Arai, H. Nagasaka; from transactions of International Conference on Nuclear Engineering - 1, Tokyo, Japan, November, 1992, .

11. "Analytical Study on Drywell Cooler Heat Removal Performance as a Passive Containment Cooling System", (pp. 281-287), K. Arai, H. Nagasaka; from transactions of International Conference on Nuclear Engineering - 1, Tokyo, Japan, November 1992.

12. "Isolation Condenser & Passive Containment Condenser Test Requirements", GENE Document No. 23A6999, Rev. 1, 11/12/91.

13. "ALPHA - The Long Term Passive Decay heat Removal and Aerosol Retention Programme", P. Coddington.

14. "TRACG, Model Description", GENE Licensing Topical Report, NEDE-32176P, February 1993. *General Electric Proprietary*

15. "TRACG, Qualification", GENE Licensing Topical Report, NEDE-32177P, February 1993. *General Electric Proprietary*

16. "Application of TRACG Model to SBWR Licensing Safety Analysis", GENE Licensing Topical Report, NEDE-32178P, February 1993. *General Electric Proprietary*

17. PCC Test Plan and Procedures, SIET 0096 ED 91, Rev. A

18. SIET Schematic 0094 RI 91, Rev. C

19. Technospecial Drawings, TS 122, Rev. 1; TS 123, Rev. 1; TS 124, Rev. 1

20. SIET Drawing, 24.02.03, Rev. C

21. Technical Specification for PCC Instrument Installation, SIET, 00157 ST 92, Rev. A

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